

**THE UNIVERSITY OF GHANA
GENERAL INFORMATION**

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Academic Year	-	August to May
Language of Instruction	-	English
Solicitors	-	Bentsi-Enchill, Letsa & Ankomah 1 st Floor Teachers' Hall Annex, Education Loop (Off Barnes Road) Adabraka P.O. Box 1632, Accra
	-	Lexcom Associates Legal Practitioners & Consultants P. O. Box 11428, Accra-North
Bankers	-	Ghana Commercial Bank, Legon Branch, Ghana
	-	Standard Chartered Bank, Legon Branch, Ghana
	-	ECOBANK Legon Branch, Ghana
	-	Ghana International Bank, Plc 69 Cheapside, London EC.2, England.
	-	Citibank, N.A. 046 P.O. 5870 Grand Central Station New York, NY 10163 USA
Auditors	-	Osei Kwabena & Associates (Chartered Accountants) 71 Palace Street, B 603/18 North Kaneshie P.O. Box 10276, Accra-North

All communication should be addressed to:

*THE REGISTRAR
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P.O. BOX LG 25
LEGON, GHANA*

MEMBERSHIP OF THE UNIVERSITY COUNCIL

Justice S.K. Date-Bah	-	Chairman
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Mrs. Elizabeth Addabor	-	Appointed by Government
Professor. J. M. Hyde	-	Appointed by Government
Professor. R.G. Baeta <i>MSc(Ghana)MSc,PhD(Brist)C.Phys F.Inst P.</i>	-	Appointed by Government
Professor Akosua Adomako Ampofo <i>BSc MSc (K'si) PhD (Vanderbilt)</i>	-	Elected by Convocation
Dr. Esther O. Sakyi-Dawson <i>BSc, MPhil; (Ghana) PhD (Cornell)</i>	-	Elected by Convocation
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Mr. K. Mensa-Bonsu, MA (Ghana)	-	Representing University, Alumni Association
Mr. S. Ofori-Adjei	-	Representing the Conference of Heads of Assisted Secondary Schools (CHASS)
Mr. M. Adu-Gyimah	-	Representing Graduate Students
Mr. J.M. Bekui	-	Representing Students' Representative Council (SRC)
Mr. P.K. Lumor, BA (Ghana)	-	Representing the TEWU of TUC
In Attendance		
Professor K. Yankah, <i>BA MA (Ghana) PhD (Indiana)</i>	-	Pro-Vice-Chancellor
Mr. S. A. Okudzeto <i>LLB (Hons) Barrister-at-Law ((Lond) FCISA MCIA</i>	-	Chairman of Council of College of Health Sciences
Mr. John Klinogo	-	Chairman of Council of College of Agriculture and Consumer Sciences
Mr. J. M. Budu <i>BA (Ghana) Dip Ed MA (London)</i>	-	Registrar/Secretary

**UNIVERSITY OFFICERS
CHANCELLOR**

Mr. Kofi Annan

PRINCIPAL OFFICERS

- Chairman, University Council - **Justice S.K. Date-Bah**
- Vice-Chancellor - **Professor Clifford N. B. Tagoe**
MB, ChB (Ghana) PhD (Leicester)

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- Pro-Vice-Chancellor - **Professor K Yankah**
BA MA (Ghana) PhD (Indiana)
- Registrar - **Mr. J. M. Budu**
BA (Ghana) Dip Ed MA (London)
- University Librarian - **Vacant**

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MB, ChB (Ghana) PhD (Leicester)
- College of Agriculture & Consumer Sciences - **Professor B. K. Ahunu**
BSc (Agric) (Ghana), M Sc (Brit Col), PhD (Alberta)

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- School of Agriculture - **Professor S. K. Offei**
BSc (Agric) (Ghana), MPhil (Lond) Dip (Seed Pathology) (Den), PhD (Lond) DIC
- Faculty of Arts - **Professor E.K. A. Osam**
BA, MPhil (Ghana) PhD (Oregon)
- Faculty of Law - **Professor E.K.A. Quashigah**
LLB (Ghana), LLM PhD (Nigeria)
- Faculty of Engineering Sciences - **Vacant**
- Faculty of Science - **Vacant**
- Faculty of Social Studies - **Vacant**
- Business School - **Mr. S. Takyi-Asiedu (Acting)**

		<i>BSc (K'si) MBA (Ghana)</i>
Medical School	-	Professor Christine Ntim-Amponsah <i>BDS (Ghana), FRCPS, FWACS</i>
Dental School	-	Dr. Grace Parkins (Acting) <i>BDS (Ghana) MSc FEACOP FRCDS (Canada)</i>
School of Allied Health Sciences	-	Professor E.K. Wiredu <i>MB ChB (Ghana) FRCPATH, MIAC FWACP</i>
Graduate Studies	-	Professor Yaa Ntiamoah-Baidu <i>BSc (Ghana) PhD (Edin)</i>
Dean of Students	-	Professor B.K. Banoeng-Yakubo <i>BSc MPhil (Ghana) MSc (Ife) PhD (Ghana)</i>
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Accra City Campus	-	Professor J.F. Wiredu <i>BA (Ghana) PhD (Ibadan)</i>
School of Nursing	-	Professor Onike P. Rodrigues (Acting) <i>MB, ChB (Leeds) FRCP(UK) DCH, FWACP</i>
School of Public Health	-	Professor F.N. Binka <i>MB ChB (Ghana) MPH (Hebrew) PhD (Basel)</i>
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Institute of Adult Education	-	Professor Yaw Oheneba-Sakyi <i>BA (Ghana), MA (SUNY) PhD (Brigham Young)</i>
Institute of African Studies	-	Professor Takyiwaa Manuh <i>LLB (Ghana) LLM (Dar-es-Salaam) PhD (Indiana)</i>
Institute of Agricultural Research	-	Dr. Francis Ofori <i>BSc (Edu) BSc MSc (Ghana) PhD (Western Australia)</i>
Institute of Statistical Social & Economic Research	-	Professor E. Aryeetey <i>BA (Econ) MA (Ghana) MSc (K'si) PhD (Dortmund)</i>
Noguchi Memorial Institute for Medical Research	-	Professor A. K. Nyarko <i>MSc (Ghana) PhD (Philadelphia)</i>
Regional Institute for Population Studies	-	Professor F. Dodoo <i>BA, MA (Washington State) PhD (Pennsylvania)</i>
School of Communication Studies	-	Dr. Audrey Gadzekpo (Acting) <i>BA (Ghana) MA (Brigham Young) PhD (Birmingham)</i>
School of Performing Arts	-	Dr. Awo Asiedu (Acting) <i>Dip in Music (Gh) MME (Montana) PhD (Pittsburgh)</i>

Legon Centre for International Affairs	-	Vacant
Centre for Tropical Clinical Pharmacology & Therapeutics	-	Dr. Francis Ofei <i>MB ChB (Ghana) MRCP (UK)</i>
Language Centre	-	Dr. Sika Ahadzie (Acting) <i>BA, MPhil (Ghana), PhD (Birmingham)</i>
Ecology Laboratory Centre	-	Professor P.K. Ofori-Danson <i>BSc Educ (UCC) MSc PhD (Ghana)</i>
Centre for Social Policy Studies	-	Dr. Ellen Bortei Doku-Aryeetey (Acting) <i>BA (KNUST) MA (Reading) PhD (Michigan)</i>
International Centre for African Music & Dance	-	Dr. A. Darkwa <i>PhD (Wesleyan)</i>
Centre for Migration Studies	-	Dr. Mariama Awumbila <i>BA Grad. Dip (Ghana) PhD (Newcastle)</i>
Centre for Gender Studies & Advocacy	-	Professor Akosua Adomako Ampofo <i>BSc MSc (KNUST) PhD (Vanderbilt)</i>

ADMINISTRATIVE DIRECTORATES/UNITS

College of Agriculture and Consumer Sciences	-	Vacant
College of Health Sciences	-	Mr. F.K. Yeboah (College Registrar) <i>BA, MPA (Ghana)</i>
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Academic Affairs Directorate	-	Mr. E. A. Amartey (Acting) <i>BA MPA (Ghana)</i>
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University Health Services	-	Dr. Eugenia K. Ofori-Adjei <i>MBChB (Ghana) DCH (Lond) MRCP (UK)</i>
Public Affairs Directorate	-	Mrs. Stella A. Amoa (Acting) <i>BA MA (Int. Affairs) (Ghana))</i>
Human Resource and Organisational Development	-	Mrs. Mercy Haizel Ashia (Acting) <i>BA EMBA.(Ghana)</i>
Internal Audit	-	Mr. F.P.K. Agbekoh (Acting) <i>BA (Ghana)</i>

Planning & Management Information Services Systems	-	Mr. A. Quartey (Acting) <i>BSc MBA (Ghana)</i>
Counselling and Placement Centre	-	Mr. J.G. Egyir-Croffet (Acting) <i>BSc (Ghana) MEd PGCE (Cape Coast)</i>
ICT Directorate	-	Mr. Emmanuel Owusu-Oware <i>BSc (Ghana) MBA (Ghana/Vrieje)</i>
Sports	-	Mr. A. Denkabe (Acting) <i>BA (Ghana) MA (Camb)</i>
Medical School	-	Mr. P. B. Yarquah (Acting Executive Secretary) <i>BA Grad. Dip (Comm. Studies) (Ghana) MEd (Birmingham)</i>
Dental School	-	Mr. M. Opare Atuah (Senior Assistant Registrar) <i>BA (Ghana) MPhil (Bergen)</i>
Noguchi Memorial Institute for Medical Research	-	Mr. V. O. Korda (Executive Secretary) <i>BA (Hons) Ghana) DPA, M.Ed Manchester)</i>
School of Nursing	-	Mrs. Mavis Otoo-Ayeh (Senior Assistant Registrar) <i>BA MPA (Ghana)</i>
School of Allied Health Sciences	-	Mr. B. K. Afari-Danso (Administrative Secretary) <i>LLB (Ghana)</i>
University of Ghana Business School	-	Mr. T. Tabi (Executive Secretary) <i>BA MPA (Ghana)</i>
School of Research and Graduate Studies	-	Mr. C. Amehoe (Ag. Executive Secretary) <i>BA (Secretaryship), Dip. Ed (UCC), MA (Ghana)</i>
Institute of Adult Education	-	Mr. D.O. Baidoo (Executive Secretary) <i>BA MBA (Ghana).</i>
Institute of African Studies	-	Ms. Mavis O. Addotey (Administrative Secretary) <i>BA Grad. Dip (Comm. Stud.) (Ghana) Grad Dip. Ed (Cape Coast)</i>
University of Ghana Basic Schools	-	Ms. Cecilia Morrison (Headmistress) <i>Dip. Ed (Winneba) BEd, M.Ed (Cape Coast) PGDE (India)</i>
Student Financial Aid Office	-	Mrs. Adzo Kokui Adu (Financial Aid Officer) <i>Dip. (Data Processing), BSc, (Ghana), MBA (Virginia)</i>
University of Ghana Hostels	-	Mr. Martin Asiedu (General Manager) <i>BSc (Hons) (Land Economy) (KNUST)</i>

HEADS OF HALLS/HOSTELS

Legon	-	Dr. D. Atta-Peters <i>BSc MPhil PhD (Ghana)</i>
Akuafu	-	Rev. Dr. S. K. Gbewonyo <i>BSc MSc (Ghana) PhD (Birmingham) MTS</i>
Commonwealth	-	Professor G. E. Armah <i>BSc, MSc (Ghana), PhD (Osaka)</i>
Volta	-	Dr. Esther O. Sakyi-Dawson, <i>BSc, MPhil (Ghana), PhD (Cornell)</i>
Mensah-Sarbah	-	Dr. J K Adomako <i>BSc MPhil PhD (Ghana)</i>
Post Graduate/Valco Trust Hostels	-	Professor Yaa Ntiamoa-Baidu <i>BSc (Ghana) PhD (Edin)</i>
International Students' Hostel/ Jubilee Hall	-	Vacant

SENIOR TUTORS OF HALLS

Legon Hall	-	Vacant
Akuafu Hall	-	Dr. George Akanlig-Pare <i>BA MPhil PhD (Ghana)</i>
Commonwealth Hall	-	Dr. Thomas Aquinas Adjadeh <i>BSc (Agric) (Ghana) MSc PhD (Iwate)</i>
Volta Hall	-	Mrs. Angelina Armah <i>BA (Hons) Grad.Dip. (Lib. Stud.), M Phil (Info. Stud.), (Ghana)</i>
Mensah-Sarbah Hall	-	Dr. Ted Annang <i>BSc MPhil PhD (Ghana)</i>

ESTABLISHMENT OF THE UNIVERSITY

THE UNIVERSITY OF GHANA was founded in 1948 as the University College of the Gold Coast on the recommendation of the Asquith Commission, on Higher Education in the then British colonies. The Asquith Commission, which was set up in 1943 to investigate Higher Education, recommended among other things, the setting up of University Colleges in association with the University of London. This was followed up by a number of separate Commissions in different regions. The West Africa Commission was under the Chairmanship of the Rt. Hon. Walter Elliot. The Elliot Commission published a majority report which recommended the establishment of two University Colleges in the Gold Coast (Ghana) and Nigeria, and a minority report which held that only one University College for the whole of British West Africa was feasible. The British Government at first accepted the minority report of the Elliot Commission and decided that a University College for the whole of British West Africa should be established at Ibadan in Nigeria. But the people of the Gold Coast could not accept this recommendation. Led by the scholar and politician, the late Dr. J.B. Danquah, they urged the Gold Coast Government to inform the British Government that the Gold Coast could support a University College. The British Government accordingly reviewed its decision and agreed to the establishment of the University College of the Gold Coast.

The University College of the Gold Coast was founded by Ordinance on August 11, 1948 *for the purpose of providing for and promoting university education, learning and research*. Its first Principal was the late Mr. David Mowbray Balme. Mr. Balme was farsighted, courageous and dedicated to the promotion of scholarship. By his vision, industry and single-mindedness of purpose, he built a college and laid the foundations for a sound University which is now a source of pride. In his ten years of Principalship, he created an institution whose keynote was orderly living with dignity in a community of scholars. One of the recommendations of the Asquith Commission was that the British Government should set up an Inter-Universities Council to advise on all matters relating to Higher Education in the new British Colonies. The Inter-Universities Council served the new University College of the Gold Coast in an advisory capacity, but it approved all academic appointments. This arrangement helped the College to maintain the high academic standards associated with the Universities in Britain. Also, it enabled the College to seek support of the Council in obtaining funds from the United Kingdom Government sources.

From its inception, the University College of the Gold Coast was admitted to the Scheme of Special Relationship extended by the University of London to certain English and overseas University Colleges. Under this scheme, the University College was allowed to teach for the external degree examinations of London University. It also allowed the College to modify the London syllabuses to suit local conditions and to take part in the setting and marking of examinations. But London University gave final approval to courses and examinations since the degrees given were those of the University of London. For thirteen years, therefore, the University College looked up to two separate institutions in Great Britain: to the Inter-Universities Council for guidance on its broad policy, and to the University of London for approval and control of details of degree regulations. The University College benefitted greatly from this arrangement which certainly helped to maintain its high academic standards.

In the 1960-61 academic year, the College Council made a request to the Government of Ghana for legislation to constitute the University College into a University with the power to award its own degrees. The Government appointed an International Commission to examine the problem. On the recommendations of that Commission, the University of Ghana was set up by an Act of Parliament on October 1, 1961 (Act 79). The then President of the Republic of Ghana, Dr. Kwame Nkrumah, became the first Chancellor of the University, with Nana Kobina Nketsia IV, *BLitt DPhil (Oxon)*, Omanhene of Essikado, as the (Interim) Vice Chancellor.

ENROLMENT AND GRADUATION STATISTICS: With a current student population of about 42,692 (representing male/female ratio of about 3:2) the University of Ghana is the oldest and largest of the five public Universities in Ghana. Breakdown in terms of programmes are as follows: Post-Graduate students – 2,504; Bachelors' Degrees – 34,354; Sub-Degrees – 5,834. Foreign students currently enrolled in the University are also 1409. Senior Members engaged in research and teaching number 951. Senior Administrative and Professional staff also number 136.

ASSOCIATIONS AND LINKS: The University of Ghana is a member of the International Association of Universities (**IAU**), the Association of Commonwealth Universities (**ACU**) and the Association of African Universities (**AAU**). The University is also a member the **League of World Universities** (which comprises 47 renowned research universities all over the world). The University has also established academic and research links with several Universities and Research Institutions worldwide. In addition, the University has also been linked to the Norwegian Universities' Committee for Development Research and Education (**NUFU**), the Council for International Educational Exchange (**CIEE**) based in New York, International Student Exchange Programmes (**ISEP**) and the Commonwealth Universities Student Exchange Consortium (**CUSAC**), among others.

INSTITUTIONAL AFFILIATIONS: There are currently a number of institutes/colleges locally which hold affiliation with the University of Ghana for the purpose of enrolment, teaching and award of degrees and diplomas of the University. These affiliations cover non-degree, Bachelor's degree and post-graduate degree programmes. Institutes/Colleges which presently hold affiliation status with the University are as follows:

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| 1. St. Peters Seminary (Cape Coast) | - Diploma/Bachelor of Arts |
| 2. St. Paul Seminary (Sowutoum) | - Bachelor of Arts |
| 3. St. Victor's Seminary (Tamale) | - Diploma/Bachelor of Arts |
| 4. Christian Service University College (Kumasi) | - Diploma |
| 5. National Film and Television Institute (NAFTI) | - Bachelor of Arts (Film & Television) |
| 6. Ghana Institute of Journalism (GIJ) | - Bachelor of Arts (Journalism & Public Relations) |
| 7. Regional Maritime University | - Master of Arts (Shipping & Port Management) |
| 8. Ghana Armed Forces Command and Staff College | - Master of Arts (International Relations) |
| 9. Ghana Institute of Languages | - Bachelor of Arts(Translation) |
| 10. Islamic University College | - Bachelor of Arts/Business Administration |
| 11. Pentecost University College | - Certificate/Diploma/ Bachelor of Arts/Business Administration |
| 12. Catholic University College | - Bachelor of Arts/Bachelor of Science (Information/Business/Technology) |
| 13. Methodist University College | - Bachelor of Arts/Business Administration |
| 14. Wisconsin University College, Ghana | - Bachelor of Arts/MA in Adult Education |
| 15. Institute of Accountancy Training | - Diploma in Public Administration |
| 16. Nursing Training Colleges | - Diploma |
| 17. Presbyterian University College | - Bachelor of Arts |
| 18. Narh-Bita School of Nursing | - Diploma |
| 19. African University College of Communications | - Bachelor of Arts |

PRECINCTS

The campus of the University lies about 13 kilometres north-east of Accra, the capital of Ghana, at an altitude of between 90 and 100 metres. From the Main University Gate on the Dodowa Road, the University Avenue extends to Commonwealth Hall on Legon Hill.

Along it are grouped other Halls of Residence, Departments, lecture theatres and laboratories. Mid-way, an open space - the University Square - with an ornamental pool is overlooked by the Balme Library (named after David Mowbray Balme, the first Principal of the University College). Across from the University Square are sports fields, a Central Cafeteria and halls of residence. Behind Commonwealth Hall is an open-air theatre with a Grecian style auditorium built into the slope of Legon Hill. On the summit of Legon Hill is the Convocation Group of Buildings which houses the University's administration offices, the Great Hall, with a seating capacity of 1,500 and a Tower donated by the Government of Ghana in 1959 to commemorate Ghana's Independence. On the southern side of the campus are residential accommodation for staff, the University Basic Schools, the Noguchi Memorial Institute for Medical Research, School of Public Health, Sports Stadium, a night market, supermarket and student hostels; while on the Northern side are more teaching departments, lecture theatres and laboratories. Across the Accra-Dodowa road from the Main University Gate is a Police Station, a University Hospital and housing for Junior Staff of the University.

The College of Health Sciences has its administration as well as the Medical/Dental /Allied Health Sciences and Pharmacy Schools located at the Korle-Bu Teaching Hospital, which is about three kilometres west of the centre of Accra, and about 18 kilometres from the main University campus.

The Accra City Campus of the University, located close to the business district of the nation's capital, was established to provide part-time education for mature persons and for persons who prefer not to study full time.

2. COLLEGE, FACULTIES, INSTITUTES, SCHOOLS AND RESEARCH FACILITIES

Academic life of the University of Ghana is centered around Colleges, Faculties, Institutes/Schools and Centres of Research/Learning.

COLLEGES

COLLEGE OF HEALTH SCIENCES

The College of Health Sciences is constituted by seven Schools which are of the status of Faculty, and one research institute. These are:

MEDICAL SCHOOL: Anaesthetics, Anatomy, Medical Biochemistry, Centre for Tropical Clinical Pharmacology and Therapeutics, Chemical Pathology, Child Health, Community Health, Haematology, Medicine and Therapeutics, Microbiology, Obstetrics and Gynaecology, Pathology, Pharmacology, Physiology, Psychiatry, Radiology, Surgery.

DENTAL SCHOOL: Biomaterial Science; Restorative Dentistry; Paedodontics and Orthodontics; Preventive Dentistry; Oral and Maxillofacial Surgery; Oral Pathology and Oral Medicine;

SCHOOL OF ALLIED HEALTH SCIENCES: Medical Laboratory Sciences, Radiography and Physiotherapy.

SCHOOL OF PUBLIC HEALTH: Health Policy, Planning & Management; Biostatistics, Epidemiology & Disease Control; Population, Family & Reproductive Health; Social & Behavioural Science; Biological, Environmental & Occupational Health Sciences

NOGUCHI MEMORIAL INSTITUTE FOR MEDICAL RESEARCH: An institute for research into medical and paramedical issues. Nutrition, Clinical Pathology, Immunology, Parasitology, Virology, Electron Microscopy, Bacteriology, Animal Experimentation.

SCHOOL OF NURSING: Community Health, Maternal & Child Health, Mental Health, Adult Health, Research, Education and Administration.

SCHOOL OF PHARMACY: The newest member of the College, the School is organized into the following Departments: Pharmaceutical Chemistry, Pharmaceutics and Microbiology, Pharmacognosy and Herbal Medicine, Pharmacology and Toxicology, Pharmacy Practice and Clinical Pharmacy

COLLEGE OF AGRICULTURE AND CONSUMER SCIENCES

The College is constituted by two Schools and three Research Institutions.

SCHOOL OF AGRICULTURE: Agricultural Economics and Agribusiness, Agricultural Extension, Animal Science, Crop Science, Home Science and Soil Science.

LEGON AGRICULTURAL RESEARCH CENTRE: Research into animal breeding, animal nutrition, veterinary medicine, pasture improvement and the development of dairy cattle by crossbreeding.

KPONG AGRICULTURAL RESEARCH CENTRE: Researches into crops and merchandized irrigation agriculture on blank soils (vertisols) of the Accra plains.

KADE AGRICULTURAL RESEARCH CENTRE: Researches into production of forest zone crops with special interest in agroecology of Perennial crop plants.

SCHOOL OF VETERINARY MEDICINE: The School will maintain cutting edge excellence in basic and applied biomedical and veterinary sciences research with emphasis on control of animal diseases and the control of such diseases with the potential for transmission to humans.

FACULTIES

ARTS: Classics, English, Language Centre, Linguistics, Modern Languages (Arabic, French, Russian, Spanish, Swahili), Mathematics, Philosophy, Study of Religions and The School of Performing Arts (with Departments of Dance Studies, Music and Theatre Arts).

LAW: (non-departmentalized).

SCIENCE: Biochemistry, Botany, Chemistry, Computer Science, Fisheries and Oceanography, Geography & Resource Development, Geology, Mathematics, Nutrition and Food Science, Psychology, Physics, Statistics and Zoology.

SOCIAL STUDIES: Archaeology, Economics, Geography and Resource Development, History, Information Studies, Mathematics, Political Science, Psychology, Statistics, Sociology and Social Work.

BUSINESS SCHOOL: Accounting, Public Administration & Health Service Management, Marketing & Consumer Management, Banking & Finance, Organization & Human Resource Management and Management Information Systems.

ENGINEERING SCIENCES: Agricultural, Biomedical, Food Process, Materials Science and Engineering (Ceramics Option) and Computer Engineering.

RESEARCH INSTITUTES AND SCHOOLS

THE BUSINESS SCHOOL: The Business School was originally established by statutory instrument in January 1960, as the College of Administration, at Achimota. It had begun as the Department of Commerce in the then Kumasi College of Technology (now Kwame Nkrumah University of Science and Technology); this Department was transferred to the Western Compound of Achimota to form the nucleus of the College of Administration. The main idea behind the transfer was that the new College would serve as a comprehensive institution, which would provide various training programmes required to meet the needs of administrative and accounting personnel in the rapidly expanding economy of Ghana. The move was also intended to give the College scope for expansion within the relatively more mature business environment of Accra and to afford both Faculty and students opportunities for close contact with the business community. The College was responsible for organizing courses in Accounting, Secretaryship, Central and Local Government Administration and Hospital Administration. These courses led to the examination of United Kingdom statutory bodies: The Association of Certified and Corporate Accountants (ACCA), The Chartered Institute of Secretaries (CIS), The Corporation of Certified Secretaries (CCS), The Clerical Examinations for Local Government Officers (NALGO) and Institute of Hospital Administration. Though useful, the courses were not fully satisfactory because they were foreign oriented, dealing mainly in United Kingdom institutions and were not properly adapted to experience and practice in Ghana. It was, therefore decided in 1961 to reshape them and make them more relevant to national needs. In order to give the study of Administration its proper place in the country's higher education system, and to attract the

best candidates, it was decided that courses run by the College should be at University level. It was thus agreed that the College of Administration should be associated with the University of Ghana and its main courses developed to the University's degree standard. Hence in October 1962, the College of Administration was integrated into the University of Ghana. The College was given a status comparable to that of a faculty in the University and was redesignated School of Administration. Its students were gradually moved from Achimota to the University's students' Halls of Residence at Legon, and on February 18, 1967, the new building of the School, centrally situated at Legon, was opened. In 2004, the name was once again changed to the Business School. The School is governed by the Statutes of the University and controlled by the University Council and the Academic Board. It does, however, continue to receive earmarked grants direct from Government, and within the framework of general University-wide policy, maintains a good degree of freedom to develop its own associations and schemes. It has a mandate to organize courses and seminars from time to time either on its own or in association with other bodies, to satisfy identified areas of need in the fields of Business and Public Administration.

THE MEDICAL SCHOOL: established in 1964 by command of government under the Ministry of Health as an autonomous institution in special relationship with the University of Ghana. The primary objectives of the Ghana Medical School (as it was then known) was to train:

- i. A broad-based generalist practitioner with sufficient grounding for subsequent specialization.*
- ii. a practitioner functionally attuned to and therefore responding aptly to the needs and exigencies of his/her environment. He/she shall attain internationally accepted standard.*
- iii. a practitioner who has participated in health care delivery while under instruction and therefore cognisant of the problems of delivery of health care in the rural/urban settings.*
- iv. an individual who accepts responsibility for self-learning and therefore readily responsive to the call for continuing medical education; and*
- v. an advocate for community health needs.*

Arrangements to integrate the medical school formally into the University of Ghana were concluded in 1969 in time to permit the award of the degrees of Bachelor of Medicine and Bachelor of Surgery (MB ChB) of the University of Ghana (Legon) to the first class of 39 medical graduates to be trained in Ghana. The Ghana Medical School thus became the University of Ghana Medical School in October 1969. However, it still retains its financial autonomy and has its own Executive Council and School Board. These arrangements have been given legal backing under the provisions of Schedule D of the Statutes of the University. The curriculum of the School has been revised on three occasions (1972, 1980 and 1991) to further enhance the training of doctors. Currently, the curriculum allows for courses leading to the award of a BSc degree in Medical Science in addition to the MB ChB professional degree. The Medical School is the largest single faculty of the university, presently.

THE DENTAL SCHOOL: The University of Ghana Dental School was established in 1995, even though basic dental training of dentist locally had been in place as far back as 1972. Before then the clinical training had been pursued outside the country, in the Universities of Manchester, London and Lagos. Candidates who completed their dental training in these universities were awarded University of Ghana degrees. At its establishment, the Academic Board decided that the new Dental School should operate under the umbrella of the University of Ghana Medical School until such time that it can stand on its own feet. The arrangement also provided for a coordinator of Dental Programmes, and later on updated to Vice Dean of Dental Studies of the Dental School, who will function under the Dean of the Medical School.

SCHOOL OF ALLIED HEALTH SCIENCES: The Ministry of Health, in 1998, initiated the establishment of a School of Allied Health Sciences to produce medical and dental technical graduates through the Medical School. Programmes for this school included physiotherapy, medical laboratory science, radiography and therapy radiography. The Academic Board and the University Council approved this proposal in 1999. In the year 2001, this School came into being as one of the constituent schools of the newly established (in 2000) College of Health Sciences. An earlier Diploma in Medical Laboratory Technology also sponsored by the Ministry of Health in 1994 was phased out, with the birth of the School of Allied Health Sciences.

SCHOOL OF NURSING: The School was formerly a Department in the Faculties of Science and Social Studies. In 2003 the University Council approved its conversion into a School. It is currently one of the constituents of the College of Health Sciences. The School has a strong link with the University of Alberta in the running of its MPhil programme. It offers undergraduate and graduate programmes in Community Health Nursing, Maternal & Child Nursing, Mental Health Nursing, Adult Health Nursing and Research, Education & Administration.

SCHOOL OF PUBLIC HEALTH: The School of Public Health was established in October, 1994, through collaboration between the Ministry of Health in Ghana and the University of Ghana, primarily to train public health workers to enable them perform effectively at District, Regional and National levels within governmental, quasi-governmental, non-governmental and private organizations. The programmes are also available to non-health personnel whose activities have an impact on the environment and public health. Properly trained Public Health personnel will be able to offer technical leadership in critical units such as Maternal and Child Health/Family Planning, Environmental Diseases Control, Health Information, Training, Research and Planning and in the running of specific disease control programmes such as AIDS, Tuberculosis, Leprosy and Onchocerciasis Control Programmes. The philosophy of the School is to operate as a "*School without Walls*" with semi-autonomous status, but with a close working relationship with the existing Schools and Faculties of the University. It is one of three Public Health Institutions in Africa that subscribe to the philosophy of school without walls meaning that attempts are made to achieve an optimum mix of classroom and field work. The School admitted its first batch of students for the MPH programme in October 1994. In addition to its range of academic programmes, the School offers short certificate courses on specific health issues. Effective January 1, 2000, the School of Public Health became one of the health-related institutions grouped under the College of Health Sciences.

INSTITUTE OF AFRICAN STUDIES: Established in 1961, it conducts fundamental research in areas of African Languages, history and culture, and runs interdisciplinary courses leading to MPhil and PhD degrees in African Studies. The Institute also organizes introductory courses in African Studies for all Level 200 students in the undergraduate degree programme of the University. These courses, which cover two semesters, are compulsory. A pass in African Studies is required for the award of a bachelor's degree of the University. Orientation courses are available for special admission students from other institutions and agencies. Interdisciplinary seminars and symposia are organized regularly. There is a Visual Arts Section with cultural exhibits for teaching and research. The Institute's library supplements the Africana collection of the Balme Library. Attached to the Institute is the Ghana Dance Ensemble – a resident professional dance company which was started in 1962 by the then Ghana Institute of Arts and Culture to link the University of Ghana with the national theatre movement.

INSTITUTE OF ADULT EDUCATION: Established originally as the Department of Extra-Mural Studies in 1948, the Institute provides university-based adult education through its branches and workers' colleges throughout the country. It provides both formal and non-formal programmes. The formal programmes consist of Diploma, degree and Masters and Doctoral

degree courses in Adult Education and remedial courses for the West Africa Senior Secondary School Certificate Examinations (WASSCE), as well as a preparatory course for the University's mature students selection examination. The non-formal programmes comprise community education programmes in health, family life education, nutrition, civic education, community initiative and adult literacy. The Institute is directly involved with the organisation of a People's Education Association to support its work. Public lectures, seminars and workshops form a vital part of the Institute's activities. The most popular and national of these is the Annual New Year School which has been held regularly since 1948. The Institute also coordinates the University's distance learning programme.

INSTITUTE OF STATISTICAL, SOCIAL AND ECONOMIC RESEARCH: Established in 1966 as the Institute of Statistics. In addition to its original concern with problems related to statistics, the Institute has expanded into the field of social and economic studies. The Institute offers Certificate and Diploma courses in Statistics as well as a Master of Arts degree in Development Studies.

NOGUCHI MEMORIAL INSTITUTE FOR MEDICAL RESEARCH: The Institute was established in 1979 in a building funded by the Government of Japan to serve as a monument in memory of Dr. Hideyo Noguchi, a Japanese medical scientist who died in Accra in May, 1928 while investigating yellow fever. The Institute provides a base for medical co-operation programmes between Ghanaian and Japanese scientists, and a centre for conducting medical research relevant to Ghana's needs. Research is conducted into problems of communicable diseases while graduate students are trained in medical research. Facilities at the Institute include specialized laboratories and services in support of public programmes. From January 1, 2000, the Institute became one of the health-related institutions grouped under the newly established College of Health Sciences.

REGIONAL INSTITUTE FOR POPULATION STUDIES: Established jointly in 1972 by the United Nations Organisation and the Government of Ghana, it promotes and strengthens research and training in demography for students from English-speaking countries in Africa. The Institute offers MA, MPhil and PhD degree courses. The Institute organizes seminars, workshops, ad hoc courses of study and in-service training in Demography and related fields at the request of governments and institutions mainly in English-speaking African countries. Given its regional and international character, a significant number of the Institute's students come from other African countries.

SCHOOL OF COMMUNICATION STUDIES: Established in 1973 as the Institute of Journalism and Mass Communication, the School offers programmes leading to the MA and MPhil degrees in Communication Studies. It provides future journalists and media practitioners with the theoretical understanding and the professional skills and techniques required in the mass media.

SCHOOL OF PERFORMING ARTS: Established in 1962 as the School of Music and Drama under the Institute of African Studies, it comprises the Department of Dance Studies, Department of Music and the Department of Theatre Arts. These three departments provide core courses for diploma, bachelor's and post-graduate degrees in Music, Theatre Arts and Dance. The School also runs a Bachelor of Fine Arts (BFA) and Master of Fine Arts (MFA) degree programmes. Occasionally, the school organizes one-year certificate courses in Theatre Arts for foreign students on special admission. Training programmes for teachers and schools, amateur drama groups, choirmasters and singing groups are also available. The School has a Resident Theatre Company called 'Abibigromma'.

SCHOOL OF RESEARCH AND GRADUATE STUDIES: The School of Research and Graduate Studies is responsible for graduate students and research. There is a separate Handbook for Graduate Studies. The Office deals with all matters which have to do with registration and records, official correspondence and welfare of graduate students. The Office of the Dean of Research and Graduate Studies is headed by a Dean who is of professorial status and appointed by the Academic Board. He/she is assisted by an Executive Secretary, a Research Administrator and a team of administrative staff. The other important function of the School is the Research Administration. The function includes Grant Applications and Reporting, Contract Report (including Consultancy), Ethical Clearance, Registration, Patenting, Commercialization of Intellectual Property and Management of External Funds.

ACCRA CITY CAMPUS (Formerly the External Degree Centre): The City Campus grew out of the 1960 Commission on University Education in Ghana which recommended the organization of courses leading to the degrees of the University of Ghana for persons who intend to study for such degrees on part-time basis. It started as the External Degree Centre, established by the University of Ghana during the 1963/64 academic session and charged with the responsibility of offering on part-time basis courses in the Humanities available to full-time students of the University of Ghana except, perhaps, the laboratory based courses. The Academic Board subsequently decided to make the Institute of Adult Education the implementing agency and the Accra Workers College as the venue. Two main categories of persons were identified for the programme.

- i. *Persons who are normally qualified for university education but who, for various reasons, prefer not to study as full-time students;*
- ii. *Person who are considered "Mature" and capable of pursuing degree programmes but who do not possess the requisite university entry qualifications. Applicants who fall into this category are required to be at least 30 years of age at the time of submitting application. They are also required to pass an examination conducted by the university which is intended to test intellectual capability and promise rather than knowledge of particular subject.*

The External Degree Centre offered courses leading to the BA and BSc (Administration) degrees. The syllabuses and other requirements for the degrees are the same as those used by the University of Ghana for full-time students except that study at the Centre is part-time/off-campus and duration extends over a period of not less than eight semesters and not exceeding 12 semesters.

The External Degree programme was originally conceived as a university programme in which all departments in the Faculties of Arts, Social Studies, Law and Administration would participate. The courses offered at the Degree Centre are taught by lecturers from the faculties of the University who are recruited through their Heads of Department. This arrangement was adopted to ensure that lecturers who teach the courses on campus are the same lecturers who teach at the External Degree Centre. Part-time students at the External Degree Centre were, therefore, not to be disadvantaged vis-à-vis their full-time colleagues since both groups of students wrote the same examination. The arrangement thus guaranteed parity of esteem between the on-campus and off-campus programmes.

In 2002, the Academic Board of the University approved an arrangement to transform the External Degree Centre into the Accra City Campus of the University of Ghana, to offer part-time degree programmes in Bachelor of Arts (BA) and Bachelor of Science in Administration (BSc Admin). Admission is on fee-paying basis and students are free to subscribe to

programmes/subjects of their choice. Time-tabling is made flexible so as to accommodate the needs of workers. Entry requirements remain the same as for admission to the main University.

CENTRES OF RESEARCH/LEARNING

REGIONAL TRAINING CENTRE FOR ARCHIVISTS: Since 1974, the University has hosted the Centre within the Department of Library and Archival Studies. It offers a sub-degree Diploma course in Archives Administration for anglophone countries in Africa as well as a Graduate programme in Archival Studies. In the 2000-2001 academic year, a Bachelor 's degree programme in Library, Archives and Information Studies was added to its range of academic programmes. The Department of Library and Archival Studies has assumed a new name: The Department of Information Studies, a move aimed at bringing the name of the department to fall in line with the new focus of its work.

LANGUAGE CENTRE: The Language Centre was founded in 1970 as a Centre for research in Language use in Ghana, having the status of a department in the Faculty of Arts. For the first ten years of its existence, it was supported by a grant from the Carnegie Corporation, which funded the building it occupies. It later received Ford Foundation support, especially for staff development. The British Council supplied its Language Laboratory in 1980 and has provided small sums at various times. The focus of the Centre is on research and teaching related to the improvement of performance in the languages used in Ghana as vectors of education, culture and community interaction - English, the official language, and various Ghanaian languages.

CENTRE FOR TROPICAL CLINICAL PHARMACOLOGY AND THERAPEUTICS: The Centre for Tropical Clinical Pharmacology and Therapeutics was established in the University of Ghana Medical School in 1982 with a grant from the UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases (TDR). The grant was to increase research and training capabilities in Clinical Pharmacology, especially pharmacokinetics of antimalarial, antischistosomal and antifilarial drugs. The grant period was from 1982-1986. The Centre has the status of a department in the Medical School. The principal activities of the Centre are directed towards achieving the institutional objectives of the University of Ghana Medical School.

LEGON CENTRE FOR INTERNATIONAL AFFAIRS (LECIA): The Legon Centre for International Affairs, LECIA, was established by the University of Ghana in December, 1989. Its central purposes are:

- i. *the inter-disciplinary postgraduate academic training for qualified applicants and Foreign Service personnel;*
- ii. *the organisation of seminars, workshops, and short courses on specified subjects of current international interest;*
- iii. *research and publication in the areas of International Affairs, International Law and Practice.*

The Centre runs a 12-month course in International Affairs leading to the award of an MA degree in accordance with the existing University of Ghana Regulations.

THE INTERNATIONAL CENTRE FOR AFRICAN MUSIC AND DANCE: The International Centre for African Music and Dance was established at the University of Ghana in the 1992-93 academic year to serve as a focus for the development of materials and programmes in African Music and Dance that meet the needs of scholars, research students and creative artists. It is intended:

- i. *to provide a forum for international meetings, conferences, seminars, workshops and special events in African music and dance;*
- ii. *to serve as an Archival Documentation and study centre for African Music and Dance;*
- iii. *to promote and coordinate research, creative and development projects in music and dance;*
- iv. *to prepare and publish monographs, source materials, bibliographies and an International Journal of African Music and Dance, and to serve as a clearing house for information on events, artists, scholars and institutions concerned with the study and promotion of African music and dance.*

The Centre operates as a unit within the School of Performing Arts which offers diploma and degree courses of the University of Ghana in music, dance and drama. In addition to participation in the Centre's programmes, visiting scholars and students affiliated to the Centre will be able to avail themselves of the classes and private lessons in African music and dance given by the traditional musicians and dance instructors of the School as well as the facilities of the reference library of the Institute of African Studies which is adjacent to the School of Performing Arts and which has a valuable collection of Africana. The Centre is governed by an International Advisory Board consisting of three ex-officio members and twelve ordinary members, six of whom represent the major sub-regions of Africa, while the remaining six represent institutions and scholars in Asia, Europe, North America, Latin America and the Caribbean. The Centre has three categories of membership:

- i. *Associate Membership, offered to directors of cooperating institutions, scholars in ethnomusicology, music education, dance ethnology or related fields who have good track record of research and publications, and creative artists who have distinguished themselves in some area of African performing arts.*
- ii. *Ordinary Membership, open to individuals through journal subscription, and*
- iii. *Corporate Membership, offered to music and dance organizations and institutions with manifest interest in African music and dance.*

The programmes of the Centre take into account the need for developing materials and resources that will make it a conference and study centre, a base for the dissemination of knowledge and materials about African music and dance as well as a place for organizing short term training programmes, including management training seminars in culture and development with particular reference to African music and dance. To enable scholars and creative artists from other African countries to contribute to this programme or use the facilities of the Centre for research and writing or presentations, provision has also been made for a few visiting Fellowships. Other scholars and artists coming on their own can register with the University of Ghana as affiliates or associates of the Centre.

OTHER RESEARCH UNITS AND FACILITIES

VOLTA BASIN RESEARCH PROJECT: The Volta basin refers to the approximately 400,000 sq. km drained by River Volta and its tributaries in the West African countries, Cote d'Ivoire, Burkina Faso, Togo, Benin, and Ghana where the basin makes up about 70 percent of the mainland. The Volta Basin Research Project (VBRP) was established by the University of Ghana in 1963 to carry out, through a multi-disciplinary methodology, research into the positive and negative changes within the Volta basin, following the damming of river Volta at Akosombo and, subsequently, downstream at Akuse, and the consequent creation of artificial lakes behind the dams. As with many major river basin development projects, it was deemed imperative to conduct pre-impoundment studies on what would be lost irretrievably after the damming, scientifically monitor and appraise continuously the expected multi-faceted social and economic impacts, and formulate measures against the many adverse effects that such a major

environmental disruption was bound to cause nationally and internationally. The five major areas identified for research were fisheries agriculture, hydrobiology, public health, socio-economic development, and archaeology. Traditionally research work is vested in full-time Research Fellows who, also, partly teach in the Departments to which they, together with their Technicians, are attached. Through this arrangement, the VBRP has generated substantial scientific information about the Volta basin, and contributed significantly towards its socio-economic development by discovering solutions for problems associated with the damming.

LEGON SEISMOLOGICAL OBSERVATORY: The Ghana Geological Survey Department has installed seismological equipment in the University's Department of Geology as part of a Telemetric Seismograph Network. The main station at Legon is served by a number of smaller stations located in the south-eastern part of Ghana (Tema, Shai Hills, Akosombo, Koforidua, Kukurantumi, Weija and Winneba) which transmit signals by radio waves. The network monitors seismic activities in the country.

LEGON BOTANICAL GARDENS: The Legon Botanical Gardens covering an area of approximately 25 hectares supports the scientific research of the Department of Botany. It contains plant species of the tropics and semi-tropics, including a large collection of palms from various tropical areas. In addition to the sale of plants and wreaths, landscaping and horticultural services, there are facilities in the gardens for picnics by individuals, families and social groups.

AGRICULTURAL RESEARCH CENTRES: There are three Agricultural Research Centres; at Legon (about 12 kilometres outside the main campus), Kpong on the Accra plains (about 90 kilometres north-east of Legon), and Kade in the Forest Zone, in the Eastern Region (approximately 175 kilometres from Legon), under the supervision of the Institute of Agricultural Research of the College of Agriculture and Consumer Sciences. Apart from research, the Centres provide technical and practical experience for students of agriculture, and extension and training facilities for farmers and other interested persons.

- ***Legon Agricultural Research Centre:*** The Centre at Legon (established in 1953) covers an area of about 740 hectares. Its main research activities are in animal breeding, animal nutrition, veterinary medicine, pasture improvement and the development of dairy cattle by crossbreeding.
- ***Kpong Agricultural Research Centre:*** The Kpong Centre (established in 1954) covers an area of about 420 hectares. It conducts research mainly into rice, sugar cane, cowpea, soya bean, sorghum and beef cattle. The Station also conducts research on mechanized irrigation agriculture on black soils (vertisols) of the Accra Plains.
- ***Kade Agricultural Research Centre:*** The Centre at Kade (established in 1957) covers an area of 99.3 hectares. It is mainly concerned with research into production of forest zone crops such as citrus, plantain, cocoyam, oil palm and rubber, with a special interest in agronomy of perennial crop plants.

LIBRARY FACILITIES: The University library system consists of the main library, the Balme Library and libraries of Schools, Colleges and Institutes as well as Departmental and Hall libraries. Together they form the library facilities that support teaching, learning and research in the University. Non-members of the University are allowed use of these volumes but do not have borrowing rights. The University library system has been automated using the Innopac Millennium Library Management System. Resources of the Library System may be searched online at <http://library.ug.edu.gh>. Available also are online academic databases covering all the subject disciplines.

CENTRE FOR REMOTE SENSING & GEOGRAPHIC INFORMATION SERVICES

(CERSGIS): The Centre for Remote Sensing & Geographic Information Services was established in 1993 as the Remote Sensing Applications Unit ; a self-accounting Unit in the Department of Geography and Resource Development with a mandate to provide Remote Sensing and Geographic Information Systems (GIS) services and to assist research in land and water resources appraisal and monitoring, including rural and urban land use patterns and trends. It also supports the teaching programmes of the environmental and resource based departments, namely Geography and Resource Development, Geology, Botany, Agriculture and Physics. The establishment of the Unit became necessary because of the establishment of a remote sensing applications laboratory and an ecological laboratory in the Department of Geography and Resource Development. The establishment of the laboratories was made possible through the generous assistance of the United Nations Development Programme (UNDP) and the Danish Government through the Institute of Geography under a linkage arrangement between the Universities of Ghana and Copenhagen (Denmark). The Ecological laboratory is equipped with modern facilities to undertake a large range of analysis including plant materials, soil conditions, water and sediments. The combination of a remote sensing laboratory and an ecological laboratory provides ideal facilities for multi-disciplinary approaches to resource and environmental problems which are bound to have far reaching implications not only for the quality and relevance of teaching and research in the University but also for the quest for the sustainable development of the resources of Ghana.

ECOLOGY LABORATORY CENTRE: The Ecology Laboratory at the University of Ghana, Legon was initiated in 1993 through DANIDA financial ENRECA – project. During the first project period, 1993–95, the Ecology Laboratory was equipped with instruments for conducting chemical and physical analysis on soil, water and plant samples. The second project period, 1997–9 was intended to support teaching and interdisciplinary research programmes on nutrient cycling, ecology and biodiversity. This is reflected in the composition of membership of the Centre’s Advisory Board and Technical Committee, to represent a wide range of Departments. The Centre is aimed, among others, at supporting interdisciplinary research activities, to facilitate necessary field research for researchers and PhD students; to encourage exchange of scientists and technicians between Ghana and Denmark; to conduct training courses on topics of interest to activities of Ecology Laboratory Centre and to organize seminars and workshops. The Ecology Laboratory Centre is located in the building housing the Ecology Laboratory at the Department of Geography and Resource Development

CENTRE FOR SOCIAL POLICY STUDIES: The Centre for Social Policy Studies was established in December, 1997 primarily to develop and improve social welfare services in Ghana. It is intended to fill a need for social welfare policy research in Ghana. The challenge is to provide a forum that can play a co-ordinating role for the establishment of social development network and at the same time to involve the general public in the process of social welfare policy development. The Centre aims at creating greater awareness on social welfare policy issues in Ghana and promoting participatory development of policies and social service programmes of action. In this respect, the Centre focuses on interdisciplinary projects that emerge from its own programmes as well as those of cognate departments, agencies, organisations and institutions. Specifically, policy areas to be covered through the Centre’s programmes and activities are: the development of the child; poverty, nutrition and household dynamics; family welfare; health; gender issues; ageing; community participation/community welfare; labour issues; environmental issues; population and development. Because of its coordinating role, the Centre serves as a Documentation and Information centre on social welfare policy for students, researchers, policy makers and professionals in the social service field. The centre has a specialised library of reference materials not available elsewhere on

campus and produces a Social Policy handbook which covers a wide range of policy issues, carrying both information and programme experiences.

CENTRE FOR GENDER STUDIES AND ADVOCACY (CEGENSA)

Established in 2005 and launched in 2006, the centre's key role is to ensure that gender issues become legitimate business of the university. This role includes academic, policy and service functions over 7 core areas: Academic Planning and curriculum development; Research & Documentation; The provision of a resource centre; The provision of a Sexual Abuse counseling centre; Policy planning; Developing mentoring programmes particularly for junior female faculty and students; Outreach and extension work within the university as well as the wider society.

CENTRE FOR MIGRATION STUDIES

The Centre for Migration Studies was formally established in October 2006 at the University of Ghana to undertake research, teaching, training, capacity building, policy assessment, development and dissemination in the area of migration. Its mission is to serve as a leading centre for the study of contemporary and future migration dynamics within and outside Ghana through a strategic and integrated approach.

3. ADMISSION REQUIREMENTS

PREAMBLE

The University of Ghana is a co-educational secular institution of higher learning, offering a wide range of academic programmes to which it admits applicants with different academic backgrounds. The University's academic programmes cover sub-degree certificates/diplomas, bachelors' degrees, masters' and doctoral degrees. As a policy, the University admits applicants from all races and nationalities, irrespective of their religious, cultural, social or ethnic persuasions. There is no minimum age limit for admission to any of the approved programmes of study in the University of Ghana.

SUB-DEGREE CERTIFICATE/DIPLOMAS

Applicants for admission must have obtained at least passes in Core English, Core Mathematics, Core Social Studies, Core Integrated Science and two electives at the Senior Secondary School Certificate Examination (SSSCE) or West African Senior School Certificate Examination (WASSCE) or the Post-Secondary Teachers Certificate 'A' of the Ministry of Education of Ghana or any relevant professional qualification approved by the Academic Board. Other suitable candidates who pass a special qualifying examination may be admitted. In addition, candidates must have satisfied approved departmental requirements.

BACHELORS' DEGREES

The general requirements for entry to Levels 100 and 200 of the bachelor's degree programmes are as follows:

- i. **Senior Secondary School Certificate/ West African Senior School Certificate Examination:** Passes in the four core subjects, namely, *English, Mathematics, Integrated Science*, and *Social Studies* and *Three Elective Subjects*, with an aggregate score of 24 or better in the Senior Secondary School Certificate Examinations (SSSCE) or West African Senior School Certificate Examination (WASSCE).
- iii. **Other Qualifications:** Other qualifications include International *Baccalaurette (IB)*, *IGCSE*, *GCSE* the *American Grades 12 and 13 examinations* and other external qualifications which have equivalences to the SSSCE or the WASSCE. Candidates with external qualifications are admitted to either Level 100 or Level 200, depending on the nature of qualification and their equivalences to local qualifications.

iii Direct entry to the next higher level is possible if a course of approved content has been taken in a recognised institution. Additional Faculty and Departmental (Subject) requirements must be satisfied. Normally, bachelor's degree courses (BA, BSc, BMus, BFA) are of a 6-Semester (3-year) duration for candidates with certificates of the General Certificate of Education and its equivalent, and an 8-Semester (4-year) duration for candidates who possess the Senior Secondary School certificate or its equivalent. The post-first degree Bachelor of Laws (LLB) degree is of a 4-semester (2-year) duration. The Bachelor's degrees in Medicine and Dentistry normally last 11 semesters (5½ years). Bachelor's degrees in Business, Agriculture, Arts, Law, Science, Social Studies, Pharmacy, and Engineering Sciences are classified (**First Class, Second Class-Upper Division, Second Class-Lower Division, Third Class** and **Pass**). Degrees are awarded with **Honours** to candidates who attain Third Class or higher. The Bachelor of Science in the Medical Sciences [BSc Med. Sci], Bachelor's degrees in Medicine and Surgery (MB ChB), Bachelor of Dental Surgery (BDS) as well as BSc in Allied Health Sciences are not classified. They may, however, be awarded with **Distinction** or **Credit** in the various disciplinary subjects.

MATURE STUDENTS

Mature persons applying for admission, who do not satisfy the approved requirements, must have attained the minimum age of 30 years at the time of submitting their applications. Successful candidates are selected on the basis of a competitive selection examination in English (Essay, Comprehension, Grammar and Usage) and General Paper (Quantitative Methods, Critical & Logical Thinking and Current Affairs). A candidate shall be deemed to have passed the examination for consideration for admission if he/she obtains a minimum of Grade C (40%) in each paper. Successful candidates are admitted to Level 200.

HIGHER DEGREES

Applicants for admission to higher degrees must hold good bachelors' degrees in appropriate subjects. All higher degrees are open to graduates of other approved universities. For Master of Philosophy degrees, at least two semesters must be spent studying in the University. For the PhD, at least two semesters for graduates of the University of Ghana and at least four semesters for those of other universities must be spent in this University. Thereafter, subject to approval by the Board of Graduate Studies, candidates may pursue their studies outside the University. Master of Arts programmes are of a two-semester full-time or four-semester part-time duration.

VISITING STUDENTSHIP (SPECIAL ADMISSIONS)

This operates under the principle of Academic Credit Transfer, requiring the recognition by one higher educational institution of courses, study periods and examinations which have been completed in another higher educational institution. Under this scheme, students who have completed two years of higher education at their overseas universities are admitted to spend a third year of study at the University of Ghana under close supervision of the host institution, after which they return to complete their final year at their home university. Acceptance is normally based on the applicant's previous academic record and his/her proposed programme. Applicants must have an academic record that is above average. Credits earned under this special study programme are transferable. To be eligible for participation in this programme, therefore, one must have obtained a minimum Cumulative Grade Point Average (CGPA) of 3.00 on a 4.00 point scale.

OCCASIONAL STUDENTSHIP

Non-members of the University may be admitted to be part of courses for up to one session/semester, subject to the approval of the Dean of Faculty and the Head of Department concerned, and upon payment of a fee. Such persons are not eligible to take university examinations.

FOREIGN STUDENTS

The University attaches great importance to the cross-cultural experience that is made possible by the presence of foreign students on campus. The successful participation of international students in our courses has helped us to acquire an excellent reputation for the quality of our teaching and research and of our student care services. We pride ourselves on the attention given to the individual needs of our students, whatever their cultural backgrounds. Foreign students may pursue courses towards the award of University of Ghana degrees, or as visiting students, study for the degrees of their own universities. Foreign students may be admitted if they hold qualifications equivalent to those listed above. Evidence of command of the English Language at the SSCE/WASSCE or its equivalent is required. There is a one-year English proficiency course (without specific entry requirements) for candidates who do not have the requisite English background.

TRANSFER STUDENTS

The University admits a limited number of students who are already enrolled in other Universities, though local transfers are not usually allowed. Such students transfer from their university to the University of Ghana to complete their course of study for a degree/diploma of the University of Ghana. A student transferring from one university to this university should accumulate a minimum study period of 4 semesters as a full time student in this university before he/she becomes eligible for graduation. The classification of the degree will be based only on the courses taken at this University.

REGISTRATION AND ORIENTATION

The University requires all freshmen to report at least one week before the commencement of the academic year to go through a process of registration and orientation. Orientation is compulsory for all freshmen. All students are required to register fully with the Hall of Residence/Attachment, the Academic Affairs Directorate and the relevant Faculty/Department(s).

All enquiries about admissions should be addressed to:

*The Director (Academic Affairs Directorate),
University of Ghana,
Registrar's Offices
P. O. Box LG 25,
Legon, GHANA*

4. STUDENT FACILITIES AND SOCIETIES

HALLS OF RESIDENCE/HOSTELS

The University believes in community living as an essential part of student life. It is therefore primarily residential, providing accommodation in Halls of Residence for both under-graduate and post-graduate students as well as flats and guest rooms for senior members and guests. There are five halls of residence (available to all students) and several Hostels. The present Halls and Hostels in their order of seniority, are as follows:

- Legon Hall** (*males and females*)
- Akuafu Hall** (*males and females*)
- Commonwealth Hall** (*males only*)
- Volta Hall** (*females only*)
- Mensah Sarbah Hall** (*males and females*)
- Postgraduate Hostel** (*postgraduate students only*)
- Valco Trust Hostel Annex** (*postgraduate students only*)
- International Students' Hostel** (*mainly for International Students*)
- SSNIT Hostels [Ghana Hostels Limited]** (*males and females*)
- Jubilee Hostel** (*males and females*)

Each Hall consists of junior members (students) and senior members (academic and senior administrative and professional staff), and is managed by a Council comprising members elected by persons belonging to the Hall. The Master (or Warden in the case of Volta Hall) is the Head of the Hall. Each Hall has Junior and Senior Common Rooms for students and Faculty, respectively. A tutorial system offers an opportunity for counselling students and ensuring their welfare at both academic and social levels. Students maintain interaction with each other and the wider community through recognized clubs and societies. Each Hall has a kitchen and a dining hall to cater for students' feeding. Chapels and a mosque are also available for use by various religious denominations. A Chaplaincy Board co-ordinates the activities of religious groups. Social life on the campus is organized mainly by the Students' Representative Council and the Junior Common Room Committees which provide various kinds of entertainment.

LEGON HALL: Legon Hall was the first to be built on the permanent site of the University of Ghana at Legon and is, therefore, the Premier Hall of the University. Its foundation tablet was laid during the Michaelmas Term of 1951 and, in September 1952, the first undergraduates were accepted into residence. On Trinity Sunday, 31st May 1953, the first service was held in the Chapel and the first meal served in the Dining Hall. From these events, the Hall took Trinity Sunday every year as its birthday, celebrated by a common "Feast" for both its Junior and Senior Members. The Hall's motto *Cui Datum* ("To whom much is given...") was selected from St. Luke's Gospel, in recognition of the special responsibility attached to the Hall's seniority. Senior Members of the University may be assigned as Fellows of the Hall by the Vice Chancellor and they usually keep their Fellowship for as long as they remain with the University. Persons of academic distinction outside the University may be elected as Honorary Fellows at a General Meeting of Fellows. The rest of the membership of the Hall is made up of persons in *statu pupillari*. The governing body of the Hall is the Hall Council, members of which are Fellows of the Hall. The principal Hall Officers are: The Master, the Vice-Master, the President of the Senior Common Room, the Senior Tutor, and the Hall Bursar. The Hall was converted into a mixed Hall of Residence in October, 1991.

AKUAFO HALL: Akuafu Hall was established with the appointment of Professor D.A. Taylor, a Master-designate and a Hall Council in 1953. The Hall Council in 1954 decided to name the Hall Akuafu to commemorate the generous gesture of the farmers of Ghana in giving

money for the foundation of the University College. A crest which depicts a cocoa tree on open book, and a drum, designed by Professor W.J. McCallien, and a motto, *laboremus et sapiamus*, suggested by Professor L.H. Ofosu-Appiah, were adopted by the Council. A commemorative plaque with a Latin inscription composed by Professor L.H. Ofosu-Appiah was set up to show the gratitude of the Hall to the farmers of the country and to the British Government who gave the University College funds for the building of the Hall. The Hall was officially opened on 17 February, 1956; but the first students numbering 131 came into residence on the 5th October, 1955. The Hall has its own statutes governing the election of officers and the administration of its affairs. Once a year, the Master has to convene a meeting of the Fellows, who form the governing body, to receive his annual report. The Senior Common Room is open to all Fellows and their guests, and the Senior Combination Room to all senior members of the University. Senior Members may also invite students to the Combination Room. The Hall was converted into a mixed Hall of Residence in October, 1991.

COMMONWEALTH HALL: The first batch of students was admitted into residence in Commonwealth Hall at the beginning of the 1956-1957 academic year. In the Lent Term of that academic year, Ghana attained its independence from Great Britain, and the Hall, hitherto known as the Third Hall, was officially christened **Commonwealth Hall** to commemorate Ghana's admission into the Commonwealth of Nations. The official opening of the Hall was performed in March, 1957. It is, so far, the only all-male Hall of Residence in the University. The motto of the Hall, **Truth Stands**, was taken from a quotation from *Satyre* by John Donne (1572-1631):

*"On a huge hill, cragged, and steep,
Truth stands and hee that will Reach her,
about must, and about must goe"*

This motto combines both the physical situation of the Hall (on a hillside overlooking most of the University and beyond) and the proper pursuit of a University education, the search for truth. It is the only Hall of Residence in the University which has a theatre and amphitheatre for lectures and plays. The Coat of Arms of the Hall depicts the strength and unity of purpose of members of the Hall deriving from the bonds of association enjoyed by the individual members of the Hall. High Commissioners of the Commonwealth countries in Ghana are accorded Honorary Membership of the Hall. There is a Hall Council which administers the affairs of the Hall, assisted by the Tutorial Board and the Senior Common Room Committee.

VOLTA HALL: Volta Hall is the only completely female Hall of Residence in the University. It started as the Fourth Hall in the 1959-60 academic year, on 16th November, 1960. The University College Council, on the recommendation of the Hall Council, named it Volta Hall. The Hall consists of the main hall originally designed to accommodate 82 students, and an annex with an original capacity for accommodating 198 students, the occupation of which began in January 1966. The motto of the Hall, chosen during the Hall's tenth anniversary celebrations, is in the Akan language and it is: *Akokobere Nso Nyim Adekyee*. This means that the secret or knowledge of life and nature is a gift to women as it is to men. The Hall has a governing Body which comprises all the Fellows assigned to it and those elected by the assigned Fellows. The government of the Hall rests with this body which delegates some of its powers to a Hall Council. The Hall Council consists of ten members, including the Warden, the Deputy Warden, the Senior Tutor and the Bursar who are ex-officio members. The day-to-day administration of the Hall is carried out by the Warden with the help of the Senior Tutor, who deals with all students' affairs, and the Bursar.

MENSAH SARBAH HALL: Mensah Sarbah Hall, the fifth Hall of the University, stands in the southern part of the campus. The Hall consists of a main Hall built around a quadrangle and a number of Annexes standing to the north and east. The last two south annexes are attached to the Hall. Until October 1991, Mensah Sarbah was the only coed Hall of Residence

in the University, which made it quite unique among the Halls. The governing body of the Hall is the Council, which is responsible to the full body of Fellows who form the Senate. Students' affairs are handled by students' own elected government headed by a President, while the general administration of the Hall is under the Master who is assisted by the Senior Tutor and Tutors on the one hand and the Bursar on the other. Other Hall Officers are the Chaplain, who is responsible for the Roman Catholic Chapel, the Prayer Room Warden, who is responsible for the Protestant Chapel, and the Librarian. Senior Common Room affairs are managed by an elected committee under the President of the Senior Common Room. The Hall is named after the famous Ghanaian jurist, writer and statesman, John Mensah Sarbah of Cape Coast. It has been customary for the Hall to celebrate the birthday anniversary of this great man every year. This anniversary is known as Sarbah Day and is highlighted by dinner and a get-together. The Hall has a crest designed to bring out the principal features of Mensah Sarbah's life. It consists of three elements: a pair of scales, a stool with a book resting upon it, and a hill surmounted by a castle. The scale signifies the legal profession, the stool and the book symbolize culture while the hill and the castle are intended to depict the familiar landscape of Cape Coast with its many hills and forts. At the same time, the castle is intended to symbolize strength and honour. The Hall's motto is: **Knowledge, Honour, Service** - three words which aptly summarise the guiding principles of Mensah Sarbah's life.

VALCO TRUST HOSTELS: The idea to build a graduate hostel was first nurtured when Legon Hall Annex C was prepared exclusively for graduate students of the Hall. The quest for a suitable accommodation for graduate students gained attention when Valco Trust Fund offered to finance the construction of a graduate hostel. As a further boost to this course, Legon Hall Annex C was converted into an Annex of the Hostel. The Valco Trust Hostel, donated to the University by the Valco Trust Fund to ease pressure on student accommodation, is a block of purpose-built, self contained flats for 190 students. The Hostel, which was completed in June 1997, is the University's first hostel for graduate students. A second block with similar facilities was opened in January 2006. Located behind Mensah Sarbah Hall on the southern part of the campus, the flats are arranged in single and double study bedrooms with en suite shower and toilet. There is a shared kitchen for every twelve rooms. Facilities in the hostels include common rooms, washrooms and a restaurant.

INTERNATIONAL STUDENTS' HOSTELS: The International Student's Hostels are located on the southern part of the campus off the road to the Noguchi Memorial Institute for Medical Research. For a long time, it had been the dream of the University of Ghana to create and strengthen links with other universities in order to enhance the international student presence on campus. The first phase was commissioned in June 1999, and the second in January 2006. The Hostels are co-educational and each has 43 single rooms and 85 double rooms. In addition, there are facilities such as well-fortified security system, kitchenettes and restaurants.

JUBILEE HALL: Jubilee Hall, located on the southern part of the campus, adjacent to the International Students' Hostel, was built to commemorate the University's Golden Jubilee celebration in 1998. Modeled after Akoafo Hall, one of the traditional Halls of the University, and funded mainly by alumni of the University, the Hall is a group of 4 (four) multi-purpose blocks containing single study bedrooms, self-contained flats and double rooms. Facilities in the Hall include common rooms, libraries and restaurants. There are rooms suitable for disabled students.

OTHER HOSTELS: The first phase of a new hostel complex, which upon completion will house 7,120 students, is expected to be ready for occupancy by the beginning of the 2009/2010 academic year. The project was financed by the University through a loan secured by a consortium of six financial institutions.

There are a number of other hostels situated close to the Legon Campus. A list of these can be obtained from the Office of the Dean of Students.

STUDENTS' SERVICES AND ASSOCIATIONS

STUDENTS' REPRESENTATIVE COUNCIL (SRC): The Students' Representative Council represents student interests at the university. It co-ordinates the activities of the academic, cultural, religious, political and recreational clubs and societies, provides a link with outside organizations and concerns itself with all aspects of student welfare within the university. Its officers are elected annually by a ballot of all students during the second semester to serve the following academic year. Executives of the Junior Common Room (JCR) also serve on the Council. All students registered at the university are automatically members of the SRC, which levies direct income from its members to finance its programmes and activities. The SRC is a constituent organization of the National Union of Ghana Students, which provides a focal point of all aspect of student activities nationally and internationally. The Union runs a broadcasting service on campus called RADIO UNIVERS, which transmits to the campus site and its environs and even as far as to the city of Accra and slightly beyond. These together with the student newspapers, provide a comprehensive information service on campus. One area of SRC activity is the SRC Women's Commission, which, organizes programmes to educate female students on their rights and responsibilities as young women. The Commission runs a number of its own community action projects, and also liaises between student volunteers and voluntary and non-governmental organizations in and around the country.

The SRC has representation on the Council of the University and on University Boards/Committees which deal with students' welfare.

GRADUATE STUDENTS' ASSOCIATION: The Graduate Students' Association was formed in the early years of the 1990's to cater for the special needs of graduate students. All graduate students registered at the University are automatically members of the Association. The Association levies direct income from its members to finance its activities. Members also maintain their membership of the Students' Representative Council, to which appropriate dues are paid. The Association organizes seminars, special fora and social mix events, all aimed at enhancing greater interaction among graduate students. The Executive is also responsible for representing the Association on the Council of the University as well as other Boards/Committees of the University which deal with welfare of students.

JUNIOR COMMON ROOM (JCR): There is a Junior Common Room in each Hall of Residence to which every student in *statu pupillari* and attached to the Hall is a member. The JCR has its own constitution. It elects its governing body of officers who seek to protect the interests of junior members of the Hall and provide cultural, social and sporting activities for the Hall. The JCR of a Hall, through its officers, maintains relations with JCRs of other Halls and is a recognised channel of communication between junior members and the Hall authorities. The revenue of the JCR is derived from students' contributions and contributions from the University through the Hall Council.

SPORTS: All sporting activities of the University are conducted by the Sports Directorate. The University has, since 2005, begun a process to better integrate sport into our academic programmes and has also taken steps to focus more on wellness issues for students and staff. This has involved significant administrative, infrastructural and programme development.

The University is working to put in place workable sports programmes at all its campuses, to ensure that all students have a good balance between their academic work and other activities which are an integral part of the university experience.

HEALTH SERVICES: The University Hospital was opened in October 1959. It consists of an Out-patient Department, an Operating Theatre, X-Ray Department, a Laboratory and a Ward section, a Paediatric Ward, Emergency Unit and a Dental Clinic. The Hospital offers medical attention to all members of the University community, namely, students, staff and staff dependants, as well as members of the public. All new students to the University are given a thorough medical examination at the beginning of their first year. Likewise, members of staff go through thorough medical examinations on their first appointment. Students requiring medical treatment are seen daily at the Students' Clinic located within the Central Cafeteria Building.

COUNSELLING AND PLACEMENT CENTRE: The Counselling and Placement Centre offers comprehensive, professional counselling as well as a career and placement service to all members of the University. The Centre strives to maintain an independent and congenial environment in which people can freely seek information and professional help on various concerns. Counselling is confidential and is provided only at the request of, or with the concurrence of, the person involved. Students may report for individual counselling on a variety of concerns ranging from short-term academic, social, personal and family concerns to longer-term emotional and psychological problems. Group counselling is provided on specific concerns frequently expressed by students. Preventive counselling lectures and seminars are organised at various times of the year on topics intended to stimulate positive and healthy development and discourage habits which tend to create problems for students. The Centre also offers a basic career and placement service for students and alumni. Under this programme:

- i. *Students are assisted with self-assessment, career choice, and self-penetration, including writing of applications and resumés, and performance at interviews;*
- ii. *Colloquia between students and representatives of major employing organisations are held yearly at which students learn about the functions and operations of major establishments in the country, the range of jobs offered to university graduates, and the corresponding qualifications and personal attributes required;*
- iii. *Students and alumni are assisted to get placement on jobs through introductory letters, direct canvassing by the Centre, liaison with employers for campus interviews etc.*

The Centre has an information room containing literature on post-graduate and professional courses offered by this University and foreign institutions as well as a modest collection of books and leaflets on a number of careers suitable for graduates in various disciplines.

OFFICE OF THE DEAN OF STUDENTS: The Office of the Dean of Students provides counselling and information services for students, administers the non-academic student disciplinary system and student grievance procedure, and assists in non-academic programme development. The Dean works in close collaboration with the Heads of Halls, SRC, the Sports Directorate, the Counselling and Placement Centre and the University Public Affairs Directorate Office. He also runs a Host Family Service for foreign students interested in being fostered by local families.

OFFICE OF INTERNATIONAL PROGRAMMES: The Office of International Programmes was established on 11 June, 1997 with the mandate to promote and co-ordinate all the University's external relations, including international students, scholars on various exchange programmes, staff on exchange and external staff training programmes. The Office also acts as the central office to deal with links between this University and other universities. The Office of International Programmes is located in the K.A.B. Jones Quarte Building.

STUDENTS FINANCIAL AID OFFICE: The Students Financial Aid Office (SFAO) was established in August 2005, necessitated by the increasing number of applications and requests from students for financial assistance. The University of Ghana sees the operation of the SFAO as strategic and an integral part of its programmes as it enables needy but bright students to access university education. Financial aid is available to Ghanaian students and is intended to remove the cost barriers that may prevent you from pursuing your educational goals. For now, financial aid provided by the University involves financial support towards academic fees only. The additional elements would be added as resources become available. Assistance is available from a variety of sources such as funding from Government, the University, and other private sources. Brilliant students who demonstrate significant financial need may qualify for financial aid. Financial Aid at the University is in the form of a full scholarship, partial scholarship and, on-campus work-study or part-time job opportunities for students. In order to qualify to apply for and receive financial aid from the University of Ghana, a student must meet all of the following requirements:

- Be a Ghanaian citizen
- Be enrolled as a regular student in full time programme of study
- Be able to demonstrate financial need
- Be brilliant, and
- Be making excellent academic progress as determined by the University.

If you are unsure about any of the items stated above, please contact the Students Financial Aid Office in the Alumni Centre or via email finaid@ug.edu.gh . The application process for financial aid for continuing students commences in December of each year. The awards are made by the end of the second semester, to be utilised in the following academic year. The process is also available to new students during the First Semester of enrolment. Information is available during new student orientation. Application forms for financial aid can be downloaded from the Students Financial Aid Office website: www.ug.edu.gh/sfao.php

OFFICE OF STUDENTS WITH SPECIAL NEEDS: The University of Ghana is committed to a policy of equal opportunity in education and to ensuring that students with disabilities have as complete and equitable access to all facets of University life as can be reasonably provided. The University has taken steps to ensure that no student with any form of disability is disadvantaged in the pursuit of academic laurels. Toward this the University has an Office of Students with Special Needs located in the Student Union Building. The Office has a Coordinator who is supported by a number of resource persons. Students with the following categories of disability may register with the office:

- Hearing Impairment/Deaf
- Visual Impairment/Blind
- Specific Learning Difficulties
- Physical Disability
- Medical Disability
- Mental Health Difficulties

The Office helps identify varied needs of the affected students and provides support services to enable them achieve optimum academic outcomes. The support includes: brailers, readers, interpreters, enlarged prints, note-takers, alternative exam arrangements, etc.

EXTRA CURRICULA ACTIVITIES ON CAMPUS

The University of Ghana is often labelled the most conservative and "academic" campus in Ghana. However, there is always a lot to do and see before and after lectures and students enjoy very active social lives, because of the various activities which they frequently organize.

Clubs and Societies: There is a wide choice of clubs and societies on campus for students. Religion is catered for by a variety of religious bodies and associations which include the *Presbyterian Students' Union, Legon Pentecostal Students' Union, Pax Romana, Ghana Muslim Students Association, Ahmaddiya Muslim Students' Union, The Anglican Society, the University Christian Fellowship, the Nichiren Shoshu* to name a few. Students are also able to join in activities organised by their Faculties on campus. *The Political Science Students' Association, The Law Students' Union, The National Association of Science Students, The Medical School Writers Club, The Ghana Association of Medical Students, Agricultural Science Students' Association, Ghana National Association of Teachers (Legon Branch)*, are a few examples of such associations which seek to protect and promote their respective academic and professional interests. A number of international clubs are also very active on campus. Students with special needs also have an association called *Disabled Students' Association* aimed at promoting their interest and welfare on campus. There are also a number of charitable and benevolent societies which operate on campus, for instance, *the Child Survival Club, the Rotaract Club and the Student Services Organisatio to name a few*. Extra-curricular activities do not end with clubs and societies. *The Students' Representative Council (SRC), The Graduate Students' Association of Ghana (Legon Branch)* and the *Junior Common Rooms* of the Halls of Residence often generate a lot of activity on campus. Students are encouraged to partake in their annual events.

Events: Hall Weekends are big events on campus. Students' imagination and innovation are put to the test in week-end celebrations. Inter Hall Football Galas are also organised to the delight of sports fans. There is also an annual inter Halls Cross Country race coordinated by the Sports Directorate.

Places: At the end of an active day's work, there is always a need to relax and have fun. Some of the popular spots on campus are *Tyme-Out* (Legon Hall), *Taco Bell* (Akuafu Hall) and *On the Run* (just outside the main University entrance) - the central meeting places for students from all halls. Fast foods and drinks are provided; films are shown as well. Other places like *The Basement, Tasty Treats* and the JCRs also provide good places to eat, drink and relax.

OTHER FACILITIES

University Bookshop: Located at the University Square, The University Bookshop stocks a wide selection of textbooks and other reading material and is open to the general public.

Printing Facilities: A Printing Press currently run by the School of Communication Studies is part of a UNESCO project on rural communications. It undertakes printing jobs not only for the various sections of the University but also for individuals and organizations outside the University. The Institute of Adult Education and the Institute of African Studies also have facilities for printing. The Balme Library has a technical unit which undertakes binding.

University Guest Centre: The Centre comprises a restaurant and a number of bed-sitters, flats and bungalows for the University's guests.

Banks and Postal Services: The Ghana Commercial Bank, the Standard Chartered Bank, Barclays Bank, Ecobank and HFC Bank have branches on the University campus. The national

postal service has a branch on the campus, and the University has an Internal Mail Office which facilitates postal services within the University.

Supermarket/Market: There is a supermarket on campus located close to the International Students' Hostels. There is also a small market in the same area where students can purchase various cooked foods and foodstuffs.

Laundry Service: Most halls of residence operate laundry services. There is also a private laundry service just outside the University campus.

Security: The University has its own Security Service which provides guard services for both departmental buildings and residential areas. The Legon Police Station is located just outside the main entrance to the University .

Development and maintenance of property: The development and maintenance of the University's infrastructural facilities and amenities are the basic responsibility of the Physical Development and Municipal Services Directorate. This function is performed under the direction of a Director, supported by a team of technical and administrative staff.

5. ALUMNI ASSOCIATION

A national association of alumni of the University meets once a year on the campus and organizes activities which keep alumni in touch with the life and work of the university. Prominent among these activities are the annual **ALUMNI LECTURES** which normally precede University Congregation. The Lecturers are always selected from amongst alumni of the University who have distinguished themselves in their respective professions and worlds of work. The list of Alumni Lectures and the topics covered, so far, are as follows:

<i>His Excellency Mr. H.V.H. Sekyi (1974)</i>	-	<i>Education, Nationalism and Nation-Building</i>
<i>His Excellency Mr. E.M. Debrah (1976)</i>	-	<i>The Civil Service, The Public and the Attainment of National Goals</i>
<i>Dr. James Nti (1977)</i>	-	<i>The Civil Service: Its Appraisal and Prospects</i>
<i>Mr. David Andoh (1978)</i>	-	<i>“The Private Sector: A Case</i>
<i>Mr. J.H. Frimpong Ansah (1979)</i>	-	<i>Economic Advice: The Giver, The Receiver and The National Interest</i>
<i>Dr. F.I.D. Konotey-Ahulu (1980)</i>	-	<i>Genes and Society and Society and Genes</i>
<i>Professor George Benneh (1981)</i>	-	<i>Getting the Economy Moving – A Layman’s View</i>
<i>Mr. E.S. Aidoo (1985)</i>	-	<i>The People, The Laws and The Court</i>
<i>Professor E. Laing (1986)</i>	-	<i>The New Biology: New Hope, New Threat or New Dilemma</i>
<i>Professor J.S. Djangmah (1987)</i>	-	<i>Science Education for National Survival in a Computer World</i>
<i>Her Excellency Mrs. Mary Chinery-Hesse (1992)</i>	-	<i>International Co-operation in Changing World Environment</i>
<i>His Excellency Mr. John R. Schram (1995)</i>	-	<i>Conflict Resolution and the New World Order</i>
<i>Dr. (Mrs.) Sylvia A.M. Boye (1998)</i>	-	<i>Recognition of Achievement: A Tool For National Development</i>
<i>Dr. K.Y. Amoako (2000)</i>	-	<i>Economic Reform and Development Issues in Africa: Lessons for Ghana</i>
<i>Most Rev. Emeritus Professor K.A. Dickson (2001)</i>	-	<i>Freedom of Religion and the Church</i>
<i>Professor K. Frimpong-Boateng (2002)-</i>		<i>Airs, Waters, Places, People and Health</i>
<i>Professor Ivan Addae-Mensah (2003) -</i>		<i>“Higher Education and Ghana’s Industrial Development – Are we Doing the Right Things at the Right Time?”</i>
<i>Major (Rtd) Dan Ablorh-Quarcoo (2005)</i>	-	<i>Encouraging Entrepreneurial Development: The Challenges and Prospects”</i>
<i>Mrs. Stephanie Baeta Ansah (2006)</i>	-	<i>“The Challenges and Rewards of Financing Housing in Ghana”</i>
<i>Dr. Gobind Nankani (2008)</i>	-	<i>“ Catching up with the ‘Giants’: A growth strategy for Ghana”</i>

6. AGGREY-FRASER-GUGGISBERG MEMORIAL LECTURES

The Aggrey-Fraser-Guggisberg Memorial Lectures were instituted in 1957 to commemorate the contribution made to the founding of Achimota College and the advancement of education, particularly higher education, in Ghana. The Lectures, a series of five given on five consecutive days, have become a great event to which the Ghanaian public looks forward. It is, indeed, the most prestigious lecture series and the high-point of the intellectual calendar of the country. It has been the practice to leave the lecturer free to choose a THEME and the TOPICS for the lecture. The list of Memorial Lecturers and the subjects covered, so far, are:

<i>Lady Robert Jackson</i>	-	<i>A background to World Affairs</i>
<i>(Barbara Ward) (1957)</i>		<i>(Five Ideas That Changed the World)</i>
<i>Sir Jajachamaraja</i>	-	<i>Traditions, Ideals and Values in</i>
<i>Wadiyar Bahadur (1960)</i>		<i>the Atomic Age</i>
<i>Sir Julian Huxley (1961)</i>	-	<i>Evolutionary Destiny and Africa</i>
<i>Davidson Nicol (1963)</i>	-	<i>Africa - A Subjective View</i>
<i>Professor Dorothy Crawfoot</i>		
<i>Hodgkin, OM (1965)</i>	-	<i>Crystallography and Medicine</i>
<i>Professor Sir Arthur Lewis (1968)</i>	-	<i>Some Aspects of Economic Development</i>
<i>Professor Sir Mark Oliphant (1969)</i>	-	<i>Science and Mankind</i>
<i>Professor Clark Kerr (1970)</i>	-	<i>Students and Society</i>
<i>Lord John Todd (1971)</i>	-	<i>Some Problems of the Technological Society</i>
<i>Robert K.A. Gardiner (1972)</i>	-	<i>The Basis for Change and Development in Ghana</i>
<i>Professor Raymond Aron (1973)</i>	-	<i>The World Crisis in Education</i>
<i>Saburo Okita (1974)</i>	-	<i>Lessons from Japanese Experience in</i>
		<i>Economic Development</i>
<i>Professor T.O. Elias (1975)</i>	-	<i>Judicial Process in Commonwealth Africa</i>
<i>Dr. Claude T. Bissell (1976)</i>	-	<i>Humanities in the Universities</i>
<i>Professor Ralf Dahrendorf (1978)</i>	-	<i>The New World Order? Problems and Prospects</i>
		<i>of International Relations in the 1980s</i>
<i>Professor K. Onwuka Dike (1979)</i>	-	<i>Factors in West African History</i>
<i>Sir Ieuan Maddock (1980)</i>	-	<i>Interaction of Technology with Society</i>
<i>Dr. M.S. Swaminathan (1981)</i>	-	<i>Agricultural Growth and Human Welfare</i>
<i>Professor Edem Kodjo (1985)</i>	-	<i>Africa Today</i>
<i>K.K. Dadzie (1990)</i>	-	<i>The Outlook for Development in the 1990s</i>
<i>L.K.H. Goma (1991)</i>	-	<i>The Hard Road to the Transformation of Africa</i>
<i>Professor F.T. Sai (1994)</i>	-	<i>Adam, Eve and the Serpent</i>
<i>Professor Ivor Wilks (1995)</i>	-	<i>One Nation, Many Histories Ghana Past and Present</i>
<i>Professor Michael Gibbons (1999)</i>	-	<i>Science Goes Beyond the Market.</i>
<i>Professor Ali A. Mazrui (2001)</i>	-	<i>Nkrumah's Consciencism and Africa's Triple</i>
		<i>Heritage: Indigenous, Islamic & Westernizing Forces</i>
<i>Dr. Kwame Anyane-Yeboah (2004)</i>	-	<i>"Did Adam and Eve Really Live in the Garden of</i>
		<i>Eden? The Genetic Connection"</i>
<i>Professor Hans Van Ginkel (2005)</i>	-	<i>"Globalization, Higher Education and</i>
		<i>Sustainable Development"</i>
<i>H.E. Mary Robinson(2006)</i>	-	<i>"Human Rights and Development"</i>
<i>Right Honourable Paul Boateng (2007)-</i>		<i>The Black Star Rising – Some Challenges for Ghana</i>
		<i>and Africa in the 21st Century.</i>
<i>James Wolfensen (2008)</i>	-	<i>Our Changing World: Will the 21st Century</i>
		<i>be the Global Century?</i>

7. REGULATIONS FOR JUNIOR MEMBERS

1. The term "Junior Member" shall apply to a person other than a Senior Member who is enrolled for the time being in the University of Ghana for an approved course of study.
2. Regulations affecting Junior Members shall be made from time to time by the Academic Board in accordance with the Statutes of the University and promulgated by the Vice Chancellor. In addition to these Regulations, each Hall, Department, Institute, School, Library, the Hospital or any other unit of the university may issue its own rules governing the conduct of Junior Members within its precincts, provided that such regulations are not inconsistent with the general regulations made by the Academic Board. Such regulations must be tabled before the Academic Board.
3. These regulations shall apply to all Junior Members.
4. Copies of all regulations shall be deposited with the Registrar, Heads of Halls, Dean of Students, Deans, Heads of Departments and should be brought to the attention of Junior Members.
5. Ignorance of Regulations or of any Public Notice shall not be accepted as an excuse for any breach of discipline. Accordingly, every student on enrolment shall be required to obtain a copy of such University, Hall and other regulations relating to his condition and are for the time being in force.
6. Junior Members shall conduct themselves in a quiet and orderly manner and shall pursue their studies with all diligence; they shall observe the statutes and shall conform to all such regulations and orders as may be made for the good government of the University.
7. The operation of these Regulations is without prejudice to the application of the general law of the land which applies to all persons in the University.
8. The officers of the University who have a special responsibility, under the Vice-Chancellor, for the discipline of Junior Members are the Dean of Students, Heads of Halls, Senior Tutors and Tutors. It shall be an offence to disobey these officers in the discharge of University duties.

9. ADMISSION AND RESIDENCE

- 9.1 A Junior Member who does not hold an award granted by the Government, or by an institution recognized by the University, shall be required to pay all approved fees on or before registration.
- 9.2 A Junior Member whose accounts are in arrears and unpaid at the beginning of an academic year or semester shall not normally be allowed to come into residence or attend lectures until his outstanding accounts have been settled.
- 9.3 Dates of Semesters are announced in University Notices. Junior Members admitted to residence are required to come into residence following registration and to remain continuously in residence until the last day of semester unless permission is granted for temporary absence. Students who are non-resident are required to register at the Halls to which they have been assigned.

- 9.4 Procedure regarding exeats is notified in the Hall Regulations. In cases of absence involving non-attendance at Lectures, Tutorials or Practicals, or Examinations, the written permission of the Department concerned must be obtained in addition to that of the Hall authorities.
- 9.5 Admission of Junior Members to the University shall be subject to their passing a Medical Examination.
- 9.6 Membership of the Students' Representative Council and the Amalgamated Clubs (organized under the Sports Directorate) of the University is compulsory for all Junior Members.
10. **NAMES OF JUNIOR MEMBERS**
- 10.1 For the purposes of the University, Junior Members are known only by the names which they have signed in the Application Form/Register of Matriculation and are known by those names only in the sequence in which they were signed (that is, first name, middle name[s] and surname).
- 10.2 **Change of Name:**
- i. Where a female Junior Member gets married, she may apply to have her name altered to include the surname acquired by marriage, followed in parenthesis, by the word "nee" and her former surname. In such cases, proof of marriage will be required before the official change is effected.
 - ii. As an institutional policy, the University does not accept to change or amend biological records.
11. **ATTENDANCE AT LECTURES AND EXAMINATIONS**
- 11.1 Junior Members are required to attend Lectures, Tutorials and Practical classes specified for their course of study, and all such Examinations as the University or the Departments may from time to time require, and to perform all written and practical work prescribed for them.
- 11.2 Junior Members who absent themselves from lectures, tutorials and practical classes for a cumulative total of 25% in any one semester will be deemed not to have satisfied the attendance requirements for the semester. Such Junior Members shall be required to withdraw from the University.
12. **USE OF ACADEMIC DRESS**
- All Junior Members are required to wear the academic dress appropriate to their status or Hall of Residence on the following ceremonial occasions:
- i. Matriculation
 - ii. Congregation
- and other occasions as required.
13. **FORMATION OF SOCIETIES AND CLUBS**
- 13.1 Student Societies and Clubs in the University shall be formed at the request of at least ten interested students. In addition, there must be a Senior Member who will be the Senior Treasurer.

- 13.2 The request should be submitted for approval by the Residence Board through the Students' Representative Council and shall be accompanied by the recommendation of the Students' Representative Council and the Constitution/Bye-laws of the proposed Society or Club.
- 13.3 The proposed Society or Club shall be formally promulgated in the University Reporter after the Residence Board has given its approval.
- 13.4 Within three months from the date of the promulgation of the Society or Club, the Secretary shall deposit the names of persons holding principal offices of the Society or Club with the Registrar and the Dean of Students. Thereafter, the Registrar and the Dean of Students shall be furnished with the names of their Principal Officers, once a year.
14. **PUBLIC FUNCTIONS WITHIN THE UNIVERSITY**
- 14.1 Students who wish to organise any public function within or outside the Hall of Residence shall obtain prior permission from the Head of Hall/Dean of Students as appropriate. The Head of Hall/Dean of Students shall in turn inform the Registrar and the Vice-Chancellor.
- 14.2 An application for permission to organise a function should provide the following information:
- i. date and time of the function;
 - ii. place where the function is to take place;
 - iii. names and description of Lecturers, Speakers, or Performers at the function.
- 14.3 This information together with evidence of fulfilment by the organizers of any requirements imposed by law in relation to the holding of such a function should normally reach the Head of Hall/Dean of Students at least three days before the function takes place. The Head of Hall/Dean of Students may impose such other requirements and conditions as may appear to him to be necessary or desirable.
- 14.4 For the purpose of this section, a public function is one to which persons other than Senior and Junior Members of the University are invited or entitled to attend.
15. **PROCESSIONS AND DEMONSTRATION**
- 15.1 Any student or students wishing to organise a Procession/Demonstration in the University shall notify the Dean of Students in writing with a copy to the Registrar at least three days before the procession/demonstration is due to begin.
- 15.2 The notification shall state the purpose of the procession/demonstration and the name(s) of the organizer(s).
- 15.3 The Dean of Students may prescribe special conditions, limitations or restrictions as may be considered appropriate in the circumstances.
- 15.4 The procession/demonstration will follow an approved route and keep as close as possible to the right side of the road in order to ensure free passage of traffic.
- 15.5 No procession/demonstration shall be held between the hours of 6.00pm and 6.00am.

- 15.6 During the procession/demonstration, nothing will be done or said that may occasion violence or cause a breach of the peace.
- 15.7 If, in the opinion of the Dean of Students, the procession/demonstration will be likely to lead to a breach of the peace or cause serious interference with the work of the University, he may so advise the Vice-Chancellor who may take appropriate action.
- 15.8 If any acts of violence and/or breach of University, Hall or other regulations occur during a procession/demonstration or other mass action, the perpetrators as well as the organizer(s) shall be held jointly and severally responsible.
- 15.9 The fact that a procession/demonstration is not prohibited in no way implies that the University has either approved of or is in sympathy with its objectives.
- 15.10 For processions/demonstrations outside the University, the organizer(s) should, in addition, seek prior permission from the Police.

16. **PUBLICATIONS**

- 16.1 The Vice-Chancellor will be informed of any intention to produce a student publication within the University and his approval in writing shall be obtained for such a publication.
- 16.2 A copy of each issue will be lodged with the Vice-Chancellor, Head of Hall and Dean of Students as appropriate and the University Librarian on the day of publication.
- 16.3 Each issue shall state the name of the Editor, the Membership of the Editorial Board, and the Publisher.
- 16.4 The members of the Editorial Board will be held jointly responsible for the full contents of each issue of the publication. (See Appendix A).

17. **OTHER REGULATIONS**

- 17.1 It shall be an offence for a Junior Member to:
 - i. Cultivate, possess, use or peddle narcotics and other drugs as listed in the Second Schedule, Part II, of the Drugs and Pharmacy Act, 1961 (Act 64). (see Appendix B).
 - ii. Willfully cause damage to University property or the good name of the University and incite others to cause such damage.
 - iii. Publish defamatory material on the campus.
 - iv. Smoke in the Library, or Lecture Theatres during lectures or work.
 - v. Throw any person into ponds in the University.
 - vi. Possess firearms on campus.
 - vii. Make undue noise within the University precincts. In particular, the hours between 10.00 p.m. and 6.00 a.m. are to be regarded as hours of quiet, provided that this rule shall not apply where permission to organise a function has been granted by the Head of Hall or Dean of Students.

18. **USE OF VEHICLES**

- 18.1 Any Junior Member who wishes to use or keep a vehicle on the campus of the University must obtain permission from the Vice-Chancellor through the Senior Tutor of his Hall.

18.2 The University accepts no responsibility for such vehicles, or for any damage that may occur to them or to their owners, drivers or passengers. The use of such vehicles is a privilege which is enjoyed at the sole risk of the persons concerned and which will be withdrawn if it is abused.

18.3 The University does not provide garages for students' vehicles. Any arrangement for garaging them in the University should be made privately by the owners.

19. **COLLECTION OF MONEY**

19.1 Permission to make general collections of money other than for club subscriptions and cinema shows or parties must be obtained from the Dean of Students/Senior Tutors of the Halls. Junior Members are advised to ask to see the license or other valid authority of any collector who comes from outside the University.

20. **THE DEAN OF STUDENTS**

20.1 The Dean of Students is responsible for the welfare and discipline of students outside their Halls of residence. The Dean works in close collaboration with the Students' Representative Council (SRC), the Halls of Residence, the Counselling and Placement Centre and the Sports Directorate.

20.2 For the efficient running of the office, the Dean shall have the support of a committee comprising:

- All Senior Tutors
- A representative of the Students' Representative Council
- The Director, Public Affairs Directorate or his representative

21. **DISCIPLINARY PROCEDURE**

21.1 **Within Hall of Residence:** If a student violates Hall regulations, disciplinary measures shall be taken by the authorities of the hall to which he/she belongs.

21.2 **Outside Hall of Residence:** If a student violates any University regulations outside the Hall of residence, it shall be reported to the Dean of Students who will notify the Senior Tutor of the student's Hall for appropriate sanctions. For serious offences involving a group of students, the Committee of the Dean of Students shall investigate the matter and apply appropriate disciplinary sanctions or make recommendations to the Vice-Chancellor.

21.3 **Disputes between Students of Different Halls:** Where disputes arise between students from different Halls, the Tutors of the students involved should attempt to resolve the dispute. Should their attempts fail, the matter should be referred to the Senior Tutors of the Halls involved. Should the dispute persist, the matter should be referred to the Committee of the Dean of Students.

22. **SANCTIONS**

22.1 Any student who does not observe the statutes and regulations, or commits any act subversive of discipline or good order or tending to bring discredit upon the Hall or the University, or neglects his duties, may be punished by a warning, or reprimand, or fine, or gating, or rustication for a period of time, or withholding of results of examinations or outright dismissal.

22.2 Sanctions which involve temporary or permanent removal from the University shall be effected only with the concurrence of the Vice-Chancellor.

23. **APPEAL**

Any Junior Member who is aggrieved by any disciplinary sanctions may appeal to the Vice Chancellor through the Head of Hall for a review within seven days of the notification to him of the sanctions imposed on him. The Vice-Chancellor, on receipt of a report from the appropriate source, may request a review of the sanctions so imposed. When carrying out a review, the Vice-Chancellor may act on the advice of a committee on which student interests are represented.

APPENDIX A

**MEMORANDUM FOR THE GUIDANCE OF STUDENT JOURNALISTS
THE LAW OF GHANA**

All student publications, even though they may be circulated only within a Hall or the University, are subject to the law of the land. This memorandum is intended to give them general information about their legal liabilities. It is not a substitute for professional legal advice, and it only deals with those parts of the law which are most likely to concern student publications. But a journalist who uses his common sense and the information given here should not run into legal difficulties.

The Civil Law of Libel

Everyone concerned with a publication runs the risk of being sued and made to pay damages if the publication libels anyone. Material published is libellous - for example, if it suggests that the person has committed a crime, or is dishonest, or immoral, or not to be trusted, or has misconducted himself in his office. It does not have to refer to the person by name - it is sufficient if ordinary people would understand what is published as referring to the person who brings the action.

The liability is not confined to the author of the libellous article or picture; everyone on the editorial committee would also be liable, and even those who take part in typing or distributing the publication may be liable as well. So if you take any part in a publication, it is wise to realise that you are legally responsible for what is included in it, and normally it makes no difference whether you troubled to read the copy or not.

You have a complete defence if what is published is true, so long as you can actually prove this in court. But this may be difficult so the safe rule is to be very careful before you publish an attack on a person's character.

You also have a defence (called "fair comment") which allows you to comment upon matters of general public concern, and express opinion and voice criticism upon such matters. To come within this defence, you must confine your opinion to matters which are of concern and interest to the public generally (though, normally, a person's private character is not of public interest). You must also avoid making false factual statements; the law allows you to express your opinions, but not to tell untruths. But there is nothing against your expressing your opinions on matters of public concern in a vigorous way, though if you express them in an indecent way then you must expect a court to doubt your good faith.

The Criminal Law of Libel

*If you carelessly publish a libel, you can be fined, and if you do so deliberately you can be imprisoned too. The details of the law are set out in the Criminal Code; the rules are broadly the same as the rules of the Civil Law, with one important difference - **truth is only a defence "if it was for the public benefit that the matter should be published"**. Consequently, even a true statement about, for example, another student's private life might be criminal even though the student himself could not sue for damages.*

The Criminal Law of Obscenity

You can be fined or imprisoned if you publish obscene material whether it takes the form of writing or pictures. Common sense is the best guide as to what the court is likely to regard as "obscene".

Comment on Judicial Proceedings

It is possible to commit offences by commenting upon legal proceedings; it is prudent to seek advice before doing so.

APPENDIX B

PHARMACY AND DRUGS ACT, 1961 (Act 64)

Part II - NARCOTIC DRUGS

1. *Indian hemp.*
2. *Coca leaves, cocaine (including synthetic cocaine) and ecgonine and their respective salts, the esters of ecgonine and their respective salts, any solution or dilution of cocaine or its salts in an inert substance (whether liquid or solid) containing any proportion of cocaine, and any preparation (not being such a solution or dilution as aforesaid) containing not less than one-tenth per cent of cocaine or any proportion of ecgonine.*
3. *Any product obtained from any of the ecgonine alkaloids of the coca leaf, not being a product which, on the 13th day of July, 1931, was being used for medical or scientific purposes.*
4. *Raw opium, medicinal opium and opium prepared for smoking.*
5. *Any product obtained from any of the phenanthrene alkaloids of opium, not being a product which, on the 13th day of July 1931, was being used for medical or scientific purposes.*
6. *Morphine and its salts, and any solution or dilution of morphine or its salts in an inert substance whether liquid or solid containing any proportion of morphine, and any preparation, admixture, extract or other substance (not being such a solution or dilution as aforesaid) containing not less than one-fifth of one per cent of morphine.*

INTERPRETATION OF THIS PART

In this part of this Schedule-

"Coca leaves" means the leaves of any plant of the family of the Erythroxylaceae from which cocaine can be extracted either directly or by chemical transformation; "ecgonine" means leavoecgonine and includes any derivatives of ecgonine from which it may be recovered industrially; "medicinal opium" means raw opium which has undergone the processes necessary to adapt it for medicinal use in accordance with the requirements of the authorized pharmacopoeia, whether it is in the form of powder or is granulated or is in any other form, and whether or not it is mixed with neutral substances; "raw opium" includes powdered or granulated opium, but does not include medicinal opium, and for the purposes of this Part of this Schedule, percentages, in the case of morphine, shall be calculated as in respect of anhydrous morphine and, in the case of liquid preparations, shall, unless regulations otherwise prescribe, be calculated on the basis that a preparation containing one per cent of a substance means a preparation in which one gram of the substance, if a solid, or one millilitre of the substance, if a liquid, is contained in every one hundred millilitres of the preparation, and so in proportion for any greater or less percentage.

PART VI - FURTHER RESTRICTIONS ON NARCOTICS

47. ***(Possession of narcotics. Amended by Act 222[c].)***
No person shall have in his possession without lawful excuse, proof of which shall be on him, any opium or Indian hemp of any species or description whatsoever or any residue from the smoking thereof.
48. ***(Smoking of opium or Indian hemp.)*** *No person shall-*
- (a) *smoke opium or Indian hemp or frequent any place used for the smoking thereof; or*
 - (b) *permit premises owned or occupied by him to be used by persons smoking opium or Indianhemp;*
 - (c) *have in his possession pipes or other utensils for use in connection with the smoking of opium or Indian hemp.*

8. UNIVERSITY EXAMINATIONS

INSTRUCTION TO CANDIDATES

(Extracts from Regulations Governing University Examinations)

- 10.1 A candidate for a University Examination must have followed the approved course as a regular student over the required period, and must have registered for the examination.
- 10.2 Entry to the Examination shall be by registration and which shall be duly endorsed by the Head(s) of Department and submitted to the Director of Academic Affairs not later than six weeks after the commencement of the semester.
- 10.3 A candidate shall not be admitted to a University Examination if:
- i. he/she has not been entered for it as in 10.2;
 - ii. the subject of the Examination has merely been audited unless the course had been followed previously.
 - iii. he/she owes fees to the University/Hall;
 - iv. he/she is under suspension or has been dismissed from the University.
- 10.4 It shall be the duty of the candidate to consult the daily time-table (to be made available at least 24 hours ahead of time) to ascertain the papers to be written each day and to make himself/herself available at the appointed place at least one-half hour before the examination.
- 10.5 A candidate shall be refused admission to a University Examination if he/she reports to the Examination more than half an hour after its commencement.
- 10.6 It shall be the candidate's responsibility to provide for himself/herself a pen, pencil, calculator and an eraser as needed. Programmable calculators are, however, strictly prohibited. It is also his/her responsibility to ensure that he/she is given the right question paper and other material needed for the examination.
- 10.7 An examination candidate shall not bring to the Examination Centre or to the wash-room of the Examination Centre or in the immediate vicinity of the Examination Centre any book, paper or written information or Cellular/Mobile phones or other unauthorised material. Any such material shall not be deposited at the entrance to the Examination Room or the washroom or in the immediate vicinity of the Examination Centre. No student shall enter the Examination Room until he/she is invited or called and/or requested to enter the Examination Room.**
- i. Any candidate who is seen with lecture notes or book or Cellular/Mobile phones or any unauthorised material in the Examination Centre or in the immediate vicinity of the Examination Centre before the commencement of the examination shall be deemed to have committed an offence, and shall be banned from the examination and awarded a grade X.**
 - ii. A candidate shall uphold the highest standard of civility and courtesy in an examination centre. A candidate who flouts the instruction(s) of a Chief Invigilator or Invigilator or misconducts himself/herself in any manner to an examination official at an examination centre commits an offence. Such candidate shall be banned from the examination and awarded a grade X.
 - iii. A candidate who is suspected of hiding unauthorised material on his/her person may be asked by the invigilator to submit to a body search. Refusal to submit to a

body search is tantamount to misconduct. It is also an offence to destroy or attempt to destroy evidence of unauthorized material.

- iv. An examination candidate shall, for the purpose of identification by the Chief Invigilator/Invigilator, carry on him his valid student identity card which shall be placed on the examination table to enable the Invigilator ascertain the identity of the person writing the examination. The Chief Invigilator shall reserve the right to refuse any candidate without a valid identity card entry to the Examination. A candidate who tries to conceal his/her identity by wilfully writing the wrong index number on the answer booklet as against the one signed on the Attendance Sheet commits an offence.
- 10.8 No communication between candidates is permitted in the examination hall.
- i. A candidate shall not pass or attempt to pass any information or instrument from one to another during an examination;
 - ii. A candidate shall not copy or attempt to copy from another candidate or engage in any similar activity.
 - iii. A candidate shall not disturb or distract any other candidate during an examination.
 - iv. Candidates may attract the attention of the Invigilator by raising their hands.
- 10.9 Smoking or drinking of alcoholic beverages is not allowed in the Examination Room.
- 10.10 Candidates may leave the examination room temporarily, and only with the express permission of the Invigilator. In such cases, the Invigilator will be required to satisfy himself that a candidate does not carry on his/her person any unauthorised material. A candidate who is allowed to leave the Examination Room temporarily will be accompanied while outside the examination room by an Attendant designated by the Invigilator.
- 10.11 A candidate who finishes an examination ahead of time may leave the Examination Room but not earlier than thirty minutes from the commencement of the examination after surrendering his/her answer books. The candidate shall not be allowed to return to the Examination Room.
- 10.12 At the end of each examination, candidates should ensure that they do not take away any answer books, whether used or unused, from the Hall.
- 10.13 Candidates should not in any way mutilate or interfere with the stapling in the answer books. Any complaints about the answer books should be brought to the attention of the Invigilator.
- 10.14 A candidate who fails to be present at an examination without any satisfactory reason shall be awarded a grade X. The award of grade X in a required paper means **failure in that paper**. The following shall not normally be accepted as reasons for being absent from any paper at a University Examination:
- i. mis-reading the time-table;
 - ii. forgetting the date or time of examination;
 - iii. inability to locate the examination hall;
 - iv. inability to rouse oneself from sleep in time for the examination;
 - v. failure to find transport;
 - vi. loss of a relation;
 - vii. pregnancy.

- 10.15 A breach of any of the foregoing regulations made for the conduct of University Examinations may attract one or more of the following sanctions:
- i. a reprimand;
 - ii. loss of marks;
 - iii. Cancellation of a paper (in which case zero shall be substituted for the mark earned);
 - iv. withholding of results for a period;
 - v. award of grade X.
- 10.16 Further to 10.15, a grade Z leading to failure in the entire semester's examination, shall be awarded wherever it is established that candidates had attempted to gain an unfair advantage in an examination be it in a Principal Subject or an Ancillary or any other paper. Further sanctions may include:
- i. being barred from a University Examination for a stated period;
 - ii. being barred from a University Examination indefinitely;
 - iii. suspension from the University;
 - iv. expulsion from the University.
- 10.17 Provisional results of University Examinations shall be posted on the University notice boards and on the MIS web on the University's website www.ug.edu.gh . It shall be the responsibility of the candidate to consult the notice boards and the MIS web portal for the provisional results of any examination taken. Alternatively, the candidate may write to the Director of Academic Affairs to enquire about his results for which purpose he may provide a stamped addressed envelope.
- 10.18 A candidate who is not satisfied with the results of a University Examination affecting him may request a review by submission of an application to the Registrar and payment of a review fee shall be determined at not less than three times the normal Examination Fee.
- 10.19 An application for a review shall be submitted to the Registrar not later than 21 days after the release of the said results as approved by the Board of Examiners, and should state the grounds for review.
- 10.20 An application entered on a candidate's behalf by a person other than the aggrieved candidate himself shall not be entertained.
- 10.21 No action shall be taken on an application which is submitted outside the time stipulated in 10.19. Review shall not proceed unless the Review Fee is fully paid.
- 10.22.1 If it emerges that a complaint for review is frivolous or ill-motivated, the Board of Examiners may prescribe further sanctions which may include barring the complainant from taking a University Examination for a stated period or an indefinite period.
- 10.22.2 No application **whatsoever** for review of course or award shall be entertained later than 5 (five) years after completion of programme.
- 10.22.3 The Board of Examiners may authorise the Registrar to amend the results as released in the light of the review.

EXAMINATION MALPRACTICE OR OFFENCE

1. Examination offences shall be understood to include any attempt on the part of a candidate to gain an unfair advantage, and any breach of the Examination Regulations and Instructions to candidates including refusal on the part of a candidate to occupy an assigned place in an Examination Room, any form of communication with another candidate, possession of a book, paper or written information of any kind except as required by the rules of a particular examination, smoking, leaving an Examination Room without permission of the Invigilator, or refusal to follow instructions.
2. The Chief Invigilator or any Examiner shall report to the **Registrar** as soon as practicable any instance of a breach of Examination Regulations. On the advice of the Registrar, the Pro-Vice-Chancellor shall constitute an Inter-Faculty Committee on Examination Malpractice to investigate all examination offences that have come to attention. In respect of offences occurring outside the precincts of an Examination Room, the Dean shall cause an enquiry to be made into any reports that reach him and submit his findings to the Registrar.
3. The Joint Board of Examiners shall review all reports received in connection with an examination malpractice or an offence. On the basis of its review, the Board of Examiners may impose a sanction involving loss of marks in a particular paper. A grade of Z shall be awarded wherever it is established that a candidate had attempted to gain an unfair advantage in an examination be it in a Principal Subject or an Ancillary or any other paper or has misconducted himself/herself in an examination. Such a candidate may be debarred from taking a University Examination for a stated period or indefinitely or expelled from the University.
4. In all instances of examination malpractices or offences a formal report from the Joint Board of Examiners shall be made to the Academic Board. The Academic Board may review all such reported cases and may vary the sanctions as it thinks fit.

9. REGULATIONS FOR THE BACHELOR'S DEGREE

1. ACADEMIC PROGRAMME

- 1.1 The University has recast its academic programmes in modular form with effect from September 1992. Under the modular course structure, the University's academic calendar has been organized into a semester system, and instruction takes the form of courses evaluated in terms of credits. Units of courses are examinable at the end of every semester and, if passed, a student shall earn credit(s) for the units. The courses are coded and numbered in progressive order of difficulty, or in levels of academic progression.
- 1.2 (a) **Each Faculty or School (with status of a Faculty) shall provide detailed information about the structure of courses leading to the award of Bachelors' Degrees.**
- (b) **It is the responsibility of each student registered at the University of Ghana to be familiar with the specific requirements of the bachelor's degree which he/she plans to pursue, as well as the rules, regulations and policies of the University and of the Faculties or Departments or Schools concerned.**
- 1.3 Each student is responsible for ensuring that the courses in which registration is effected satisfy the programme requirements of the bachelor's degree sought; advice and/or counselling for all who need assistance is freely available.
- 1.4 It is also understood that every student, by the act of registering, agrees to abide by all rules, regulations and policies of the University of Ghana and of the Faculties or Departments or Schools in which that student is registered.
- 1.5 Each student is expected to be familiar with the General Information outlined in this Handbook as well as the information pertaining to the Faculty or Department or School in which he/she is enrolled. Students shall therefore be held liable for any lapses. When in doubt, students may consult their Heads of Department in writing with a copy to the *Director, Academic Affairs Directorate* asking that advice be given in writing.
- 1.6 **The University reserves the right to conduct academic work (especially examinations) on any particular day of the week.**
- 1.7 **Except with the express written approval of the Vice-Chancellor, no student is permitted to register for two programmes at the same time either within or outside the University. The sanction for such an offence shall be the cancellation of the University registration or loss of studentship.**
- 1.8 **The University reserves the right to change rules, regulations and policies, as well as programme and course requirements in this Handbook without prior notice.**
- 1.9 Exemption from any of these General Regulations may be granted only by the express permission of the Academic Board on the recommendation of the appropriate Faculty Board.

2. APPLICATION

Currently, the following Bachelor's Degree programmes are available to any interested candidate, on application:

<i>Bachelor of Arts</i>	-	<i>BA</i>
<i>Bachelor of Fine Arts</i>	-	<i>BFA</i>
<i>Bachelor of Laws*</i>	-	<i>LLB</i>
<i>Bachelor of Music</i>	-	<i>BMus</i>
<i>Bachelor of Science in Administration</i>	-	<i>BSc (Admin.)</i>
<i>Bachelor of Science in Agriculture</i>	-	<i>BSc (Agriculture)</i>
<i>Bachelor of Science in Engineering</i>	-	<i>BSc (Engineering)</i>
<i>Bachelor of Science in Home Science</i>	-	<i>BSc (Home Sc.)</i>
<i>Bachelor of Science in the Natural Sciences</i>	-	<i>BSc</i>
<i>Bachelor of Science in the Allied Health Sciences¹</i>	-	<i>BSc</i>
<i>Bachelor of Science in Nursing¹</i>	-	<i>BSc (Nursing)</i>
<i>Bachelor of Science in Pharmacy</i>		
<i>Bachelor of Science in Veterinary Medicine</i>		
<i>Bachelor of Science in the Medical Sciences¹</i>	-	<i>BSc (Med Sci)</i>
<i>Bachelor of Dental Surgery¹</i>	-	<i>BDS</i>
<i>Bachelor of Medicine and Bachelor of Surgery¹</i>	-	<i>MB ChB</i>

For details on Entry Requirements and Regulations, refer to section on College of Health Sciences in the Handbook for the Sciences

* Available only to candidates who hold a Bachelor's degree from a recognised institution

3. ADMISSION TO THE BACHELOR'S DEGREE COURSE

3.1 West African Senior School Certificate:

3.1.1. Applicants with the West African Senior School Certificate Examination (WASSCE) (Ghanaian) must meet the following requirements:

Humanities (BA)

- Core Mathematics, English & Social Studies
- Three Electives

Engineering

- Core Mathematics, English & Integrated Science
- Three Electives from Elective Mathematics, Chemistry, Physics

Science/Pharmacy (BSc)

- Core Mathematics, English & Integrated Science
- Three Electives from Biology, Chemistry, Physics & Elective Mathematics

Agriculture/ (BSc)

- Core Mathematics, English & Science
- Three Electives from, Chemistry, Physics & Biology/General Agriculture

Veterinary Medicine

- Core Mathematics, English, Integrated Science
- □□□□ Three Electives from Biology, Chemistry and either Physics or Mathematics

Nursing

- Core Mathematics, English & Science (Minimum C4-C6)
- Three Electives from, Chemistry, Physics , Biology or Elective Mathematics
OR
- General Agriculture, Physics & Chemistry
OR
- Three General Arts Electives

- *Additionally Science candidates shall be required to pass Social Studies at least at grade D 7 and non-Science candidates shall be required to pass Integrated Science at least at grade D 7.*

3.1.2 **Foreign Applicants (with other WASSCE qualifications)**

Science:

English, Maths, Biology/Agriculture, Physics and Chemistry plus one Arts subject.

Arts:

English, Maths, Biology/Agriculture and any three Arts subjects.

Engineering:

English, Maths, Physics, Further Maths and Chemistry plus Biology/Agriculture or one Arts subject.

3.1.3 **Minimum Aggregate**

In determining eligibility for admission to Level 100 programmes, candidates' aggregate score in the three core and three elective subjects as indicated above shall not exceed 24.

- 3.1.4 A pass in the Senior Secondary School Certificate Examination (SSSCE) or West African Senior Secondary School Certificate Examination (WASSCE) is understood to mean a candidate's performance at grades interpreted as follows:

WASSCE		SSSCE			
A1	-	A	-	1	(Excellent)
B2	-	B	-	2	(Very Good)
B3	-	C	-	3	(Good)
C4	-	D	-	4	(Credit)
C5	-	"	-	"	"
C6	-	"	-	"	"
D7	-	E	-	5	(Pass)
D8	-	"	-	"	"

- 3.1.5 Senior Secondary School candidates shall be admitted into Level 100 (First Year) of the 4-year Bachelor's Degree Programme.

3.2 **General Certificate of Education Examinations (Ordinary and Advanced Levels*):**

- 3.2.1. **General Requirements:**
- i. A pass (at least grade 6) in five subjects including English Language, Mathematics, Science, and an Arts subject.
 - ii. Three passes, including at least one pass at grade D or better, must be obtained at the Advanced Level examination. In exceptional cases, a candidate who has taken three 'A' Level subjects at one and the same sitting and obtained two passes with at least Grade C in each may be considered.
 - iii. GCE Advanced Level candidates shall be admitted into Level 200 (Second Year) of the 4-Year Bachelor's Degree programme.

3.3. **Other Admissions:**

3.3.1 **Candidates in Possession of a Diploma:** A diploma (FGPA of 3.25 or higher) from the University of Ghana or its equivalent and passes in five subjects including English Language at the GCE 'O' Level or passes in Core Mathematics, Core Social Studies, Core English, Core Integrated Science, and two elective subjects at SSSCE or WASSCE are required. Diplomas awarded to students of Trinity Theological Seminary, Legon, St. Victor's Major Seminary, Tamale, St. Peter's Major Seminary, Pedu, Cape Coast, and Christian Service University College, Kumasi, and other affiliate institutions may be considered. On recommendation by the Head of Department, a candidate who obtains a diploma with distinction in any subject may also be considered.

3.3.2 **Mature Students:** Candidates aged at least 30 years who undergo a Qualifying Examination in English (Essay, Comprehension, Grammar and Usage) and General Paper (Quantitative Methods, Critical & Logical Thinking and Current Affairs) may be considered for admission to the Bachelor of Science in Administration and Bachelor of Arts degree programmes. Applications must be lodged initially with the Resident Tutor, Accra Workers' College.

** Foreign qualifications only. The University with effect from the 2007/2008 academic year ceased to accept for admission the West African Examinations Council GCE Ordinary and Advanced Levels qualifications. Individuals with such qualifications are encouraged to apply through the Mature Students Selection programme.*

3.3.3 **Former Students:** Candidates who previously have successfully completed Levels 100, 200 or 300 of the Bachelor's Degree may re-apply for admission. A candidate who has previously attempted Level 100, 200 or 300 unsuccessfully may also re-apply for admission. Such applications shall be considered on a fee paying basis.

3.3.4 **Candidates on Transfer from another University:** A candidate must have been formally admitted as a regular student to a Bachelor's Degree course in a recognized University and made satisfactory progress over not less than one academic year. Local transfers are not usually allowed. Transcripts of academic record must be made available to the Admissions Board. (Refer also to Section 38 of this Regulation).

3.3.5 **Visiting/Occasional/Foreign Students:** The University admits other students for varying durations in the Bachelor's degree programme, as Visiting (Special Admission), Occasional and Foreign students. (For details refer to Chapter 3 of this Handbook).

4. **ADMISSIONS**

4.1 **Admissions Board:**

4.1.1 The Admissions Board shall be presented with a list of all candidates who satisfy the

conditions for admission as stipulated in paragraphs 3.1, 3.2 and 3.3, for the Board to decide which candidates may be offered admission and to which subjects. In the case of former students of the University of Ghana (3.3.3) subjects previously taken shall not be approved. In the case of students entering the University on the basis of possession of a diploma (3.3.1), the subject in which the diploma is held shall be approved as one of the subjects to be studied. The student shall further be required to major in that subject or offer it as a combined major with another subject.

4.1.2 Candidates who do not satisfy the conditions for admission as in paragraphs 3.1, 3.2 and 3.3 are not eligible for admission and may not be considered by the Admissions Board.

4.1.2 The University reserves the right to ask a candidate who accepts an offer of admission while not satisfying the admission requirements as in paragraph 3.1, 3.2 and 3.3 to withdraw from the University, notwithstanding progress made in the course.

4.2 **Combination of Subjects**

Owing to Time-Table constraints, it is not practicable to allow all the combinations of subjects that are desirable. Applicants are therefore advised to select the subjects of their preference from any three of the following groups of subjects; applicants are not to choose more than one subject from the same group:

Group I	Group II	Group III	Group IV
<i>Sociology</i>	<i>Economics</i>	<i>Theatre Arts</i>	<i>Archaeology</i>
<i>Linguistics</i>	<i>Information Studies</i>	<i>Geography</i>	<i>English</i>
<i>Social Work</i>	<i>Psychology</i>	<i>Home Science</i>	<i>Mathematics</i>
			<i>Music</i>
Group V	Group VI	Group VII	Group VIII
<i>History</i>	<i>Dance Studies</i>	<i>Arabic</i>	<i>Statistics</i>
<i>Nursing</i>	<i>Political Science</i>	<i>Spanish</i>	<i>Religions</i>
<i>Classics</i>	<i>Accounting/Mgt</i>	<i>Swahili</i>	<i>French</i>
<i>Computer Sc.</i>	<i>Philosophy</i>	<i>Russian</i>	

5. **COURSE OF STUDY**

A candidate who is admitted to a degree programme shall be required to follow the approved programme of study over the prescribed period. No change of subject is allowed without the approval of the Dean of Faculty. A student may not graduate if he/she is found not to have followed the subjects assigned to him/her at Level 100 or 200.

6. **ACADEMIC SESSION**

The Academic Session shall comprise two Semesters, as follows:

- First Semester - August - December
- Second Semester - January - May

7. **STRUCTURE OF SEMESTER**

A Semester shall be of 17 weeks' duration and shall be structured as follows:

- 13 weeks of Teaching
- 1 week of Revision
- 3 weeks of Examinations

8. **ACADEMIC ADVISER**

Students shall be assigned academic adviser(s) in every department who shall provide

counsel on course offerings.

9. **REGISTRATION**

9.1 For a student to obtain credit in any course, he or she must be admitted into the Department, and must be properly registered for that course during the official registration period at the beginning of each semester. The student shall plan his/ her courses in consultation with his/her academic adviser(s). Choice of free electives must be consistent with the subject groupings, the teaching and examination timetables.

9.2 A fine shall be imposed on any student who fails to register during the normal time stipulated for registration by the University.

9.3 A student who fails to register during the registration period specified may forfeit his/her right to register for the semester or the entire academic year.

9.4 No student shall be permitted to register by **proxy**. In such a situation the impersonator's registration shall be cancelled. The implication is that the impersonator cannot pursue studies for that academic year.

10. **DURATION OF STUDY PROGRAMMES**

10.1a The minimum period for completion of the Bachelor's degree programmes in Arts, Social Studies, Administration, Agriculture, Engineering Sciences, Pharmacy and Science shall be 6 semesters and the maximum period shall be 10 semesters for Level 200 entrants. For Level 100 entrants, the minimum shall be 8 semesters and the maximum shall be 12 semesters. For the Bachelor of Law, the minimum period shall be 4 semesters and the maximum shall be 6 semesters.

In the case of language students in the Faculty of Arts who go on year abroad programmes, however, the minimum period shall be 8 semesters for Level 200 entrants, and 10 semesters for Level 100 entrants.

10.1b The minimum period for completion of the Bachelor's degree programme in Engineering Science shall be 8 semesters and the maximum period shall be 16 semesters.

10.2 These minimum and maximum periods are calculated from the date of first registration.

10.3 After exhausting the minimum duration as specified in 10.1 a above, a student in Arts, Social Studies, Administration, Agriculture, Engineering Sciences, Pharmacy or Science may apply for extension of up to four more semesters, during which he/she shall be required to pay the relevant fees, pro-rated, according to the number of credits offered.

10.4 Under exceptional circumstances, a student in any of the programmes mentioned in 10.1 above, who is unable to complete his/her programme within the maximum period specified, may be allowed up to four additional semesters to complete his/her programme, on a fee paying basis.

10.5 A student who is unable to complete his/her programme within 8 semesters beyond the minimum period allowed (altogether 14 semesters for Level 200 entrants and 16 semesters for Level 100 entrants) shall lose all credits accumulated, and his/her studentship cancelled. Such a student may be allowed to re-apply for admission into the University.

11. **INTERRUPTION OF STUDY PROGRAMME**
- 11.1 A student may interrupt his/her study programme for two continuous semesters only, provided that the maximum period allowable for the completion of the programme is not exceeded.
- 11.2 A student who wishes to interrupt his/her study programme shall apply at least four weeks before the commencement of the semester to his/her Dean of Faculty, through the Director of Academic Affairs, stating reasons why he/she wants to interrupt his/her study programme, with permission duly granted before he/she leaves the University. The decision of the Dean shall then be communicated to the Registrar who shall also communicate same to the applicant before he/she leaves the University. The Dean, in giving approval, may consult with the Counselling and Placement Centre, where necessary.
- 11.3 With the express written permission of the Vice Chancellor, a student may be permitted to interrupt his/her studies by two additional semesters, but not exceeding four semesters overall.
- 11.4 A student who interrupts his/her studies for more than 4 continuous semesters shall be deemed to have lost any accumulated credits. Consequently, his/her studentship shall be cancelled. Such a student may, however, be allowed to re-apply for admission into the University.
- 11.5 Where the ground for interruption of studies is medical, the Director of University Health Services shall be required to advise the Registrar on the propriety and length of period of interruption. The Registrar shall cause the Director of University Health Services to investigate any medical report reaching his office from any health delivery facility outside the University Hospital and advise accordingly.
- 11.6 Any student who does not go through the approved procedures before interrupting his/her studies shall be deemed to have abandoned his/her studentship. Subsequently, the Registrar shall cause the name of such a student to be removed from the student roll.
12. **INABILITY TO COMPLETE STUDY PROGRAMME WITHIN MAXIMUM PERIOD**
A student who is unable to complete his/her study programme within the maximum period allowed shall lose all credits accumulated and his/her studentship cancelled. Such a student may be allowed to re-apply for admission into the University on a fee paying basis.
13. **COURSE CREDIT**
One (1) course credit shall be defined as follows:
One hour lecture,
One hour tutorial, or
One practical session (of two or three hours), or
Six hours of field work per week for a semester.
14. **CODING AND NUMBERING OF COURSES**
All degree courses shall have letter and number codes beginning with four letters signifying a Department or subject, followed by a three-digit number in one of the following ranges:

Level 100 Courses	:	100 - 199
Level 200 "	:	200 - 299
Level 300 "	:	300 - 399
Level 400 "	:	400 - 499

The third digit in the number code shall be:

Zero (0), for a course that is offered in both Semesters;

Odd (1, 3, 5, 7, or 9) for a course offered in the first Semester;

Even (2, 4, 6, or 8) for a course offered in the second Semester.

15. MINIMUM AND MAXIMUM WORK-LOAD PER SEMESTER FOR FULL-TIME STUDY

15.1 A full-time student shall be required to carry a minimum workload of 18 credits per semester and a maximum of 21. Students in the Faculty of Engineering Sciences may, however, after Level 100 carry a maximum workload of 24 credits. Candidates registered for the BSc Agriculture degree shall, however, carry a minimum workload of 21 credits per semester.

15.2 Under special circumstances, a student may, with the approval of the Dean of Faculty, be allowed to carry a workload outside these limits, provided that the minimum workload will not fall below 15 credits per Semester.

16. PART-TIME STUDY

16.1 A student may, on application to the appropriate Faculty Board, be allowed to study for the Bachelor's degree on part-time basis.

16.2 A part-time student shall be required to carry a work-load below the minimum prescribed for full-time students and shall also be required to complete the degree programme within the periods specified in paragraph 10 above.

16.3 A part-time student shall not be eligible for on-campus accommodation.

17. STUDY PROGRAMME FOR BACHELOR'S DEGREE

The Total Study Programme (TSP) for the Bachelor's degree shall comprise:

- i. General University Requirements
- ii. Faculty Requirements (where applicable)
- iii. Core Courses - i.e. Major Departmental requirements
- iv. Prescribed Electives (to be defined by Department)
- v. Free Electives - i.e. of student's own choosing

18. GENERAL UNIVERSITY/FACULTY REQUIREMENTS

18.1 **Gen. Univ. Requirements -** African Studies
(Entrepreneurial Development ¹)

18.2 **Faculty Requirements:**

- Arts* - Language and Study Skills
- Science* - History and Philosophy of Science
Language and Study Skills²
Computer Literacy³

1 Suspended

2 For students entering at Level 100 only

3 For Biological Science Students

Social Studies - Basic Statistics
[Economics students take Mathematics/Statistics for Economists in lieu of Basic Statistics]

*Engineering/Pharmacy/
Vet.Science* - As listed under programmes

19. **ADMISSION INTO FACULTIES/PROGRAMMES**

19.1 **GCE Advanced Level Certificate Holders and its equivalent**

19.1.1 Students offered admission into Level 200 in the Faculties of Arts and Social Studies shall be offered three subjects.

19.1.2 Level 200 students in the School of Agriculture and the Business School shall follow the programme approved by the Academic Board.

19.1.3 Level 200 students in the Faculty of Science shall follow programmes in either *Biological Sciences* or *Biomathematical Sciences* or *Mathematical Sciences* or *Physical Sciences* or *Earth Sciences*. Biology at Level 100 shall not be a pre-requisite for Level 200 Biology.

19.1.4 The Faculty of Engineering Science will not admit students to Level 200. All students (including Advanced Level Students) will be admitted to Level 100.

19.2 **West Africa Senior School Certificate Holders**

19.2.1 West Africa Senior School (WASSCE) candidates shall be admitted into Level 100 in the Faculties of Arts, Science, Engineering, Social Studies, Business School, School of Agriculture, School of Pharmacy or School of Veterinary Medicine according to one's elective area of study at the Senior Secondary School Level and/or subject area or programme of interest at the university level. The programmes at this Level are so designed as to give students a firm grounding in the respective disciplines to enable them cope with the specialized areas of study in the subsequent years.

19.2.2 Level 100 students in the Faculty of Science shall be admitted to read one of the following programmes: *Biological Sciences, Biomathematical Sciences, Mathematical Sciences, Physical Science or Earth Sciences*. Biology at Level 100 shall not be a pre-requisite for Level 200 Biology.

19.2.3 Level 100 students in the Faculty of Engineering Sciences shall be admitted to read one of the following programmes: *Computer Engineering, Food Process Engineering, Agricultural Engineering, Materials Science and Engineering (Ceramics Option) and Biomedical Engineering*.

19.3 **Admission into the Allied Health Sciences/Medicine/Dentistry**

Candidates for the Allied Health Sciences, Medicine and Dentistry shall be admitted after Level 100 in the Biological and Biomathematical Sciences in the Faculty of Science. In all cases, selection shall be based on programme at examination using cumulative grade point averages. Candidates shall also be interviewed. [For full details refer to the College of Health Sciences handbook]

20. **DEPARTMENTAL MAJORS**

- 20.1 Students in the Faculty of Science and Business School shall, with the approval of the Department(s)/School concerned, indicate their **major** (subject of study) before the beginning of Level 300. Students in the Faculty of Science may, however, opt to study for a **combined major** degree.
- 20.2 Students in the Faculty of Engineering Sciences shall indicate their **major** fields of study (two options) and shall be granted one such option before starting Level 100. All students however will take the common Levels 100 and 200 courses.
- 20.3 In the Faculties of Arts and Social Studies students shall follow the 3:2:1/ 3:2:2 Bachelor of Arts degree structure. This means that students shall be required to study in two principal subjects towards either a **Major** and a **Minor** or a **Combined Major** degree.
- 20.4 In the School of Agriculture, students shall specialize after Level 300. The approved programme for Major in any particular Department may be obtained from the Dean of School or the Head of the relevant department.
- 20.5 For students in faculties other than Agriculture, to major in a particular subject, at least 50% of the total number of credits required for graduation shall have been earned in respect of **core** and **prescribed elective** courses of the relevant department.
- 20.6 Where a student opts for a combined major, 30-40% of the credits required for graduation shall have been prescribed by each of the two departments and shall cover core courses in the two subjects or departments.

21. **GRADING SYSTEM**

21.1 Student performance in a course shall be graded as follows:

Grade	Numerical Marks %	Interpretation	Grade Point
A	70 - 100	Excellent	4.00
A-	65 - 69	Very Good	3.75
B+	60 - 64	Good	3.50
B	55 - 59	Above Average	3.00
B-	50 - 54	Average	2.50
C+	45 - 49	Pass	2.00
C	40 - 44	Pass	1.50
D	30 - 39	Fail ⁶	1.00
F	0 - 29	Fail	0
X	-	Fail	0
Z	-	Disqualification	-
I	-	Incomplete	-
Y	-	Continuing	-
AUDI	-	Audit	-

⁶ *May be accepted as fulfilling pre-requisite for other courses*

- 21.2 **Grade Point (GP):** Each Grade is assigned an equivalent grade point as indicated above. The number of (grade) points earned by a student, for each course completed, is computed as the product of the number of credits for the course and the grade point equivalent letter of the grade obtained in that course.
- 21.3 **Cumulative Grade Point Average (CGPA):** The student's cumulative grade point average is calculated by dividing the total number of grade points obtained, up to any specified time, by the total number for credits of **all** courses for which the student has registered up to that time.
- 21.4 **Final Grade Point Average (FGPA):** The FGPA is the CGPA for all courses under consideration calculated up to the end of a student's academic programme.
22. **DEFINITION OF GRADES**
- 22.1 **Pass Grades:** Grades A to C constitute **Pass** grades.
- 22.2 **Failure Grades:** Grades D, F, X, Z constitute **Failure** grades.
- 22.3 **Continuing:** A grade Y (for **Continuing**) shall be awarded at the end of a Semester to any student who is taking a course which continues into the next semester.
- 22.4 **Audit:** A grade AUDI shall be awarded for attendance at lectures, but where no examination is taken, or where an examination is taken, but no mark can be returned, for good reasons. The Grade AUDI is not factored in the calculation of the FGPA.
- 22.5 **Non-Completion of Course:**
- i. A grade I (for **Incomplete**) shall be awarded to a student who is unable to complete a course for reasons adjudged by the Board of Examiners as satisfactory. Such a student shall be expected to complete the course the very next time the course is available.
 - ii. A grade X shall be awarded to a student who is unable to complete a course for reasons adjudged by the Board of Examiners as unsatisfactory.
- 22.6 **Disqualification:**
- i. A grade Z denotes **Disqualification** from an examination as a result of an examination malpractice or offence, and shall be awarded whenever it is established that a candidate had attempted to gain an unfair advantage in an examination, be it in a Principal subject or an Ancillary or any other paper.
 - ii. A candidate awarded a grade Z may be debarred from taking a University Examination for a stated period, or indefinitely, or may be expelled from the University altogether.
 - iii. A grade Z may be awarded only by the Board of Examiners.
23. **ELIGIBILITY FOR EXAMINATIONS**
- 23.1 A student shall attend all such lectures, tutorials, seminars and practicals and undertake all other assignments as are approved by the University.
- 23.2 Further to (23.1), a student shall be expected to attend lectures, tutorials, practicals and other activities prescribed for the courses for which he/she has registered, and to execute all assignments given.

- 23.3 Each Department shall, with the approval of the Academic Board, determine the requirements for the courses they offer. A student who does not fulfil the requirements for any course shall not be allowed to take the examination for that course.
- 23.4 In any case, a student who is absent for a **Cumulative Period of 25%** from all lectures, tutorials, practicals and other activities prescribed for any course in any semester shall be deemed to have withdrawn from the course. Such a student shall not be permitted to sit for the semester examination.
24. **REGISTRATION FOR EXAMINATIONS**
- 24.1 Registration for a University Examination shall require endorsement of the Registration List by the Head of Department to the effect that the candidate has pursued satisfactorily the approved course(s) of study in each subject being offered over the prescribed period. A candidate's registration shall not be valid unless it is so endorsed.
- 24.2 Endorsement as in (24.1) shall be withheld if a candidate is not deemed to have followed satisfactorily the approved course of study (as in Section 23). In any event of the withholding of an endorsement, the Head of Department shall request the appropriate Faculty Board to confirm the action taken.
- 24.3 Where applicable, candidates shall have up to 3 weeks (21 days) from the commencement of the semester within which to **ADD** or **DROP** courses.
- 24.4 After 21 days of the Semester, Departments shall publish for verification by students, lists of registered candidates for all the courses offered by the departments. The lists of registered candidates shall be forwarded to the Office of the Director, (Academic Affairs Directorate) before the end of the sixth week of the semester. **These lists shall be deemed as constituting final registration for end of Semester examinations.** This means that by the end of the sixth week, students whose names do not appear in any course list shall not be allowed into the end-of-Semester examination for that particular course. Similarly, students who are duly registered for a course but who fail to take the end-of-Semester examination for that course shall be deemed to have absented themselves from the examination of that particular course, for which grade X shall be awarded.
25. **SEMESTER EXAMINATIONS**
- 25.1 Each course, with the exception of a Project, shall normally be completed in one semester.
- 25.2 A final (end-of-semester) examination shall normally be required as a part of every course. An examination schedule showing time and place of examination for each course shall be published each semester.
- 25.3 In the Sciences (Faculties of Science, Engineering and College of Agriculture and Consumer Sciences, School of Pharmacy and School of Veterinary Medicine) the marks obtained in the end-of-semester examination shall contribute 70% of the grade for the course while continuous assessment contributes the remaining 30%, except for practicals or other courses which are assessed entirely by continuous assessment. Continuous assessment is suspended in the Humanities. The end-of-semester examination therefore constitutes 100% of the grade for the course.

- 25.4 Time allotted to examination papers shall be as follows:
- | | |
|-----------------------|----------------|
| 1- Credit Course | - 1 hour |
| 2- Credit Course | - 2 hours |
| 3 or 4- Credit Course | - 2 to 3 hours |
26. **STUDENT IN GOOD STANDING**
A student in good standing shall be one whose Cumulative Grade Point Average (CGPA) is at least 1.50 (Grade C).
27. **PASSING, PROBATION AND WITHDRAWAL**
- 27.1 **Level 100:**
- 27.1.1 A Level 100 candidate shall be deemed to have satisfied the requirements for progression to Level 200, if he/she has obtained a CGPA of 1.50 or better overall in all Level 100 examinations.
- 27.1.2 In addition to 27.1.1 the candidate shall have satisfied Faculty/Departmental requirements for entry to courses at Level 200.
- 27.1.3 There shall be no probation at Level 100.
- 27.1.4 A candidate who does not qualify to progress to Level 200 on the basis of (27.1.1) and (27.1.2) above shall be asked by the Registrar to withdraw from the University.
- 27.2 **Level 200:**
- 27.2.1 **Pass:** A student is deemed to have passed, if he/she has a CGPA of 1.50 or better and has passed a minimum of 24 credits of required courses at the end of Level 200.
- 27.2.2 **Probation:** Means repeating failed courses and, where possible, making up the workload with the appropriate courses from the next Level. Accordingly, a student shall be put on probation if he/she has:
- i. a CGPA of 1.50 or better and has passed between 18 and 23 credits at Level 200 (or between 21 and 26 credits for students of Agriculture), **or**
 - ii. a CGPA of less than 1.50 and has passed 24 credits or more (or 27 credits or more for students of Agriculture).
- 27.2.3 A student who is put on probation shall forfeit his/her residential status. Such a student shall be made to resit his/her failed courses as a non-residential student.
- 27.3 **Level 300:**
- 27.3.1 **Pass:** A student is deemed to have passed, if he/she has a CGPA of 1.50 or better and has passed a minimum of 60 credits of required courses at the end of Level 300.
- 27.3.2 **Probation:** Means repeating failed courses and, where possible, making up the workload with the appropriate courses for the next level. A student at Level 300 who does not pass as in 27.3.1 shall be put on probation if he/she has:
- i. a CGPA of 1.50 or better and has passed between 48 and 59 credits at the end of Level 300. (In the School of Agriculture, a student on probation shall have passed between 56 and 69 credits), **or**
 - iii. a CGPA of less than 1.50 and has passed 60 credits or more. (or 70 credits or more in the case of Agriculture).

27.3.2 A student who is put on probation shall forfeit his/her residential status. Such a student shall be made to resit his/her failed courses as a non-residential student.

27.4 **Withdrawal**

- i. *A student who does not pass as prescribed for Levels 200 and 300 above and also does not meet the requirements for probation, as in Levels 200 and 300, shall be asked by the Registrar to withdraw from the University, or*
- ii. *A student who, after a year's probation, does not pass as prescribed for Levels 200 and 300 above shall be asked by the Registrar to withdraw from the University.*

28. **DEFERMENT OF EXAMINATION**

28.1 **On Grounds of Ill-Health:** A student who has satisfied all the requirements as prescribed in Section 23, but is unable to take the main (end of semester) examination on grounds of ill health, shall, on application to the Registrar, and on provision of a Medical Certificate issued by the Director of University Health Services, be allowed to defer the semester examinations, and shall be allowed to take the examination at the next offering. Subsequent applications for deferment, on grounds of ill-health, shall be subject to a Medical Certificate issued by a properly constituted Medical Board.

28.2 **On Grounds Other than Ill-Health:** In cases of requests for deferment on grounds other than ill-health, the appropriate Dean shall invite the applicant for an interview and advise the University accordingly. It shall be the student's responsibility to satisfy the University beyond reasonable doubt why he/she wishes to defer the examinations.

28.3 In all cases of requests for deferment of examinations, the applicant(s) shall obtain written responses from the Registrar before leaving the University.

29. **DECLARATION OF RESULTS**

29.1 Results of Semester examinations taken at the end of each Semester shall normally be published by the Registrar before the commencement of the next Semester.

29.2 A result slip indicating the student's performance in the examination, may be accessed through the MIS web portal on the University's website www.ug.edu.gh

30. **ELIGIBILITY FOR THE BACHELOR'S DEGREE**

30.1 A Bachelor's Degree appropriately designated shall be awarded to a candidate who has been properly admitted to the University, and who has followed the approved courses¹ of study over the prescribed period and has satisfied the following conditions:

- i. **University Requirements:**
 - a. evidence of regular enrolment in the degree programme;
 - b. discharge of all obligations owed to the University;
 - c. a pass in all University required courses;
 - d. satisfactory performance in the appropriate University Examinations.
- ii. **Faculty/Departmental Requirements:** satisfactory discharge of such requirements as may be prescribed for the degree.

¹ *For the avoidance of doubt, a student may be denied graduation if he/she*

does not follow subjects assigned to him/her at either Level 100 or 200

30.2 Candidates who are graduating Major and Minor as well as candidates graduating Combined Major from both the Faculties of Arts and Social Studies must satisfy the Faculty requirements prescribed by both Faculties.

31. **REQUIREMENTS FOR BACHELOR'S GRADUATION**

31.1 A student shall be deemed to have satisfied the requirements for graduation if:

- i. he/she has satisfied all General University and Faculty requirements;*
- i. he/she has accumulated the minimum number of credits required by the Faculty, including core and prescribed electives as follows:*

31.1.1 ***Administration, Arts, Social Studies, Home Science, Nursing and Science***

Entry into Levels 100 and 200

- a. 108 credits and passed at least 90 credits.*
- b. he/she must not have failed more than 18 credits of core courses and prescribed electives, provided that the failed grades are not lower than "D"*

Entry into Level 300

- a. 72 credits and passed at least 60 credits.*
- b. he/she must not have failed more than 12 credits of core and prescribed electives, provided that the failed grades are not lower than "D"*

31.1.2. ***Agriculture***

- a. 126 credits and passed at least 105 credits*
- b. he/she must not have failed more than 21 credits of core and prescribed electives, provided that the failed grades are not lower than "D"*

31.1.3. ***Law***

- a. 96 credits and passed at least 72 credits including all core courses*
- b. he/she must not have failed any of the core courses (where failure means a grade below "C")*
- c. he/she must not have failed more than 12 credits of elective courses (where failure means a grade below "C")*

31.1.4. ***Engineering Sciences***

- a. 144 credits and passed at least 120 credits*
- b. he/she must not have failed more than 24 credits of core and prescribed electives, provided that the failed grades are not lower than "D"*

31.2 Long Essay/Project Work, wherever applicable, shall be submitted for assessment before the date of the last paper in the second semester examination. In default the candidate shall be asked to submit the Long Essay/Project Work the following semester and shall be treated as a Repeat Examination, with all its implications.

32. **CLASSIFICATION OF DEGREE**

32.1 All end-of-semester examination results from Level 200 except University and Faculty required courses, shall be taken into account in the computation of the Final Grade Point Averages (FGPA) for the classification of the bachelor's degree. Level 100 courses in the Faculty of Engineering Sciences shall, however, count towards computation of the FGPA for the classification of the bachelor's degree*.

* *With the exception of the Faculty of Engineering Sciences, Level 100 courses shall not usually count towards the*

computation of the FGPA for the classification of the Bachelor's degree.

- 32.2 The GPAs at Levels 200, 300 and 400 shall be weighted in the proportions 1:2:2. In the Faculty of Engineering Sciences the weighting shall be 1:1:2:2.
- 32.3 In the determination of the FGPA, a weighted average of all repeat courses shall be used, as for instance, a 3-credit course with a 'D' at first attempt and an 'A' at the second attempt shall attract a total of 6 credits in the computation of the Grade Point Average of that particular course.
- 32.4 The full scheme of classification shall read as follows:
- | | |
|-----------------------------|---------------------------------|
| First Class | - FGPA of 3.60 or better |
| Second Class (Upper) | - FGPA of 3.25 - 3.59 |
| Second Class (Lower) | - FGPA of 2.50 - 3.24 |
| Third Class | - FGPA of 2.00 - 2.49 |
| Pass | - FGPA of 1.50 - 1.99 |
| Fail | - FGPA of below 1.50 |
- 32.5 The following degrees of the College of Health Sciences, BSc (Med Sci), MB ChB, BDS and BSc in the Allied Health Sciences shall not be classified.
- 32.6 University and Faculty required courses shall continue to remain ancillary subjects and a pass in every subject shall be required by all undergraduate degree students for the award of a Bachelor's degree; marks obtained shall be entered on the student's transcript, but shall not count towards the classification of the degree.
33. **CONFIRMATION OF AWARD OF DEGREE**
A list of candidates who are deemed eligible as in Sections 30, 31 and 32 shall be laid before the Academic Board for approval at the first meeting in the following academic year. No award shall be confirmed unless the Academic Board is satisfied that the candidate has satisfied all the conditions for the award of a degree.
34. **PRESENTATION OF AWARD**
Following confirmation of an award of a degree as in Section 33, the candidate shall be entitled to be awarded a diploma of the appropriate Bachelor's Degree under the seal of the University at a Congregation of the University assembled for that purpose. The diploma shall indicate the Principal Subject or Subjects offered and the class of degree awarded.
35. **CANCELLATION OF AWARD**
- 35.1 Notwithstanding previous confirmation of an award of a degree as in Section 33 and presentation of a diploma as in Section 34, the Academic Board may at any time cancel an award, even with retrospective effect, if it becomes known that:
- i. a candidate had entered the University with false qualifications, or
 - ii. a candidate had impersonated someone else, or
 - iii. a candidate had been guilty of an examination malpractice for which a grade Z would have been awarded, or
 - iv. that there are other reasons that would have led to the withholding of confirmation of the award in the first place.
- 35.2 In any such event, the decision of the Academic Board shall be published on the

University Notice Board and the candidate notified. Such cancellation and the reasons for it shall be entered on the candidate's transcript.

36. **DATING OF BACHELOR'S DEGREE**

The Bachelor's Degree of the University of Ghana shall be dated with reference to the last day of the Semester during which the final examination is taken. This provision shall, however, not apply to the Medical and Dental Schools.

37. **TRANSCRIPT OF ACADEMIC RECORD**

37.1 At the end of a student's programme, the University shall, on the payment of an appropriate fee, issue to the particular student a complete transcript of his/her academic record. This transcript shall be marked *Student Copy* and shall record all courses attempted and all results obtained.

37.2 In writing the Bachelor's degree certificate or in writing a student's transcript, it shall be clearly indicated which subjects constitute the candidate's **Major, Minor** or **Combined Major** disciplines, where appropriate.

38. **TRANSFER STUDENTS**

38.1 A student transferring from one university to this university shall accumulate a minimum of 72 credits over a study period of 4 semesters as a full-time student in this University before he/she shall become eligible for graduation. For the BSc. Agriculture, a minimum of 84 credits shall be accumulated.

38.2 The classification of the degree shall be based only on the courses taken at this University.

39. **REPEAT EXAMINATION**

39.1 A student may decide to re-register for and repeat **a failed course only** on a future occasion upon payment of the appropriate fee. If he/she repeats the course and passes its examination, he/she shall be awarded the full grade earned on that occasion. The student's transcript will show the number of occasions the candidate took the examination for that particular course and the grades earned on all such occasions.

39.2 However, in determining the FGPA, a weighted average of all repeat courses shall be used, as for instance, a 3-credit course with a 'D' at first attempt and an 'A' at the second attempt shall attract a total of 6 credits in the computation of the Grade Point Average of that particular course.

APPROVED GROUPING OF SENIOR SECONDARY SCHOOL SUBJECTS

CORE COURSES	ELECTIVE GENERAL ARTS	ELECTIVE SCIENCE	ELECTIVE AGRICULTURE
English Language Mathematics Integrated Science Social Studies Physical Education* Religious/Moral Education*	Any 3 or 4 of: Literature in English French Ghanaian Language History Economics Geography Government Christian Religious Studies Islamic Religious Studies Traditional Religious Studies Music	Mathematics Any 2 or 3 of: Biology Chemistry Physics Technical Drawing Geography French or Music	General Agriculture Any 2 or 3 of: Crop Husbandry & Horticulture or Animal Husbandry or Fisheries or Forestry Chemistry Physics Mathematics French or Music

...see over leaf

ELECTIVE BUSINESS	ELECTIVE TECHNICAL	ELECTIVE VOCATIONAL
<p><u>Accounting Option</u> Any one or two of: Business Mathematics or Principles of Costing Economics Mathematics Typewriting French or Music</p>	<p>Technical Drawing Any one or two of: Building Construction Woodwork Metal Work Auto Mechanics Applied Electricity Electronics Any one or two of: Physics Mathematics French</p>	<p><u>Visual Arts Option</u> General Knowledge in Art Any one of: Graphic Design Picture Making Any one of: Basketry Leather work Ceramics Sculpture Textiles Any one of: French Music Economics Literature in English</p>
<p><u>Secretarial Option</u> Intro Business Management (including Office Duties) Typewriting Any one or two of: Accounting Business Mathematics or Principles of Costing Mathematics Economics Literature in English French or Music</p>		<p><u>Home Economics Option</u> Management in Living Any one of: Food & Nutrition Clothing Any one or two of: General Knowledge in Art Economics French</p>

 *To be examined internally

SSSCE SUBJECT CLASSIFICATION FOR ADMISSION TO THE BACHELOR'S DEGREE

GROUP I CORE COURSES	GROUP II SCIENCE	GROUP III GENERAL ARTS	GROUP IV VOCATIONAL/ TECHNICAL
English Language Mathematics Integrated Science Social Studies	Mathematics (Elective) Physics Chemistry Biology or General Agric. Geography Technical Drawing	Literature in English French Ghanaian Language Music Christian or Islamic or Traditional Religious Std. Economics History Government General Knowledge in Art Management in Living Mathematics (Elective)	Applied Electricity Electronics Auto Mechanics Building Construction Metal Work Woodwork Technical Drawing Crop Husbandry and Horticulture Animal Husbandry Fisheries/Forestry Introduction to Business Management Business Mathematics Principles of Costing Typewriting Accounting Graphic Design Picture Making Ceramic/Leatherwork/ Sculpture/Basketry/ Textiles/Jewellery/ Foods & Nutrition Clothing

10. INSTITUTE OF AFRICAN STUDIES

Takiwaa Manuh <i>LLB (Ghana) LLM (Dar-es-Salaam) PhD (Indiana)</i>	-	Professor/Director
Brigid Sackey <i>MA (Marburg)Ph.D(Temple)</i>	-	Associate Professor/ Deputy Director
Mavis O. Addotey <i>BA Grad. Dip (Comm. Stud.) (Ghana)</i> <i>Grad Dip. Ed (Cape Coast)</i>	-	Administrative Secretary
Olive A. Adjah <i>BA Dip (Ghana) MA (Liverpool) MPhil (Ghana)</i>	-	Senior Assistant Librarian
Martin De Porres Maaseg <i>Dip. Religion ,BA, MA (Ghana)</i>	-	Archivist

FACULTY

Societies and Cultures Section

Osman.A.R. Alhassan, <i>BA PhD (GH) MPhil (Bergen)</i>	-	Research Fellow/Head of Unit
Akosua Adomako Ampofo <i>BSc MSc (K'si) PhD (Vanderbilt)</i>	-	Associate Professor
Christine Oppong <i>MA (Ghana) PhD (Cantab)</i>	-	Professor *
Takiwaa Manuh <i>LLB (Ghana) LLM (Dar-es-Salaam) PhD (Indiana)</i>	-	Professor
S. Kojo Amanor <i>BA (Hons) MA PhD (London)</i>	-	Associate Professor
Albert K. Awedoba <i>BA MA (Ghana) DPhil (Oxford)</i>	-	Associate Professor
Owusu Brempong <i>BA (Iowa) MA PhD (Indiana)</i>	-	Senior Research Fellow

Languages, Literature and Drama Section

Esi R.A. Sutherland-Addy <i>BA (Ghana) MA (Calif)</i>	-	Senior Research Fellow/Head
Mary E. Kropp Dakubu <i>BA (Queen's Canada) MA (Penn) PhD (London)</i>	-	Professor
Edward Nanbigne <i>Dip Eng (Winneba) BA MPhil (Ghana)</i>	-	Research Fellow

Religion and Philosophy Section

Brigid Sackey <i>MA (Marburg) PhD (Temple)</i>	-	Associate Professor/Head of Unit
Rev. Abraham A. Akrong <i>LTH BA MA (Gh) THM (Lutheran) TH (USA)</i>	-	Senior Research Fellow

History and Politics Section

Kojo O. Aidoo, BA, MPhil, PhD (Ghana)	-	Research Fellow/Head of Unit
Irene Odotei, BA, PhD (Ghana)	-	Associate Professor *
Ebenezer Ayesu, BA, MPhil (Ghana)	-	Research Fellow
Richard Asante, BA, MPhil (Ghana)	-	Research Fellow

Music and Dance Section

Godwin K. Adjei <i>Dip Music (Winneba) BA, MPhil (Ghana)</i>	-	Research Fellow/Head of Unit
Alexander A. Agordoh , BA, MPhil, PhD (Ghana)- Misonu Amu , Dip in Music MPhil (Ghana)	-	Senior Research Fellow *
M. Nii Dortey , BA (Ghana) MPhil (Ghana)	-	Research Fellow
B. Obido Ayettey <i>Dip. Music (Ghana) MFA (USA)</i>	-	Tutor
Abdulai Z. Zakari , Dip, in Dance MA (Ghana)	-	Tutor

Media and Visual Arts Section

Kwame Amoah Labi <i>BA (KNUST) MPhil PhD (Ghana)</i>	-	Snr. Research Fellow/Head of Unit
Thomas K. Aning , Dip Admin (Ghana) MA (London)- Yaba Badoe , BA Hons (Cantab) MPhil (Sussex)	-	Senior Archivist Visiting Scholar

* Post-retirement contract

1. *The University of Ghana Act, 1961 (Act 79) stipulates the following among the aims of the University:*

"... so far as practicable students should be given an understanding of world affairs and in particular of the histories, institutions and cultures of African civilizations".
2. *Towards this objective, a course in African Studies is offered as an integral part of ALL Bachelor's degree programmes.*
3. The general theme of the programme of African Studies for undergraduate candidates is **Society, Culture and Development** in Africa. Since October 1976 the programme features two groups of courses, namely:

Group A - Consisting of lecture courses over a range of topics each of one semester duration.

Group B - Consisting of proficiency courses taught through lectures – demonstration, guided reading, workshop, etc. each of one semester duration.

(GROUP A - LECTURE COURSES)

AFST 200	Course A1:	Appropriate Technology for Rural Development in Africa
AFST 210	Course A2:	Social Framework of Economic Development
AFST 220	Course A3:	Africa in the Modern World
AFST 230	Course A4:	Culture and Development
AFST 240	Course A5:	Our African Heritage Through Literature
AFST 250	Course A6:	African Popular Culture: Traditional Festivals and Funeral Ceremonies
AFST 221	Course A7:	Africa and the Diaspora
AFST 223	Course A8:	Chieftaincy and Development
AFST 255	Course A9:	Issues in Africa's Population

(GROUP B - PROFICIENCY COURSES)

AFST 260	Course B1:	Language Proficiency
AFST 270	Course B2:	African Music
AFST 280	Course B3:	African Dance
AFST 290	Course B4:	African Drama

COLLEGE OF AGRICULTURE AND CONSUMER SCIENCES

B.K. Ahunu <i>BSc (Agric)(Ghana) MSc.(Brit. Col) PhD (Alberta)</i>	-	Provost
S. K. Offei , <i>BSc (Agric) (Gh) MPhil (Lond)</i> <i>Dip. In Seed Path (Den) Ph.D (Lond) DIC</i>	-	Dean, School of Agriculture
Vacant	-	College Registrar
R.H. Alorbi , <i>BSc (Admin) MBA (Ghana), CA (Ghana)</i>	-	Accountant
E. Baidoo , <i>BA Grad Dip (Arch Stds) (Ghana)</i>	-	Senior Assistant Registrar
Patricia Awuah , <i>BA (Cape Coast), PG Diploma (GIMPA)</i>	-	Assistant Registrar

FACULTY

Department of Agricultural Economics & Agribusiness

D.B. Sarpong , <i>BSc (Agric) (Ghana) M.A (Int. Rel: Int. Econ.) (Inter.Uni. Japan) PhD(Econ.) (Nagoya)</i>	-	Senior Lecturer/Head
Ramatu Al-Hassan , <i>BSc (Agric) (KNUST) MA (Agric Econs) (WSU) PhD (Agric Econs) (Iowa State)</i>	-	Senior Lecturer
Rev. S. Asuming-Brempong <i>BSc (Agric) (Ghana) MSc (Agric Econs) (UPIB Philipines) MA (Econs) MSc PhD (Michigan)</i>	-	Senior Lecturer
G. Tsey-Mensah Kwadzo <i>BSc (Agric.) (Ghana) PhD (Strathclyde, Glasgow)</i>	-	Lecturer
D.P.K. Amagashie , <i>BSc MPhil (Agric. Econs)(Ghana)</i>	-	Lecturer
Irene S. Egyir , <i>BSc (Agric) MPhil Ph.D (Agric Econ) (Ghana)</i>	-	Lecturer
A. Mensah Bonsu <i>BSc MPhil (Agric. Econ) (Ghana) PhD (VU-Amsterdam)</i>	-	Lecturer
J.B.D. Jatoe , <i>BSc MPhil (Agric Econ) (Ghana)</i>	-	Lecturer
J.K. M. Kuwornu <i>BA (Econs) (Ghana), MSc, PhD (Wageningen)-</i>	-	Lecturer
Y. Osei-Asare <i>BSc (Agric) MPhil (Agric Econs) (Ghana) PhD (Bonn)</i>	-	Lecturer
W. Seini	-	Associate Professor
E.K. Andah , <i>BA (Econ) MA (Applied Econs) (Alberta) PhD (Agric Econ) (Manitoba)</i>	-	Part Time Lecturer

Department of Agricultural Extension

E.E. Ackah-Nyamike Jr. , <i>BSc MPhil (Ghana), PhD (Reading)-</i>	-	Lecturer/Head of Dept
P.B. Atengdem <i>BSc (Agric) (Ghana) MSc PhD (Agric Ext) (Reading)</i>	-	Lecturer
O. Sakyi Dawson <i>BSc (Agric) (Ghana) MSc PhD (Agric Ext) (Reading)</i>	-	Senior Lecturer
S.D. Boateng , <i>BSc (Agric) MPhil (Ghana)</i>	-	Lecturer
J.N. Anaglo , <i>NDA BSc (Agric) MPhil (Ghana)</i>	-	Lecturer
Comfort Y. Freeman <i>BSc, MPhil, (Ghana), PhD (Wageningen)-</i>	-	Lecturer

Department of Animal Science

Gertrude S. Aboagye , <i>BSc (Agric) (Ghana) MSc (Guelph)</i>	-	Associate Professor/ Ag. Head
B.K. Ahunu , <i>BSc (Agric) (Ghana) MSc (Brit Col) PhD (Alberta)-</i>	-	Professor
K.G. Aning , <i>BDVM (Ibadan), PhD (Liverpool)</i>	-	AssociateProfessor/ Coordinator, Veterinary Medicine
Anna R. Barnes , <i>BSc (Agric) (Ghana) MSc (Cornell)</i>	-	Associate Professor
B. Awumbila <i>MSc (Ukraine) Dr MedVet (Justus Liebig-Giessen)-</i>	-	Associate Professor
K.A. Amaning-Kwarteng , <i>MSc (Agric) (Gh) PhD (Sydney)</i>	-	Senior Lecturer
B.B. Kayang , <i>BSc (Agric) MPhil (Ghana) PhD (Gifu)</i>	-	Senior Lecturer
A.D. Agyei , <i>MSc PhD (Wales)</i>	-	Part-Time Lecturer
F. Konadu-Ampratwum , <i>BVSc (Bangalore) MVSc (Izatnagar)-</i>	-	Part-Time Lecturer
K. Boa-Amponsem <i>BSc (Agric.) (Kumasi),</i>	-	

<i>MPhil (Edinburgh), PhD (VSU)</i>	-	Part Time Lecturer
F. Y. Obese , <i>MSc (Kumasi), PhD (Melbourne)</i>	-	Part Time Lecturer

Department of Crop Science

J. Ofosu-Anim , <i>BSc (Agric) (Ghana) MSc (Kagawa) PhD (Nagoya)</i>	-	Senior Lecturer/Head
E.Y. Danquah , <i>BSc (Agric) (Gh) MPhil PhD (Camb)</i>	-	Professor
J.N. Ayertey , <i>BSc (Ed) (UCC) BSc (Ghana) PhD (Lond) DIC</i>	-	Professor
J.C. Norman , <i>Dip in Agric (Gh) BSc MSc (Calif) PhD (Bonn)</i>	-	Professor
D. Obeng Ofori , <i>BSc (Agric) (Ghana) MPhil PhD (Camb)</i>	-	Professor
S.K. Offei , <i>BSc (Agric) (Ghana) MPhil (Lond)</i> <i>Dip in Seed Pathology (Den) PhD (Lond) DIC</i>	-	Professor
K.A. Oduro , <i>BSc (Agric) (Gh) MSc (Hort) (Hawaii) PhD (Calif)</i>	-	Associate Professor
Essie T. Blay , <i>BSc (Agric) (Gh) MSc (Hawaii) PhD (Calif)</i>	-	Associate Professor
F.K. Kumaga , <i>BSc (Agric) (Ghana) PhD (Wales)</i>	-	Associate Professor
K. Ofori , <i>BSc (Agric) (Ghana) MSc PhD (Sask)</i>	-	Associate Professor
Christiana Amoatey , <i>BSc (Agric) MPhil (GH) PhD (Reading)</i>	-	Lecturer
B. Boateng Agyeman , <i>BSc MPhil (Ghana)</i>	-	Lecturer
E. Cornelius , <i>BSc (Cape Coast) MPhil (Ghana)</i>	-	Lecturer
E.V. Doku , <i>BSc (Agric) (Lond) PhD (New England)</i>	-	Prof. Emeritus Part-Time
F.K. Oppong , <i>BSc (Agric) (Ghana) PhD (Wales)</i>	-	Part-Time Lecturer
E.P.N. Johnson , <i>BSc MPhil (Ghana) PhD (Cranfield)</i>	-	Part-Time Lecturer

Department of Soil Science

G.N.N. Dowuona , <i>BSc (Agric) (K'si) MSc (Ghana) PhD (Sask)</i>	-	Associate Professor/Head
M.K. Abekoe , <i>BSc (Cape Coast) MPhil (Ghana) PhD (Sask)</i>	-	Associate Professor
S.K.A. Danso , <i>BSc (Agric) (Ghana) MSc PhD (Cornell)</i>	-	Professor
K.B. Laryea , <i>BSc (Ghana) MSc (Sydney) PhD (Guelph)</i>	-	Professor
S.G.K. Adiku , <i>BSc (Agric) (Gh) MSc (Tu-Berlin) PhD (Griff)</i>	-	Professor
E. Owusu-Benoah , <i>BSc MSc (Agric) (Ghana) PhD (Reading)</i>	-	Professor
Stella Asuming-Brempong , <i>BSc (Agric) (Ghana)</i> <i>MSc (Philippines) PhD (Michigan State)</i>	-	Senior Research Fellow
T.A. Adjadeh , <i>BSc Agric (Ghana) MSc PhD (Iwate)</i>	-	Senior Lecturer
E.K. Nartey , <i>BSc (Cape Coast) MPhil (Ghana) PhD (Ehime)</i>	-	Lecturer
I.Y.D. Lawson , <i>BSc (Agric) (Ghana) MSc (Shizuoka)</i> <i>PhD (Gifu)</i>	-	Lecturer
J.K. Amatekpor , <i>BA (Ghana) MSc (Gent) PhD (Cornell)</i>	-	Part-Time Lecturer

Agricultural Research Centre, Kpong

M. Yangyuoru , <i>BSc (Ghana) MSc, PhD (Kyoto)</i>	-	Snr. Res. Officer/Head
K. Nyalemegbe , <i>BSc (Agric) (Ghana) MSc (Wageningen) PhD (Reading)</i>	-	Senior. Research Officer
E.O. Darkwa , <i>BSc (Wolverhampton Poly) MSc (Exeter) PhD (Lond)</i>	-	Research Officer
F.K. Mawunya , <i>BSc MPhil (Ghana)</i>	-	Research Officer
Dylis S. Kpogor , <i>BSc (Ghana), MPhil PhD (Bonn)</i>	-	Research Officer
J. O. Honger , <i>BSc MPhil (Ghana)</i>	-	Research Officer
L. A. Abatanya , <i>BSc MPhil (Ghana)</i>	-	Research Officer
S. Narh , <i>BSc MPhil (Ghana)</i>	-	Research Officer

Agricultural Research Center, Legon

T. Adogla Bessa , <i>BSc (Ghana) MSc PhD (Reading)</i>	-	Snr. Res. Officer/Head
A. Naazie , <i>BSc (Agric) (Ghana) MSc (Edin) PhD (Alberta)</i>	-	Senior Research Officer
E. Akorli Canacoo , <i>BSc (Agric) (Ghana) DVM (Ibadan) MSc (James Cook)</i>	-	Senior Research Officer
L.K. Adjorlolo Jnr. , <i>BSc MPhil (Ghana)</i>	-	Research Officer

E. Timpong-Jones , <i>BSc (Ghana) MSc (ITC Netherlands)</i>	-	Research Officer
E. A. Mahama , <i>MSc (Bulgaria) MPhil (Ghana)</i>	-	Research Officer

Agricultural Research Centre, Kade

J.K. Osei , <i>BSc MSc (Agric) (Ghana) PhD (Penn State)</i>	-	Assoc. Professor/Head
K. Afreh-Nuamah , <i>BSc MSc (Gh) PhD (Lond) DIC</i>	-	Assoc. Professor
K.G. Ofosu Budu , <i>BSc (Agric) (Ghana) MSc PhD (Hiroshima)-</i>		Senior Research Officer
G.K. Hotsonyame , <i>BSc (Agric) MSc (Ghana) PhD (Guelph)</i>	-	Senior Research Officer
G. Oduro Nkansah , <i>BSc (Agric)(Gh.) MSc (Hort) PhD (Chiba)-</i>		Senior Research Officer
F.C. Brentu , <i>BSc MPhil (K'si)</i>	-	Research Officer
S. Adjei-Nsiah , <i>BSc (K'si) MPhil (Ghana)</i>	-	Research Officer

Biotechnology Centre, Legon

S.K. Offei , <i>BSc (Agric) (Ghana) MPhil (Lond)</i> <i>Dip in Seed Pathology (Den) PhD (Lond) DIC</i>	-	Professor/Head
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LEVEL 100 COURSES

ANIM 101	Biology of Farm Animals	2
CROP 101	Introduction to Agricultural Botany	2
SOIL 101	Introduction to Soil and the Environment	2
AGRC 101	Agricultural Chemistry I	3
AGRC 102	Agricultural Chemistry II	3
AGRC 103	Practical Chemistry I	1
AGRC 104	Practical Chemistry II	1
AGEC 102	Introduction to Economics	2
AGEN 102	Introduction to Agricultural Engineering	2
AGEX 102	Fundamentals of Extension	2
FASC 101	General Mathematics	3
AGRC 105	Practical Physics I	1
AGRC 106	Practical Physics II	1
AGRC 107	General Physics I	3
AGRC 108	General Physics II	3
LANG 102	Language Skills	2

LEVEL 200 COURSES

All the Courses available in Level 200 are compulsory for all students.

AGRC 201	Computer Science	3
SOIL 201	Soil Genesis and Physical Properties	3
SOIL 202	Chemical and Biochemical Properties of Soils	3
CROP 201	Insect biology and plant microbes	3
CROP 202	Introduction to Crop Production	3
ANIM 201	Animal Production	3
ANIM 202	Elements of Microbiology and Immunology	3
AGEC 201	Microeconomics (Principles and Applications to Households and Firms)	3
AGEC 202	Macroeconomics (Principles and Applications to Economy of Ghana)	3
AGEN 201	Elementary Soil and Water Engineering	3
AGEN 202	Farm Power and Machinery	3
AGRC 202	Introductory Statistics	3
AGRC 200*	Long Vacation Farm Practicals (Pass/Fail)	
BCHM 201 ¹	General Biochemistry I	2
BCHM 202	General Biochemistry II	2

AGEX 201	Methods & Approaches in Extension	3
AGEX 202	Development Communication	3

¹ *BCHM 201 is a prerequisite for BCHM 202 General Biochemistry II*

*AGRC 200, taken during the long vacation, is pre-requisite to all Level 300 courses in Agriculture

LEVEL 300 COURSES

The student shall be required to take all CORE courses. Additionally, Two electives not more than One from any Department each semester to be selected.

Core

AGRC 301	Introductory Genetics	3
AGEC 301	Farm Management	3
AGEC 302	Project Analysis	3
AGEN 302	Agro-Climatology, Farm Building & Environmental Control	3
CROP 301	Crop Protection	3
CROP 302	Crop Physiology	3
ANIM 301	Principles of Animal Nutrition	3
ANIM 302	Animal Production	3
SOIL 301	Management of Soil Environment I	3
SOIL 302	Management of Soil Environment II	3
AGEX 301	Extension Programme Development & Implementation	3

Electives

(Two Electives not more than one from any Department/Major each semester to be selected from the following)

AGEC 303	Microeconomic and Macroeconomic Theory	3
AGEC 304	Research Methods, Statistics and Mathematics for Economists	3
AGEC 305	Managerial and Business Economics	3
AGEC 306	Agribusiness Management	3
ANIM 303	Elements of Animal Health	3
ANIM 304	Introductory Animal Breeding	3
ANIM 305	Principles of Grassland Management	3
ANIM 306	Anatomy And Digestive Physiology	3
CROP 303	Weed Science	3
CROP 304	Crop Diseases and Pest Management	3
CROP 305	Ornamental Horticulture	3
CROP 306	Principles of Biotechnology	3
SOIL 303	Soil Characterization and Classification	3
SOIL 304	Soil Degradation and Rehabilitation	3
SOIL 305	Environmental Soil Chemistry	3
FAPH 301	Properties of Agricultural Materials	3
FAPH 302	Physical aspects of crop storage design	3
FAPH 303	Introduction to Postharvest Technology & Crop Losses	3

LEVEL 400 COURSES

The student shall select ONE of the FOUR Subject Areas listed under MAJORS, in addition to the Core. Level 400 students are expected to report at the Faculty 4 weeks before the commencement of the First Semester to begin their Research Project.

Prescribed Courses

AGEX 401	Extension Experience	3
AGEN 402	Agricultural Material Handling, Storage and Processing	3
AGRC 401	Entrepreneurial Skills	3
AGRC 402	Introductory Agro-forestry	3

Majors

AGRICULTURAL ECONOMICS

Core

AGEC 400	Research Project	6
AGEC 401	Agricultural Marketing and Trade	3
AGEC 402	Agricultural Development Planning and Policy	3
AGEC 404	Price Analysis	3
ECON 301	Microeconomic Theory I	3
ECON 303	Macroeconomic Theory I	3

Electives

AGEC 411	Introductory Agribusiness Management	3
ECON 302	Microeconomic Theory II (Prerequisite: ECON 301)	3
ECON 304	Macroeconomic Theory II (Prerequisite: ECON 303)	3
ECON 403	Econometrics I	3
ECON 404	Econometrics II	3

AGRIBUSINESS

Core

AGEC 400	Research Project	6
AGEC 401	Agricultural Marketing and Trade	3
AGEC 402	Agricultural Development Planning and Policy	3
AGEC 403	Research Methods, Statistics and Mathematics for Agribusiness	3
AGEC 405	Quantitative Methods and Operations Research	3
AGEC 406	Financial Management	3
AGEC 407	Management Accounting	3

Electives

AGEC 408	Fundermentals of Business Planning and Policy	3
AGEC 409	Market Reseach and Analysis	3
AGEC 410	Agrifood Business and Agroprocesssing	3
AGEC 412	Company Law I and Applications to Agribusiness	3

ANIMAL SCIENCE

Core

ANIM 400	Research Project	6
ANIM 401	Biometry	3
ANIM 402	Health, Reproductive And Obstetric Problems	3
ANIM 403	Ruminant Production	3
ANIM 404	Monogastric Production	3
ANIM 405	Applied Animal Nutrition	3
ANIM 406	Animal Breeding	3

Prescribed Elective

ANIM 407	Reproductive & Environmental Physiology	3
ANIM 408	Meat Science and Meat Hygiene	3
ANIM 409	Grassland Management	3

Free Elective

ANIM 411	Micro-livestock Production	3
ANIM 412	Animal Behaviour	3

CROP SCIENCE

Specialization in Crop Science (General)**Core**

CROP 400	Research Project	6
CROP 401	Field Crops	3
CROP 402	Crop Entomology	3
CROP 403	Plant Pathology	3
CROP 404	Fruit and Vegetables	3
CROP 405	Statistics for Agriculturists	3
CROP 406	Genetics and Plant Breeding	3

Electives

CROP 407	Seed Science and Technology	3
CROP 408	Plantation and Industrial Crops	3
CROP 409	Post-Harvest Science	3
CROP 413	Molecular Biology	3
CROP 414	Plant Virology	3

Specialization in Postharvest Technology

CROP 400	Research Project	6
CROP 405	Statistics for Agriculturists	3
FAPH 401	Postharvest Physiology	3
FAPH 402	Farm Structures and Environmental Control	3
FAPH 403	Storage Pests & Diseases, Their Prevention & Control	3
FAPH 404	Processing & Preservation of Agricultural Produce	3
FAPH 405	Packaging & Environmental Issues in Post-harvest	3
FAPH 406	Marketing of Agricultural Produce, Food Laws and Legislation	3
FAPH 407	Quality Assurance in Postharvest Technology	3
FAPH 408	Micro Enterprise Development & Management	3

Electives

CROP 401	Field Crops	3
CROP 402	Crop Entomology	3
CROP 407	Seed Science and Technology	3
CROP 408	Plantation and Industrial Crops	3
CROP 416	Plant Materials	3

Specialization in Horticulture**Core**

CROP 400	Research Project	4
CROP 402	Crop Entomology	3
CROP 403	Plant Pathology	3
CROP 404	Fruit and Vegetable Crops	3
CROP 405	Statistics for Agriculturists	3
CROP 406	Genetics and Plant Breeding	3
CROP 415	Environmental Horticulture	3

Electives

CROP 401	Field Crops	3
CROP 408	Plantation and Industrial Crops	3
CROP 414	Plant Materials	3
FAPH 401	Post Harvest Physiology	3

SOIL SCIENCE

Core		
SOIL 400	Research Project and Seminar	6
SOIL 401	Soil Science Practical and Special Topics	3
SOIL 402	Soil Biochemistry and Microbiology	3
SOIL 403	Soil Genesis, Survey and Land-Use Planning	3
SOIL 404	Soil Chemistry and Fertility	3
SOIL 405	Soil and Environmental Physics	3
CROP 405	Statistics for Agriculturists	3
Electives		
SOIL 406	Introduction to Paleopedology	3
SOIL 407	Soil Mineralogy	3
SOIL 408	Introduction to Agricultural Systems Analysis and Simulation	3
SOIL 409	Isotopes in Environmental and Industrial Research	3
SOIL 410	Introduction to Bio-remediation of Contaminated Soils	3

COURSE DESCRIPTIONS

ANIM 101 Biology of Farm Animals

Blood and circulation – composition of blood, functions of blood, heart and blood vessels; the respiratory system – structure of the respiratory system of mammalian and avian species, gaseous exchange in the lungs and tissues, transport of oxygen and carbon dioxide. The excretory system – structure of the kidneys, the functional unit of the kidneys and formation of urine; the reproductive system – reproductive organs of livestock and avian species, spermatogenesis and oogenesis, endocrine functions of the testes and ovaries, skeletal system of livestock and avian species; the digestive system – structure and functions of the different sections of the digestive systems of livestock and avian species.

CROP 101 Introduction to Agricultural Botany

Plant cell, tissues and organs, Fine cell structures and their functions. Mitosis, meiosis, molecular basis of inheritance, protein synthesis. Root modification of roots, arrangement of tissues in monocotyledonous (monocot) and dicotyledonous (dicot) roots. Stem: modification of stems, arrangement of tissues in monocot and dicot stems. Leaf: simple, compound, venation, shapes, arrangement and modification of leaves; arrangement of tissues in monocot and dicot leaves. Flower: parts, types, floral arrangements (inflorescence), and floral diagrams. Fruit and seed: structure, types germination and dormancy. Principles of classification including concepts of species, genus, family, order, division and kingdom, binomial system of nomenclature.

SOIL 101 Introduction to Soil and the Environment

Pedology (6 weeks): Concepts of soil; composition of the earth-crust and its environment, pedogenic factors and their interactions, major components of soils; introduction to inorganic components of soils (origin and nature of rocks); **Soil Physics (2 weeks):** Soil as a 3-phase dispersed system, definition of physical quantities, the solid phase, soil texture, classification systems, Stoke's law and particle size analysis; specific surface, bulk density, particle density; **Soil Chemistry: (2 weeks)** Soil acidity: definition, calculations, effect on the soil environment, liming and liming materials. Agricultural chemicals and the soil; fertilizers, pesticides, etc. **Soil Microbiology and Biochemistry (3 weeks)** Major groups of microorganisms, requirements for microbial/bacterial growth classification of bacteria-morphological and/or physiological characteristics, soil carbohydrates with examples of monomers, dimers, polymers etc., soil organic N compounds especially proteins, amides, amino acids, peptides, proteins. Enzymes and their roles in the soil.

AGRC 101 Agricultural Chemistry I

Atomic Structure: Rutherford Model, Bohr's model, Quantum chemistry, isotopes; Bonding and Intermolecular Forces: Ionic and covalent bonding, van der Waals forces, hydrogen bonding; Introduction to organic chemistry: Structure of organic molecules, alkanes and cycloalkanes, alkanes as hydrocarbons, sp³ functional groups, Sources of alkanes, nomenclature and physical properties,

isomerism in alkanes; Substitution reactions, halogenation, free radical, effects of halogenation on the ozone layer. Alkenes: sp^2 hybridization, double bond formation, geometry of C=C bond, nomenclature, isomerism: cis and trans configuration, E and Z configuration. Laboratory preparation, cracking of petroleum. Reactions: electrophilic addition with Cl_2 , Br_2 etc. Hydrogenation (saturation of the double bond), addition of HBr, HCl (Markovnikov's rule), $KMnO_4$, Br_2/CCl_4 (tests for multiple bonds). Alkynes: sp hybridization, shape and nomenclature. Laboratory preparation: Reactions with H_2O , H_2 (saturation), acidity of terminal alkynes, reaction with $AgNO_3/NH_3$, Fehling's solution (Cu^{2+} salts), reaction with $NaNH_2$ or Na/liquid NH_3 . Aldehydes and ketones. Structure of carbonyl groups, nomenclature, physical properties, laboratory preparation. Reactions: Nucleophilic addition of HCN, oxidation with $KMnO_4$, $K_2Cr_2O_7$ to carboxylic acids. Reduction reactions: Clemmensen reduction, Wolff-Kishner reduction, Aldol condensation, Cannizzaro reaction, reduction by $LiAlH_4$ or $NaBH_4$. Alcohols: Functional group, Classification of alcohols, physical properties, isomerism nomenclature, laboratory preparation, fermentation. Some reactions: oxidation to carbonyls and carboxylic acids, dehydration, ester formation (test), Lucas tests for primary, secondary and tertiary alcohols. Carboxylic acids: Functional group, physical properties (H-bonding, dimerisation), nomenclature. Some reactions: Ester formation (esterification) with $LiAlH_4$ or $NaBH_4$, laboratory preparation, acidity of carboxylic acids. Some common natural carboxylic acids (e.g., palmitic acid from palm oil), ethanoic acid as a component of vinegar, butanoic acid (responsible for bad odour from rancid butter). Aromatic functional groups: Brief introduction to aromaticity, physical and chemical properties with benzene as typical example, some structures. Structures and namings: nitrobenzene, toluene, chloro, bromobenzenes, aniline, naphthalene, phenanthrene. Some reactions: Friedel-Craft alkylation, acylation, halogenation, oxidation of toluene, benzene with halogens (ring splitting).

AGRC 102 Agricultural Chemistry II

Equilibrium in aqueous solutions: Arrhenius, Bronsted and Lewis concepts. Acid Strengths and ion pairs, simple pH calculations for solutions of acids and bases Principle of pH determination, cation/anion hydrolysis. Solubility, K_{sp} and selective precipitation. Electrochemical Series. Redox systems: Oxidation numbers; Balancing of Redox reactions. Systematic Inorganic Chemistry. Periodic classification of elements, Periodic Table (groups and periods), Atomic properties and periodic table, Chemistry of alkali and alkali earth metals, halogens and transition elements.

AGRC 103 Practical Chemistry I

Routine laboratory procedures; Significant figures; Accuracy and precision; Weighing; Calibration of volumetric glassware; Solution preparation; Standardization of solutions; Acid base titration; Determination of pH of solutions and suspensions; Redox potentials of liquids and solids from various environments; Redox titration.

AGRC 104 Practical Chemistry II

Qualitative Analysis

AGEC 102 Introduction to Economics

This is an introductory course in Economics at the basic level. It covers microeconomics and macroeconomics issues, with particular reference to agriculture. The objective of the course is to provide beginning students with the basic economic tools that will enable them appreciate the economic systems of the world and how an economy works.

AGEN 102 Introduction to Agricultural Engineering

1. Introduction: Engineering in Agriculture; the development of Agricultural Engineering; Agricultural engineering application.
2. Agricultural Mechanics
3. Farm Power: Sources of farm power; history of engines, principles of operation of tractor engines, selection and management of tractor power.
4. Farm Machinery: Power and machinery in agriculture; selection and management of farm machines; farm machinery applications – tillage, sowing and planting, irrigation, drainage, weed control, harvesting, processing and storage.

5. Rural Electrification: basic electricity and electrical terms, using electricity on the farm.
6. Processing Agricultural Products: crop and food processing.
7. Farm Structures: planning farm structures, materials for farm structures, cares and maintenance of farm structures.
8. Soil and Water Engineering: farm surveying, soil erosion control, land clearing, irrigation and drainage.

AGEX 102 Fundamentals of Extension

Origin and Evolution of Extension; Definitions of Extension; Key elements in the definition of Extension; Sectors/areas in which Extension is practiced; Concept of Community; Socio-Cultural factors and Extension; Concept of Change; Methods for influencing human behaviour; Introduction to the Concept of Communication, Learning, Perception, Diffusion, and Adoption; Delivery and Funding of Extension (Organisation and Management of Extension); Principles of Extension; Importance of Extension in Agricultural, Rural and National Development.

AGRC 105 Practical Physics I

1. Determination of coefficient of friction using the inclined plane apparatus
2. Determination of acceleration due to gravity (g) using a simple pendulum apparatus.
3. Determination of g using the simple helical spring.

AGRC 106 Practical Physics II

1. Measurement of internal resistance of a cell in a circuit.
2. Measurement of voltage and current in a circuit with resistance connected in series.
3. Measurement of voltage and current in a circuit with resistance connected in parallel.
4. Measurement of voltage and current in a circuit with resistance connected in series and parallel

AGRC 107 General Physics I

Mechanics and properties of matter

Viscosity, surface tension, buoyancy, fluid pressure, Newton's laws, force, momentum types of forces, work power, energy, conservation of mass, momentum and energy. **Heat:** Temperature, heat, work, gas laws, specific heat capacities, heat transfer, melting point, dew point, relative humidity. **Waves:** Wave phenomenon types of waves, heat waves, electromagnetic waves.

AGRC 108 General Physics II

Magnetics: Magnetic field, magnetic effect of current, force on current-carrying conductors, and electromagnetic induction, heating effect of magnetism. **Electricity:** Electric field, and coulomb's law, dielectric, time domain reflectometry, conductors and insulators, electric current, electromotive force, Ohm's law, power, electric motors and transformers, electric circuits. **Nuclear Physics:** Radioactivity, fusion, fission, application of nuclear physics.

LEVEL 200 COURSES

All the Courses available in Level 200 are compulsory

AGRC 201 Computer Science

This course is aimed at introducing students to general concepts of computers in problem solving.

1. **Introduction to computer:** What is computer?; Advantages and disadvantages of using a computer; Types of computers-mainframe, minis, micro, super computer; Analogue and Digital computers; General Purpose and Special Purpose computers; Network and stand alones; Evolution of computers.
2. **Hardware Concepts:** Components of a computer, their functions and how they are related. Mention should be made of different types of each device; A typical modern computer system using a microcomputer as an illustration; Representation of data on a computer: Number systems, bits, bytes, words etc.
3. **Data and Information Processing:** Data and information defined; Components of data/ Information

- processing; Uses of information; Qualities of good information.
4. **Software Concepts:** Systems Software and Utility Programmes; Application Packages; User Developed Software; Types of computer languages, differences and similarities.
 5. **Basic Operating Systems Concept:** Need for Operating systems; Basic operating system commands using DOS and Windows; Filing Concepts (DOS & WINDOWS)
 6. **Packages to be taught:** Electronic Spreadsheet using MS-EXCEL; Statistical Computing using SPSS; Word processing using MS-WORD; Database management using MS-ACCESS.

SOIL 201 Soil Genesis and Physical Properties

Theory Soil Genesis (6 weeks): Inorganic components of soils: rocks and minerals, primary minerals, secondary minerals, clay minerals (1:1 and 2:1); weathering of rocks and minerals: types of weathering, types of parent materials; soil formation and profile development: processes and factors of profile development; nomenclature and identification of soil horizons: master and sub-horizons and layers, transitional and combination horizons, suffix symbols, soil catena concept. **Soil Physics (7 weeks):** The liquid phase of soil: soil water content, methods of determination; gravimetric, electrical resistance, neutron scattering, time domain reflectometry, soil water storage, concept of equivalent depth, soil water potentials, potential diagrams, soil moisture characteristic and use, available water capacity, saturated water flow in soils, Darcy's law. **Practical (13 weeks):** Identification of minerals and rocks; soil moisture content determination methods (gravimetric, volumetric, gypsum blocks, etc.), water storage, particle and bulk density, particle size analysis, soil moisture characteristic determination, saturated hydraulic conductivity.

SOIL 202 Chemical and Biochemical Properties of Soils

Theory Chemical Properties (6 weeks): Clay minerals: origin, composition and chemical nature of clay minerals, soil colloids and ion exchange phenomenon, soil reaction, soil as a buffer, nutrient elements: forms and their availability in soils, functions in plants, deficiency symptoms, fertilizers and calculations involving rates of application. **Biochemical/Microbiology Properties (7 weeks):** Methods of studying the soil microbial population, factors influencing microbial growth, microbial nutrition, autotrophy and heterotrophy, inter-relationships between soil organisms, symbiosis, proto-cooperation, commensalism, ammensalism, predation, parasitism and competition. **Organic matter:** composition and functions, the C/N ratio, compost and composting and other forms of organic source. **Practical (13 weeks):** Soil pH, soil organic carbon/organic matter, total soil nitrogen, total soil phosphorus, available soil phosphorus, cation exchange capacity, exchangeable bases; gram stain procedure for typing microbes, plate dilution method for estimating microbial numbers, streaking and obtaining pure bacteria isolates, most probable number technique, microbial respiration and static incubator methods for accessing microbial activity.

CROP 201 Insect biology and Plant Microbes

Insects as arthropods and their inter-relationships with other members of the phylum Arthropoda. Characteristics of insects, features of insects that have enhanced their success. Importance of insects to agriculture. Morphology of insects; Anatomy and physiology of organ systems. Locomotion in insects, and some aspects of insect behaviour. Entomological techniques. Classification of insects, with emphasis on the recognition of representation of all the insect orders. History of Microbiology: role of discovery and spontaneous generation of microbes and germ theory of diseases. Characteristics of plant microbes (fungi, bacteria, viruses, viroids, mollicutes, nematodes, algae and protozoa): morphology, structure and function, growth, reproduction, dispersal and classification of the microbes. Importance of plant microbes in agriculture: including soil fertility involving rhizobia, mycorrhiza and algae.

CROP 202 Introduction to Crop Production

The physical environment and crop production. Adapting crops and management practices to the environment. Soil and water conservation. Farming, cropping and agroforestry systems. Plant propagation, crop establishment and management. Weed control strategies. Pest and disease control. Integrated crop nutrient management.

ANIM 201 – ANIMAL PRODUCTION: MONOGASTRIC

Origin, classification, global distribution. Adaptive physiology / Mechanism of adaptation, stress syndrome in swine. Anatomic and physiological characteristics, importance of swine to man. Breeds. Behaviour: maternal, social, investigatory, territorial, sexual; Anomalous behaviour; Growth and development in pigs. Nutrient requirements in life cycle; definition of technical terms. Origin and domestication of Poultry, Classification and world/global poultry distribution. Anatomy and physiological characteristics and adaptation of poultry to the tropics. Terminology in poultry. Importance of Chicken to Man. Factors affecting Poultry Production. Systems of production. Incubation and Hatchery management. Brooding of chicks. Management and rearing of Broilers and layers; Requirements/Standards for Poultry Feeds. Poultry Behaviour. Record keeping.

ANIM 202 Elements of Microbiology and Immunology

Distinguishing characteristics of microbes – bacteria, viruses, fungi, mycoplasma, rickettsia, protozoa and prions. Morphology, growth, metabolism and nutrition of common microbes of human and animal importance. Infection, disease and pathogenicity/virulence of micro-organisms. Germ theory of disease (Koch's postulates). Biology of important microbes in animal agriculture. Virus replication, infection of cells and disease induction. Constitutive and inducible resistance to infection. Antigen and antibody; immunity and immune response to infection; immunoglobulins, and immuno – pathologic consequences of immune response. Hypersensitivity, allergic reactions and disease. Principles of vaccine production immunoprophylaxis in tropical animal production practice. Serology, disease diagnosis and control.

AGEC 201 Microeconomics (Principles and Applications to Households and Firms)

This course builds on AGECEC 102: Introduction to Economics. The Course focuses on teaching students the Principles of Microeconomics. At the end of the course, students will be able to derive basic economic relationships and concepts and their applications to households and firms, using geometry and basic calculus. Examples from Ghana, inter alia, are used in the course.

AGEC 202 Macroeconomics (Principles and Applications to Economy of Ghana)

This course builds on AGECEC 102: Introduction to Economics. The Course focuses on teaching students the Principles of Macroeconomics and its application to the economy of Ghana.

AGEN 201 Elementary Soil and Water Engineering

Introductory Surveying: Definitions and types of surveying. Principles of land surveying. Field Surveying: Measurements, mistakes, errors, correction, obstacles etc, staking and right angles. Calculation of areas by Simpson's and Trapezoidal rules, squares etc. Leveling Instruments: Theory and bookings systems etc. Differential and profile leveling. Contours – Establish contours with simple devices, Map work, scale, reading interpreting map. Land Leveling: Constructing a Canal, Terraces.

Definition of Soil and Water Engineering, its component parts and position in agricultural Engineering. Fundamentals of Hydrology: Hydrologic cycle, Precipitation, Infiltration, Evapotranspiration, Runoff. Factors Affecting runoff. Introductory hydraulics: Units, Continuity and Bernoulli's equations, Flow through pipes and channels. Use of Chezy, Darcy-Weisbach, and Manning equations. Erosion: Types, causes and effects. Erosion control, Universal soil loss equation, Contour farming, Construction of contour guidelines.

AGEN 202 Farm Power and Machinery

Sources of power on the farm (Human, Animal, Solar, mechanical etc). **Internal Combustion (IC) Engines:** Internal energy of a gas, components of IC engines, working principles of IC engines (2- and 4-stroke engines), necessary conditions for IC engine operation, Classification of IC engines, cooling and lubricating system. Mechanical Power transmission: Principal reasons for the application of drives, different types of couplings and their applications, chain drives, belt and pulley drives, gear drives, Tractor Power Transmission System. **Tillage:** Objectives of tillage, primary and secondary tillage equipment (plows, harrows, etc). Planters and seed drills; methods of seed establishment, functions of a seeder, seed metering devices. Fertilizer distribution/broadcasters, Problem set 2. **Field sprayers/dusters:** Types of sprayers (hydro-pneumatic, mist blower etc). Factors affecting sprayer

performance. **Harvesting equipment:** Harvesting methods, combine harvester (basic operations, working principles, combine losses).

AGRC 202 Introductory Statistics

1. **Descriptive Statistics:** Graphical Forms and Charts; Measures of Central Tendency; Summary statistics; Measures of Dispersion.
2. **Probability and Sampling Distributions:** Normal Distribution; Student's t-distribution; F-distribution; χ^2 -distribution.
3. **Sampling :** Simple Random Sampling; Stratified Sampling; Cluster Sampling; Independent Samples and Paired observation.
4. **Estimation and Hypothesis Testing:** Bias, Precision, Accuracy; Type I and Type II Errors; One Sample Hypothesis; Two-Sample Hypothesis.
5. **Chi-Square Analysis and Contingency Tables**
6. **Correlation Analysis:** Types of Correlation, *Rank, Product Moment (standard Correlation) Dichotomous Nominal, Point Biserial, Intra-class, etc.* Test of significance; Comparisons of Correlations.
7. **Simple Linear REGression:** Assumptions and Pitfalls; Least Squares Estimation of parameters; Test of Significance and R^2 Comparing Linear Regression models (*Introduction to Multiple Regression)
8. **Introduction to Analysis of Variance:** The Simple One-Factor Model; Two-Factor Models; Interactions in Analysis of Variance.

BCHM 201¹ General Biochemistry I

Cell Structure & Function: Prokaryotes & eukaryotes; subcellular organelles (compartmentalization of cellular processes); the plant cell; the bacterial cell; the animal cell; unicellular & multicellular organisms; methods for studying the cell (cell disruption, fractionation). *pH and Buffer Solutions:* Definition of pH, the pH scale, buffer solutions & buffer capacity; the Henderson-Hasselbach equation in the preparation of buffers.

Chemistry and Functions of Biological Compounds

Biomolecules: monomers, polymers, macromolecules, supramolecules. Carbohydrates: mono-, di-, oligo- and polysaccharides, stereoisomerism, mutarotation, reactions of. Lipids: different types (fatty acids, triacylglycerols, phospholipids, sphingolipids, steroids, cholesterol, eicosanoids). Proteins: amino acids and protein structure, classification. Nucleic acids: Nitrogenous bases, nucleosides, nucleotides and nucleic acids. Vitamins and coenzymes. Enzymes: Properties & classification, cofactors & coenzymes, kinetics, effect of pH, temp., [S], [E] on enzyme-catalyzed reactions, Michaelis-Menten equation; regulation (activation & inhibition)

BCHM 202 General Biochemistry II

METABOLISM - Digestion of food

Carbohydrates: glycolysis, substrate level phosphorylation; hexose monophosphate shunt; gluconeogenesis; synthesis of other carbohydrates from monomers (e.g. glycogen synthesis); fate of pyruvate in different organisms. The electron transport chain in mitochondria and ATP synthesis.

Lipids: β -oxidation of fatty acids, fate of acetyl-CoA units (TCA cycle, ketone bodies, cholesterol); fatty acid biosynthesis. *Amino acids:* Oxidative deamination; decarboxylation; transamination; urea cycle; NH_3 assimilation (reductive amination, glutamate dehydrogenase); fate of carbon skeleton (glucogenic and ketogenic amino acids); metabolism of some individual amino acids. *Nitrogen fixation:* Conversion of nitrates, nitrites and gaseous N_2 to ammonia.

Metabolic diseases

Nucleic acid replication and protein biosynthesis: DNA replication, transcription and translation.

Photosynthesis: Light trapping events; the energy conversion process (PSI & PSII); cyclic and non-cyclic photophosphorylation; carbon fixation (Calvin cycle, C_3 & C_4 plants).

¹ BCHM 201 is a prerequisite for BCHM 202 General Biochemistry II

AGEX 201 Methods & Approaches in Extension

The concept of extension methods. Types of extension methods. The use of different extension methods. Advantages and disadvantages and conditions under which each method is used. The major theoretical background to farmers use of extension. The nature and characteristics of formal agricultural education and training in Ghana. Vocational agricultural training, Technical agricultural education. The selection of practical learning experiences for achieving curriculum objectives and goals in both formal and non-formal training. Integration of practical learning experiences with classroom teaching of syllabus.

AGEX 202 DEVELOPMENT COMMUNICATION

Definitions and key Concepts in Communication; Approaches and Models of Communication; Models of Development; Role of Communication in Community Development; Communication Channels and Forms; Indigenous Communication; Information Organisation, Distortion and Loss; Non-Verbal Communication; Communication Strategy and Skills; Public Relations.

LEVEL 300 COURSES

The student shall be required to take all CORE courses. Additionally, Two electives not more than One from any Department each semester to be selected.

Core**AGRC 301 Introductory Genetics****AGEC 301 Farm Management**

To provide the basic management tools for effective farm level evaluation and decision making.

AGEC 302 Project Analysis

To enable students understand the principles of Agricultural Project Analysis to be able to prepare investment reports.

AGEN 301 Irrigation & Drainage Engineering

Definition of irrigation, reasons for irrigation, irrigation worldwide and in Africa. Irrigation principles: basic soil-water-plant relations; irrigation terminology – soil densities, porosity, intake rate, soil water holding capacity, irrigation scheduling, irrigation efficiencies, irrigation system components – water source, diversion works, storage, delivery, and application systems. Irrigation Scheduling: evapotranspiration measurement and prediction – pan evaporation, gravimetric methods, lysimeters, agricultural weather stations, FAO Penman-Monteith ET model, Hargreaves model, reference and crop evapotranspiration estimation, FAO CROPWAT and USU REFET computer software. Types of irrigation systems: watering can, sprinkle, trickle/micro-irrigation, and surface irrigation systems; advantages and disadvantages of various irrigation types. Simple sprinkler irrigation design and installation: pipeline hydraulics, friction loss calculations, mainline and lateral design, and pipe size selection, sprinkler types and selection from manufacturer catalogues. Simple surface irrigation design and installation: basic open channel and overland flow hydraulics; furrow, basin, border, and corrugation systems. Simple micro-irrigation system installation: types of water applicators, water requirements per plant, system uniformities and efficiencies. Agricultural drainage: reasons for drainage, surface and subsurface drainage systems. Darcy's equation, Hooghoudt equation; rational formula for drainage design.

AGEN 302 Agro-Climatology, Farm Building & Environmental Control

Introduction to atmosphere and its relation to agriculture. Basic concepts of energy, balances, units; Radiation; Heat and energy; Heat conduction; Atmospheric humidity; Laminar boundary Layer; Animal microclimate; Turbulent boundary Layer; Energy and water balance of crops and forests; Climate and Plant Growth; Climate classification; Weather systems; Atmospheric change.

Wood: characteristics, defects, seasoning and preservation. Earth as a building material: soil classification; grading; soil stabilization. Binders: lime, cement. Concrete: ingredients/batching, mixing, placing and compaction, and curing. Reinforce concrete. Elements of construction: loads on building components; footings and foundation floors; walls; roofs; electrical supply; water supply. Environmental Control: fundamentals and definition of heat, temperature, quantity of heat etc.

Methods of heat transfers: conduction, convection, etc. Psychrometrics and use of psychrometric chart. Temperature and moisture balance. Insulation. Principles of refrigeration: Controlled atmosphere storage.

CROP 301 Crop Protection

Concept of pests. Classification of pests. Economic importance of pests. Effects of pest presence. Methods of insect pest control. Merits and demerits of different methods, with emphasis on pesticides. Current trends in pest control. Meaning, scope and history of plant pathology; concept of diseases in plants; Importance, classification, causes, symptoms and general control of plant diseases.

CROP 302 Crop Physiology

Major physiological processes in plants including seed germination, plant-water relations, mineral nutrition, photosynthesis, biological nitrogen fixation and respiration. Introductory environmental physiology including photoperiodism, vernalization and temperature stress as well as air, soil and water pollution stresses on plants. Plant growth substances and growth regulation. Crop growth analysis, especially, leaf area index, leaf area duration, crop growth rate and net assimilation rate.

ANIM 301 Principles of Animal Nutrition

Animal nutrition and its importance in modern agriculture; introduction to animal nutrition; feed composition and common methods of analysis for nutrients and feedstuffs; the gastrointestinal tract and nutrition; measurements of feed and nutrient utilization and requirements by farm animal.

ANIM 302 – Animal Production: Ruminant

Systematic classification of cattle, sheep and goats; origin, distribution and characteristics of ruminants. Special attributes and economic importance. Factors affecting productivity. Systems of production. Factors to be considered in the establishment of cattle, sheep and goat enterprises. Selection and care of foundation, breeding and replacement stock. Management practices. Record keeping.

SOIL 301 Management of Soil Environment I

Theory Pedology (7 weeks): Essence of soil classification, types of soil classification (natural and technical), basic characteristics of the USDA soil orders and their FAO (WRB) equivalents, basic problems associated with the soil orders, management of the soil orders for agricultural and other purposes, profile characteristics of major soil orders in Ghana, potential, problems and management of major soil orders in Ghana, use of soil classification in soil management and extrapolation of agronomic research results. **Soil Physics (6 weeks):** Soil structure, aggregate stability, factors affecting soil structure, e.g., organic matter, cations, etc., surface residue management, soil strength, Coulomb's law, shear stress; Tillage: conventional and conservation tillage; Physics of rainfall: amount, intensity, kinetic energy, momentum; Soil erosion and conservation: mechanisms of water erosion, types of soil erosion, factors affecting soil erosion, soil erosion models e.g., the Universal Soil Loss Equation (USLE), methods of erosion control: agronomic and engineering. **Practical (13 Weeks):** Soil profile description: soil depth, boundary between horizons, texture by feel, soil colour, consistence; Soil structure determination: aggregate stability by mean weight diameter, single drop method, determination of raindrop size and distribution, rainfall intensity, estimation of rainfall erosivity index, erodibility assessment, soil strength determination using shear box method and penetrometers.

SOIL 302 Management of Soil Environment II

Theory Soil Chemistry (6 weeks): Kinds of fertilizers, manufacture of nitrogen, phosphorus and potash fertilizers, manufacture of secondary, micronutrient and mixed fertilizers. Fertilizer usage: fertilizer and economic development, cost/benefit of fertilizer use, effect of fertilizer use on the soil environment. Fertilizer application methods: broadcast and band application, side-dressing, top dressing, foliar application, fertilization, instrumentation, principle of soil, plant and water analysis, soil and water salinity. **Biochemistry/Microbiology (7 weeks):** Crop residue and organic matter decomposition and management (cellulose, hemicellulose, lignin, C/N ratio.) biochemistry of composting, microbiology of composting, green manuring, nitrogen, phosphorus and sulphur cycles,

microbial respiration and its importance to ecosystem processes (glycolysis, Krebb cycle, respiratory chain, oxidative phosphorylation, proteins in soil. **Practical (13 Weeks):** Soil fertility assessment, pot experiments with N, P, K, and analysis of plant tissue, micro-nutrient analysis, free iron determinations, pH changes due to nitrogen fertilizers (demonstration in solution culture) heavy metals, soil salinity assessment: electrical conductivity, determination of inorganic carbon, soil carbonate content.

AGEX 301 Extension Programme Development & Implementation

Function of Programmes in Extension work; Concept of Extension Programmes; Importance of an extension programme; Stages of an Extension Programme; Measures for enhancing effectiveness of Extension Programmes; Extension Programme Cycle; Concept of Planning; Planning Levels; Approaches to Planning; Activities involved in Planning Extension Programmes; Extension Programme Document; Appraisal of Programme Document; Professional abilities needed in Planning; Implementation of extension programmes; Responsibilities of Extension Managers and Agents during Implementation; Events that may disrupt Implementation of Extension Programmes; Monitoring of Extension Programmes; Evaluating Extension Programmes During Implementation; Post-implementation stage of Extension Programmes; Terminal Evaluation.

Electives

(Two Electives not more than one from any Department/Major each semester to be selected from the following)

AGEC 303 Microeconomic and Macroeconomic Theory

This builds on courses AGECE 201 and AGECE 202. It presents the theoretical underpinings of both microeconomic and macroeconomic phenomena. At the end of the course, candidates should be able to understand economic phenomena using geometry, calculus and difference equations. Candidates are also required to apply the theories learnt to the economy of Ghana.

AGEC 304 Research Methods, Statistics and Mathematics For Economists

The purpose of the course is to introduce students to methods of research in agricultural economics and also to provide a solid statistical/mathematical foundation for understanding econometrics to perform economic analysis of agricultural problems. It is also to facilitate a thorough understanding of the principles of economic modeling in agricultural research.

(a) Research Methods

The Scientific Method in Economic Research; The Research Proposal; Development of Agricultural Research; Data/Information gathering; Qualitative/Quantitative Methods of Data Collection; Sampling Methods; Farming systems research; Economic Analysis of Agronomic Data.

(b) Statistics and Mathematics for Economists

Statistics: Overview/Importance of Statistics in Economic Research; Concepts of distribution functions; Concept of a model/Use of Economic models; Classical normal regression assumptions and estimation procedures of the Ordinary Least squares; Presentation and interpretation of results of economic modelling; Examples of empirical models.

Mathematics: The derivative and the rules of differentiation and their applications in economics; Calculus of multivariable functions and their applications in economics; A review of logarithms and exponentials and their applications in economics; Fundamentals of matrix or linear algebra and their applications; Integral calculus and their applications.

AGEC 305 Managerial and Business Economics

The purpose of the course is to introduce students to the economic environment in which business operates, and provide an understanding of how economic principles are applied in management and business. The Scope and Nature of Managerial and Business Economics, The Internal Organization of Firms, The Firm and its Environment, Alternative Business Objectives, Markets and Industries, Demand Estimation, Forecasting, Production and Costs, Linear Programming and Production Analysis, Cost

Estimation, Entrepreneurship and Profit, Business Behaviour in Different Market Structures, Pricing Practices, Decision Making Under Uncertainty, Capital Budgeting, The Economics of Human Resource Management, Business information, Forms of business organizations, The Role of Government in the Market Economy.

AGEC 306 Agribusiness Management

Course Objective: The course objective is to develop the capacity of the student to analyse the economic environment in which the farm business operates, and to apply management principles in the operation of the agribusiness firm. That is, to help the student learn how to apply economic analysis to managerial decision-making.

ANIM 303 Elements of Animal Health

Signs and factors affecting health in farm animals. Deficiency diseases of farm animals (mineral and vitamin deficiencies in cattle sheep goats and poultry). Selected major diseases of farm animals in Ghana: Incidence, aetiology, transmission, epizootiology pathogenesis clinical symptoms, pathology, diagnosis, treatment and control of bacterial, viral, protozoan and parasitic diseases of ruminants, pigs and poultry. Notifiable and zoonotic diseases, responsibilities of stockowners and others in relation to requirements of the Veterinary Services Department of Ghana.

ANIM 304 Introductory Animal Breeding

Genes and gene action – the nature and control of gene function and the phenotypic expression of genes; definitions, types and consequences of mutations and chromosome aberrations; detrimental and lethal genes in farm animals; concept of gene frequencies; variations in economic traits of farm animals – genetic, Environmental and phenotypic variance, heritability and repeatability; definitions and measurements of inbreeding and relationships; introduction to the principles of selection – theory and practice.

ANIM 305 Principles of Grassland Management

Definitions of ecological terms. Ecosystem concept and function. Types of biological relationships. Succession and range condition. Ecology and range management. Economic importance and types of grasslands. Factors affecting development of grasslands. Aims and techniques of forage conservation. Criteria for choice of species for forage production. Pasture establishment process and methods. Factors influencing pasture establishment. Factors limiting forage production in Ghana.

ANIM 306 Anatomy and Digestive Physiology

Basic structure of the alimentary tract. The oesophagus and its functions. The monogastric and ruminant stomachs. Secretions of the pancreas and small intestine. Functions of the Large intestine. Movements of the digestive tract. Regulation of the secretion of digestive juices Digestion and absorption of carbohydrates, proteins and fats. Digestion and absorption of carbohydrates, proteins and fats. Digestion in the chicken. Axial and Appendicular skeleton of livestock species. The skeletal system of avian species. Basic structure of the alimentary tract. The oesophagus and its functions. The monogastric and ruminant stomachs. Secretions of the pancreas and small intestine. Functions of the Large intestine. Movements of the digestive tract. Regulation of the secretion of digestive juices Digestion and absorption of carbohydrates, proteins and fats. Digestion and absorption of carbohy-drates, proteins and fats. Digestion in the chicken. Axial and Appendicular skeleton of livestock species. The skeletal system of avian species.

CROP 303 Weed Science

Characteristics of weeds. Classification of weeds. Reproduction in weeds. Global distribution of weeds. Economic importance of weeds. Methods of weed control with emphasis on cultural, chemical, biological, preventive and integrated control.

CROP 304 Crop diseases and pest management

Principles of plant disease control. General methods of controlling plant diseases, namely Exclu-sion, Eradication, Resistance, Chemical protection and Avoidance. Selected diseases of crops in Ghana and

their control. Concepts of susceptibility, apparent resistance, true resistance and tolerance. Disease forecasting. Molecular, biological and plant disease control. Concept of pest and vector management. Components of pest management strategies. Pest management on selected crops. Role of biological control in pest management. Case studies of successful biological control practices, especially in Africa. Prospects for successful pest management in Africa.

CROP 305 Ornamental Horticulture

Introduction to ornamental crop industry in Ghana and career opportunities in ornamental horticulture. Methods of propagation, environmental factors affecting production and control of flowering. Production systems for flower, foliage and turf crops, particularly floral designs, nursery management, house plant care, postharvest handling and marketing. Landscape design, maintenance and specialised crop production will also be discussed.

CROP 306 Principles of Biotechnology

An introduction to biotechnology and career opportunities in biotechnology. Basic biological properties: Cells, Information and Information transfer, Extra-Chromosomal DNA. Introductory genetic engineering. Cell Culture and Cell fusion: plant and animal cell culture, production of hybrid cells by membrane fusion. Fermentation. The application of biotechnology: Case studies, Cystic fibrosis, *Bacillus thuringiensis* and engineered foods, cancer. Issues in biotechnology: Ethical issues: Biomedical ethics, Intellectual Property Rights, Biosafety, Regulatory issues, Priority setting, Social issues, Financing issues.

CROP 308 Plant Propagation

Principles and practices of propagating plants covering anatomical, physiological and practical aspects. Importance and basic types of plant propagation, Propagating structures, media and containers. Seed maturity and development. Seed purity, storage and certification. Seed dormancy and germination. Seed testing.

SOIL 303 Soil Characterization and Classification

Soil properties used in soil characterization; surface and subsurface diagnostic horizons and other diagnostic properties; soil classification: basic principles and purposes of soil classification, soil as a population, pedon and polypedon concepts, categories and classes, single and multiple category systems, technical and natural (taxonomic) classification systems: USDA, FAO-WRB, Ghana and other classification systems.

SOIL 304 Soil Degradation and Rehabilitation

Soil quality and degradation, basic concepts: resilience and rehabilitation; Soil physical degradation: extent in Ghana and their causes, e.g. deforestation, erosion, mining, water-logging, etc.; Soil chemical degradation: extent in Ghana, depletion of soil nutrients and organic matter, causes of chemical degradation e.g. leaching, salinity, sodicity, ameliorative measures; Soil biological degradation: extent in Ghana and causes, loss of beneficial micro-organisms, preponderance of harmful micro-organisms; soil macro-organisms: earthworms, termites; Soil restoration and reclamation practices.

SOIL 305 Environmental Soil Chemistry

Overview of environmental soil chemistry: soil physico-chemical reactions in relation to agriculture, forestry and ecosystem health; Solution chemistry of nutrients and pollutants: hydrolysis and polymerization, dissolution-precipitation, complexation, ion-pair formation; Surface chemistry of nutrients and pollutants: cation, anion, molecular adsorption; Chemistry of N, P, K and micro-elements in soils.

FAPH 301 Properties of Agricultural Materials

Biological Properties: Plant cell structure and differentiation, tissue system, variations and possible effects on physical properties, whole plant structure; plant hormones and growth regulators; Chemical Properties: quality assessment in durable and non-durable crops, texture and flavour, techniques for monitoring biochemical changes; Physical Properties: shape, size, volume, density, basic rheology,

application of rheology, aero and hydrodynamic properties, friction and cohesion, mechanical damage, light transmission and reflection, electrical resistance, dielectric, and electrostatics.

FAPH 302 Physical Aspects of Crop Storage Design

Introduction to the range of physical parameters concerning the store: thermal properties of building materials; strength of materials (basic introduction to tension, compression, shear); component details (construction materials, local and traditional materials, modern materials-concrete, steel timber, Soil); selected structural details (Crib construction, traditional store construction, building frames and trusses, floors and foundation, working principles of belt such as chain, bucket, auger and pneumatic and conveying systems.); services including access road, vehicle sizes, electrical service or other form of energy, water, office etc; building surveying (measurements, laying out right angles, and control of depth in foundations etc; proofing details (e.g. water proofing, site water out, off drains etc, damp-proofing if required, rodent and vermin proofing details; safety. ***This Course should be accompanied by at least a Case Study, choosing Differing Levels of farm and store size, differing crops locations etc.**

FAPH 303 Introduction to Postharvest Technology & Crop Losses

Meaning, brief history and importance of postharvest technology in Ghana and in the world, Population growth, global food situation and postharvest technology issues, Gender issues in post-harvest technology, Types of stored food produce; perishable and durable products, National food security, assessment of regional variations and food balance sheet, Role of postharvest technology in the economic development of Ghana, Methods for increasing food supply e.g. increasing land under cultivation, improving productivity, reducing losses etc, Components of the system (e.g. harvesting, Agriculture produce (form, varieties/breeds), Environmental factors (e.g. tropical region, temperature, relative humidity, moisture, gases, light), Pests and diseases, Storage structures, Processing and preservation conveying/transportation, Packaging; Post-harvest losses (definition, origin, nature and extent of losses); agents of losses: biological, microbiological, chemical, physical, technical, genetic; detection and assessment of losses (importance of loss assessment, detection of external and hidden infestation. description of various detection methods, inspection procedures and frequency for bagged and bulk durable produce, description of loss assessment methods, simple and complex methods, their merits and demerits, description of equipment used to determine losses, sampling techniques used in loss assessment, demonstration of sampling techniques

LEVEL 400 COURSES

The student shall select ONE of the FOUR Subject Areas listed under MAJORS, in addition to the Core. Level 400 students are expected to report at the Faculty 4 weeks before the commencement of the First Semester to begin their Research Project.

Prescribed Courses

AGEX 401 Extension Experience

Visual aids, what they mean. Classification into projected and non-projected aids. The importance of visual aids. Development and use of non-projected visual aids. Selection of visual aids for specific learning situations. Report Writing. Methods of data gathering for development work. Gaining entry into communities. Establishing community structure and leadership pattern. The use of field demonstration to solve rural community problems. Participatory community programme implementing and evaluation.

AGEN 402 Agricultural Material Handling, Storage and Processing

Technological basis of processing; air, temperature, humidity, physical and mechanical properties of agro products. Moisture content measurements. Introductory fluid mechanics; Pumps, Fans. *Reasons for Drying*: Drying methods; natural & artificial solar dryers. Classification of drying machines, capital and running cost of dryers. *Material Handling*: The role and significance of conveying machines, classification of conveying machines. Principal components of a conveyor. Types of conveyors; Belt, Chain, screw, Bucket, Pneumatic, Lifts, Cranes, Carts of trailers. Principles and Practices of sorting, grading, waxing, polishing and cleaning. Machines for sorting, grading, waxing, polishing and cleaning. Storage conditions, design considerations of storage systems.

Majors

AGRICULTURAL ECONOMICS

Core

AGEC 401 Agricultural Marketing and Trade

Course Objectives: To help the students understand the essential of effective seed marketing; to provide practical skills in the operation of a farm input marketing firm, to help them prepare an operational marketing plan, to familiarize students with the theory and practice of international trade, and to help students to grasp the trade policy options available generally and for developing countries in particular.

AGEC 402 Agricultural Development Planning and Policy

Course Objective: The main objective of the course is to provide basic knowledge in the theory and process of general economic development with emphasis on agricultural development.

AGEC 404 Price Analysis

This course focuses primarily on the determination and analysis of Agricultural Prices. The main tools of analysis are microeconomic theory and basic econometrics. The course objectives are:

1. To familiarize students with the behaviour of Agricultural Prices;
2. To review analytical techniques used by economists to explain the behaviour of Agricultural Prices;
3. To introduce students to empirical analysis using these analytical tools and other research procedures to address issues relating to Agricultural Prices.

ECON 301 Microeconomic Theory I

Economic model-building. Positive and normative economics. Micro and Macro. Comparative Static and dynamic models. Consumer Behaviour and Demand Theory, Cardinal utility approach to demand theory: law of diminishing marginal utility, consumer equilibrium, Marshal's derivation of law of demand. Ordinal utility approach: indifference curve analysis; principle of diminishing marginal rate of substitution; consumer equilibrium, price consumption curve; income consumption curve; income effect; substitution effect; price effect; inferior good, Giffen good. Revealed preference approach: brief treatment. Demand function; individual and market demand schedules and curves; ceteris paribus assumptions; elasticity of demand; price elasticity of demand; income elasticity of demand; price and marginal revenue; cross-elasticities. *Theory of Production:* Production function: Total, average, and marginal product. 3-stage analysis. Isoquants. Marginal note of technical substitution. Isocost curves. Relationships between costs and inputs. Expansion path. Social costs and private costs. Short-run cost theory: fixed, variable, total, average and marginal cost. Long-run costs. Cost elasticity. Economies and diseconomies of scale. *Theory of the Firm: Perfect Competition:* Basic concepts, definitions, assumptions: the firm, market, product homogeneity, perfect knowledge, profit maximization, free entry. Short-run equilibrium of firm and industry. Long-run equilibrium of the firm. Constant and increasing costs industries.

ECON 303 Macroeconomic Theory I

Introduction: Macroeconomic variable; functional relationships and parameters; national income and national product accounting; circular flow of income and spending. *Classical Macroeconomics:* Say's law of market; the quantity theory of money; saving, investment and the rate of interest to the classical full-employment equilibrium; Wicksell's formulation: monetary and fiscal policy in classical economics. *Keynesian Macroeconomics:* The consumption function; the multiplier; simple Keynesian model; liquidity preference and the speculative demand for money; the liquidity trap; extensions of the simple Keynesian model, government - expenditure multiplier; balanced-budget multiplier; investment and foreign-trade multiplier; policy implications of the Keynesian model. *Aggregate Demand and Supply Curves.* *Theory of Inflation:* Demand-pull and cost-push inflation; the dynamics of inflation; hyper-inflation and creeping inflation; Phillips curve; controls of inflation.

Electives

ECON 302 Microeconomic Theory II (Prerequisite: ECON 301)

Monopoly: Definition and assumption of model. Demand curve under monopoly. Short-run equilibrium. Long-run equilibrium. Price discrimination. Monopolistic Competition. Meaning: product differentiation, many sellers. Pricing decision under monopolistic competition; short-run and long-run equilibrium. excess Capacity. *Oligopoly*: Concepts, Duopoly models. Kinked demand curve. Theory of games (brief introduction). Brief discussion of behavioural theories of the firm. Theory of Distribution. Marginal productivity theory in perfectly competitive markets; demand for a factor of production, supply of a variable factor; product exhaustion; distribution and relative factor share, elasticity of substitution; technological progress. Modifications of the theory - introduction of imperfections in product and factor markets; monopoly and monopsony; trade unions. *Theory of rent*: Ricardian treatment. Modern treatment - derived demand, transfer costs, opportunity costs quasi-rent. Capital and interest: as an application of marginal productivity theory. Determination of rate of interest by supply and demand. *Welfare Economics*: Pareto optimality; optimum conditions of production and exchange. The role welfare economics in modern economic analysis.

ECON 304 Macroeconomic Theory II (Prerequisite: ECON 303)

Consumption Demand. Absolute Income, Life Cycle, Permanent income and Relative Income Hypothesis; Theory of Investment. Motivation of investment; determination of 'present' value of investment; marginal efficiency of capital; acceleration principle. Combination of the Classical and Keynesian Models. The equality of saving and investment; introduction of supply and demand for money; the Hicks-Hansen analysis and synthesis; flexible wages and employment; critical evaluation of the Keynesian model. The Demand for Money and Money Supply. Theory of Economic Growth. The Classical growth of model; Harrod-Domar growth model; policy implications. External Trade. Theory of Economic Policy

ECON 403 Econometrics I

The Meaning and Purpose of Econometrics: Econometrics of Demand. Econometric demand equations. Theory of the disturbance term. Cross-sectional analysis, and Engel curves. *Econometric Methods*: Least Square (LS) Tests of original hypotheses, and analysis of residuals. A battery of statistical and economic tests of the economic and statistical hypotheses of the equation of relation; co-efficient of correlation, determination, variation; t-tests; test for randomness or serial correlation of the disturbances of graphing the residuals, and by the Durbin-Watson 'd' statistic. The general linear equation of relation with many variables estimated by classical least square, and using matrix methods. The sample error co-variance matrix of estimated parameters. Econometrics of the Firm and of Supply.

ECON 404 Econometrics II

Models Embodying Many Equations: Least squares bias in the estimation of parameters in simultaneous equations systems. Elementary methods of attaching this bias problem. Indirect Least Squares (ILS); Instrumental Variables (IV); Two Stage Least Squares (TL); Rules for testing identification. Laboratory exercise involves a simple three equation model of the economy of Ghana, in which one over-identified three variable equation is estimated by LS and TL. The TL result is put through all of the tests. *Miscellaneous Econometric Problems*: Collinearity of explanatory variables. Delayed responses and lagged variables. Estimation when disturbances are serially correlated. Use of artificial or shift variable (dummy variables). Testing for change of structure - the Chow Test.

AGRIBUSINESS

Core

AGEC 401 Agricultural Marketing and Trade

Course Objectives: To help the students understand the essential of effective seed marketing; to provide practical skills in the operation of a farm input marketing firm, to help them prepare an operational marketing plan, to familiarize students with the theory and practice of international trade, and to help students to grasp the trade policy options available generally and for developing countries in particular.

AGEC 402 Agricultural Development Planning and Policy

Course Objective: The main objective of the course is to provide basic knowledge in the theory and process of general economic development with emphasis on agricultural development.

AGEC 403 Research Methods, Statistics and Mathematics for Agribusiness

The purpose of the course is to introduce students to methods of research in agribusiness and also to provide a solid statistical/mathematical foundation for understanding econometrics to perform economic analysis of agribusiness problems. It is also to facilitate a thorough understanding of the principles of economic modeling in agricultural research.

(a) Research Methods

The Scientific Method in Economic Research; The Research Proposal; Development of Agricultural Research; Data/Information gathering; Qualitative/Quantitative Methods of Data Collection; Sampling Methods; Farming systems research; Economic Analysis of Agronomic Data.

(b) Statistics and Mathematics for Agribusiness

Statistics: Overview/Importance of Statistics in Economic Research; Concepts of distribution functions; Concept of a model/Use of Economic models; Classical normal regression assumptions and estimation procedures of the Ordinary Least squares; Presentation and interpretation of results of economic modelling; Examples of empirical models.

Mathematics: The derivative and the rules of differentiation and their applications in economics; Calculus of multivariable functions and their applications in economics; A review of logarithms and exponentials and their applications in economics; Fundamentals of matrix or linear algebra and their applications; Integral calculus and their applications.

AGEC 405 Quantitative Methods and Operations Research

Course Objective: The objective of the course is to provide basic tools to enable the student perform quantitative analysis of agribusiness enterprises.

Course Outline

Probability and Decision Making; Index Numbers; Time Series Analysis; Forecasting; Network Analysis and Scheduling; Inventory Control; Simulation Analysis; Correlation and Regression Analysis; Waiting Lines Analysis; Linear Programming – Simplex Method and Advanced Methods; Transportation and Assignment Problem

AGEC 406 Financial Management

Course Objective: The general objective of the course is to foster an indepth understanding of the application of financial management principles in the operation of an agribusiness firm. This includes the use of financial statements, capital budgeting and risk management techniques and analysis of the impact of risk and time on business decisions. The regulatory framework and the financial institutions serving the farm and agribusiness sector will be discussed.

AGEC 407 Management Accounting

Course Objective: The aim of this course is to acquaint students with the fundamentals of managerial accounting to enable them use accounting information in managing an organization.

Electives

AGEC 408 Fundamentals of Business Planning and Policy

Course Objective: The course is designed to equip the students to think strategically, plan, strategise and implement business policies in the agribusiness (business) sector. The students must be able to prepare strategic plans and also develop business plans for any given business in the agricultural sector.

Course Outline: The nature and Importance of Business Policy and Planning; Policy and levels of planning; Strategic planning; Choosing the strategy, implementing the strategy, Evaluating the strategy; Annual plans; information system for planning; Contingency planning; The route to market entry; and Business plan; Term paper on Business Plan Preparation.

AGEC 409 Market Research and Analysis

Course Objective: The main objective of the course is to provide basic knowledge in gathering and evaluating market intelligent information for understanding consumers' requirements and use in business management decision making.

AGEC 410 Agrifood Business and Agroprocessing

Course Objective: The purpose of the course is to introduce students to modern dynamics and trends in agrifood business. The course focuses on case studies to introduce students to methods and concepts in agrifood business and agro processing.

Course Outline: A Systems approach to agro industrial analysis: production chain linkages, macro-micro policy linkages, institutional linkages, international linkages. Organization of Agri-food Business: vertical integration/differentiation, horizontal integration/differentiation, coopera-tive systems, outgrower systems. Case Studies:- Management strategies, Marketing strategies, Financing strategies: Egg Production Business, Chicken meat processing business, Palm Oil Processing business, Pineapple Processing business, Grain processing business.

ANIMAL SCIENCE

Core

ANIM 401 Biometry

Statistical inference; one-way analysis of variance; experimental design-single factor. Factorial experiments. Qualitative and quantitative factors. Fixed, random and mixed models. Nested and nested-factorial experiments. Experimental design – Two or more factors. Split-plot Design; confounding systems. Introduction to computer software and statistical data analysis.

ANIM 402 Health, Reproductive And Obstetric Problems

Intensive production and reproductive problems in farm animals. Common general pathologic and inflammatory conditions affecting the male and female genitalia of food animals. Classical health problems associated with pregnancy, gestation and the pueperal period in livestock. Abortions and other post-parturient conditions in farm animals. Intensive production and management health problems in poultry. Reproductive failure in farm animals – sterility, infertility and their management and control signs, diagnosis and production significance of pregnancy in food animals. Problems of parturition – dystocia, retained placenta, management of uterine prolapses, ruptures and abnormal presentations in farm animals.

ANIM 403 Ruminant Production

Limitations to the small ruminant industry in Ghana and Government interventions to enhance the industry; reproductive wastage and factors that affect reproductive rates in small ruminants – litter size, young mortality and lambing/kidding interval; management practices – flushing, mating, creep feeding, weaning, castration, dehorning, spraying and drenching; Year round programming for a small ruminant enterprise; status of the dairy industry in Ghana; constraints to cattle milk and meat production in West Africa; factors affecting profitability of a dairy enterprise. Variations in normal lactation; factors affecting yield and composition of milk; dairy management; production systems in the tropics – extensive, semi-intensive and intensive.

ANIM 404 Monogastric Production

Avian biology and its importance in management; hatchery set up and management; processing and marketing of poultry; rearing of broiler breeder; management of various species of poultry; Housing and equipment for swine production; breeding and marking of swine; management of gilts and sows during pregnancy and farrowing; requirements and managements of suckling pigs; Health problems of swine, Record keeping in swine production.

ANIM 405 Applied Animal Nutrition

Feeding standards and nutrient requirements of farm animals for bodily processes and productive functions; ration formulation – factors affecting nutrient utilization, information needed for ration

formulation and mechanics of ration formulation; metabolism of nutrients; factors affecting feed intake and utilization; feeding and digestibility trials – in-vivo, in-vitro and in-situ.

ANIM 406 Animal Breeding

Principles of selection; improvement of livestock through selection factors affecting rate of genetic improvement, basis for selection, types of selection, mating systems; system of breeding and selection of livestock; special problems of implementing genetic improvement of livestock programmes in the tropics (with particular reference to Ghana); Open nucleus breeding schemes. Characterization and conservation of Animal Genetic Resources.

Prescribed Elective

ANIM 407 Reproductive & Environmental Physiology

Comparative anatomy of the reproductive organs of the different livestock species. Functions of the testes and ovaries. Oestrous cycles and synchronization of estrus. Fertilization and maintenance of pregnancy; structure of the mammary glands initiation and maintenance of lactation. Reproductive organs of the hen and egg laying. Artificial Insemination. Response of farm animals to high and low ambient temperatures; effects of high ambient temperatures on the productivity of farm animals. Alleviation of heat stress through management practices.

ANIM 408 Meat Science and Meat Hygiene

Structure, chemical composition and growth of muscles; muscular tissue proportion in meat animals; conversion of muscle to meat; qualitative and quantitative evaluation of carcass/cuts; by-products of the meat industry; storage and preservation of meat; microbial flora of meat and meat products; factors that affect the quality of cured meats; objective and subjective methods of measuring tenderness and juiciness of meat; marketing of meat and meat products; transportation of livestock intended for slaughter, lairage and holding of animals prior to slaughter; ante-mortem and post-mortem examination; modern concepts of meat hygiene.

ANIM 409 Grassland Management

Ecology (review) – definition, ecosystem concept and function, succession, range conditions. Vegetational zones of West Africa/Ghana; the value of vegetation to livestock, factors that affect herbage intake; vegetation measurement – weight, cover, density, frequency and quality; stocking rate, carrying and grazing capacity, management and improvements of grasslands – grazing management, re-seeding, fertilization, control of invading vegetation; Grazing management systems – continuous, rotational, zero and creep grazing. Forage conservation – silage, hay.

Free Elective

ANIM 411 Micro-livestock Production

Types of microlivestock; the importance of microlivestock in Ghana; production and management of rabbits; management practices required for snail production; domestication and raising of grasscutters and guinea pigs.

ANIM 412 Animal Behaviour

Sexual behaviour in farm animals: - measurement of intensity of sexual behaviour, factors that affect intensity, hormonal control and effects on reproductive efficiency; abnormal sexual behaviour in farm animals; Grazing and ingestive behaviour, social behaviour, maternal behaviour and its effects on offspring survival; mother young bond formation.

CROP SCIENCE

Core

CROP 400 Research Project

In the final year, a B.Sc. student in Crop Science must choose a topic for a research investigation directed at solving a specific plant science-related problem in consultation with a lecturer who becomes the student's supervisor. A bound dissertation describing this investigation must be presented to the Department before the final examinations begin. Although the research project is

basically for training students in scientific research, it must be done conscientiously and the dissertation must contain all the elements of a publishable scientific paper. The course is spread over the first and second semesters.

CROP 401 Field Crops

Origin, botany, distribution, adaptation, propagation, cultural practices, harvesting, utilization and post-harvest handling of tropical food crops including cereals, legumes, root and tuber crops and plantain. Other crops include beverages, oil, spice and fibre crops. Constraints to production and research needs.

CROP 402 Crop Entomology

A detailed study of the biology, economic importance and control of major and minor insect pests of Field, Plantain and Horticultural crops including vegetables: Emphasis would be placed on pests of the above crops both in the field and in storage.

CROP 403 Plant Pathology

Review of characteristics of the major plant pathogen groups; Introductory plant pathology. Development of disease in plants. Emphasizing some important terminologies, plant disease triangle, disease cycle and relationship between disease cycle and epidemics in plants; pathogenic attack of plants – role of enzymes, toxins, growth regulators etc. in plant diseases; effect of disease on plant metabolisms; defence of plants against pathogens – the concept and basis of resistance; genetics of plant diseases, Diagnosis and Assessment of plant diseases. Elements of seed pathology. Some selected plant diseases and their control in Ghana.

CROP 404 Fruit and Vegetables

The fruit industry. Classification of fruit crops. Factors affecting fruit production. Establishment of an orchard: propagation and nursery practices and fruit crop management; fruit quality and marketing. Detailed knowledge of the botany, physiology and production practices for citrus, banana, mango, avocado pear, cashew and pineapple. Minor fruit crops of Ghana. Importance of vegetables enterprises. Classification of vegetables. Factors affecting vegetables production in Ghana. The vegetable production process: site selection and soil preparation; fertilizers and plant nutrition; water sources; propagation practices; weed, pest and disease control. Vegetable cropping systems. General principles of harvesting, postharvest handling, marketing and storage of vegetables. Cultural practices involved in the production of major vegetable crops in Ghana. Research needs. Importance of spices and their role in foods. Major spice crops of Ghana. Production practices involving spices and research needs. Minor vegetable and spice crops of Ghana.

CROP 405 Statistics for Agriculturists

Introduction to planning and execution of agricultural experiments. Principles of scientific experimentation. Statistical methods commonly used in agricultural research and experimental biology. Descriptive statistics. Normal 't' and 'F' distributions and their uses. Experimental designs, analysis of variance, chi-square tests, simple correlation and regression. Factorial experiments. Introduction to multiple regression and non-parametric statistics. Emphasis will be on applications of these methods rather than on mathematical derivations.

CROP 406 Genetics and Plant Breeding

Introduction to evolutionary, population and quantitative genetics. Plant genetic resources. Reproductive systems in crop plants. The genetics basis and methods for breeding self- and cross-pollinated crops. Mutation breeding. Polyploidy. Inter- and intra-specific hybridisation. Introduction to techniques of biotechnology utilized or with potential to be utilized in crop improvement.

Electives

CROP 407 Seed Science and Technology

Biology of seeds – ontogeny, structure, storage, germination and storage behaviour. Principles and practices involved in the production, harvesting, processing, conditioning, storage, testing, quality

management and use of agricultural seeds. Seed improvement, national seed laws, international seed institutions and regulations, seed industry policy and germplasm policy for Ghana. Developments in the international seed arena including patenting. Establishment and management of seed production as a business.

CROP 408 Plantation and industrial Crops

Ecology, agronomy, physiology, production systems and research needs of major plantation crops in Ghana. Emphasis will be on cocoa, coffee, rubber, shea, sugarcane, oil palm, coconut, tobacco, cotton and citronella. Processing utilization and marketing potential. Prospects and problems of production.

CROP 409 Post-Harvest Science

The postharvest system. Concept of perishable and durable crops. Perishable crops: postharvest diseases and their importance, infectious and non-infectious causal agents; postharvest infection. Mechanisms and factors (such as maturation, harvesting, transportation, storage and marketing) affecting them. Use of ethylene and other chemicals in postharvest technology. Control measures, including use of modified atmospheres. Durable crops: the environment for handling durable crops, characteristics features of this environment. Major pests in the postharvest system. Biology, economic importance and control of selected pests of stored products. Merits and demerits of the use of chemicals in the storage environment.

CROP 413 Molecular Biology

The nature of DNA nucleic acids. Replication of double stranded DNA. The Genetic code, Gene and Gene expression. Production of Recombinant DNA. The Polymerase Reaction. Cloning of prokaryotic and eukaryotic genomes. Genome libraries. Analysis of recombinants. Construction of transgenic plants. Application of DNA technology in agriculture.

CROP 414 Plant Virology

History, classification and terminologies in virology. Virus structure, components of viruses. Isolation and characterization of viruses. Transmission of viruses. Life cycle of virus – synthesis and Genome replication of viruses. Virus entry, movement and assembly. Plant virus pathogenesis, cell damage and Host contribution to pathogenesis. Virus evolution, origin and divergence. Prevention and control of viral disease including plant defense agents

Practical sessions should include: Detection and assaying of plant viruses using host plants, serology and nucleic acid based techniques. Transmission of virus to test plants, symptomatology and Electron microscopy.

CROP 415 Environmental Horticulture

Landscape Design: History of garden and landscape design. Contemporary trends, types and elements of the landscapes. Objectives of landscaping. Conduction of a landscape survey and analysis of landscape survey data. Materials of design. Principles of design and Principles of landscape design. The functions and design of beds and borders, home gardens, open space and public parks. Road, street and industrial landscaping. Landscape graphic techniques. Preparation of plans. The sequence of operations for Landscape, projects. Preparation of costs and estimates. Landscape Horticulture: Importance of landscape plants in the environment. Selection of plants for landscaping. Establishment and maintenance of landscape trees, shrubs, climbing plants, hedges and shelter belts, bedding plants, lawns in garden and parks, and aquatic plants in water garden. Establishment of landscape maintenance program.

CROP 416 Plant Materials

An introduction to plant taxonomy. Identification, classification, nomenclature, description, usage, propagation and cultural requirements of the more common landscape plants. Advantages, disadvantages and methods of vegetative propagation. Propagation by specialized stems and roots. Anatomical and physiological factors affecting the rooting of cuttings. Techniques of propagating by cuttings. Layering. Anatomical and physiological factors affecting the healing of the graft union. Selection and storage of

scion wood and root stocks. Graft incompatibility. Stock scion relationship. Methods of grafting and budding.

SOIL SCIENCE

Core

SOIL 400 Research Project and Seminar

A project to be carried out by the student under the supervision of senior member(s) of the Department. The student will be required to investigate in some depth a selected problem in soil science or agronomy and present seminars and a dissertation in partial fulfillment of the requirements of the B.Sc. Agriculture degree.

SOIL 401 Soil Science Practical and Special Topics

Soil sampling techniques, new methods of soil analysis, assessment of soil productivity rating/judgement; special topics in soil and environmental science: term papers based on reviews of previous works; interpretation and discussion of analytical data.

SOIL 402 Soil Biochemistry and Microbiology

Decomposition of organic residues in soils; Legume bacteriology; Transformations of sulphur, iron, manganese in soils, decomposition of pesticide. Biological nitrogen fixation: symbiosis (including grain legumes, trees, Azolla, pasture/forage) and non symbiotic; Biochemistry of nitrogen fixation (symbiotic and non symbiotic), methods of measuring biological nitrogen fixation (BNF); Legume bacteriology, inoculation, mycorrhiza, methods of studying microbial ecology-antibiotic resistance and select-able markers, serology, gene typing and other methods of molecular biology; Biochemistry of nitrification, denitrification and nitrate reduction; Biochemical transformation of phosphorus, sulphur, hydrocarbons and pesticides (including herbicides). Biochemical processes in the rhizosphere.

SOIL 403 Soil Genesis, Survey and Land-Use Planning

Reactions and processes of soil genesis: weathering and end-products of inorganic and organic fractions; Eluviation and illuviation of bases, silica, aluminum, iron, clay and organic matter; Development of pans, nodules and concretions; Progressive soil development; Soil orders and the genesis of their diagnostic horizons; Soil survey: scales and kinds of soil survey, soil mapping units, soil survey operations; Understanding what we see in terms of soil genesis: concept of benchmark soils, defining soil series - the hypothetical model; Soil survey reports: land evaluation, land-use planning, introduction to GIS (Geographic Information Systems).

SOIL 404 Soil Chemistry and Fertility

Basic concepts: Law of mass action and equilibrium constant – solubility product, dissociation of strong and weak electrolytes, equilibrium constant and ion exchange in soils, equilibrium and constant free energy relationship. Solid phase: Origin and distribution of charge on soil colloid surface, point of zero charge, electrical characteristics of soil/water interface, double layer theory; mechanism of cation and anion fixation in soils. Liquid phase: composition, concentration, activities and activity coefficients, Debye-Huckel theory; Fertilizers: sulphur, aluminum, and pyrites in the formation of soil acidity; Chemical factors affecting plant growth: growth expressions, Mitscherlich's law of diminishing returns, Liebig's law of the minimum. Application of the principles of soil fertility to soil management - fertilizer application, liming, mulching, green manuring, composting, methods of evaluating soil fertility. Farming systems. Soil management in shifting cultivation areas. Soil and plant factors that affect N availability to plants; Behaviour of P fertilizers and their availability in soils.

SOIL 405 Soil and Environmental Physics

Soil water potentials; potential diagrams, the soil moisture characteristic, soil water balance, infiltration, water flow in soils; Steady and non-steady state flow, continuity equation, Darcy-Richards equation, transport of solute and nutrients in soil; Soil temperature and heat movement; Climatic factors affecting plant growth: wind, soil and environmental temperature, environmental moisture: saturated vapour

pressure, relative, humidity, dew point; Radiation, energy balance, models of water and heat transport in soil, demonstration of transport models such as LEACHM, SODICS, SWIM, etc.

CROP 405 Statistics for Agriculturists

Introduction to planning and execution of agricultural experiments. Principles of scientific experimentation. Statistical methods commonly used in agricultural research and experimental biology. Descriptive statistics. Normal 't' and 'F' distributions and their uses. Experimental designs, analysis of variance, chi-square tests, simple correlation and regression. Factorial experiments. Introduction to multiple regression and non-parametric statistics. Emphasis will be on applications of these methods rather than on mathematical derivations.

Electives

SOIL 406 Introduction to Paleopedology

Phytolith analysis: history of phytolith research, production, deposition and dissolution of phytolith, phytolith morphology, field techniques and research design, interpretation of phytolith assemblages, the role of phytoliths in paleo-environmental reconstruction; Relative and absolute dating; Pollen stratigraphy.

SOIL 407 Soil Mineralogy

Crystal chemistry and mineral structures: types of and properties of bonding; Structural classification of soil minerals; Minerals in soil environments; Clay mineralogy: phyllosilicates, allophanes, imogolites; Mineral separation and identification: fractionation and analytical methods; Applications of clay minerals in industry, agriculture and environmental management.

SOIL 408 Introduction to Agricultural Systems Analysis and Simulation

Systems dynamics: definition, types of systems, causal and flow diagrams, Behaviour of systems, homeostasis, heterostasis, chaos; Simulation of biological systems; Models: types of agricultural models, methods of modelling, validating models, sensitivity analysis, construction of simple models using DYNAMO, for population growth, predator-prey systems, nitrogen cycle, pesticide transport and nutrient leaching. Demonstration of some soil/crop models e.g. QUEFTS and NuMAS, etc.

SOIL 409 Isotopes in Environmental and Industrial Research

Definition and types: atomic theory, radiogenic and stable isotopes; Fractionation of isotopes; Variations of isotopes in terrestrial environments; Analytical procedures; Applications: dating of materials, plant nutrition and metabolism, origin and reactions of minerals in soils and sediments, hydrological cycle, mineral exploration and human health.

SOIL 410 Introduction to Bio-remediation of Contaminated Soils

Microbial and chemical techniques to reclaim contaminated soils; Effect of chemicals and pollutants on microbial population, basic principles governing bio-degradation, bio-transformation reactions, pathways for major classes of pollutants e.g. oxygenases, aromatic compounds, heterocycles, chloro and fluoro aliphatic compounds, anaerobic reactions. Emerging technologies such as genetic engineering, intrinsic remediation, bio-augmentation etc.; Chemical techniques; sorption of non-ionic organic contaminant by soil.

Specialization in Postharvest Technology

FAPH 401 Postharvest Physiology

Definitions; developmental cycle of plants (dormancy and germination of seed and storage organs; vegetative and reproductive growth; seed development and fruit ripening); structure and composition of produce; physiology and biochemistry of produce (e.g. process of respiration including glycolysis, electron transport system, TCA cycle; issues in respiration for post-harvest technologists including rates of respiration of different commodities, variation in respiration rates with temperature, oxygen, and carbon dioxide, production of heat and water during respiration); food chemistry and microbiology; food poisoning, food borne infections and toxicants; environmental factors (temperature, moisture, relative humidity, light, insulation, irradiation); Physiological disorders, low

temperature and mineral deficiency disorders; Commodity treatment (e.g. Controlled ripening and de-greening, sprout inhibitors, growth regulators -synthesis, measurement, mode of action, effects and sources, irradiation, ventilation, waxing, cooling, fungicide application, et); Quality assessment (simple methods including development of abscission layer, visual or appearance such as colour, size, shape, surface morphology, structure; specific gravity/dry matter content; texture firmness, composition e.g. sugar, starch, juice, oil content); Complex methods including density, impact, force deformation, sonic vibration, ultrasonic techniques, and electrical properties; optical properties, near infrared analysis; x-rays and gamma rays; nuclear magnetic resonance, machine vision and aroma)

FAPH 402 Farm Structures and Environmental Control

Materials for building construction: wood, concrete, steel, aluminum, insulation, roofing, finishing materials. Structural design: systems, requirements, analysis. Functional planning: functional planning for storage structure, materials handling centers, machinery and shop buildings. Electrical, mechanical and utilities: electrical systems, heating and cooling, ventilation systems, water supply. Crop storage environment: thermal factors in crop storage, moisture in storage, gases in storage environment, radiation.

FAPH 403 Storage Pests & Diseases, Their Prevention & Control

Identification of infestation and infection; Sources and causes of infestation and infection; Life cycle of storage pests (arthropods, vertebrates and microorganisms); Monitoring techniques; Post-harvest diseases (nature, symptoms, causal agents, management); Factors influencing growth and development of storage pests and disease organisms; Isolation and preservation of storage pests and disease organisms; Mycotoxins (nature, causes, effects, prevention and control); Prevention and control measures (physical, chemical, biological, attractants and repellents and other methods e.g. Integrated Animal and Crop Pest; Management - IACPM); Prevention of re-infestation and re-infection; Environmental hazards e.g. misapplication, misuse, disposal of agrochemicals

FAPH 404 Processing & Preservation of Agricultural Produce

Principles, concepts, definitions and importance; Types of processing plants (primary, secondary, tertiary); Processing methods (e.g. drying, dehydration, blanching, canning, freezing etc); Processing equipment; Preservation methods (e.g. pickling, salting, fermentation, smoking, pasteurization, asepsis, irradiation); Processing of selected produce (small-scale, medium-scale, industrial-scale); Cereals and legumes (e.g. drying, milling); Roots and tubers (e.g. chipping, grating, drying, starch extraction, “garification”); Fruits (e.g. juice extraction) and vegetables (e.g. chopping, drying, pickling); Oil crops (e.g. oil extraction); Beverage crops (e.g. fermentation, drying etc); Fibre crops (e.g. retting); Medicinal and aromatic plants; Spices e.g. drying, milling etc); Herbs (e.g. drying, milling etc); Meat, dairy, poultry and fish; By-product utilization and management

FAPH 405 Packaging & Environmental Issues in Post-harvest

Packaging (definition; effects of packaging on product quality, Principles and functions of packaging; Containment (e.g. individual packing, jumble packing, pattern packs, cell packs); Protection against shock, vibration, static compression, external agents (e.g. insects); Apportionment/Convenience and Labeling; Communication; Packaging materials e.g. plant materials (fibres, leaves, jute, fibre board); Synthetics (e.g. polythene, PVC, paper; Inorganic materials (e.g. metals), Structure and properties of packaging materials; Types of packaging (e.g. cartons, boxes, cases, wrappers, bags); Package design and evaluation; Cushioning materials and their properties; Packaging stations, equipment and machinery; safety and accident prevention; Pack houses; Public health and packaging (disposal of packaging materials); Environmental Issues; Environmental impact assessment; Waste disposal and management techniques: Incineration, Composting of waste agricultural products, Land fills (land reclamation), Biogas generation from waste products, Recycling of waste products, Pollution and remediation technologies, Agrochemicals; Food laws and regulations (food legislation); Consumer protection (e.g. production of goods, use of goods, second hand goods, sale of goods-guarantees, damages, trade description); Additives and contaminants; Food safety and hygiene; Plant hygiene and safety; Adulteration; Advertising and labeling

FAPH 406 Marketing of Agricultural Produce, Food Laws and Legislation

Concepts and importance; Marketing evolution; Marketing systems; Market analysis; Theories of supply, demand and equilibrium pricing; Competition; Seasonal variation in supply; Marketing organizations and functions; Government policy; Product quality grading; Labeling, pricing and sales; Domestic and international markets; Marketing channels and international trade; EUREP and GAP regulations; Recording system; Tractability; Common standards to sell under common labels; Co-operative marketing strategies; Determination of import and export parity prices; Market efficiency; Legal aspects of marketing; Distribution and salesmanship: Food Standards, Laws and Legislation (definitions); Food standards, laws and legislation of local and international agencies, e.g. GSB, WTO, GATT; The role of the regulatory agencies including Ghana Standards Board (GSB), Food and Drugs Board (FDB), Veterinary Services (VS), Plant Protection and Regulatory Services Directorate (PPRSD), World Trade Organization (WTO), General Agreement on Trade and Tariffs (GATT), African Growth and Opportunities Act (AGOA); Outreach programmes (e.g. need for outreach programmes, use of appropriate extension tools e.g. video documentaries, Farmers Field Schools, Radio and TV, Internet connectivity, local area networks, print media etc to reach beneficiary or target groups (farmers, agents, traders, processors, transporters, consumers, etc)

FAPH 407 Quality Assurance in Postharvest Technology

Aims and objectives (assurance of food safety, nutritive value and public health, prevention of fraud e.g. adulteration, product identification to facilitate trade (especially international trade), awareness creation among producers and handlers about benefits of quality assurance and its importance on the economic development of Ghana; Food Technology (e.g. definition, history of food technology, food quality and health etc); Scope of Quality Assurance; Pre-harvest indices of raw materials; Primary processing; Secondary processing; Storage of raw materials and products; Packaging and labeling; Consumers; Attainment/Achievement of Quality in Crops :varietal selection (physical, chemical, biological, economic characteristics, etc); water quality and quantity; soil amendments (animal manure, compost, chemical fertilizer); Agro-chemicals (types and modes of action, judicious uses of approved agro-chemicals (insecticides, fungicides, herbicides, nematicides, growth regulators, etc), Updated inventory of banned agro-chemicals; Farm sanitation; Harvesting (maturity (physiological and commercial maturity, market demands), methods); Handling (cleaning and sorting, hygiene in handling, treatment (including waxing, fungicide application, colour inducers, etc, grading, packaging and labeling, preconditioning (cooling, relative humidity control, light etc.); transportation; storage; Attainment/Achievement of Quality in Animals: Selection for slaughter (market weight, age); Feeds and feeding, Health and welfare, judicious use of approved veterinary drugs, dosage and withdrawal period etc, Farm sanitation, Pre-slaughter and post-slaughter handling, Personal hygiene and sanitation, Processing and Packaging, Preservation/Storage, Waste management; Good processing/manufacturing practice; Fish and fish products; Dairy products; Poultry products; Other meat products; Assessment methods: HACCP (hazard analysis, critical control point determination, critical limit determination, development of monitoring procedures, development of corrective action plan, development of record keeping procedures, verification procedures); ISO-9000 (standards for processing equipment, overview training, audit readiness, training for auditing, quality manual, sample procedures, Total Quality Management (TQM); Constraints to Quality Assurance in Ghana (lack of appropriate quality standards, ignorance of quality standards, poverty, commodity supply or availability, technical barriers (equipment and personnel), insufficient knowledge of market promotions, lack of consumer protection

Note: The concept of all quality issues should be related to specific agricultural commodities and products in an interdisciplinary approach. Reduction of cross contamination at the processing and consumer levels. Good agricultural and management practices at the primary level.

FAPH 408 Micro Enterprise Development & Management

Objectives (At the end of the course students should be able to: identify opportunities in Micro Enterprise, conduct a feasibility study, prepare a business plan, set up a micro enterprise business, manage the said business successfully, train others to acquire the above knowledge, skills and

competencies; Introduction (definition of micro enterprise, classification of micro enterprise: primary (agriculture, fisheries, forestry); secondary (agro-based small-scale industries); tertiary (transport, small business, other service activities); importance and role of micro enterprise to the socio-economic development of the country; Enterprise management skills: human resource development and management, customer care, product management, salesmanship, financial management, marketing; Risk management (Risk taking behaviour); hope for success and fear of failure; Learning from feedback; Starting a Micro Enterprise: scanning the environment (both local and foreign) for micro enterprise opportunities; Product/service identification; Role of research and development; Feasibility studies: components, procedures, market survey to identify, target market: segments/strata of target market (the income strata, educational strata, geographical distribution, wholesale buyers, retail buyers size and volume, spread, etc.), sources of raw materials; Development of a Business Plan: Business Plan (definition, types and objectives); Components/elements of a business plan (type of ownership, legal status, address and location, the name, the bankers, registration, when to start operation, description of the product/service, production plan - technology and source of raw material, marketing plan, Financial analysis (analysis of cash flow): sensitivity analysis, cost-benefit analysis (fixed and variable), Break even analysis; Implementation Plan: Categories of resources (physical – premises, supply of raw materials, tools, equipment, machinery etc, technical – technical-know-how, prototypes, designs, technical training etc, financial – funds needed for physical, technical facilities and inputs for the enterprise; sourcing for funding (cooperative societies e.g. credit unions, “Susu”, banks – Commercial and rural, Chamber of Commerce, Entrepreneurs association, Small business development organizations e.g. National Board for Small-Scale Industries (NBSSI), NGOs, Relatives and friends; Acquisition of materials and machinery; Development of Strategic Plan (Vision and Mission statements, Major strategic thrusts, Long term and short term Plan, How to attain set goals for the enterprise; Development of logical frame (Performance, Evaluation, Review Techniques (PERT) and Strengths/Weaknesses/Opportunities and Threats (SWOT,) etc.; Monitoring and Evaluation (definition, concepts and scope, Indicators, importance and techniques; Challenges of Micro Enterprises (concepts and scope of challenges, challenges of working capital, quality standards, management and gender issues, minimizing the effects of challenges; Enterprise Development Opportunities in the Post-harvest chain (development of micro enterprises in Storage/Warehousing, Transportation, Value-added processing, Packaging and labeling, Sales and distribution, Advertising, Financing, Manufacturing of tools and equipment for post harvest services, Processing services, etc.; Industrial profiles of major agricultural commodities including Cassava, Plantain, Maize, Coconut, Yam, Oil palm Cocoyam, Cocoa, Groundnuts, Coffee, Cowpea, Fruits, Soybean, Spices, Millet, Sorghum, Meat, Chicken, Fish etc.

DEPARTMENT OF HOME SCIENCE

FACULTY

Angelina O. Danquah <i>BSc. (Biochem) (KNUST) MSc (Acadia) PhD (McGill)</i>	-	Senior Lecturer/Head of Department
Docea A.G. Fianu <i>BSc. (Home Sci) (Ghana) MSc (Guelph)</i>	-	Associate Professor
Clara Opare Obisaw <i>BSc (Home Sci) (Ghana) MSc (Guelph) PhD (Nutrition) (Ghana)</i>	-	Associate Professor
Laetitia A.P. Hevi-Yiboe <i>BSc (Home Sci) (Gh) MSc (Guelph) PhD (Iowa State)</i>	-	Associate Professor
Christina A. Nti <i>BSc (Ghana) MSc (Oslo) PhD (Nutrition) (Ghana)</i>	-	Senior Lecturer
Elizabeth M. Ba-ama <i>Dip. (Winneba) BSc (Home Sci) MPhil (Ghana)</i>	-	Lecturer
Cynthia Gadegbeku <i>Dip BSc (UCC) MPhil (Ghana)</i>	-	Lecturer
Augusta A. Ayertey <i>Dip (Winneba) BSc. MPhil (Ghana)</i>	-	Lecturer

Vivian Tackie-Ofosu BSc (Home Sci) Ghana MPhil (Ghana) MPA (Iowa)	-	Lecturer
Efua Vandyck Dip. (Winneba), BSc. (Home Sci) (Ghana) MPhil (Ghana)	-	Lecturer
Nana Yaa A. Nyarko BA (Psychology & Sociology) MPhil (Psychology) (Ghana)	-	Lecturer
Sheriffa Mahama BA (Psychology) MPhil (Ghana)	-	Lecturer
Nabilla Williams BSc (Stout State) MSc (Guelph)	-	Part-Time Lecturer
Agnes Amissah B. Tech., M. Tech (Nutrition) (South Africa)	-	Part-Time Lecturer
Doris Aglobitse BSc (Home Sci) (Ghana) MPhil (Ghana)	-	Part-Time Lecturer
Margaret A. Essamuah BSc Grad. Dip (Architecture) (KNUST) MPhil (Home Science) (Ghana)	-	Part-Time Lecturer
Vivian Biney-Aidoo , B.Ed. (UCC), MPhil (Ghana)	-	Part-Time Lecturer

LEVEL 100 COURSES

The Courses available in Level 100 are compulsory for all BSc. students

HOSC 101≠	Introduction to Family Resource Management	2
HOSC 102≠	Fundamentals of Textiles and Clothing	2
HOSC 103≠	Introduction to Human Development	2
HOSC 104≠	Introduction to Foods and Nutrition	2
ANIM 101 ⁺	Introduction to Biology of Farm Animals	2
FASC 101 ⁺	General Mathematics I	3
AGRC 101 ⁺	General Chemistry I	3
AGRC 102 ⁺	General Chemistry II	3
AGRC 103 ⁺	Practical Chemistry I	1
AGRC 104 ⁺	Practical Chemistry II	1
AGRC 105 ⁺	Practical Physics I	1
AGRC 106 ⁺	Practical Physics II	1
AGRC 107 ⁺	General Physics I	3
AGRC 108 ⁺	General Physics II	3
LANG 102 ⁺	Language and Study Skills	2
BIOL 104 ⁺	Growth of Flowering Plants	2

LEVEL 200 COURSES

The Courses in Level 200 are compulsory for all BSc. students

HOSC 201≠	Scope and Philosophy of Home Science	2
HOSC 202≠	Experimental Foods	3
HOSC 203≠	Principles of Foods	3
HOSC 204≠*	Human Development II	2
HOSC 207	Human Physiology I	2
HOSC 208≠	Consumer Studies	2
HOSC 212	Human Physiology II	2
PSYC 201 ⁺	Introduction to General Psychology	3
PSYC 202 ⁺	Theories of Psychology	3
SOCI 201 ⁺	Basic Concepts in Sociology	3
SOCI 202 ⁺	Comparative Social Institutions	3
FASC 101 ⁺	General Mathematics I	3
STAT 208 ⁺	Introduction to Statistics	3
HOSC 213	Introduction to Textiles	3
HOSC 214	Introduction to Clothing	3
HOSC 217≠*	Human Development I	3

LEVEL 300 COURSES

Core

HOSC 300**	Vacation Internship Programme	3
HOSC 301≠	Basic Nutrition	2
HOSC 302	Food Hygiene, Food Spoilage and Preservation	3
HOSC 303≠	Concepts of Home Management	2
HOSC 304≠	Family Resource Management	3
HOSC 305	Fundamentals of Design	2
HOSC 306	Textile Design	3
HOSC 307*	Individuals and Family Relations	2
HOSC 308	Research Methods	3
HOSC 312	Housing Design and Alternatives for Individuals & Families	3
HOSC 319	Principles of Housing	3

Electives

In addition, students may choose from any Department to make up the Required credits.

HOSC 309	History, Philosophy and Current Programmes in Early Childhood Education	3
HOSC 311	Work Simplifications in the Home	3
HOSC 313	Woven Textile Design	3
HOSC 314	Curriculum for Children in Child Care Settings	3
HOSC 315	History of Costume	2
HOSC 316	Personal and Family Finance	3
HOSC 317	Preparation for Marriage	3
HOSC 318	Home Furnishing	3
HOSC 321	Sensory Evaluation of Food Products	3
HOSC 322	Parenting	3

LEVEL 400 COURSES

Core

HOSC 400	Research Project and Research Seminars	6
HOSC 401≠	Meal Management and Feeding the Family	3
HOSC 402	Special Issues in Clothing and Textiles	3
HOSC 403≠	Equipment in the Home	3
HOSC 404	Special Topics in Foods and Nutrition	3
HOSC 405	Advanced Clothing Construction	3
HOSC 406≠	Family Resource Management: Live-in-Experience	3
HOSC 411≠*	Home Science Extension Theory	2
HOSC 412≠*	Home Science Extension Practicals	1

Electives

In addition, students may choose from any Department to make up the Required credits

HOSC 414	Special Topics in Home Management	3
HOSC 415	Issues in Family Economics	3
HOSC 416	Tailoring of Clothing	3
HOSC 417	Textiles and Clothing Maintenance	3
HOSC 418	Clothing Construction Internship	3
HOSC 419	Special Techniques in Sewing	3

HOSC 421	Practicals in the Child Study Centre	2
HOSC 422	Food Product Development	3
HOSC 423	Food Service Management	3
HOSC 424	Special Issues in child Studies	3

NB

- ** HOSC 300 is pre-requisite for all Level 300 and 400 Courses in Home Science for a B.Sc/B.A. Degree.
- + Check the course descriptions from their respective Departments.
- ≠ Compulsory courses for BA Students.
- * Until a Lecturer is available in the Department to teach HOSC 204 and HOSC 217, students are advised to take PSYC 307 (Human Growth and Development: Infancy, Childhood and Adolescence) PSYC 308 (Human Growth and Development: Adulthood and Ageing).
- * In the absence of a Lecturer in the Department to teach HOSC 307, students are advised to take SOCI 317 (Sociology of the Family) from the Department of Sociology.
- * If HOSC 411 and HOSC 412 are not being offered students should take AGEX 301 (Extension Programme Development &Implementation). (In the absence of a Lecturer to teach HOSC 308 students are advised to take SOCI 306 (Research Methods).
- * **BA students to note:** HOSC 213 is a pre-requisite for HOSC 214 and HOSC 306.

COURSE DESCRIPTIONS

HOSC 101 Introduction to Family Resource Management

The course is an introduction to basic concepts of management of family resources. It will include discussion of the management process; decision making; values; goals and standards; and other motivating factors. The management of specific resources will also be covered.

HOSC 102 Fundamentals of Textiles and Clothing

This course will treat the properties, uses and care of cotton, linen, polyester and nylon fibres and fabrics. Basic fabric and clothing construction and finishing methods, with emphasis on locally produced textiles, will also be covered.

HOSC 103 Introduction to Human Development

The course aims at helping the student understand his/her own development with special reference to progress towards mature adulthood. Characteristics of the mature adult, developmental tasks of the late adolescent and young adult will be highlighted. Areas of adjustment will be discussed to include: heterosexual relationships, building social relationships, personal adjustment, academic achievement and vocational choice.

HOSC 104 Introduction to Foods & Nutrition

This course will give the student fundamental knowledge of food preparation methods, terms, and basic measuring techniques. The student will be introduced to kitchen and laboratory appliances and their uses. Safety measures in the laboratory and kitchen will be emphasized. The food groups and their functions in the body will be covered. Recommended Dietary Allowance and planning daily meals will be discussed.

HOSC 201 Scope and Philosophy of Home Science

Philosophy, Scope, objectives and historical development of Home Science. Examination of basic human needs. The impact of local and global issues on the needs and overview of programme

approaches in Home Science, which help meet the needs for good quality of life for the family, the focus of the Home Science Programme.

HOSC 202 Experimental Foods

The course will treat the application of basic scientific principles to prepare foods under hygienic conditions and also to retain a maximum amount of nutrients present in the food. Appreciation of cultural and aesthetic influences on food preparation and evaluation of foods based on established standards will be covered.

HOSC 203 Principles of Foods

This course will look at the objectives in the study of foods, basic composition of foods, their physical and chemical properties and their relationship to food preparation, and how to select foods for their economy, quality and nutrient content.

HOSC 204 Human Development II

The course will examine the place of adulthood and aging in the human life cycle.

HOSC 207 Human Physiology I

Composition of blood: Anaemia: Blood groups; homeostasis and blood coagulation: Conditions that cause excessive bleeding; Functions of blood: Structure of the heart: cardiac cycle: Circulatory systems: Factors that affects heart rate. Structural organization of the respiratory system: Mechanisms of inspiration and expiration: Types of breathing: Pulmonary volumes and capacities: Transport of oxygen and carbon dioxide; Factors that affect respiratory rate: Regulation of respiration Hypoxia and respiratory disorders. Structural organization of the urinary system; the nephron; formation of urine filtration, reabsorption and secretion: Regulation acids-base balance; Effect of kidney malfunction on the body.

HOSC 208 Consumer Studies

Market place arrangement, which influence production and consumer choice. The need for consumer protection and action groups. Problems of consumer products and services in Ghana. Levels of consumer behaviours.

HOSC 212 Human Physiology II

Basic structure of the digestive system: secretion, functions and regulation of saliva, gastric juice, pancreatic juice, intestinal juice and bile: movements of the small and large intestine: Digestion and absorption of carbohydrates, fats and proteins: Peptic ulcer. Physiologic anatomy of the male reproductive organs: Spermatogenesis; endocrine functions of the testes: The female reproductive organs; Oogenesis; endocrine functions of the ovaries; the female sexual cycle. The pituitary gland and its hormones; the thyroid gland and its hormones: Hypothyroidism and Hyperthyroidism; Regulation of blood calcium level; Hormones of the adrenal glands: Hyperadrenalism and Hypoadrenalism; Pancreatic hormones; regulation of blood Glucose level.

HOSC 213 Introduction to Textiles

Introduction to natural and man made fibres and fabrics, yarn and fabric construction. Methods of fibre identification, fabric finishes, fabrics names, selection, use and care of fabrics based on specific end uses.

HOSC 214 Introduction to Clothing

Basic processes, equipment and tools used in clothing construction. Fundamentals of pattern making and the application HOSC 213 select fabrics to construct garments for personal or family use.

HOSC 217 Human Development I

This course will focus on five major periods of child development: the prenatal period, infancy, early childhood and adolescence.

HOSC 300 Vacation Internship Programme

A six to eight week intensive practical training in related fields of Home Science. This takes place at the end of the second semester of Level 200.

HOSC 301 Basic Nutrition

Brief history and definition of nutrition; Nutrients, their food sources, digestion, absorption, utilization, storage and functions in the body. Nutritional deficiency disorders will be covered.

HOSC 302 Food Hygiene, Food Spoilage and Preservation

Why and how food spoilage occurs. Emphasis on: The study of the physical and chemical processes that control changes in foods during ageing; the role of microorganisms in food spoilage and the consequences of eating unwholesome some. Principles of food preservation and application of both traditional and modern methods food storage and preservation that reduce food spoilage; enhance nutritive value, food safety and sensory qualities; Sanitary measure in handling and storing food at home and in the market to minimize food contamination and losses.

HOSC 303 Concepts of Home Management

Introduction to the basic concepts of management and their application to the home. The management systems and the interrelatedness of the various sub-systems involved in the process of management. Differentiation between the process of management and decision-making.

HOSC 304 Family Resource Management

The purpose of family resource management, identification of various human resources available to the family. Exploring ways of developing human resources and using them for family goal's attainment. The role of communication as a significant family resource.

HOSC 305 Fundamentals of Design

The elements and principles of design and their application to textiles and clothing production, food preparation and service, housing environment and the choice of consumer goods.

HOSC 306 Textile Design

Dyes, pigments and methods of applying design to fabrics-dyeing, printing compatible with intended end-use. Production of batik/tie and dye/screen printed fabrics.

HOSC 307 Individuals and Family Relations

The course will introduce students to the family as a social institution, its impact on individual personality development. The relationships between family members, outsiders and the community will be emphasized.

HOSC 308 Research Methods

Introduction to the basic principles of research in studying the family, the home environment, and the utilization of resources. Problem identification, data gathering techniques including the use of questionnaire, interviews, and observation. Statistical analysis and presentation of results; report writing (Students are required to carry out their own investigation on a special problem in any of the fields of Home Science during the long vacation present a written and oral report during the final year).

HOSC 309 History, Philosophy and Current Programmes in Early Childhood Education.

This course will focus on a general overview of the development of educational programmes for young children from a historical perspective. Attention will be given to the theories and practices which underlie the varying approaches used in programmes for the young child. Description of specific programmes will be used to highlight general theoretical perspectives.

HOSC 311 Work Simplifications in the Home

The purpose of simplifying home-related work. Application of principles body mechanic relating to the workplace, work methods, time and motion. Disabilities and home related work life; Housing and Maslow's notion of human needs.

HOSC 312 Housing Design and Alternatives for Individuals and Families

This course examines the principles of housing in relation to settlements and the housing unit. As a basis to understanding the settlement and the housing unit certain technical areas are covered: skills in assessing architectural drawings; design considerations for the climatic zones of Ghana; and the essential parts of a building. The course then goes on to discuss residential and community life, traditional housing and the two basic housing typologies in contemporary Ghana – The compound and self-contained houses. The principles of kitchen design and interior design are presented together with the importance of the outdoor space and land-scaping.

HOSC 313 Woven Textile Design

Introduction to basic fabric construction techniques. Production of articles on the broad loom and knitting machine.

HOSC 314 Curriculum for Children in Child Care Settings

The course purports to orient the student to the basic concepts of Early Childhood Developments Programmes such as important goals and clarification of terms. It is meant to give the students an idea, about teaching and learning process I ECDP. It deals with the factors. Contributing to learning with reference to young children it includes the programme and curriculum of the grade. Types of curriculum organization, different curriculum models and the curriculum of the first grade also form part of the course. This course also includes units on Science, Mathematics, Music, Art, etc, to provide the knowledge to the students which would help them to plan and organize effective programme for early childhood level. The course would also provide a knowledge regarding what is school readiness and the importance of readiness? Programmes at Early Childhood Development Centres.

HOSC 315 History of Costume

Introduction to the history of the evolution of fashion. Influence of selected cultures on Ghanaian fashion.

HOSC 316 Personal and Family Finance

Understanding the strategic role of money in the daily financial decisions of individuals and families. Relationship of: Attitudes about money to economic success; economic conditions to income and its use; life stage to earning potential; plan of action formulation for family financial management.

HOSC 317 Preparations for Marriage

This course will focus on marriage preparation and partner selection, basic components of marital adjustment and from marriage to family living.

HOSC 318 Home Furnishing

Historical development of furniture. Selection and functions of furnishings. Practical interior furnishing Techniques Construction of items used for home furnishings.

HOSC 319 Principles of Housing

This course examines principles that establish the right to housing for all. It goes to analyze the concepts of the family and defines the household- the basic units that occupy housing- and considers human need in relation to shelter. Some issues related to housing, socio-cultural and environmental are studied. The course then focuses on housing quality, needs and provision; the provision of utilities and infrastructure; and the housing conditions in Ghana today.

HOSC 321 Sensory Evaluations of Food Products

The course will look at areas in food production where sensory evaluation is applicable. Will examine the basic characteristics of food that are evaluated, the facilities required including establishing the sensory panel, methods used in the evaluation and sources of error that may occur.

HOSC 322 Parenting

This course is aimed at assisting students who are prospective parents and those who are already parents in exploring the concepts of parenting so that they might develop skills necessary for effectiveness in their roles as parent.

HOSC 400 Research Project and Research Seminars

Creative review of literature and investigation on a special problem in any of the field of Home Science, condition of oral examination on the problem studied during scheduled seminar periods and the submission of a typed written report a week before the second semester examinations begin.

HOSC 401 Meal Management and Feeding the Family

A study of meal management goals and techniques of planning balance diets to meet the food and nutritional needs of members of the family at varying physiological stages in the life cycle. Experience in applying management principles in food selection, food purchasing, planning, preparing and serving meals for all family members considering nutrient needs, food preferences aesthetic values, time, energy and budget resource of the family. Opportunity to use under-utilized but nutrient-dense local foods to plan meals and to apply meal service techniques.

HOSC 402 Special Issues in Clothing and Textiles

Clothing for special groups, second-hand versus custom-made and ready-made, clothing specifications. Introduction to clothing and human behaviour, the impact of fashion on clothing buymanship.

HOSC 403 Equipment in the Home

Principles and factors that influence the selection of equipment and tools for the home and the dynamisms of technology in the home. Practical exposure to different types of equipment, tools and appliance used in the home emphasizing those likely to be found in urban and rural Ghanaian homes. Selection, use and care of equipment in the home relating to source of energy available.

HOSC 404 Special Topics in Foods and Nutrition

The course covers topics in foods and nutrition related to cultural, socioeconomic, physiological and religious influences; principles of nutrition education; determining nutritional status, food and nutritional problems in Ghana, government and non-governmental problems in Ghana, government and non-governmental programmes, aimed at solving food and nutritional problems; and food legislation and consumer protection.

HOSC 405 Advanced Clothing Constructions

Pattern development with emphasis on flat pattern construction techniques required for custom-made clothes. Principles of design produce garments for personal or for personal or for use by a family member.

HOSC 406 Family Resource Management Live-In-Experience

A residential course during the final year when students move from their usual residences on or off campus to live in groups at the Family Resource Management Centre "FIDUA" at the University of Ghana, Legon for a specific period to simulate living. Students put into practice all theories learnt in previous courses in Home Science.

HOSC 411 Home Science Extension Theory

Principles of learning and teaching, setting objectives and working with adults. Programme planning and development based on identified needs at home or family level. Communication techniques,

motivation and use of demonstrations, group dynamics, mass-media and simple audio-visual. Selection and use of local leaders and use of methods of programme evaluation.

HOSC 414 Special Topics in Home Management

People as environment Resource, Home Management in single parent families; In Low-income families and Families with handicapped members(s), family life cycle, Home Management and Young Families, middle year and the Elderly.

HOSC 415 Issues in Family

Special study in managing income and credit, Wealth as a resource, the family as a Productive and a consuming unit in the national economy.

HOSC 416 Tailoring of Clothing

Development of patterns for men and women's suits. Construction techniques needed for the production of suits.

HOSC 417 Textiles and Clothing Maintenance

Structure and properties of soaps, detergents, dry cleaning agents, bleaches and stain removers. Effects of water hardness on detergency and soil removal. Finishes which influence soil removal.

HOSC 418 Clothing Construction Internship

One semester of intensive practical training under the tutelage of a fashion designer.

HOSC 419 Special Techniques in Sewing

Construction techniques required for special cushion-made clothes e.g linings: bound packets and button-holes; alteration for problem figures.

HOSC 421 Practicals in the Child Study Centre

This course will provide students with the opportunity for direct contact with children and families of the children, it will build up a repertoire of practical skills required for working with young children in an effective way; and give opportunity to evaluate ones own skills and interests in working with young children.

HOSC 422 Food Product Development

The course will cover selected topics in the development of food products whether in the formulation of an entirely new, reformulation of an existing product, use of new processing technology or in some other activity that directly impacts a product. Will cover designing new products from a market perspective, safety and regulatory aspects, nutrition promotion. Standardizing recipes will be covered.

HOSC 423 Food Service Management

The course aims at enabling the student to have a comprehensive appraisal of all elements involved in good management of food service systems. Areas to be covered will include food service organization and management, personnel management and cost control.

HOSC 424 Special Issues in Child Studies

This course will focus on issues of salient social problems that affect children. It will also analyze the social institutions and agencies which will deal with children's problems

BACHELOR OF VETERINARY MEDICINE AND SURGERY

Course Structure

The pre-professional phase of the course will consist of Biological Science or Biomathematical Science options of Level 100 of the Faculty of Science or the Level 100 Agricultural Science programme of the School of Agriculture. Semesters 1 & 2 shall, therefore be used to upgrade the level of science of the SSSCE candidates to levels currently prevailing at the GCE Advanced Level in the Sciences.

Each semester shall consist of 16 weeks as follows:

13 weeks of Teaching
1 week of Revision
2 weeks of Examinations

The professional phase of the curriculum (Level 200-600), lasting 10 semesters will consist of:

- (i) Basic Veterinary Sciences (Semester 3&4).
- (ii) Para-Clinical Veterinary Medicine (Semesters 5,6,7&8).
- (iii) Clinical Veterinary Medicine (Semesters 9,10,11, & 12).

Each semester of the professional phase shall consist of 18 weeks as follows:

15 weeks of Teaching
2 weeks of Revision
1 week of Examinations

Course Outline of the Degree of BVMS

First Year (Preliminary or LEVEL 100)

A. Biology Sciences (Faculty of Science)

Code	Course Title	Credits
BIOL 101	Interactions in Nature	2
BIOL 102	Genetics and Evolution	2
BIOL 103	Mammalian Physiology	2
BIOL 104	Growth of Flowering Plants	2
GEOL 104	Introduction of Earth Sciences	2
CHEM 101	General Chemistry I	3
CHEM 102	General Chemistry II	3
CHEM 103	General Chemistry Practicals. I	1
CHEM 104	General Chemistry Practicals. II	1
PHYS 101	Practical Physics I	1
PHYS 102	Practical Physics II	1
PHYS 111	General Physics I	3
PHYS 112	General Physics II	3
FASC 101	General Mathematics	3
LANG 111/112	Academic Writing	3
	Total	32

OR

B. Biomathematical Sciences (Faculty of Sciences)

BIOL 101	Interaction in Nature	2
BIOL 102	Genetics and Evolution	2
BIOL 103	Mammalian Physiology	2
BIOL 104	Growth of Flowering Plants	2
GEOL 104	Introduction to Earth Science	2
MATH 101	Algebra and Trigonometry	3
MATH 102	Calculus	3
MATH 103	Vectors and Geometry	3
MATH 104	Vectors and Mechanics	3
MATH 105	General Mathematics I	3
MATH 105	General Mathematics II	3
MATH 106	General Mathematics II	3
LANG 111/112	Academic Writing	<u>3</u>
	Total	<u>39</u>

OR**C. Agriculture Sciences (School of Agriculture)**

ANIM 101	Biology of Farm Animals	2
CROP 101	Introduction to Agric. Botany	2
SOIL 101	Introduction to Soil and the Environment	2
AGRC 101	Agricultural Chemistry I	3
AGRIC 103	Practical Chemistry II	1
AGRIC 104	Practical II	1
AGEC 102	Introduction to Economics	2
AGEN 102	Introduction to Agric. Engineering	2
AGEX 102	Fundamentals to Extension	2
FASC 102	General Mathematics	3
AGRC 105	Practical Physics I	1
AGRC 106	Practical Physics II	1
AGRC 107	General Physics I	3
AGRC 108	General Physics II	2
LANG 102	Language Skills	<u>2</u>
	Total	<u>33</u>

Note: All Veterinary Medical Students will be required to take and pass courses AGECE 102 AGEX 102

BASIC VETERINARY SCIENCES (YEAR 2)**SECOND YEAR (BVMS I) LEVEL 200**

Course Code	Title	Credit s
VBAS 201	Veterinary Gross Anatomy I	3
VBAS 202	Veterinary Gross Anatomy II	3
VBAS 203	Embryology	2
VBAS 205	Histology	4
VBAS 207	Endocrine and Repr. Physiology	4
VBAS 204	Cardiopulmonary Physiology	4
VBAS 206	Veterinary Physiology	4
VBAS 209	Molecular Cell Biology	3
VBAS 208	Intermediary Metabolism	5

VBAS 210	Medical Genetics	4
VBAS 201	Animal Production	3
VBAS 211	Animal Management I	<u>2</u>
	Total	<u>46</u>

1st Semester 21 credits

2nd Semester 25 credits

PARA-CLINICAL PROGRAMME (YEAR 3 & 4)
THIRD YEAR (BVMS (II) LEVEL 300)

<u>Course Code</u>	<u>Title</u>	<u>Credits</u>
VPCS 301	Veterinary Microbiology I (Bacteriology & Mycology)	4
VPCS 302	Veterinary Microbiology II (Virology & Immunology)	4
VPCS 303	Veterinary Parasitology I	4
VPCS 304	Veterinary Parasitology II (Entomology & Protozoology)	4
VPCS 305	General Pathology	3
VPCS 307	General & Autonomic Pharmacology (Theory)	3
VPCS 309	General & Autonomic Pharmacology (Practice)	1
VPCS 311	Antacids, Anti-inflammatory and Anti- Microbial Agents	2
VPCS 308	Systemic Pharmacology, Endocrines (and Toxicology) (Theory)	4
VPCS 310	Systemic Pharmacology, Endocrines (and Toxicology) (Practical)	1
ANIM 301	Principles of Animal Nutrition	3
ANIM 304	Introduction to Animal Breeding	3
VBAS 301	Animal Management II	3
VBAS 302	Field Practice II	<u>6</u>
	Total	<u>45</u>
1 st Semester	- 23	
2 nd Semester	- 22	

FOURTH YEAR (VBMS III) LEVEL 400

<u>Code</u>	<u>Title</u>	<u>Credits</u>
	<u>Core</u>	
VPCS 401	Systemic Pathology I	3
VPCS 402	Systemic Pathology II	3
VPCS 404	Avian Pathology	2
VPCS 403	Chemotherapy	2
VPCS 405	Veterinary Toxicology	2
ANIM 305	Principles of Grassland Management	3
ANIM 403	Ruminant Production	3
ANIM 404	Monogastric Production	3
ANIM 407	Reproductive and Environment Physiology	3
VBAS 402	Biostatistics	3
VBAS 404	Field Practice III	<u>6</u>
	Total	<u>33</u>

CLINICAL PROGRAMME (YEARS 5 AND 6)

FIFTH YEAR (BVMS IV) LEVEL 500

<u>Course Code</u>	<u>Title</u>	<u>Credits</u>
VBAS501	Clinical Anatomy	2
VPCS 501	Clinical Pathology	3
VCLS 505	Avian medicine I	2
VCLS 507	Porcine Medicine	2
VCLS 509	Epidemiology and Disease Prevention	2
VCLS 511	Food (Meat and Milk) Hygiene	2
VCLS 513	Anaesthesia and Intensive Care	2
VCLS515	Small Animal Surgery	2
VCLS 502	Avian Medicine II	2
VCLS 504	Ruminant Medicine	3
VCLS 506	Small and Lab. Animal Medicine	3
VCLS 508	Animal by-product utilization and Inspection	1
VCLS 510	Zoonoses and Environmental Health	2
VCLS 512	Orthopaedic surgery	2
VCLS 514	Surgical diseases	2
VCLS 516	Veterinary Gynaecology	3
VCLS 518	Public Health and Preventive Medicine Clinics I	3
VCLS 520	Surgery Clinics I	3
VCLS 522	Medicine Clinics I	3
VCLS 524	Therigenology Clinics I	3
VCLS 526	Field Practice IV	<u>6</u>
	Total	52
Semester 1	-	19
Semester 2	-	34

SIXTH YEAR (BVMS V) LEVEL 600

<u>Course Code</u>	<u>Title</u>	<u>Credits</u>
VCLS 601	Equine Medicine	2
VCLS 603	Vet. Ethics. Jurisprudence, Extension	2
VBAS 601	Vet. Econs/Business Mgt.	2
VCLS 605	Wildlife/Fish Ecology & Diseases	3
VCLS 607	Operative Surgery	2
VCLS 609	Andrology & Artificial Insemination	2
VCLS 611	Obstetrics, Mastitis & Udder Management	2
VPCS 602	Veterinary Pharmacy	2
VPCS 601	Computer Application in Vet, Practice	2
VCLS602	Diagnostic Imaging	2
VCLS 604	Surgical Exercises	2
VCLS 606	Small Animal Reproduction	2
VCLS 610	Public Health and Preventive Med. Clinics II	6
VCLS 613	Surgery Clinics II	6
VCLS 615	Therigenology Clinics II	6
VCLS 617	Medicine Clines II	1
VCLS 619	Clinical Seminars	6
VPCS 611	Diagnostic Clinics	6
VCLS 620	Student Project	<u>6</u>
	Total	<u>62</u>

Semester I	-	19
Semester II	-	43

DESCRIPTION OF COURSES

FIRST YEAR (PRELIMINARY YEAR OR LEVEL 100)

Courses description as for Level 100 Faculty of Science and College of Agriculture and Consumer Sciences.

SECOND YEAR (BASIC VETERINARY SCIENCES)

VBAS 201 Veterinary Gross Anatomy I

Anatomical nomenclature; perpendicular axial and general skeleton of mammals and birds; anthology. Introduction to mycology; muscles of the head, neck, back, loins and thorax. The muscles of the limbs and abdomen, including blood and nerve supply, points of origin and insertion and action. Lymphoid organs. The respiratory system of mammals; The avian respiratory system; The cardiovascular system; Lymphatic system. Endocrine System. Comparative aspects.

VBAS 202 Veterinary Gross Anatomy II

The skin and its appendages; The Digestive System; Renal System; Reproductive System Nervous System. Comparative aspects.

VBAS 203 Histology

(See ANAT 203 under UGMS)

VBAS 205 Embryology

(See ANAT 205 under UGMS)

VBAS 207 Endocrine and Reproductive Physiology

(See PHYS 201 under UGMS)

VBAS 204 Cardio-pulmonary Physiology

(See PHYS 202 under UGMS)

VBAS 206 Veterinary Physiology

Comparative feeding behaviour; apprehension and mastication salivary secretion, deglutition, eructation; Digestion in the simple-stomach, gastric secretion; contractile activity of the stomach, emesis. Digestion in the ruminant stomach, function of the epithelium; microbial digestion, volatile fatty acids, nitrogen conservation, carbohydrate digestion; Absorption across rumen epithelium. Digestion in the small and large intestine.

Comparative Reproduction

Comparative Renal physiology – Fluid Compartments of the body; Exchange between Intracellular and Intracellular fluids; composition of the body fluids; Alternations in fluid balances. Acid – base relationships to body fluids; kidney function; Acid – base regulation; Micturation, Thermoregulation. Tropical temperature adaptation.

VBAS 209 Molecular Cell Biology

(See BIOC 201 under UGMS)

VBAS 208 Intermediary metabolism

(See BIOC 202 under UGMS)

VBAS 210 Medical Genetics
(See BIOC 204 under UGMS)

ANIM 201 Animal Production
(See under CACS)

VBAS 211 Animal Management 1

Introduction to livestock husbandry, species, breeds and distribution. Animal management in vet practices. Animal behaviour and restraint. Practical guide and demonstration on estimation of weight and age. Disbudding, hoof trimming, tagging and branding. Feeds and feeding. Grooming of companion animals.

THIRD AND FOURTH YEARS (PARA-CLINICAL COURSES) LEVEL 300

VPCS 301 Veterinary Microbiology (Bacteriology and Mycology)

History of microbiology, General characteristics of bacteria, fungi, mycoplasma and rickettsias; classification, structure and functions of cellular components; Pathogenesis of microbial disease. Bacteria of veterinary importance: Staphylococci, Streptococci, Neisseria, Bacillus, Lactobacillus, Corynebacterium, Erysipelothrix, Listeria, Bacillus, Clostridium, Escherichia, Shigella, Salmonella, Arizona, Proteus, Klebsiella, Brucella, Yersinia, Campylobacter, Vibrio, Actinobacillus, Haemophilus, Mycobacterium, Pseudomonas, Dermatophilus, Leptospira, Chlamydia, Mycoplasma, Rickettsia, Ehrlichia. Fungi of Veterinary Importance: Mucoraceae, Ascomycetes, Cryptococcaceae, Fungi imperfecti, Mycetozoa in farm animals.

VPCS 302 Veterinary Microbiology II (Virology and Immunology)

Morphology and classification of viruses. Reproduction and growth characteristics of viruses. Methods of isolation, identification and purification of viruses. Strain variation and pathogenicity of viruses. Important RNA and DNA Viruses of animals, their pathogenicity and diseases they cause. Prions and Viroids.

Basic immunology – History and definitions, Innate immune systems, determinants: mechanical and physicochemical barriers, phagocytes, Natural Killer cells and soluble factors, complement. Adaptive immune system: fundamental features; Development of the immune system; Development and differences between T and B lymphocytes; Antibody determination, principles of immunological testing, serological tests. Immunological diseases: Hypersensitivities, Immunodeficiencies, Auto-immune diseases.

VPCS 303 Veterinary Parasitology (Helminthology and Acarology)

Definitions, classification and taxonomy of helminths and ticks parasites of animals, Principles of diagnosis and control of parasitic disease. Nematodes of animals – Ascaris, Toxocara, Trichostrongyles, Strongyles, Spirurids, Filaria; Cestodes (Tapeworms) Taenia, Moniezia, Echinococcus, Diphyliidium, Davainea etc. and Trematodes (Flatworms) – Fasciola, Schistosoma, Dicrocoelium; Their characteristics, life cycles, intermediate hosts, locations in the final hosts, economic importance and control.

Ticks of Veterinary importance; classification and identification; Hard Ticks – Amblyomma, Boophilus, Hyalomma, Ripicephalus, Haemophysalis; Soft – ticks – Argas, Ornithodoros, Otobius. Their biology and ecology, life cycles – Three – host, two-host and one-host ticks. Economic importance and control of ticks. Considerations in tick control: cost, availability, of acaricides, safety, environmental contamination. Interference of enzootic stability.

VPCS 304 Veterinary Parasitology II (Entomology and Protozoology)

Introduction to the Insect orders: Nematoceran flies (Iceratopogonidae, Simuliidae, Culicidae), Cyclorrhaphan flies (Tsetse, Stomoxys, Haematobia, Oestrus, Hypoderma, Gastrophilus and Musca). Their characteristics and identification, biology, ecology and life cycle and economic importance.

Mites of Veterinary importance (Psoroptes, Chorioptes, Otodectes, Sarcoptes, Notoedres, etc). General characteristics, classification and identification, life cycle and economic importance. Lice and Fleas of animals – General features, life cycle and control.

Protozoology: General introduction to, and study of protozoan parasites of domestic animals and wildlife. Features and identification, life cycles, ova, epidemiology, pathogenicity, clinical signs, diagnosis, treatment and control of protozoan diseases (trypanosomiasis, coccidiosis, anaplasmosis, babesiosis, theileriosis, histomoniasis, trichomoniasis, avian malaria, etc.)

VPCS 305 Pathology I (General Pathology)

This course is concerned with the basic reactions of cells and tissues to injurious agents or stimuli and practical diagnostic procedures in gross and microscopic lesions.

The theoretical part should cover a brief introduction to pathology, structural and functional aspects of the normal cell (cell membrane, the cytoplasm with its various inclusions and vesicles). This is followed by: (1) Cell injury and death of cells and tissues, necrosis and infarction, cellular infiltrations and degenerations mineral deposits and pigments (2) Disturbance of growth (3) Disturbance of circulation, (4) Inflammation and body reaction (5) Neoplasia (6) Disorders of the immune system.

VPCS 307 General and Autonomic Pharmacology (Theory)

The course is designed for students to grasp the general principles of drug action, pharmacokinetics including drug disposition and autonomic pharmacology. Also included in this course will be the study of the pharmacology of the autacoids, anti-inflammatory and chemotherapeutic agents.

Detailed syllabus

General principles: Introduction to pharmacology and its relation to physiology and biochemistry. Basic concepts; dose and drug dosage forms e.g. Injection, mixture, tablets. Routes of administration of drugs, factors guiding the choice of routes. Advantage and disadvantage of various routes. Pharmacokinetics-factors affecting absorption, distribution, biotransformation and excretion of drugs. Enzyme induction and inhibition and implications. General factors affecting drug action. Targets for drug action-concept of receptors and drug receptor theories, enzymes, ion channels, carrier systems, Receptor super families. Agonists, practical agonists and antagonists. Drug antagonism and types-competitive versus non-competitive, physiological and chemical. Affinity, efficacy and potency defined. DR relationships (Log DR versus DR curves) and significance of slope and shape of DR curves.

VPCS 309 General and Autonomic Pharmacology Practical)

Autonomic pharmacology: Somatic, efferent and ANS. Parasympathetic and sympathetic, Ganglionic transmission, blockers, Transmitter processing at the cholinergic synapse. Sites for drug action. Nomenclature for muscarinic receptors, agonists, antagonist, effectors.

Adrenergic transmission. Adrenergic receptor classification. Pre-and post-functional sites for drug Uptake Metabolism and inhibitors. False transmitters. Neural blocking drugs eg. guanethidine. Symptomatic amines.

Skeletal neuromuscular junction, myasthenia gravis, Focal and multiple innervations-birds versus mammals. Competitive and depolarizing blocking drugs and their use in surgery, Pre and post-functional effects, synthesis, storage and release. Non-depolarizing and depolarizing blockers. Role of anti-cholinesterases. Pesticides and organ phosphorus poisoning.

VPCS 311 Antacids, Anti-inflammatory & Anti-Microbial Agents

Anti-inflammatory agents and antacids (10 hours) Histamine, synthesis, storage and release, Types of histaminic receptors and antagonists. Role of histamine in inflammation and anaphylaxis. Peptides modulators of inflammation, bradykinin and antagonists, interculins. The complement system.

Mediators of inflammation, arachidonic acid metabolites, prostaglandins, leukotrienes. Aspirin and other COX inhibitors, PAF Drug management of asthma in the cat. Rheumatoid arthritis. Non-steroidal anti-inflammatory agents, classification and actions. Steroids and inflammation, Role of methotrexate in IBD.

Chemotherapeutic agents General concepts of selective toxicity.

Anti-microbial agents: Classes, mechanisms, indications, pharmacokinetics and adverse effects of the sulphonamides, Beta lactams, penicillins and cephalosporins, use of beta lactam inhibitors e.g. clavulanic acid. Inhibitors of protein synthesis, aminoglycosides, tetracyclines, chloramphenicol. Macrolides, quinolones, polymyxins, General factors influencing the choice of antibiotics, general problems of chemotherapy including resistance mechanisms. Antiseptics and disinfectants and their use in domestic animals.

Anti-fungal agents: Classes, mechanisms of action, pharmacokinetics, clinical uses and adverse effects of anti-fungal agents.

Antiviral agents: Viral life cycle and its implications for chemotherapy. Targets for antiviral drugs. Drug management of infections caused by different viruses. Mechanisms, pharmacokinetics, interactions and side effects of major anti-viral agents.

Antiprotozoal therapy: Drug treatment of trypanosomiasis, amoebiasis, trichomoniasis, giardiasis, coccidiosis.

Anthelmintic therapy: Intestinal parasites especially those infesting domestic and farm animals.

VPCS 308 Systemic Pharmacology, Endocrines & Toxicity (Theory)

This is a course in clinical pharmacology with emphasis on drugs commonly used in veterinary practice. The major objective will be to stimulate studies to appreciate drug action and use in the cardiovascular system. The course will be broadened to study the action and use of haematinics, coagulants, anticoagulants and the pharmacology of drugs acting on the CNS, GIT and endocrine systems. Comparative pharmacology involving possible species differences in drug action and use should be emphasized.

Detailed syllabus

Cardiovascular and Renal pharmacology: Role of nitric oxide (NO) in the vasculature, hypercholesterolaemia and atherosclerosis. Control and modification of arterial BP, CNS mechanisms, Renin-angiotensin system. Drugs affecting renin release: Kidneys and hypertension. Diuretics. Vasodilators. Site of action, pharmacokinetics, side effects and indications for osmotic diuretics, thiazides, carbonic anhydrase inhibitors, loop diuretics, potassium sparing diuretics. Blood coagulation and clotting factors, Coagulants and anticoagulants, plasmin, streptokinase. Hematinics. Iron, Folic acid, vitamins and blood substitutes.

Central nervous system: Pharmacology of general and local anesthetic agents, side effects, GABA synthesis and degradation. GABAergic terminal and sites of drug action. GABA and GABA. Antagonists, agonists, modulators. Glycine, Hypno-sedatives. Anticonvulsants, Benzodiazepines and their use in animals. Drug management. 5-HT receptor agonist and antagonist. Antidepressant therapy. MAO inhibitors, tricyclic anti-depressants. Atypical antidepressants.

Endocrine Pharmacology: Euthyroid, Hypothyroid and Hyperthyroid conditions. Synthesis, storage and release of T3 T4 and rT3 as targets for antithyroid agents. Antithyroid agents. Classification, pharmacokinetics, indications, side effects. Mineralocorticoids and glucocorticoids, Actions and side effects, Replacement therapy. Natural and synthetic sex hormones. Control of fertility in domestic and farm animals. Anabolic androgenic preparations. Pancreatic hormones and control of hyperglycaemia. Insulins and oral hypoglycaemic agents. Pituitary hormones and drugs.

Gastro-intestinal Pharmacology: Therapeutic strategies for GI disorders. Control of acid secretion, Role of PPI's and antibiotics in ulceration. Anti-emetic agents. Anti-spasmodic, laxatives, Anti-diarrhoeal agents. Management of IBD, Drugs and the hepato-biliary systems.

ANIM 301 Principles of Animal Nutrition

See under CACS

ANIM 304 Introduction to Animal Breeding

See under CACS

VBAS 301 Animal Management II

A course on animal welfare, applied ethology, nomadism, animal housing and hatchery management, Management of farm wastes, Management of grasscutter and rabbits. Application of restraint techniques in animal handling. Animal judging for quality; care of sucking, food and companion animals. Application of modern techniques in domestic animals management; wildlife routine management and health. Routine farm operations. Adaptation of animals to harsh environments, stress and pain in animals. Animal transportation. Kennel and stable management.

VBAS 302 Field Practice II

A long vacation field practical of six weeks duration in diagnostic laboratories. Inspection visits shall be conducted to such places by lecturers from the Veterinary Para-clinical Department.

LEVEL 400

VPCS 401 Systematic Pathology I

Systematic or special pathology is the application of the basic changes that have been learnt in general pathology to the various body systems or various specific diseases.

The theoretical part of special pathology should cover pathological changes taking place in the various organ systems of the body (circulatory, haemopoietic, respiratory, digestive, reproductive, urinary, musculo-skeletal, and endocrine). The studies here should take note of non-infectious (teratogenic deficiencies, metabolic, traumatic, toxicological) and infectious diseases (bacterial, viral, mycoplasma, fungal and other parasitic diseases).

The practical aspects of special pathology will consist of collection of pathological samples of the systems studied from slaughter houses, examining the samples grossly and diagnosing the causes. Studies will also be taken through histopathology of diseases affecting the various organs systems.

VPCS 402 Systematic Pathology II

A study of the pathology of the nervous, haematopoietic, urinary and genital, system, Post-mortem diagnostic procedures.

VPCS 403 Chemotherapy

A study of chemotherapeutic agents including anti-protozoal, anti-cancer drugs, anthelmintics, antiseptics, disinfectants, vitamins and immunotherapeutic drugs.

VPCS 405 Veterinary Toxicology

General principles of toxicology. Toxicology of heavy metals, poisonous plants, toxins, nitrates, cyanides and environmental poison. Toxicological antidotes and clinical usages.

VPCS 404 Avian Pathology

Systemic and special pathology of the avian species; gross and microscopic pathology of the nutritional and other non-infectious diseases; bacterial, fungal, viral, rickettsial, Chlamydial, parasitic and neoplastic disease of poultry in the tropics. Post-mortem diagnostic procedures for avian species.

VCLS 401 General Medicine

Introduction to veterinary clinical examination: history taking, influence of environment on diseases, use of common diagnostic instruments; diagnostic methods used for the detection and differentiation of disease according to the systems, principles of treatment and prognosis. General systemic diseases affecting companion and farm animals.

VCLS 402 General Surgery

Concepts in surgery, instrumentation and suturing, theatre techniques; nature of surgical disease; the emergency case; patient assessment, principles of anesthesia, operative techniques; post-operative care; wound healing, complications in surgery; shock, fluid theory; cryo-and electro-surgery.

ANIM 305 Principles of Grassland Management

See under CACS

ANIM 403 Ruminant Production

See under CACS

ANIM 404 Monogastric Production

See under CACS

ANIM 407 Reproductive and Environmental Physiology

See under CACS

VBAS 402 Biostatistics

Veterinary recording and data types. Classification and tabulation of data; Descriptive and inferential statistics. Sampling methods; Variations, rates and rational means; median and mode. Normal and other distributions, standard deviations and variance. Chi-square and student T tests. Elements of vital statistics. Uses of statistics in veterinary practice and research work.

VBAS 404 Field Practice III

A long vacation field practice of six weeks duration in diagnostic laboratories. Inspection visits shall be conducted to such places by the supervising departments.

FIFTH YEAR: BVMS IV (500 LEVEL)

CLINICAL COURSE (YEARS 5 AND 6)

VBAS 501 Clinical Anatomy

Topographic morphology of domestic animals with special reference to surgical and medical practice. A review of gross anatomy relevant to meet inspection, obstetrics and gynaecological problems in animals.

VPCS 501 Clinical Pathology

A study on clinical haematology and biochemistry as well as exfoliative cytology. Blood volume and water balance; haemorrhage and blood restoration. Blood cells in diseases; Effects of ionizing radiations on blood. Clinical chemistry: cardiac, liver and kidney function tests. Clinical chemistry of some diseases in domestic animals; diarrhea, colic, diabetes, gastritis, pregnancy, parturition, congestive heart failure, etc.

VPCS 505 Avian Medicine I

A study of the aetiology, clinical signs, diagnosis, treatment and control of parasitic fungal, nutritional and other non-infectious diseases of poultry. Emphasis will be placed on major tropical diseases.

VCLS 507 Porcine Medicine

A course study on infectious, non-infectious, metabolic and nutritional diseases of pigs. Primary emphasis will be placed on the epidemiology, clinical signs, treatment and control of relevant disease of importance in the tropical environment.

VCLS 509 Epizootiology and Specific Disease Prevention Techniques.

History, scope and uses in veterinary practice. Descriptive, analytic and experimental phases; medical detection, ecological and mathematical approaches. Occurrence, frequencies and implications. Diseases in populations, Mass action against diseases: Chemoprophylaxis, chemotherapy, sero-prophylaxis, serotherapy. Immunization procedures, etc. Effects of climates on animal population.

VCLS 511 Food (meat and milk) Hygiene

Principles of meat hygiene. Biological and chemical bases of meat hygiene, ante-mortem and post-mortem procedures. Description of various categories of slaughter policies. Basic construction and principles of a functional abattoir. Potable water supply; canning, freezing, smoking and other preservation methods. Water, meat and milk-borne diseases. Food microflora and spoilage; food poisoning. Control of vermin. Detection of drug residues in meat. Effluents and their disposal. Milk and milk products; Inspection and laboratory examination for milk quality.

VCLS 513 Anaesthesia and Intensive Care

Anaesthesia principles and techniques in small and large animals; drugs and apparatus used in anesthetic management; anaesthetic accidents and emergencies, care of the unconscious animal, maintenance of circulation. Pulmonary hepatic and renal homeostasis in animals suffering from trauma and advanced diseases before, during and after surgery.

VCLS 515 Small Animal Surgery

Cosmetic, palliative, curative and operative procedures on the head, neck, thorax, abdomen and perineum of small animals.

VCLS 502 Avian Medicine II

As in Avian Medicine I.

VCLS 504 Ruminant Medicine

A course of study on infectious and non-infectious, including metabolic and nutritional diseases of small and large ruminants. Emphasis would be placed on epidemiology, clinical signs, diagnosis, treatment and control of specific diseases of importance in the tropics.

VCLSD 506 Small and Laboratory Animal Medicine

Lectures and discussions on infectious, non-infectious metabolic and nutritional disease of cats and dogs, infectious and non-infectious diseases of laboratory animals including rabbits, rats, mice, etc. Emphasis will be placed on the epidemiology, clinical signs, diagnosis and treatment of diseases of importance in the tropics.

VCLS 508 Animal by-product utilization and inspection

Harvesting and processing various animal by-products, including hides, skins, bones, blood, hoof; uses of each by-product; inspection of animal by-products; international trade in animal by-products; Food canning and inspection of canned foods.

VCLS 510 Zoonoses and Environmental Health

Concepts, definitions and classifications of zoonoses. Studies on specific bacterial, viral, protozoan, rickettsial, protozoan and fungal zoonoses with emphasis on prevention, early detection, control and eradication. Ecology, water sources and purification, waste disposal, public health significance of rodents, birds, flies and mosquitoes. Environmental pollution and control.

VCLS 512 Orthopaedic Surgery

Fractures and bone repair, orthopaedic examination of the patient, reduction and fixation of fractures; orthopaedic nursing; diagnosis and treatment of fractures of long bones, pelvis, spine and skull; diagnosis and treatment of lameness in horses, cattle, sheep and pigs; Management of infections, nutritional and neoplastic bones diseases; joint diseases.

VCLS 514 Surgical Diseases

Clinical features, investigative procedures, treatment options and prognosis of common surgical conditions in small and large animals; congenital anomalies, trauma, non-neoplastic lumps, neoplasia, obstructions, displacements, degenerations and fluid leakage.

VCLS 516 Veterinary Gynaecology

Functions and clinical examination of female reproductive organs of large animals; puberty and sexual reproductive hormones and glands; oestrous cycle processes of copulation, fertilization and gestation; anomalies of foetal development (including genetic and acquired causes) Oogenesis disturbances of ovulation and nidation. Causes of infertility and sterility in female animals. Diseases influencing sexual functions.

VCLS 517 Public Health and Preventive Medicine Clinics I

Record keeping in veterinary clinics. Hospital practices, ethics and hospital administration. Clinics and practical training of students in handling of vaccines, vaccination techniques in cattle and other ruminants, poultry, dogs and cats. Diseases preventive measures in domestic animal species. Meat inspection practical zoonotic disease detection techniques.

VCLS 519 Surgery Clinics I

A course covering the first and second semester in which hospital cases are used to instruct the student in diagnosis and management of surgical diseases of small and large animals.

VCLS 521 Medicine Clinics I

Clinical and practical training of students with emphasis on the handling and examination of animals, including the introduction to patient care and hospital practices including the clinical exposures and management of disease outbreaks.

VCLS 523 Theriogeneology Clinics

Clinical training of students with emphasis on the handling of gynecological cases, treatment of infertility in animals. Instrumentation, Micurotomy, Pregnancy diagnosis.

VCLS 526 Field Practice IV

Field practice of six weeks duration in an abattoir and livestock movement control posts. Inspection visits shall be conducted to such places by lectures and co-ordinators to assess student's participation.

SIXTH YEAR: BVMSV (600 LEVEL)**VCLS 601 Equine Medicine**

Infectious and non-infectious (including metabolic and nutritional) diseases of equidae with particular reference to horses used for polo and security patrols of mounted troops. Emphasis would be placed on the clinical signs, diagnosis, treatment and control of specific disease of economic importance in the tropics. The course highlights the problem-oriented approach in the management of equine disease and disorders.

VCLS 603 Vet. Ethics, Jurisprudence and Extension

Various legislation regulating veterinary practice, legal and professional responsibilities of veterinary surgeons in the control of animal movements, control of animal diseases, meat inspection, animal husbandry, wildlife and fish handling and management. Organization of Veterinary Services in Ghana. Concepts of veterinary and livestock production extension. Veterinary extension promotion and delivery. Rural sociology and rural health education.

VBAS 601 Vet. Economic/Business Management

Basic micro and macro-economic concepts. Cost of public health schemes. Demand and supply of veterinary services. Economics of livestock production. Economics of operating a Veterinary practice/hospital. Benefit – cost analysis. Business organization, administration and promotion. Veterinary business management. Introduction to Project appraisal and feasibility reports.

VCLS 605 Wildlife/Fish Ecology and Diseases

Fish anatomy, physiology, microbiology, parasitology, pathology and medicine. Fish ecology and nutrition. Capture, restraint and handling of live-trapped animals. Wildlife pharmacology, Wildlife habitats, types, values and distribution of biotic communities. Care of zoo animals. Methods of sampling of wildlife species. Dynamics and characteristics of wildlife populations, social organization of game species. Diseases of wildlife species – primates, ungulators, hares, rodents, reptiles, birds, carnivores and amphibians. Introductory aquatic ecology, fisheries management and fish cultures, fishing gears and methods. Nutritional deficiencies, neoplastic, environmental parasitic, viral, bacterial diseases of fish. Wildlife surgery and theriogeneology, Agriculture.

VCLS 607 Operative Surgery

Indications; pre-operative care and details of procedures; After-care; possible complications of model operations on small and large animals.

VCLS 609 Andrology and Artificial Insemination

Clinical examination of the male reproductive organs; service behaviour; Male infertility; diseases of testes and accessory sex organs. Serving ability and semen disorders. Inability of male to copulate and fertilize. History of artificial insemination; its advantages and disadvantages; handling, evaluation, dilution, storage, deep freezing. Semen collection evaluation and insemination techniques. Reproductive disorders affecting insemination.

VCLS 611 Obstetrics, Mastitis and Udder Management

Anatomy of the pelvis and pelvic ligaments. Disease and accidents during gestation. Parturition and its disease; types of dystocia, causes and presentation; obstetrical procedures and post-operative complications; care of the newborn. Abnormal conditions of the placenta, uterus and vagina; types of mastitis, clinical signs, diagnosis and treatment. Management of the udder of dairy animals. Dairy farm analysis. Strategies for boosting milk production in the tropics.

VPCS 602 Veterinary Pharmacy

Principles of drug dependency; compounding and prescription. Common drug abbreviations. Apothecary and avoirdupois weights, household equivalents of weights and measures. The therapeutic strategies, choice of drugs, monitoring of therapeutic responses. Organization of pharmacy; inventory in a veterinary hospital. Formulation of veterinary drugs. Medicinal plants of veterinary importance.

VPCS 601 Computer Application in Veterinary Practice

History of computers. Hardware components. Operating and application of software. Feature and uses of word processing packages; Introduction to spreadsheets; Introduction to Database. Database Management Systems and designing computer-based. Veterinary disease reporting system. Introduction to word processing. Data transmission. Introduction to basic programming. Input and Output statements. Other uses of computers in veterinary practice.

VCLS 602 Diagnostic Imaging

Introduction, including history; production of x-rays; Radiation safety; X-ray film exposure and processing; radiographic interpretation; radiation therapy. Principles of ultrasound scanning; application of scanning in veterinary medicine. Echocardiography, Principles of Computed Tomography (CT Scan). The uses of diagnostic imaging techniques in pregnancy diagnosis and in reproductive disorders. Review of Clinical imaging cases.

VCLS 604 Surgical Exercises

Laboratory (practical) sessions on selected procedures designed to enable students develop basic technical skills in anaesthesia, theatre routines and selected soft tissue and orthopaedic procedures.

VCLS 606 Small Animal Reproduction

Lectures on small animal reproduction involving the oestrous cycle in the bitch and queen, including hormonal changes. Fertilization and maintenance of pregnancy. Pseudopregnancy, parturition. Different methods of pregnancy detection. Infertility investigation. Vaginal smear interpretation. Management of the neonatal period. Contraception. Andrology and Artificial Insemination.

VCLS 610 Public Health and Preventive Medicine Clinics

Clinics and practicals in field epizootiological investigations in farms, ambulatory visits to farms to carry out deworming, vaccinations in all species; disease investigation and control. Disease reporting and surveillance techniques. Veterinary extension techniques. Pilot projects in veterinary extension; Control of zoonoses. Prevention of occupational hazards to veterinarians, butchers and animal product processors. Ambulatory clinical services.

VCLS 613 Surgery Clinics II

This is a continuation of the course Surgical Clinics I (500 Level)

VCLS 615 Theriogenology Clinics II

A course in which hospital cases are used to instruct students on diagnosis and management of obstetrical and gynaecological problems. Examination of the bull, ram, boar, dog, stallion for breeding soundness. Semen collection and processing in various species (including the use of electro-ejaculator and artificial vagina). Using clinical rectal palpation in males and females. Diagnosis of infertility and their causes. Use of Phantoms for treatment of dystocia.

VCLS 617 Medicine Clinics II

This is a continuation of the course Medicine Clinics I (500 Level), with emphasis on clinical and practical training of students in the handling and examination of animals as well as diagnosis and treatment of disease conditions including patient care, fluid therapy, hospital practices and ambulatory services.

VCLS 619 Clinical Seminars

A course involving case work-ups and seminar presentation by each students.

VPCS 611 Diagnostic Clinics

Clinical training covering the 1st and 2nd Semesters with emphasis on post-mortem examinations, handling of specimens and diagnostic procedures (including bacteriological and parasitological diagnosis).

VCLS 620 Student Project

A project involving a simple research topic in any area of any discipline studied in the pre-clinical, para-clinical or clinical years. Examination shall be by presentation of project report and in some cases with viva-voce.

FACULTY OF ENGINEERING SCIENCES

S. Sefa-Dedeh , <i>BSc (Ghana) MSc PhD (Guelph)</i>	-	Dean
J.K. Osei , <i>BA (Ghana), Post-Grad Dip. (GIMPA)</i>	-	Faculty Officer

DEPARTMENT OF AGRICULTURAL ENGINEERING

FACULTY

Malcolm N. Josiah , <i>BSc (Eng) (KNUST)</i> <i>Msc MPhil (Newcastle) PhD (Calif)</i>	-	Senior Lecturer (Head of Department)
Edward Baryeh , <i>BSc (Eng) (KNUST)</i> <i>Msc PhD (Iowa State)</i>	-	Professor (On contract)
Richard J. Bani , <i>BSc (KNUST) Msc PhD (Cransfield)</i>	-	Senior Lecturer
Aliu A. Mahama , <i>Msc PhD (Tashkent)</i>	-	Senior Lecturer
Dr. S. Abenney-Mickson , <i>BSc (Agric) (Ghana) Msc PhD (Okayma)</i>	-	Senior Lecturer
Dr. Eric K. Kra , <i>BSc (Agric) (Ghana) Msc (Brit Col) PhD (Utah State)</i>	-	Lecturer
Dr. Edward B. Sabi , <i>BSc (Eng) (KNUST) Msc PhD (Gifu)</i>	-	Lecturer
Mrs. Peace K. Amoatey , <i>BSc (Eng) (KNUST) Msc (Karlshure)</i>	-	Lecturer
Mr. E. Kuatsinu , <i>BSc (Eng) (KNUST) Msc (Wageningen)</i>	-	Part-Time Lecturer
Mr. J. Y. Amoah , <i>BSc (Eng) (Pakistan) Msc (Wageningen)</i>	-	Part-Time Lecturer
Mr. A. K. Ussher , <i>BSc. (Ghana) Msc (Melbourne)</i>	-	Part-Time Lecturer

LEVEL 100 COURSES

CORE		
FENG 101	Mathematics I	4
FENG 102	Mathematics II	4
FENG 105	General Physics	3
FENG 106	Basic Electronics	3
FENG 109	Introduction to Information Technology I	2
FENG 111	Basic Mechanics I	3
FENG 112	Introduction to Information Technology II (C Programming)	2
FENG 113	Introduction to Engineering	1
FENG 114	Basic Mechanics II	2
FENG 115	General Chemistry	3
FENG 116	Biology	2
FENG 117	Engineering Drawing I	3
FENG 118	Psychology	2
FENG 120	Applied Electricity	3
FENG 124	Engineering Drawing II	3
LANG 100	Academic Writing	2
ELECTIVE		
FENG 122	Internship (Industrial Practice I)	1

LEVEL 200 COURSES

CORE		
FENG 201	Mathematics III	4
FENG 202	Mathematics IV	4
FENG 204	Environmental Science	2
FENG 205	Strength of Materials	3
FENG 207	Digital Circuits	3
FENG 208	Fluid Mechanics	3
FENG 209	Thermodynamics	3

FENG 211	Principles of Management	2
FENG 212	Engineering Technology	2
FENG 214	Introduction to Economics	3
FENG 216	Sociology	3
AENG 201	Engineering Surveying	3

ELECTIVES

Aside FENG 218, one elective will be taken each semester.

FENG 218	Internship (Industrial Practice II)	1
ANIM 201	Animal Production	3
CROP 202	Introduction to Crop Production	3

LEVEL 300 COURSES

CORE

AENG 301	Soil Mechanics	3
AENG 302	Agricultural Materials Handling	3
AENG 303	Machine Design	3
AENG 304	Soil Mechanics Application to Mechanization	3
AENG 305	Heat and Mass Transfer	3
AENG 307	Farm Structures	2
AENG 308	Agricultural Machinery Technology	3
AENG 309	Soil and Water Engineering	3
AENG 311	Physical and Engineering Properties of Biological Materials	3
AENG 312	Energy and Power Utilization on Farms	2
AENG 314	Hydrology	2
AENG 316	Crop and Animal Environment Engineering	3
FENG 300	Technical Report Writing	2
FENG 302	Internship (Industrial Practice III)	1
FENG 304	Statistics for Engineers	3

ELECTIVE

CENG 301	Numerical Methods	3
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CORE

AENG 400	Project	6
AENG 401	Farm Machine Design	3
AENG 402	Technology of Tractor and Implement	3
AENG 403	Storage of Agricultural Produce	2
AENG 404	Irrigation and Drainage Engineering	3
AENG 405	Agro-Meteorology	2
AENG 406	Water Resource Management	3
AENG 407	Rural Engineering	3
AENG 408	Refrigeration and Cold Chain Management	3
AENG 409	Maintenance and Management of Agricultural Machinery	2
FENG 401	Law for Engineers	3
FENG 402	Entrepreneurship	3

ELECTIVE

FDEN 409	Engineering and Design of Food Process III (Plant Products)	3
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COURSE DESCRIPTIONS

FENG 101 Mathematics I

Set of Real Numbers, Indices, Logarithms and Surds. Concept of a function of a single variable, graphs of functions. Linear, quadratic and higher degree polynomial functions, Rational functions. Inequalities in one and two variables. Binomial theorem. Circular measure. Trigonometric functions. Exponential and logarithmic functions, function e^x ; hyperbolic functions. Complex numbers and their algebra. Vectors: addition, scalar multiplication, scalar products, vector product. Scalar and vector triple products. Geometrical applications: vector equations of lines and planes. Parametric representation of a curve; the circle and other conic sections.

FENG 102 Mathematics II

Limits and Continuity of a function of a single variable. Differentiation: Rules of differentiation, chain rule and parametric differentiation, differentiation of trigonometric functions and their inverses, exponential and logarithmic functions, higher order derivatives, Leibnitz's rule. Differentiability: Rolle's Theorem, mean-value theorem, approximate methods of solving equations (graphical and Newton-Raphson methods). Integration and its applications: Area under curve, volumes of solids of revolution. Numerical integration: Trapezium and Simpson's rules. Vector function of a single variable: Differentiation and integration of vector functions, kinematics of a single particle in motion. Newton's laws of motion, motion in a straight line and in a plane, projectiles and circular motion, work, energy and power; impulse and momentum, moment of a force, couple, conditions for equilibrium of rigid bodies

FENG 105 General Physics

Vibrations: Simple harmonic motion, damped harmonic motion, forced harmonic motion. Waves: Wave types, wave phenomena – interference and diffraction. Electricity and Magnetism: Coulomb's law, electric field, Gauss's law, electric potential, current electricity – EMF, Kirchhoff's laws, DC circuits, Magnetic field: Bio-Savart's law, Ampere's law. Induction: Faraday and Lenz's law, AC circuits. Introductory Modern Physics: Bohr's atom, quantum theory of atom, electronic transitions, optical spectrum, X-rays, photo-electric effect, motion of charges in electric and magnetic fields

FENG 106 Basic Electronics

History of electronics from vacuum tubes to large scale integration, classification of electronic signals (digital, analog, role of A/D and D/A converters), electronic components, symbols and identification. Semiconductivity. Diodes and Diode Circuits: diode characteristics, model, and behavior in relation to circuits and analysis. Field-Effect Transistors and Circuits: MOSFET characteristics and model, biasing techniques, circuit symbol, analog MOSFET amplifier. Bipolar Junction Transistors (BJT): Physical structure of the BJT, circuit representation, transistor biasing, and transistor ratings. Fundamentals of Digital Electronics: Ideal logic gates, logic level definition and dynamic response of logic gates, logic gates examples. Signal Amplifiers: Concept of amplification, operational amplifier and its application as a filter, the BJT and MOSFET transistor as amplifiers, small signal behavior of the transistor. Basic Analog and Digital circuit elements, frequency response, signal generator, filters and waveform shaping circuits.

FENG 109 Introduction to Information Technology I

Introduction to computers and digital technology and culture. The role of computers in IT, issues of computers and crime, computers and work, general issues on the impact and control of computers. Structure and use of the Internet and applications in e-business, e-learning, e-governance, e-health. The basic foundations and functions of computer hardware and software. Introduction to common engineering application software. Spreadsheet for engineers. Introduction to MATLAB and its applications to engineering problem solving.

FENG 111 Basic Mechanics I

General principles of mechanics, methods of problem solution, and numerical accuracy. Force vectors and mathematical operations. Static Particles: Coplanar force on a particle, resultant of forces,

resolution of forces, conditions for the equilibrium of a particle, Newton's first law, free-body diagram, forces in space. Force System Resultants. Statics of a rigid body and conditions for equilibrium. Centroids and centers of gravity

FENG 112 Introduction to Information Technology II – C Programming

History of the C language. Structure of the C Program. Variables Declarations: Global variables, type and range of variables, declaration of variables, scope of variables, reading and printing of variables. Constants Declarations. The C Operators: Arithmetic, Relational, Logical, and order of operation precedence. Conditional Instructions. Looping and Iterations. Arrays and Strings: Single and multi-dimensional. Functions: VOID function, Functions and Arrays, Function prototyping. Data Types: Unions, type casting, enumerated types, static variables. Pointers: pointers and variable, pointers and functions, pointers and arrays, arrays of pointers, multi-dimensional arrays and pointers, static initialization of pointer arrays, pointers and structures, common pointer pitfalls. Dynamic Memory Allocation and Dynamic Structures: MALLOC and SIZEOF and FREE, CALLOC and REALLOC, Linked Lists, sample full C program

FENG 113 Introduction to Engineering

History of engineering and technology, contemporary applications, and future directions of engineering. Professional development. Ghana Institution of Engineers and its role in engineering developments in Ghana. Various engineering disciplines and developmental trends

FENG 114 Basic Mechanics II

Branches of dynamics. Rectilinear Motion of Particles: Displacement, velocity, acceleration, uniformly accelerated motion, relative motion, dependent motions, and graphical methods. Curvilinear Motion of Particles: Displacement, velocity, acceleration, rectangular components, tangential and normal components. Kinetics of Particles: Newton's second law of motion, equations of motion. Work, Energy, Power and Efficiency: Work done by a force, springs, kinetic and potential energy, conservation of energy, principle of work and energy, power, efficiency. Impulse and Momentum: Impulse, linear and angular momentum, conservation of momentum, system of particles. Kinematics of Rigid Bodies. Introduction to Vibration: Undamped free vibration, undamped forced vibration, rotational vibration, energy method, damped free vibration, damped force vibration, electric analogue

FENG 115 General Chemistry

Atomic Structure: The Schrödinger equation, quantum numbers, solution to the Schrödinger equation for one electron atom. Hund's Rule, Pauli's and Aufbau principles. Periodic properties of elements: Overview of general features of S-block, P-block and D-block elements. Thermochemistry: Heat and energy, heat of formation, Hess Law, estimation of bond energies. Acids and Bases: pH, strengths of acids and bases, buffers, salts, electrolytic solutions solubility and solubility products concept. Oxidation: Reduction reactions, standard electrode potential, electrochemical cell, concentration dependence of electrode potential, electrochemical series, corrosion, prevention of corrosion, electrolysis, and Faraday's laws

FENG 116 Biology

Molecular basis of cellular structure and functions (prokaryotic, eukaryotic). Bioelements. Biomolecules: carbohydrates, amino acids, lipids, nucleotides and nucleic acids (DNA, RNA), Chromosome structure, introduction to basic genetics, genes, gene action. Protein synthesis, gene splicing, genetic engineering. Brief coverage of major groups of (plant and animal) kingdoms and their characteristics (morphological, anatomical). Brief coverage of animal body organization and plant body organization. Animal locomotory adaptations: the skeleton and muscles, locomotion in unicellular animals, snakes, mechanisms of bird flight, walking and running and locomotion in water. The construction and use of biological laboratory and field equipment: microscope, centrifuge, incubator, microtome, kymograph, insect traps, vertebrate traps (fishes, reptiles, birds, mammals), radio-tracking equipment, thermometers, thermohygraphs, etc.

FENG 117 Engineering Drawing I

Introduction to the history of drawing, drawing instruments, scales and lettering, drawing lines. Orthographic Projections: Points, lines and planes. Projections of points, lines and figures on planes. Intersections of lines and with figures. Intersections of lines with solids. Intersections of figures with planes. Determination of true lengths of line segments and angles of inclination of a line to the plane of projections through projections on planes, rotation of rabatment, projections of planes; Interpenetration of figures and solids. Developments: Surfaces, prisms, right pyramids, cylinders, cones. Isometric Drawings. Introduction to AutoCAD.

FENG 118 Psychology

Introduction: What is Psychology, Brief history of psychology, goals of psychology, psychology and science, para-psychology and pseudo-psychology. Fields of Psychology: Basic, research, and applied psychology Psychology and Environment: Psychological environment, physical/built environment, noise, crowding, etc Psychology and Industry: Motivation, man-machine systems, work and safety. Relevance of psychology to engineering. Attitude, perception, and engineering

FENG 120 Applied Electricity

Foundations of electricity: voltage, current, resistance, DC and AC, AC waveforms, magnitude and phase, applications of AC and DC systems. Series and Parallel circuits. Transformers: Principle of operations, transformer types, ratings, considerations for transformer selection. AC Circuits: Single and three-phase systems, voltage levels and frequencies used in Ghana, harmonics in power systems. Power Factor and its calculation and correction in power systems, power in resistive and reactive AC circuits, active power, reactive power, and apparent power. Motors and Controls: Principles of operation of motors, control techniques for motors, motor types and applications. Electricity Generation: Generation sources, Power generation process, transmission and distribution in Ghana. Conductors and Insulators: Power transmission and distribution conductors, sizes, choice of conductor sizes, fuses, insulator break-down. Electrical Safety: Importance of electrical safety, shock current, safe practices, common sources of hazards, safe circuit design and safe meter usage.

FENG 122 Internship

First year attachment with industry.

FENG 124 Engineering Drawing II

Dimensioning: Lines and symbols, rules for dimensioning, dimensioning methods, dimensioning standard features, limits and tolerances, fit and allowances, notes and specification, surface texture. Sections and Conventions: Types of sections, section lining, conventional practices, conventional breaks. Working Drawings: Detail drawings, assembly drawings, part lists. Screw Threads and Fasteners: Thread representation, threaded assemblies, fasteners, keys, rivets. Applications of AutoCAD in engineering drawings.

LANG 111 Academic Writing (2 credits)

Introduction to the quality use of language. Strategies for paragraph development. Study reading. Gathering and using information from Library and other sources. Integration of Information into essays. General style of writing.

LEVEL 200 COURSES**FENG 201 Mathematics III**

Vector spaces and Subspaces: Linear independence and dependence of vectors, Basis and dimension, linear transformations and matrices, determinants, application to the solution of systems of linear equations Eigenvalues and Eigenvectors. Sequences and Series: Evaluating limits of sequences, tests of convergence of finite series, power series; radius and interval of convergence, Maclaurin and Taylor series. Improper integrals: Convergence, Gamma and Beta functions, Lagrange polynomials, finite differences, and least square approximation

FENG 202 Mathematics IV

Functions of Several Variables: Limits and continuity, partial differentiation, critical points and their classifications, increments and differentials, implicit differentiation, the chain rule, directional derivatives. Differential operators: The gradient, the divergence and the curl operators, line integrals, multiple integrals, integration of vector functions, Green's theorem, divergence and Stoke's theorem. Differential Equations: First and Second order ordinary differential equations, series solutions, system of ordinary differential equations. Initial-value problems: Laplace transforms, partial differential equations, boundary-value problems, applications to strings and membranes, Fourier series and transforms.

FENG 204 Environmental Science

Human and Nature. Introductory ecology. Electromagnetic/Spectrum. Ozone and Global warming. Natural resources. Population. Concept of Environmental pollution: Noise, air, land and water pollution. Impact of Engineering Projects on the Environment, and control measures; Environmental Laws and regulations in Ghana

FENG 205 Strength of Materials

Introduction: Basic concepts of material bonding, material structure and material defects. Properties of Materials: Mechanical properties, thermal properties, electronic and ionic conductivity of materials, dielectric and magnetic properties of materials. Simple stress and strain within elastic limit and thermal stress. Tensile bending and shear bending of beams. Torsion of circular shafts. Torsional stress and strain. Strength of solid and hollow shafts. Theories of failure. Compound stress-strain system (Mohr's stress and strain circles). Torsion of circular shafts Torsional stress and strain. Fatigue failure and Struts. Beams of small radius of curvature. Springs (helical, spiral and flat), Strain energy method (Castigliano's theorem). Bending under plastic conditions. Torsion under plastic conditions. Thin walled pressure vessels. Composite shafts

FENG 207 Digital Circuits

Concepts of Data Representation: Number systems, data organization, hexadecimal number systems, signed and unsigned numbers, ASCII character set. Arithmetic and Logical Operations on binary numbers, bits and strings. Boolean algebra. Combinational Logic: Introduction to Truth Tables, logic gates and networks, relations between electronic circuits and Boolean function, timing diagrams, signal race, half and full adders, subtractors, BCD adder and subtractors. Logic Circuits: Operation of transistors as simple switches, the NMOS logic gates, the CMOS and TTL logic gates, programmable logic devices (PLD), Karnaugh Map and concept of minimization. Multiplexer Circuits: Multiplexers and switching algebra operations, combinational circuit analysis and synthesis, combinational circuit minimization, timing hazards. Decoder and Encoder Circuits: Decoder circuits and operations, Encoder circuits and operations, code converters. Basic circuits for Latches, Clocked and Unclocked Flip-Flops (RS, D and JK). Data registers, shift registers, synchronous and asynchronous counters, divide-by-N counters, clocking considerations.

FENG 208 Fluid Mechanics

Introduction: nature of fluids, analysis of fluid behaviour, viscosity, surface tension and capillary effects. Fluid Statics: hydrostatic forces on submerged plane and curved surfaces; buoyancy and stability; Elementary Fluid Dynamics: static, dynamic and total pressure; energy line and hydraulic grade line. Fluid Kinematics: velocity and acceleration fields; control volume and system representations; Reynolds transport theorem. Control Volume Analysis: continuity equation; linear momentum and moment-of-momentum equations; energy equation; irreversible flow. Differential analysis of fluid flow: fluid element kinematics; conservation of mass; conservation of linear momentum; inviscid flow; plane potential flows. Similitude, dimensional analysis, and modeling: dimensional analysis; Buckingham Pi Theorem; common dimensionless groups; modelling and similitude. Flow in pipes: laminar and turbulent flow; fully developed laminar flow; fully developed turbulent flow; dimensional analysis of pipe flow; pipe networks; flowrate measurement. Flow over immersed bodies: drag and lift; friction and pressure drag; flow over flat plates, across cylinders and spheres. Open-channel flow: general characteristics: surface waves; energy considerations; uniform

flow; gradually varied flow; rapidly varied flow; flow measurement. Turbo-machines: basic energy and momentum considerations; centrifugal pumps; dimensional parameters and similarity laws; axial-flow and mixed-flow pumps; fans; turbines; compressible flow turbomachines.

FENG 209 Thermodynamics (3 credits)

Fundamental concepts of thermodynamics. First and second Laws of Thermodynamics. Properties of Substances: Properties of pure, simple and compressible substances. Introduction to Gas and Vapor Power Cycles

FENG 211 Principles of Management (2 credits)

Nature of Management: Management defined, Management roles (interpersonal, informational, decisional), the management hierarchy (levels of management), management skills (technical, human, and conceptual)

Evolution of Management: Scientific management, administrative management and bureaucracy, the human factor in management, mathematics and management, contemporary theories. The Environment of Management: Internal and external. Management Functions: Planning and decision making, organizing (authority and responsibility, line and staff positions, span of management, departmentalization), directing (motivation, leadership, communication), controlling.

FENG 212 Engineering Technology

Introduction to industrial safety, hygiene, and metrology. Standard systems and uses of conventional measuring instruments. Industrial Tour: Familiarization tour of mechanical engineering laboratories, equipment identification in the laboratories. Electrical wiring systems: Domestic and industrial set ups. Civil Works: Foundations, cement/sandstone mixes, steel reinforcement, concrete foundations and columns. Surveying: Land surveying, parallelism, use of theodolite for machine installation, Bench work: filling, making out tool grinding; Machine tools; drilling and shaping

FENG 214 Introduction to Economics

Introduction to economics, basic terminologies and definitions, the need for engineers to study economics

Micro-economics: The art and science of economics analysis, some tools of economic analysis, the market system (elasticity of demand and supply, consumer choice and demand, cost and production in the firm), market structures, pricing and government regulation. Macro-economics: Aggregate demand and aggregate supply, measuring economic aggregates and the circular flow of income, fiscal and monetary policy, international trade and finance, problems of developing countries

FENG 216 Sociology

Sociology, its origin and main concerns. Sociology as a Science. Some basic concepts in Sociology, society, culture, norms, institutions, status and roles. Concept of social structure of the Ghanaian society. The land, people and their spatial distribution. The traditional world view. The family, kinship and lineage systems. Traditional religious beliefs and their social functions. The traditional economy: land tenure, modes of production and distribution. Chieftaincy: structure and function. Modes of Socialization: The rites of passage. Health care practices

FENG 218 Internship

Second year attachment with industry.

AENG 201 Engineering Surveying

Definitions and types of surveying. Principles, field surveying, leveling instruments, differential and profile leveling, contours, mapwork, scale, reading and interpreting maps. Theodolite and its applications. □ Description of the Instrument – the 3 main parts. The usage of the instrument – setting up the instrument, readings of the vertical and horizontal angles. Applications – traversing and control points establishment.

ANIM 201 Animal Production (3 credits)

Refer to College of Agriculture and Consumer Sciences curriculum for course details.

CROP 202 Introduction to Crop Production (3 credits)

Refer to the College of Agriculture and Consumer Sciences curriculum for course details.

LEVEL 300 COURSES

AENG 301 Soil Mechanics

Classification, Definition, Compaction, Effective Stress, Steady State, Flow nets, Anisotropic flow, One-dimensional compression, One-dimensional settlement, One-dimensional consolidation, Numerical solutions, Elasticity of soils, Settlement of foundations, Soil strength, Stress-strain, Earth pressure (Rankine's method), Earth pressure (Coloumb's method).

AENG 302 Agricultural Materials Handling

Principles, concepts, definitions and importance, classification of agricultural materials (fluids, semifluids unitized). Conveying - classification of conveying equipment methods and types of equipment reliability of conveyers and conveyer systems, safety engineering.

AENG 303 Machine Design

Quick reminder of stress and strain analysis and theories of failure. Factor of safety, stress concentration, design of machine elements like shafts and axles, couplings, riveted joints, welded joints, bolted joints. Product specification and selection of standard parts like bearings, gears, keys and springs. Manufacturing processes, role of CAD/CAM.

AENG 304 Soil Mechanics Application to Mechanization

The application of soil mechanics principles to the design of soil engaging equipment for tillage and earthmoving, methods for predicting performance and results of detailed field and laboratory studies on soil faces and soil disturbance.

AENG 305 Heat and Mass Transfer

Basic definitions, introduction of the different modes of heat transfer. Conduction of heat transfer; Fourier's law, steady state heat transfer, heat transfer through plane walls, cylinders and spheres. Electrical analogy, heat transfer through materials in series and parallel and in fins. Convection heat transfer: Introduction to dimensional analysis, forced convection, Reynold's analogy, flow over plates, flow in tubes; natural or free convection. Radiation heat transfer: Black body and grey body concepts, emmissivity, absorbtivity, transmissivity, radiosity, Lambert's law, geometric factor, radiation shields, parallel plates, electrical analogy. Mixed mode heat transfer. Mass transfer: mixture of gases and humid air, diffusion, convective mass transfer, change of phase mass transfer, Fick's law, steam condenser applications.

AENG 307 Farm Structures

Different types of on-farm structures. Planning of a farm structure: selection and preparation of site, layout and design. Building materials: selection, properties, wood, plywood, earth as a building material. Elements of construction, theory and design of structures: frames, elementary stress analysis of structural members. Professional services, types of contracts, supervision of contracts, safety. Structures for poultry, dairy, cattle and pigs.

AENG 308 Agricultural Machinery Technology

The performance and design characteristics of crop establishment, protection, harvesting and handling equipment, the selection of suitable machinery to meet the performance requirements of various agricultural operations.

AENG 309 Soil and Water Engineering

Agro-hydrology; hydrologic cycle, rainfall run off, water balance; evapotranspiration, soil and water relations soil texture structure hydrograph analysis.

AENG 311 Physical and Engineering Properties of Biological Materials

Physical characteristics: Shape, size, weight, volume, surface area, density, porosity, color, appearance, drag coefficient, center of gravity. Mechanical properties: Hardness, compressive strength, tensile strength impact resistance, compressibility, shear resistance, sliding coefficient of friction, static coefficient of friction, coefficient of expansion, plasticity, bending strength, aerodynamic properties, hydrodynamic properties. Thermal properties: Specific heat, thermal capacity, thermal conductivity, surface conductance, absorptance, emittance, transmittance. Electrical properties: Conductance, resistance, capacitance, dielectric properties, electromagnetic properties. Optical properties: Light transmittance, light reflectance, light reflectance, light absorptance, color.

AENG 312 Energy and Power Utilization on Farms

Power sources, human, animal, wind, water solar energy, produce gas methane, petrol and diesel engines. Power transmission by V belt and chains, energy strategies.

AENG 314 Hydrology

Components and processes of natural hydrologic systems, Hydrologic cycle, Precipitation and snow melt. Infiltration. Storm frequency and duration analysis. Hydrograph analysis. Frequency and probability with application to precipitation, floods and drought. Evaporation, transpiration and evapotranspiration. Ground water resources. Pumping tests and water balance studies.

AENG 316 Crop and Animal Environment Engineering

Heat and moisture production by crops and animals, environmental control, feeding systems and waste management, thermal insulation and moisture barriers, ventilation control and quantification of performance, ventilation rates, energy and mass balance, equipment for environmental control.

FENG 300 Technical Report Writing

Preparing an outline. Technical Style. Use of abbreviations. Numbering of Headings. Documentation footnotes and alphabetical list of reference. Table and figures, Bar charts, graphs, curves Organization charts and flow sheets. Drawing. Photographs. Case Study

FENG 302 Internship

Third year attachment with industry.

FENG 304 Statistics for Engineers

Probability functions axioms and rules, counting techniques, conditional probability, independence and mutually exclusive events. Discrete Random Variable: Expectation and variance, Binomial distribution, Hypergeometric distribution, Poisson distribution, relationship between Poisson and Binomial. Continuous Random Variable: Percentiles and cumulative distribution function, expectation and variance, uniform distribution, normal distribution, exponential distribution and other distributions. Joint Distributions.

Covariance and Correlation. Sampling Distributions: Distributions of statistics, central limit theorem, samples from normal distribution (t-distribution, X^2 distribution and F-distributions). Estimation: Common point estimators, interval estimators. Hypothesis Testing. Introduction to Regression Analysis. Engineering applications in quality control, process control, communication systems and speech recognition

CENG 301 Numerical Methods

Refer to the Computer Engineering curriculum for course details and prerequisites.

Level 400 Courses**AENG 400 Project**

Students work independently on original project under the direction of their approved advisor, make an oral presentation at annual conference, prepare and submit thesis for approval.

AENG 401 Farm Machine Design

Study of agricultural machinery with reference to functional and design requirements of various farm machines; cost – benefit analysis, machinery testing methods. Design for manufacture.

AENG 402 Technology of Tractor and Implement

Tractor and implement, construction and operational features transmission systems, implement attachment and control, tractive performance, performance and efficiency indices, soil compaction and smear, tractor design and function, kinematic and equilibrium analysis of tractor/implement combination draw bar for performance prediction, steerability.

AENG 403 Storage of Agricultural Products

Choice of systems for reception, storage and handling of agricultural produce, types of storage systems: construction details and design of systems, access roads, dust extractors, capacity of equipment, system selection and reliability. Grain storage methods, storage of fresh fruits and vegetables, storage of roots and tubers; Physiological disorders, chemical and integrated pest control methods, legislation on chemical use, quality assurance, bio-deterioration, inspection procedures, loss assessment, pest proofing. Safety in stores

AENG 404 Irrigation and Drainage Engineering

Water for irrigation - surface and ground water quality and water flow rate; types, performance and selection criterion for pumps, irrigation requirements and scheduling, farm irrigation systems design, surface sprinkler, trickle, subsurface and surface drainage design and practices, drainage and environmental conservation.

AENG 405 Agro-Meteorology

Solar radiation, short and long wave radiation, direct and diffuse radiation, Net radiation, measurement and estimation; radiation utilization in photosynthesis; Convective transfer at surfaces at small and extensive surfaces; Energy balance/Bowen ratio; Evaporation and evapotranspiration models; Soil temperatures; Heat transfer and balance; Drought; Windbreaks and shelter belts. Introduction to Meteorological Instrumentation and Observation; Weather Analysis/Forecasting; Physical Climatology - Causes of Climatic Phenomena including Heat and Water balance of the Earth Atmosphere system and application of the Physical Principles involved in Agro-meteorology and Hydrology.

AENG 406 Water Resources Management

Principles of water conservation, water storage structures. Water harvesting. Embankments and farm ponds. Flood control, open channels and vegetative water ways. Terracing: - functions of terraces, terrace classification, terrace design.

AENG 407 Rural Engineering

Rural infrastructure planning, earth moving and land clearance, open channels, roads, fencing and animal shelter, construction of small structures, materials management, rural water supply and sanitation.

AENG 408 Refrigeration and Cold Chain Management

Principles of refrigeration; refrigeration equipment; refrigerated storage construction; air circulation and fruit temperatures; pack house design and management; quality and safety in cold storage; hazard analysis critical control path; packaging and cold storage; cold chain from producer to consumer; safety

AENG 409 Maintenance and Management of Agricultural Machinery

Defects of farm machinery (wear and breakages); instruments to measure defects; materials for repairs; diagnostic testing; bench work, blacksmithing and welding; repair and maintenance of farm equipment (tractors, tillage equipment, harvesting equipment, etc); lubrication and preservation of farm machines; field capacity and efficiency, machinery costs, machinery selection and replacement

FENG 401 Law for Engineers

Course discussions cover contracts (formation, performance, breach, and termination), corporations and partnerships, insurance, professional liability, risk management, environmental law, torts, property law, evidence and dispute resolution. The course emphasizes those principles necessary to provide engineers with the ability to recognize issues which are likely to arise in the engineering profession and introduces them to the complexities and vagaries of the legal profession.

FENG 402 Entrepreneurship

Entrepreneurial process. Evaluation opportunities: Analysis of new ventures, valuation techniques, intellectual property issues, product and market research. Legal forms of organizations. Accessing and acquiring resources of financing. Developing a Business plan. Managing Enterprises. Marketing. Organizational behavior. Exit Strategies.

FDEN 409 Engineering and Design of Food Process III – Plant Products

Refer to the Food Process Engineering curriculum for course details.

Graduation Requirements for B.Sc. Engineering (Agricultural Engineering)

To graduate B.Sc. Engineering (Agricultural Engineering), a student must satisfy all requirements of the University, Faculty and the Department.

University Requirements

A student shall be deemed to have satisfied the requirements for graduation if:

- (i) She/he has satisfied all the General University requirements.
- (ii) She/he has accumulated the minimum number of credits required by the Faculty, including both core and prescribed elective courses, namely, 144 credits.
- (iii) She/he has not have failed more than a total of 24 credits from the core courses and prescribed electives, provided that the failed grades are not lower than a “D”.
- (iv) She/he has submitted a report originating from a Project Work. The Report must be submitted for assessment before the date of the last paper in the second semester examinations. In default the candidate shall be asked to submit the Report the following semester and shall be treated as a repeat examination with all its implications.

Faculty Requirements

1. Student must pass a minimum of 6 credits out of the following courses: FENG 118: Psychology, FENG 211: Principles of Management, FENG 214: Introduction to Economics, FENG 216: Sociology, FENG 401: Law for Engineers.
2. Student must take and pass FENG 402 Entrepreneurship.
3. Student must have taken at least two out of the three Internship (Industrial Practice) programmes one of which must be FENG 302 Internship III (Level 300).

Departmental Requirements

In addition to the University and Faculty requirements, to graduate with BSc Engineering (Agricultural Engineering) a student must pass the following courses:

AENG 308	Agricultural Machinery Technology
AENG 400	Project
AENG 403	Storage of Agricultural Produce
AENG 404	Irrigation and Drainage Engineering

DEPARTMENT OF BIOMEDICAL ENGINEERING

Elsie Effah Kaufmann , <i>BSE, MSE, PhD (Pennsylvania, USA)</i>	-	Senior Lecturer/ Head of Dept
J. K. Kutor , <i>BSc., MSc. (UCC), PhD (Zhejiang, China)</i>	-	Lecturer
H. A. Ogoe , <i>BSc. (KNUST), MSc. (Åbo Akademi, Finland)</i>	-	Lecturer
I. A. Oppong , <i>BSc. (KNUST), PgDip (Holland), MSc. (Greenwich, UK), MSc. (Surrey, UK)</i>	-	Lecturer
S. D. Osae , <i>BSc. (Ghana), MSc, PhD (Okayama, Japan)</i>	-	Part-Time Lecturer
P. K. Obeng , <i>BSc., MSc. (Patrice Lumumba, Moscow, Russia)</i>	-	Part-Time Lecturer
K. K. Adutwum-Ofofu , <i>BSc Dip Ed (UCC), MPhil (Ghana)</i>	-	Part-Time Lecturer
<i>F. Vuvor, BSc., MPhil (Ghana)</i>	-	Part-Time Lecturer
Edward Addo Essah , <i>BSc.(KNUST), MSc.(MULuebeck, Germany)</i>	-	Part-Time Lecturer
D. G. Achel , <i>BSc., MPhil (Ghana)</i>	-	Part-Time Lecturer
Irene Ayi , <i>BSc.(KNUST), PhD (Tokyo, Japan)</i>	-	Part-Time Lecturer

LEVEL 100 COURSES

Core

FENG 101	Mathematics I	4
FENG 102	Mathematics II	4
FENG 105	General Physics	3
FENG 106	Basic Electronics	3
FENG 109	Introduction to Information Technology I	2
FENG 111	Basic Mechanics I	3
FENG 112	Introduction to Information Technology II (C Programming)	2
FENG 113	Introduction to Engineering	1
FENG 114	Basic Mechanics II	2
FENG 115	General Chemistry	3
FENG 116	Biology	2
FENG 117	Engineering Drawing I	3
FENG 122	Internship (Industrial Practice I)	1
FENG 124	Engineering Drawing II	3
FENG 126	Applied Electricity	3
LANG 100	Academic Writing	2

Elective

FENG 118	Psychology	2
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LEVEL 200 COURSES

Core

FENG 201	Mathematics III	4
FENG 202	Mathematics IV	4
FENG 204	Environmental Science	2
FENG 205	Strength of Materials	3
FENG 206	Introduction to Software Engineering	3
FENG 207	Digital Circuits	3
FENG 208	Fluid Mechanics	2
FENG 209	Thermodynamics	2
FENG 212	Engineering Technology	2
FENG 218	Internship	1
CENG 201	C++ Programming	3

Elective

FENG 211	Principles of Management	2
FENG 214	Introduction to Economics	3
FENG 216	Sociology	3

LEVEL 300 COURSES**Core**

BIEN 301	Introduction to Biomedical Engineering	2
BIEN 302	Human Biology II (Physiology)	2
BIEN 303	Human Biology I (Anatomy)	2
BIEN 304	Solution and Colloid Chemistry	3
BIEN 305	Bioinstrumentation	3
BIEN 306	Biomedical Engineering Systems	3
BIEN 307	Biomaterials	3
BIEN 308	Engineering Principles of Human Physiology and Anatomy	2
BIEN 309	Biomechanics	3
BIEN 311	Biomedical Engineering Lab. I	1
BIEN 314	Biomedical Engineering Lab. II	1
CENG 301	Numerical Methods	3
FENG 300	Technical Report Writing	1
FENG 302	Internship (Industrial Practice III)	1

Electives

AENG 311	Physical and Engineering Properties of Biological Materials	3
BIEN 313	Independent Study	1
BIEN 315	Local Issues in Biomedical Engineering	3
BIEN 316	Medical Physics	3
BIEN 318	Independent Study	1
MSEN 322	Quantum Physics of Materials	2
MSEN 325	Materials Science and the Future	2
CENG 304	Non-Linear Circuits	3
CENG 305	Linear Circuits	3
CENG 307	Programming Language Fundamentals	3
CENG 316	Signals and Systems	3

LEVEL 400 COURSES**Core**

BIEN 400	Design Project	3
BIEN 402	Tissue Engineering and Biotechnology	4
BIEN 403	Medical Imaging	3
BIEN 404	Design and Selection of Biomaterials	3
BIEN 405	Transport Processes in Living Systems	2
BIEN 406	Design of Mechanical Systems	3
BIEN 407	Cell and Molecular Biology	3
BIEN 408	Professional Development Seminar	2
BIEN 409	Cardiovascular Mechanics	2
BIEN 411	Haemodynamics	2
FENG 402	Entrepreneurship	3

Elective

BIEN 413	Independent Study	1
BIEN 414	Independent Study	1
BIEN 415	Advanced Topics in Physical and Chemical Biomedical Engineering	3
MSEN 403	Composite Design and Fabrication	3
MSEN 407	Bioceramic Materials	2
MSEN 416	Advanced Topics in Bioceramics	3
CENG 415	Software Engineering	3
CENG 419	Digital Signal Processing	3
CENG 433	Computer Vision and Robotics	3
CENG 442	Digital Control Systems	3
FENG 401	Law for Engineers	3

COURSE DESCRIPTIONS AND PREREQUISITES

Core (Level 100)

FENG 101 Mathematics I

Set of Real Numbers, Indices, Logarithms and Surds. Concept of a function of a single variable, graphs of functions. Linear, quadratic and higher degree polynomial functions, Rational functions. Inequalities in one and two variables. Binomial theorem. Circular measure. Trigonometric functions. Exponential and logarithmic functions, function e^x ; hyperbolic functions. Complex numbers and their algebra. Vectors: addition, scalar multiplication, scalar products, vector product. Scalar and vector triple products. Geometrical applications: vector equations of lines and planes. Parametric representation of a curve; the circle and other conic sections.

Reference books and materials

J. K. Backhouse and S. P. T Houldsworth, *Pure Mathematics I and II*, Longman , 1985

G. James, *Modern Engineering Mathematics*, 3rd Ed., Prentice Hall, 2005

FENG 102 Mathematics II

Limits and Continuity of a function of a single variable. Differentiation: Rules of differentiation, chain rule and parametric differentiation, differentiation of trigonometric functions and their inverses, exponential and logarithmic functions, higher order derivatives, Leibnitz's rule. Differentiability: Rolle's Theorem, mean-value theorem, approximate methods of solving equations (graphical and Newton-Raphson methods). Integration and its applications: Area under curve, volumes of solids of revolution. Numerical integration: Trapezium and Simpson's rules. Vector function of a single variable: Differentiation and integration of vector functions, kinematics of a single particle in motion. Newton's laws of motion, motion in a straight line and in a plane, projectiles and circular motion, work, energy and power; impulse and momentum, moment of a force, couple, conditions for equilibrium of rigid bodies

Reference books and materials

J. K. Backhouse and S. P. T Houldsworth, *Pure Mathematics I and II*, Longman , 1985

G. James, *Modern Engineering Mathematics*, 3rd Ed., Prentice Hall, 2005

FENG 105 General Physics

Vibrations: Simple harmonic motion, damped harmonic motion, forced harmonic motion. Waves: Wave types, wave phenomena – interference and diffraction. Electricity and Magnetism: Coulomb's law, electric field, Gauss's law, electric potential, current electricity – EMF, Kirchhoff's laws, DC circuits, Magnetic field: Bio-Savart's law, Ampere's law. Induction: Faraday and Lenz's law, AC circuits. Introductory Modern Physics: Bohr's atom, quantum theory of atom, electronic transitions, optical spectrum, X-rays, photo-electric effect, motion of charges in electric and magnetic fields

Reference books and materials

D. C. Giancoli, *Physics for Scientists and Engineers with Modern Physics*, 3rd Ed. Prentice-Hall, 2000

D. Halliday and R Resnick, *Physics (Part 1 and 2)*, John Wiley, New York, 1977

FENG 106 Basic Electronics

History of electronics from vacuum tubes to large scale integration, classification of electronic signals (digital, analog, role of A/D and D/A converters), electronic components, symbols and identification. Semiconductivity. Diodes and Diode Circuits: diode characteristics, model, and behavior in relation to circuits and analysis. Field-Effect Transistors and Circuits: MOSFET characteristics and model, biasing techniques, circuit symbol, analog MOSFET amplifier. Bipolar Junction Transistors (BJT): Physical structure of the BJT, circuit representation, transistor biasing, and transistor ratings. Fundamentals of Digital Electronics: Ideal logic gates, logic level definition and dynamic response of logic gates, logic gates examples. Signal Amplifiers: Concept of amplification, operational amplifier and its application as a filter, the BJT and MOSFET transistor as amplifiers, small signal behavior of the transistor. Basic Analog and Digital circuit elements, frequency response, signal generator, filters and waveform shaping circuits.

Reference books and materials

A. P. Malvino, *Electronics Principles*, 6th Ed., Glencoe/McGraw-Hill,

C. A. Schuler, *Experiment Manual for Electronics: Principles and Applications*, 5th Ed., Glencoe/McGraw-Hill, 1999.

R. C. Jaeger and T. N. Blalock, *Microelectronic Circuit Design*, 2nd Ed., McGraw-Hill, 2004.

FENG 109 Introduction to Information Technology I

Introduction to computers and digital technology and culture. The role of computers in IT, issues of computers and crime, computers and work, general issues on the impact and control of computers. Structure and use of the Internet and applications in e-business, e-learning, e-governance, e-health. The basic foundations and functions of computer hardware and software. Introduction to common engineering application software. Spreadsheet for engineers. Introduction to MATLAB and its applications to engineering problem solving.

Reference books and materials

B. S. Gottfried, *Spreadsheet Tools for Engineers using Excel*, McGraw-Hill, 2003

K. C. Laudon, K. Rosenblatt, and D. Langley, *Interactive Computing Series: Microsoft Excel 2002*, McGraw-Hill, 2002

FENG 111 Basic Mechanics I

General principles of mechanics, methods of problem solution, and numerical accuracy. Force vectors and mathematical operations. Static Particles: Coplanar force on a particle, resultant of forces, resolution of forces, conditions for the equilibrium of a particle, Newton's first law, free-body diagram, forces in space. Force System Resultants. Statics of a rigid body and conditions for equilibrium. Centroids and centers of gravity

Reference books and materials

D. Kleppner and R. J. Kolenkow, *An introduction to Mechanics*, McGraw-Hill, 1997

F. P. Beer and R. Russell Johnson Jr., *Vector Mechanics for Engineers*, 5th Ed., McGraw-Hill, 1988

R. C. Hibbeler, *Engineering Mechanics: Statics*, 11th Ed., Prentice Hall, 2006

FENG 112 Introduction to Information Technology II – C Programming

History of the C language. Structure of the C Program. Variables Declarations: Global variables, type and range of variables, declaration of variables, scope of variables, reading and printing of variables. Constants Declarations. The C Operators: Arithmetic, Relational, Logical, and order of operation precedence. Conditional Instructions. Looping and Iterations. Arrays and Strings: Single and multi-

dimensional. Functions: VOID function, Functions and Arrays, Function prototyping. Data Types: Unions, type casting, enumerated types, static variables. Pointers: pointers and variable, pointers and functions, pointers and arrays, arrays of pointers, multi-dimensional arrays and pointers, static initialization of pointer arrays, pointers and structures, common pointer pitfalls. Dynamic Memory Allocation and Dynamic Structures: MALLOC and SIZEOF and FREE, CALLOC and REALLOC, Linked Lists, sample full C program

Reference Books and Materials

H. H. Tan and T. B. D’Orazio, *C Programming for Engineering and Computer Science*, McGraw-Hill, 1999

FENG 113 Introduction to Engineering

History of engineering and technology, contemporary applications, and future directions of engineering. Professional development. Ghana Institution of Engineers and its role in engineering developments in Ghana. Various engineering disciplines and developmental trends

FENG 114 Basic Mechanics II

Branches of dynamics. Rectilinear Motion of Particles: Displacement, velocity, acceleration, uniformly accelerated motion, relative motion, dependent motions, and graphical methods. Curvilinear Motion of Particles: Displacement, velocity, acceleration, rectangular components, tangential and normal components. Kinetics of Particles: Newton’s second law of motion, equations of motion. Work, Energy, Power and Efficiency: Work done by a force, springs, kinetic and potential energy, conservation of energy, principle of work and energy, power, efficiency. Impulse and Momentum: Impulse, linear and angular momentum, conservation of momentum, system of particles. Kinematics of Rigid Bodies. Introduction to Vibration: Undamped free vibration, undamped forced vibration, rotational vibration, energy method, damped free vibration, damped force vibration, electric analogue

Reference Books and Materials

D. Kleppner and R. J. Kolenkow, *An introduction to Mechanics*, McGraw-Hill, 1997

F. P. Beer and R. Russell Johnson Jr., *Vector Mechanics for Engineers*, 6th Ed., McGraw-Hill,

J. L. Meriam, *Dynamics: SI Version*, 2nd Ed., John Wiley & Sons Inc.,

FENG 115 General Chemistry

Atomic Structure: The Schrödinger equation, quantum numbers, solution to the Schrödinger equation for one electron atom. Hund’s Rule, Pauli’s and Aufbau principles. Periodic properties of elements: Overview of general features of S-block, P-block and D-block elements. Thermochemistry: Heat and energy, heat of formation, Hess Law, estimation of bond energies. Acids and Bases: pH, strengths of acids and bases, buffers, salts, electrolytic solutions solubility and solubility products concept. Oxidation: Reduction reactions, standard electrode potential, electrochemical cell, concentration dependence of electrode potential, electrochemical series, corrosion, prevention of corrosion, electrolysis, and Faraday’s laws

Reference books and materials

G. Hill and J. Holman, *Chemistry in Context*, 5th Ed., Nelson Thornes

T. Lister and J. Renshaw, *New Understanding Chemistry for Advanced Level*, 3rd Ed., Nelson Thornes

U. Kask and J. D. Rawn, *General Chemistry*, Wm C. Brown Publishers

FENG 116 Biology

Molecular basis of cellular structure and functions (prokaryotic, eukaryotic). Bioelements. Biomolecules: carbohydrates, amino acids, lipids, nucleotides and nucleic acids (DNA, RNA), Chromosome structure, introduction to basic genetics, genes, gene action. Protein synthesis, gene splicing, genetic engineering. Brief coverage of major groups of (plant and animal) kingdoms and their characteristics (morphological, anatomical). Brief coverage of animal body organization and

plant body organization. Animal locomotory adaptations: the skeleton and muscles, locomotion in unicellular animals, snakes, mechanisms of bird flight, walking and running and locomotion in water. The construction and use of biological laboratory and field equipment: microscope, centrifuge, incubator, microtome, kymograph, insect traps, vertebrate traps (fishes, reptiles, birds, mammals), radio-tracking equipment, thermometers, thermohygrographs, etc.

FENG 117 Engineering Drawing I

Introduction to the history of drawing, drawing instruments, scales and lettering, drawing lines. Orthographic Projections: Points, lines and planes. Projections of points, lines and figures on planes. Intersections of lines and with figures. Intersections of lines with solids. Intersections of figures with planes. Determination of true lengths of line segments and angles of inclination of a line to the plane of projections through projections on planes, rotation of rabatment, projections of planes; Interpenetration of figures and solids. Developments: Surfaces, prisms, right pyramids, cylinders, cones. Isometric Drawings. Introduction to AutoCAD.

Reference books and materials

T. E. French, *A Manual of Engineering Drawing for Students and Draftsmen*, McGraw-Hill
J. A. Leach and B. A. Duffy, *AutoCAD 2002 Assistant*, McGraw-Hill, 2003

FENG 122 Internship

First year attachment with industry.

FENG 124 Engineering Drawing II

Dimensioning: Lines and symbols, rules for dimensioning, dimensioning methods, dimensioning standard features, limits and tolerances, fit and allowances, notes and specification, surface texture. Sections and Conventions: Types of sections, section lining, conventional practices, conventional breaks. Working Drawings: Detail drawings, assembly drawings, part lists. Screw Threads and Fasteners: Thread representation, threaded assemblies, fasteners, keys, rivets. Applications of AutoCAD in engineering drawings.

Reference Books and Materials

T. E. French, *A Manual of Engineering Drawing for Students and Draftsmen*, McGraw-Hill
C. Jensen and J. D. Helsel, *Engineering Drawing and Design*, McGraw-Hill,
J. A. Leach and B. A. Duffy, *AutoCAD 2002 Assistant*, McGraw-Hill, 2003

FENG 126 Applied Electricity

Foundations of electricity: voltage, current, resistance, DC and AC, AC waveforms, magnitude and phase, applications of AC and DC systems. Series and Parallel circuits. Transformers: Principle of operations, transformer types, ratings, considerations for transformer selection. AC Circuits: Single and three-phase systems, voltage levels and frequencies used in Ghana, harmonics in power systems. Power Factor and its calculation and correction in power systems, power in resistive and reactive AC circuits, active power, reactive power, and apparent power. Motors and Controls: Principles of operation of motors, control techniques for motors, motor types and applications. Electricity Generation: Generation sources, Power generation process, transmission and distribution in Ghana. Conductors and Insulators: Power transmission and distribution conductors, sizes, choice of conductor sizes, fuses, insulator break-down. Electrical Safety: Importance of electrical safety, shock current, safe practices, common sources of hazards, safe circuit design and safe meter usage.

Reference books and materials

E. Hughes, *Electrical Technology*, 7th Ed., Longman 1995

LANG 111 Academic Writing

Introduction to the quality use of language. Strategies for paragraph development. Study reading. Gathering and using information from Library and other sources. Integration of Information into essays. General style of writing.

Electives (Level 100)

FENG 118 Psychology

Introduction: What is Psychology, Brief history of psychology, goals of psychology, psychology and science, para-psychology and pseudo-psychology. Fields of Psychology: Basic, research, and applied psychology

Psychology and Environment: Psychological environment, physical/built environment, noise, crowding, etc

Psychology and Industry: Motivation, man-machine systems, work and safety. Relevance of psychology to engineering. Attitude, perception, and engineering

Reference Books and Materials

R. S. Feldman, *Essentials of Understanding Psychology*, McGraw-Hill, 2005

Atkinson, L.R. et al., *Introduction to Psychology*, 17th Ed., San Diego, Harcourt Brace Jovanovich College Publishers, 1993

Core (Level 200)

FENG 201 Mathematics III

Vector spaces and Subspaces: Linear independence and dependence of vectors, Basis and dimension, linear transformations and matrices, determinants, application to the solution of systems of linear equations. Eigenvalues and Eigenvectors. Sequences and Series: Evaluating limits of sequences, tests of convergence of finite series, power series; radius and interval of convergence, Maclaurin and Taylor series.

Improper integrals: Convergence, Gamma and Beta functions, Lagrange polynomials, finite differences, and least square approximation

Reference books and materials

A. Jeffrey, *Mathematics for Engineers*, Chapman-Hall,

E. J. Purcell and D. Varberg, *Calculus*, Prentice-Hall,

E. W. Swokowski, *Calculus*, Weber-Schmidt,

FENG 202 Mathematics IV

Functions of Several Variables: Limits and continuity, partial differentiation, critical points and their classifications, increments and differentials, implicit differentiation, the chain rule, directional derivatives

Differential operators: The gradient, the divergence and the curl operators, line integrals, multiple integrals, integration of vector functions, Green's theorem, divergence and Stoke's theorem.

Differential Equations: First and Second order ordinary differential equations, series solutions, system of ordinary differential equations. Initial-value problems: Laplace transforms, partial differential equations, boundary-value problems, applications to strings and membranes, Fourier series and transforms

Reference books and materials

E. J. Purcell and D. Varberg, *Calculus*, Prentice-Hall,

E. W. Swokowski, *Calculus*, Weber-Schmidt,

FENG 204 Environmental Science

Human and Nature. Introductory ecology. Electromagnetic/Spectrum. Ozone and Global warming

Natural resources. Population. Concept of Environmental pollution: Noise, air, land and water pollution. Impact of Engineering Projects on the Environment, and control measures; Environmental Laws and regulations in Ghana

FENG 205 Strength of Materials

Introduction: Basic concepts of material bonding, material structure and material defects

Properties of Materials: Mechanical properties, thermal properties, electronic and ionic conductivity of materials, dielectric and magnetic properties of materials. Simple stress and strain within elastic limit and thermal stress. Tensile bending and shear bending of beams. Torsion of circular shafts. Torsional stress and strain. Strength of solid and hollow shafts. Theories of failure. Compound stress-strain system (Mohr's stress and strain circles). Torsion of circular shafts Torsional stress and strain. Fatigue failure and Struts. Beams of small radius of curvature. Springs (helical, spiral and flat), Strain energy method (Castigliano's theorem). Bending under plastic conditions. Torsion under plastic conditions. Thin walled pressure vessels. Composite shafts

FENG 206 Introduction to Software Engineering

Basic process of creating software systems such as requirement specifications, design, development, implementation, testing, maintenance, and software life cycle. Planning: Cost of development, constructive cost models, development time and cost models. Management: Organization and management of teams, staffing, directing, and controlling, program and project documentation, documentation of software products.

Analysis and Design. Software Development. Design of User Interfaces. Software Metrics. Program Performance. Testing and Evaluation. Software Tools: Programming environments, program complexity, quality analysis tools, tracing tools, profilers, debuggers, source code repository, test harnesses. Legal and Economic aspects of software production.

Reference Books and Materials

R. Pressman, *Software Engineering – A Beginners Guide*, McGraw Hill, 1988

R. Pressman, *Software Engineering – A Practitioner's Approach*, 6th Ed., McGraw Hill, 2005

S. R. Schach, *Object-Oriented and Classical Software Engineering*, 6th Ed. McGraw Hill, 2005

FENG 207 Digital Circuits (Prerequisite: FENG 106)

Concepts of Data Representation: Number systems, data organization, hexadecimal number systems, signed and unsigned numbers, ASCII character set. Arithmetic and Logical Operations on binary numbers, bits and strings. Boolean algebra. Combinational Logic: Introduction to Truth Tables, logic gates and networks, relations between electronic circuits and Boolean function, timing diagrams, signal race, half and full adders, subtractors, BCD adder and subtractors. Logic Circuits: Operation of transistors as simple switches, the NMOS logic gates, the CMOS and TTL logic gates, programmable logic devices (PLD), Karnaugh Map and concept of minimization. Multiplexer Circuits: Multiplexers and switching algebra operations, combinational circuit analysis and synthesis, combinational circuit minimization, timing hazards. Decoder and Encoder Circuits: Decoder circuits and operations, Encoder circuits and operations, code converters. Basic circuits for Latches, Clocked and Unclocked Flip-Flops (RS, D and JK). Data registers, shift registers, synchronous and asynchronous counters, divide-by-N counters, clocking considerations.

Reference Books and Materials

S. Brown and Z. Vranesic, *Fundamentals of Digital Logic with VHDL Design*, 2nd Ed., McGraw-Hill, 2005.

FENG 208 Fluid Mechanics

Introduction: nature of fluids, analysis of fluid behaviour, viscosity, surface tension and capillary effects. Fluid Statics: hydrostatic forces on submerged plane and curved surfaces; buoyancy and stability; Elementary Fluid Dynamics: static, dynamic and total pressure; energy line and hydraulic grade line. Fluid Kinematics: velocity and acceleration fields; control volume and system representations; Reynolds transport theorem. Control Volume Analysis: continuity equation; linear momentum and moment-of-momentum equations; energy equation; irreversible flow. Differential analysis of fluid flow: fluid element kinematics; conservation of mass; conservation of linear momentum; inviscid flow; plane potential flows. Similitude, dimensional analysis, and modeling:

dimensional analysis; Buckingham Pi Theorem; common dimensionless groups; modelling and similitude. Flow in pipes: laminar and turbulent flow; fully developed laminar flow; fully developed turbulent flow; dimensional analysis of pipe flow; pipe networks; flowrate measurement. Flow over immersed bodies: drag and lift; friction and pressure drag; flow over flat plates, across cylinders and spheres. Open-channel flow: general characteristics: surface waves; energy considerations; uniform flow; gradually varied flow; rapidly varied flow; flow measurement. Turbo-machines: basic energy and momentum considerations; centrifugal pumps; dimensional parameters and similarity laws; axial-flow and mixed-flow pumps; fans; turbines; compressible flow turbomachines.

Reference Books and Materials

Cengel, Y. A. and Turner, R. H, *Fundamentals of Thermal-fluid sciences*, McGraw-Hill, 2001

Mott, R. L, *Applied Fluid Mechanics*, Pearson Education, 6th Ed., 2006.

Munson, B. R., Young, D. F., and Okiishi, T. H, *Fundamentals of fluid mechanics*, 5th Ed., John Wiley and Sons, 2006.

FENG 209 Thermodynamics

Fundamental concepts of thermodynamics. First and second Laws of Thermodynamics. Properties of Substances: Properties of pure, simple and compressible substances. Introduction to Gas and Vapor Power Cycles

Reference books and materials

J. B. Jones and R. E. Dugan, *Engineering Thermodynamics*, Prentice-Hall,

W. C. Reynolds and H. C. Perkins, *Engineering Thermodynamics*, McGraw-Hill,

FENG 212 Engineering Technology

Introduction to industrial safety, hygiene, and metrology. Standard systems and uses of conventional measuring instruments. Industrial Tour: Familiarization tour of mechanical engineering laboratories, equipment identification in the laboratories. Electrical wiring systems: Domestic and industrial set ups. Civil Works: Foundations, cement/sandstone mixes, steel reinforcement, concrete foundations and columns. Surveying: Land surveying, parallelism, use of theodolite for machine installation, Bench work: filling, making out tool grinding; Machine tools; drilling and shaping

Reference Books and Materials

Vic Moore, *Farm workshop and maintenance* 3rd Ed., Granada publications

FENG 215 Chemistry of Materials

Crystal Chemistry: Nature of the crystalline state, symmetry and space lattices, binding of forces in the solid state, intermolecular forces, van der Waals forces. Molecular crystal, covalent crystals, characteristics, properties, examples. Metals: Close-packing arrangements, structure of pure metals, bonding in metals, alloys, interstitial compounds. Ionic crystals: Structure of simple salts, effects of polarity, complex ions in crystals, introduction to silicates. Glasses structure and types, properties. Polymers structure, co-polymers, properties. Ceramics classification, structure and properties. Composites structure and properties.

FENG 218 Internship – Industrial Practice II (Prerequisite: Level 200 standing)

Second year attachment with industry.

CENG 201 C++ Programming (Prerequisite: FENG 112)

Refer to the Computer Engineering curriculum for course details and prerequisites.

Electives (Level 200)

FENG 211 Principles of Management

Nature of Management: Management defined, Management roles (interpersonal, informational, decisional), the management hierarchy (levels of management), management skills (technical, human, and conceptual)

Evolution of Management: Scientific management, administrative management and bureaucracy, the human factor in management, mathematics and management, contemporary theories. The Environment of Management: Internal and external. Management Functions: Planning and decision making, organizing (authority and responsibility, line and staff positions, span of management, departmentalization), directing (motivation, leadership, communication), controlling.

Reference Books and Materials

Stoner, J.A.F., Freeman, R.L. and Gilbert, D.R., *Management*, 6th Ed., Sadde River, Prentice-Hall, 1996.

T. Hellriegel and J. W. Slocum, *Management*, Addition Wesley, 1996

Koontz, Harold and H. Weigrigh, *Management: A Global Perspective*, 10th Ed., McGraw-Hill, 1993

T. S. Bateman and Zeithaml, *Management: Function and Strategy*, Boston, 1993

FENG 214 Introduction to Economics

Introduction to economics, basic terminologies and definitions, the need for engineers to study economics

Micro-economics: The art and science of economics analysis, some tools of economic analysis, the market system (elasticity of demand and supply, consumer choice and demand, cost and production in the firm), market structures, pricing and government regulation. Macro-economics: Aggregate demand and aggregate supply, measuring economic aggregates and the circular flow of income, fiscal and monetary policy, international trade and finance, problems of developing countries

Reference Books and materials

R. H. Frank and B. S. Bernanke, *Principles of Economics*, 2nd Ed., McGraw-Hill, 2004

FENG 216 Sociology

Sociology, its origin and main concerns. Sociology as a Science. Some basic concepts in Sociology, society, culture, norms, institutions, status and roles. Concept of social structure of the Ghanaian society. The land, people and their spatial distribution. The traditional world view. The family, kinship and lineage systems. Traditional religious beliefs and their social functions. The traditional economy: land tenure, modes of production and distribution. Chieftaincy: structure and function. Modes of Socialization: The rites of passage. Health care practices

Reference Books and materials

R. J. Gelles and A. Levine, *Sociology: An Introduction*, 6th Ed., McGraw-Hill, 1999

Core (Level 300)

FENG 300 Technical Report Writing

Preparing an outline. Technical Style. Use of abbreviations. Numbering of Headings. Documentation footnotes and alphabetical list of reference. Table and figures, Bar charts, graphs, curves Organization charts and flow sheets. Drawing. Photographs. Case Study

FENG 302 Internship (Pre-requisites: Level 300 standing)

Third year attachment with industry.

FENG 304 Statistics for Engineers (Prerequisites: *FENG 201, FENG 202, CENG 301*)

Probability functions axioms and rules, counting techniques, conditional probability, independence and mutually exclusive events. Discrete Random Variable: Expectation and variance, Binomial distribution, Hypergeometric distribution, Poisson distribution, relationship between Poisson and Binomial. Continuous Random Variable: Percentiles and cumulative distribution function, expectation and variance, uniform distribution, normal distribution, exponential distribution and other distributions. Joint Distributions.

Covariance and Correlation. Sampling Distributions: Distributions of statistics, central limit theorem, samples from normal distribution (t-distribution, X^2 distribution and F-distributions). Estimation: Common point estimators, interval estimators. Hypothesis Testing. Introduction to Regression Analysis. Engineering applications in quality control, process control, communication systems and speech recognition

Reference Books and materials

W. A. Rosenkrantz, *Introduction to Probability and Statistics for Scientists and Engineers*, McGraw-Hill, 1997
M. H. Degroot, *Probability & statistics*, Addison Wisely Publishing Co. Inc., 1986
A. Leon-Garcia, *Probability and Random Processes for Electrical Engineering*, 2nd Edition, Prentice-Hall, 1994

BIEN 301 Introduction to Biomedical Engineering

Discussion of application of Science and Engineering to problems in Biology and Medicine. Includes design project.

Reference books and materials

Enderle J, Blanchard S, Bronzino J: *Introduction to Biomedical Engineering*, Academic Press, 2000.
Custom courseware

BIEN 302 Human Biology II - Physiology (Pre-requisite: *FENG 116*)

Study of the functions and specific biophysiochemical properties and problems of the organs and systems of the human body. Basic concepts of homeostasis. The cardiovascular, respiratory, musculo-skeletal, digestive, urinary, reproductive and nervous systems. Metabolism, hormones, sensory organs.

Reference books and materials

Guyton AC: *Textbook of Medical Physiology*, 8th Edition. Philadelphia: W. B. Saunders Company, 1991.

BIEN 303 Human Biology I (Pre-requisite: *FENG 116*)

Histology. Basic tissues of the body. Structure, organization and the function of the major systems of the body.

Reference books and materials:

McKenzie JC, Klein RM: *Basic Concepts in Cell Biology and Histology*, New York: McGraw-Hill, 2000.

Alberts B, Bray D, Lewis J, Raff M, Roberts K, Watson J. D: *Molecular Biology of the Cell*, 3rd Ed., New York: Garland Publishing, Inc., 1994.

BIEN 304 Solution and Colloid Chemistry - Electrochemistry (Pre-requisites: *FENG 115, FENG 209* Co-requisite: *BIEN 314*)

Ideal solutions, non-ideal equilibria, electrochemical cells, surface phenomena and colloids, spectroscopy, transport properties in gases and solutions.

Reference books and materials

Castellan, GW, *Physical Chemistry*, 3rd Ed., Addison-Wesley, 1983.
Handbook of Chemistry & Physics, 82nd Ed., CRC Press, 2001/ 2002.
Bockris J O'M, Reddy AKN, *Modern Electrochemistry*, 2nd Ed., Plenum Press, 1998.

BIEN 305 Bioinstrumentation (Pre-requisites: *FENG 105, FENG 106, FENG 207*)

Design of electronic instrumentation for the recording and analysis of physiological signals. Noise and interference. Design and analysis of simple amplifiers and filters for signal conditioning. Applications of digital filters. Electrical safety requirements (extensive circuit and computer design work required).

Reference books and materials:

Webster JG, *Medical Instrumentation: Application and Design*. New York: Wiley, 1992.
Akay M, *Biomedical Signal Processing*, Academic Press, 1994.
Dempster J: *Computer Analysis of Electrophysiological Signals*, Academic Press, 1993.

BIEN 306 Biomedical Engineering Systems (Pre-requisite: *BIEN 303* Co-requisite: *BIEN 302*)

Compartmental modeling. Open loop and closed loop control principles. Stability criteria. Class project in which each student selects and analyses a biological control system.

Reference books and materials

Jacquez JA: *Compartmental Analysis in Biology and Medicine*, 2nd Ed., University of Michigan Press, 1985.
Ackerman E, Gatewood L. C, *Mathematical Models in the Health Sciences: A Computer-Aided Approach*., University of Minnesota Press, 1979.

BIEN 307 Biomaterials (Pre-requisites: *FENG 115, FENG 215*, Co-req.: *BIEN 303, BIEN 311*)

Application of concepts of atomic and molecular structure to understanding the chemical and physical properties of materials. Analysis of both natural and synthetic materials in the biological environment.

Reference books and materials

Park JB: *Biomaterials science and engineering*. New York: Plenum Press, 1987.
Park JB, Lakes RS: *Biomaterials—An Introduction*, 2nd Edition. New York: Plenum Press, 1992.
Scully JC: *The Fundamentals of Corrosion*, 2nd Edition. Oxford: Pergamon Press, 1987.

BIEN 308 Engineering Principles of Human Physiology and Anatomy (Pre-requisite: *BIEN 303* Co-requisites: *BIEN 302, BIEN 314*)

Quantitative aspects of human physiology. Physiological modeling. Applications to clinical and Biomedical Engineering problems will be emphasized.

Reference books and materials

Schneck DJ: *Engineering Principles of Physiologic Function*. New York University Press, 1990.
Deutsch S, Deutsch A: *Understanding the Nervous System—An Engineering Perspective*. IEEE Press, 1993.

BIEN 309 Biomechanics (Pre-requisites: *FENG 111, FENG 114, FENG 205* Co-requisites: *BIEN 303, BIEN 311*)

Application of statics and dynamics to do simple force analyses of the musculoskeletal system. Biomechanics of soft and hard tissues. Microstructure, mechanical and viscoelastic properties. Biomechanics of injury.

Reference books and materials

Fung YC: *Biomechanics: Mechanical Properties of Living Tissues*, 2nd Ed., Springer-Verlag, 1993.
Burstin AH, Wright TM: *Fundamentals of Orthopaedic Biomechanics*. Williams & Wilkins, 1994.
Nordin M, Frankel VH: *Basic Biomechanics of the Musculoskeletal System*, 2nd Ed., Lea & Febiger, 1989.

BIEN 311 Biomedical Engineering Lab. I

First practical course in Biomedical engineering.

Reference books and materials

Lab manual

BIEN 314 Biomedical Engineering Lab. II (Pre-requisite: BIEN 311)

Second practical course in Biomedical engineering.

Reference books and materials

Lab manual

CENG 301 Numerical Methods

Refer to Computer Engineering curriculum for course details and prerequisites.

CENG 316 Signals and Systems

Refer to Computer Engineering curriculum for course details and prerequisites.

Electives (Level 300)**BIEN 313/318 Independent Study**

An individual research project with a faculty supervisor leading to the submission of a project report.

BIEN 315 Local Issues in Biomedical Engineering

Discussion of issues relevant to Ghanaian society including cardiovascular diseases, sickle cell anaemia, joint degeneration, geriatrics, sports injury and biomechanics of the spine.

Reference books and materials

Custom courseware

BIEN 316 Medical Physics (Pre-requisite: *FENG 105*)

Medical radiation engineering. Electromagnetic and particulate radiation and its interaction with matter. The physics of radiation therapy and nuclear medicine.

Reference books and materials

Alpen EC, *Radiation Biophysics*, Prentice Hall, 1990.

Webb S, *The Physics of Medical Imaging*, Bristol: Hilger, 1990.

Zagzebski J. A, *Essentials of Ultrasound Physics*, St. Louis: Mosby, 1996.

AENG 311 Physical and Engineering Properties of Biological Materials

Refer to Agricultural Engineering curriculum for course details and prerequisites.

MSEN 322 Quantum Physics of Materials

Refer to Materials Science and Engineering curriculum for course details and prerequisites.

MSEN 325 Materials Science and the Future

Refer to Materials Science and Engineering curriculum for course details and prerequisites.

CENG 304 Nonlinear Circuits

Refer to the Computer Engineering curriculum for course details and prerequisites.

CENG 305 Linear Circuits

Refer to the Computer Engineering curriculum for course details and prerequisites.

CENG 307 Programming Language Fundamentals

Refer to the Computer Engineering curriculum for course details and prerequisites.

Core (Level 400)**BIEN 400 Design Project** (Pre-requisite: *Level 400 standing*)

An individual design project leading to the submission of a project report or design thesis.

BIEN 402 Tissue Engineering and Biotechnology (Pre-requisites: *BIEN 307, BIEN 407*)

Cell and Molecular Biology, cellular therapies, delivery of cell therapies in a clinical setting. Basic and core techniques of Biotechnology. Medical applications of Biotechnology.

Reference books and materials

Custom Courseware: Recent Journal Articles

Bronzino JD (Ed.), *The Biomedical Engineering Handbook*, CRC Press, 1995.

BIEN 403 Medical Imaging (Pre-requisites: *BIEN 302, BIEN 303*)

Radiation imaging, ultrasound, nuclear magnetic resonance (NMR), magnetic resonance imaging (MRI) and biomedical optical imaging. Principles/fundamentals, instrumentation and imaging devices as well as biological effects will be discussed for all the techniques.

Reference books and materials

Bronzino JD (Ed.), *The Biomedical Engineering Handbook*, CRC Press, 1995.

Alpen E. C, *Radiation Biophysics*, Prentice Hall, 1990.

Cho Z. H, Jones J. P and Singh M, *Foundations of Medical Imaging*, Wiley, 1993.

BIEN 404 Design and Selection of Biomaterials (Pre-requisites: *BIEN 307, BIEN 309*)

Design and selection of engineering materials for the biomedical environment. Principles of fabrication, processing and clinical application. Students will design a specific device.

Reference books and materials

Custom courseware

American Society for Testing and Materials (ASTM), Annual book of Standards—Specifications for various biomaterials [<http://www.astm.org>].

BIEN 405 Transport Processes in Living Systems (Pre-requisite: *BIEN 304*)

Fluid mechanics, energy and mass transport with emphasis on applications to living systems—respiratory, circulatory, renal, etc. Mass, momentum and energy conservation, mass diffusion, convective diffusion.

Reference books and materials

Cooney DO: *Biomedical Engineering Principles: An Introduction to Fluid, Heat and Mass Transport Processes*. New York: Dekker, 1976.

Lightfoot EN: *Transport Phenomena and Living Systems*. New York: Wiley, 1974.

BIEN 406 Design of Mechanical Systems (Pre-requisites: *BIEN 307, BIEN 309*)

Introduction to the design of biomechanical systems. Structural characteristics of bone, muscle, joints and teeth. Design of prostheses for use in orthopaedics and dentistry. Students will design a specific device or system.

Reference books and materials

Dawson T. H, *Engineering Design of the Cardiovascular System of Mammals*, Prentice Hall, 1991.

Welkowitz W, *Engineering Hemodynamics: Application to Cardiac Assist Devices*, 2nd Ed., New York University Press, 1987.

BIEN 407 Cell and Molecular Biology (Pre-requisites: *BIEN 302, BIEN 303*)

Small molecules and macromolecules. Molecular organization of cells: genetic mechanisms, energy conversion, cellular compartments, control of gene expression, signaling, cell growth and division. Multicellular organisms and systems.

Reference books and materials

Alberts B, Bray D, Lewis J, Raff M, Roberts K, Watson JD, *Molecular Biology of the Cell*, 3rd Ed., Garland Publishing, Inc., 1994.

BIEN 408 Professional Development Seminar (Pre-requisite: *Level 400 standing*)

Moral and ethical issues. Rehabilitation engineering and assistive technology: Principles, engineering and ergonomic principles, career opportunities and outlook, role of rehabilitation engineers and assistive technologists, physical and psychological consequences of disability. Clinical engineering and electrical safety: Role of the clinical engineer, future of clinical engineering and career opportunities. Safety in the clinical environment.

Reference books and materials

Abrams N, Buckner MD (Eds.), *Medical Ethics*, MIT Press, 1983.

Bronzino J. D, *Management of Medical Technology*, Butterworth, 1992.

Sanders M. S, McCormick E. J, *Human Factors in Engineering and Design*, 7th Ed., McGraw-Hill, 1993.

BIEN 409 Cardiovascular Mechanics (Pre-requisites: *FENG 208, BIEN 302, BIEN 303, BIEN 309*)

Basic principles of Biofluid mechanics - generation of flow in the cardiovascular system. Flow in elastic vessels. Pulsatile and turbulent flow. Mucociliary and peristaltic flow. Cardiac valve mechanics.

Reference books and materials

Chandran K. B, *Cardiovascular Biomechanics*, New York University Press, 1992.

BIEN 411 Haemodynamics (Pre-requisites: *FENG 208, BIEN 302, BIEN 303*
Co-requisites: *BIEN 409*)

The structure and operation of the mammalian cardiovascular system. Hemodynamics in vascular channels. Blood rheology and non-Newtonian properties. Red blood cell behaviour in capillaries. Air flow and mixing in lungs.

Reference books and materials

Fung Y. C, *Biodynamics: Circulation*, Springer-Verlag, 1984.

FENG 402 Entrepreneurship

Entrepreneurial process. Evaluation opportunities: Analysis of new ventures, valuation techniques, intellectual property issues, product and market research. Legal forms of organizations. Accessing and

acquiring resources of financing. Developing a Business plan. Managing Enterprises. Marketing. Organizational behavior. Exit Strategies.

Electives (Level 400)

BIEN 413/414 Independent Study

An individual research project with a faculty supervisor leading to the submission of a project report.

BIEN 415 Advanced Topics in Physical and Chemical Biomedical Engineering (Co-requisite: BIEN 405)

Advanced topics in physical chemistry including solution and colloid chemistry, electrochemistry, spectroscopy and kinetics applied to biological systems.

Kinetics of homogeneous and heterogeneous reactions in biological environments. Mechanisms and models of transport across membranes. Convective diffusion with and without chemical reaction. Diffusion in restricted areas. Irreversible thermodynamic approaches to transport and reactions in biological systems.

Reference books and materials

Bockris J O' M, Reddy A. K. N, *Modern Electrochemistry*, 2nd Ed., Plenum Press, 1998.

Chang R, *Physical Chemistry with Applications to Biological Systems*, 2nd Ed., Macmillan Publishing Company, 1981.

Bard A. J and Faulkner L. R, *Electrochemical Methods: Fundamentals and Applications*, Wiley & Sons, 2000.

MSEN 403 Composite Design and Fabrication

Refer to Materials Science and Engineering curriculum for course details and prerequisites.

MSEN 407 Bioceramics

Refer to Materials Science and Engineering curriculum for course details and prerequisites.

MSEN 416 Advanced Topics in Bioceramics

Refer to Materials Science and Engineering curriculum for course details and prerequisites.

CENG 415 Software Engineering

Refer to the Computer Engineering curriculum for course details and prerequisites.

CENG 419 Digital Signal Processing

Refer to the Computer Engineering curriculum for course details and prerequisites.

CENG 433 Computer Vision and Robotics

Refer to the Computer Engineering curriculum for course details and prerequisites.

CENG 442 Digital Control Systems

Refer to the Computer Engineering curriculum for course details and prerequisites.

FENG 401 Law for Engineers

Course discussions cover contracts (formation, performance, breach, and termination), corporations and partnerships, insurance, professional liability, risk management, environmental law, torts, property law, evidence and dispute resolution. The course emphasizes those principles necessary to provide engineers with the ability to recognize issues which are likely to arise in the engineering profession and introduces them to the complexities and vagaries of the legal profession.

Graduation Requirements

To graduate from the Department of Biomedical Engineering, a student must satisfy all requirements of the University, Faculty and the Department.

University Requirements

A student shall be deemed to have satisfied the requirements for graduation if:

- (i) She/he has satisfied all the General University requirements.
- (ii) She/he has accumulated the minimum number of credits required by the Faculty, including both core and prescribed elective courses, namely, 144 credits.
- (iii) She/he has not have failed more than a total of 24 credits from the core courses and prescribed electives, provided that the failed grades are not lower than a “D”.
- (iv) She/he has submitted a report originating from a Project Work. The Report must be submitted for assessment before the date of the last paper in the second semester examinations. In default the candidate shall be asked to submit the Report the following semester and shall be treated as a repeat examination with all its implications.

Faculty Requirements

1. Student must pass a minimum of 6 credits out of the following courses : FENG 118 Psychology, FENG 211 Principles of Management, FENG 214, Introduction to Economics, FENG 216, Sociology, FENG 401 Law for Engineers.
2. Student must take and pass FENG 402 Entrepreneurship.
3. Student must have taken at least two out of the three Internship (Industrial practice) programmes one of which must be FENG 302 Internship III (Level 300).

Departmental Requirements

In addition to the University and Faculty requirements, to graduate with a BSc Engineering (Biomedical Engineering) a student must pass the following courses.:

- BIEN 305 Bioinstrumentation (Bioelectric Phenomena, Biomedical Sensors and Biosignal Processing)
- BIEN 306 Biomedical Engineering Systems
- BIEN 307 Biomaterials
- BIEN 308 Engineering Principles of Human Physiology and Anatomy
- BIEN 309 Biomechanics
- BIEN 400 Design Project
- BIEN 402 Tissue Engineering and Biotechnology
- BIEN 405 Transport Processes in Living Systems

COMPUTER ENGINEERING DEPARTMENT

Faculty

G. A. Mills , <i>BSc (E.E. Eng), K'si, MSc, PhD (E.E. Eng), Gunma</i>	- Lecturer/Head of Dept.
I. K. Nti , <i>BSc (Geod. Eng), K'si, MSc (Geom. IT), Karlsruhe</i>	- Lecturer
W. Owusu-Banahene , <i>BSc (Geod. Eng), K'si, MSc (Res. Eng), MSc(Geom. IT), Karlsruhe</i>	- Lecturer
K. Obu-Cann , <i>BSc (E.E. Eng), K'si, MSc, PhD (E.E. Eng), Tottori</i>	- Lecturer/Part-time
K. O. Boateng , <i>BSc (E.E. Eng), K'si, MSc, PhD (E.E. Eng), Ehime</i>	- Snr. Lecturer/Part-time
E. E. Bentil , <i>BSc (Eng. Sci), Harvard, MSc (Eng. Manag), Dartmouth</i>	- Lecturer/Part-time
F. K. Boachie , <i>BSc (E.E. Eng), K'si, MSc (Info. Eng), London</i>	- Lecturer/Part-time
B. Adomako-Owusu , <i>BSc (Comp. Sci), Legon, MSc (Telecom. Eng), Denmark</i>	- Lecturer/Part-time
Mr. Agyare Debra	- Lecturer/Part-Time
Mr. Paul Obeng	- Lecturer/Part-Time

Summary of Courses

Level 100 Courses

Semester I

Core

Course Code	Course Title	Credits
FENG 101	Mathematics I	4
FENG 105	General Physics	3
FENG 117	Engineering Drawing I	3
FENG 109	Introduction to Information Technology I	2
FENG 111	Basic Mechanics I	3
FENG 113	Introduction to Engineering	1
LANG 100	Academic Writing	2
Electives		
FENG 115	General Chemistry	3
Total		21

Semester II

Core

FENG 102	Mathematics II	4
FENG 106	Basic Electronics	3
FENG 126	Applied Electricity	3
FENG 124	Engineering Drawing II	3
FENG 112	Introduction to Information Technology II (C Programming)	2
FENG 114	Basic Mechanics II	2
Electives		
FENG 116	Biology	2
FENG 118	Psychology	2
FENG 122	Internship	1

Level 200 Courses

Semester I

Core

FENG 201	Mathematics III	4
FENG 203	Data Structures and Algorithms	3
FENG 207	Digital Circuits	3
FENG 211	Principles of Management	2
Electives		
FENG 205	Strength of Materials	3
FENG 209	Thermodynamics	3
CENG 201	C++ Programming	3
Total		21

Semester II

Core

FENG 202	Mathematics IV	4
FENG 206	Introduction to Software Engineering	3
CENG 202	Digital Systems Design	3
FENG 212	Engineering Technology	2
FENG 214	Introduction to Economics	3
Electives		
FENG 204	Environmental Science	2
FENG 216	Sociology	3
Total		20

FENG 218	Internship (Industrial Practice II)	1
Level 300 Courses		
Semester I		
Core		
CENG 301	Numerical Methods	3
CENG 315	Discrete Mathematical Structures	
CENG 305	Linear Circuits	3
CENG 307	Programming Language Fundamentals	3
CENG 309	Computer Architecture	3
CENG 311	Computer Communication Networks	2
CENG 313	Operating Systems	3
FENG 300	Technical Report Writing	1
	Total	21
Semester II		
FENG 304	Statistics for Engineers	3
CENG 304	Non-linear Circuits	3
CENG 306	Digital Systems Engineering	3
CENG 308	Microelectronic Circuits	3
CENG 316	Signals and Systems	3
CENG 318	Object Oriented Programming	3
CENG 322	Data Communication Networks	2
FENG 300	Technical Report Writing	1
	Total	21
FENG 302	Internship (Industrial Practice III)	1
Level 400 Courses		
Core		
Semester I		
CENG 400	Independent Project	3
CENG 429	Microprocessor Systems and Integration	3
CENG 407	Communication and Control	3
FENG 401	Law for Engineers	3
CENG 409	Artificial Intelligence	3
CENG 419	Digital Signal Processing	3
Elective (total of 3 credits)		
	Total	21
Electives		
A. Software Systems		
CENG 415	Software Engineering	3
CENG 433	Computer Vision and Robotics	3
B. Communication and Computer Networks		
CENG 435	Computer Network Security	3
CENG 437	Wireless Communications Systems	3
C. Computer Hardware and Integration		
CENG 423	Design of Analog IC Circuits	3
CENG 439	VLSI Design and Systems	3
Semester II		
CENG 400	Independent Project	3
CENG 404	Embedded Systems	3
CENG 442	Digital Control Systems	3

CENG 412	Advanced Computer Architecture	3
CENG 432	Database and Information Management	3
Elective	(total of 3 credits)	3
Total		21
Electives		
FENG 402	Entrepreneurship	3
A. Software Systems		
CENG 414	Computer Graphics	3
CENG 434	Web Software Architecture	3
B. Communication and Computer Networks		
CENG 436	Distributed Computing	3
CENG 438	Multimedia Systems	3
C. Computer Hardware and Integration		
CENG 424	Design of Digital IC Circuits	3
CENG 444	Digital Signal Processing System Implementation	3

Course Description and Prerequisites

Level 100 – Core courses

FENG 101 Mathematics I

Set of Real Numbers, Indices, Logarithms and Surds. Concept of a function of a single variable, graphs of functions. Linear, quadratic and higher degree polynomial functions, Rational functions. Inequalities in one and two variables. Binomial theorem. Circular measure. Trigonometric functions. Exponential and logarithmic functions, function e^x ; hyperbolic functions. Complex numbers and their algebra. Vectors: addition, scalar multiplication, scalar products, vector product. Scalar and vector triple products. Geometrical applications: vector equations of lines and planes. Parametric representation of a curve; the circle and other conic sections.

FENG 102 Mathematics II

Limits and Continuity of a function of a single variable. Differentiation: Rules of differentiation, chain rule and parametric differentiation, differentiation of trigonometric functions and their inverses, exponential and logarithmic functions, higher order derivatives, Leibnitz's rule. Differentiability: Rolle's Theorem, mean-value theorem, approximate methods of solving equations (graphical and Newton-Raphson methods). Integration and its applications: Area under curve, volumes of solids of revolution. Numerical integration: Trapezium and Simpson's rules. Vector function of a single variable: Differentiation and integration of vector functions, kinematics of a single particle in motion. Newton's laws of motion, motion in a straight line and in a plane, projectiles and circular motion, work, energy and power; impulse and momentum, moment of a force, couple, conditions for equilibrium of rigid bodies

FENG 105 General Physics

Vibrations: Simple harmonic motion, damped harmonic motion, forced harmonic motion. Waves: Wave types, wave phenomena – interference and diffraction. Electricity and Magnetism: Coulomb's law, electric field, Gauss's law, electric potential, current electricity – EMF, Kirchhoff's laws, DC circuits, Magnetic field: Bio-Savart's law, Ampere's law. Induction: Faraday and Lenz's law, AC circuits. Introductory Modern Physics: Bohr's atom, quantum theory of atom, electronic transitions, optical spectrum, X-rays, photo-electric effect, motion of charges in electric and magnetic fields

FENG 106 Basic Electronics

History of electronics from vacuum tubes to large scale integration, classification of electronic signals

(digital, analog, role of A/D and D/A converters), electronic components, symbols and identification. Semiconductivity. Diodes and Diode Circuits: diode characteristics, model, and behavior in relation to circuits and analysis. Field-Effect Transistors and Circuits: MOSFET characteristics and model, biasing techniques, circuit symbol, analog MOSFET amplifier. Bipolar Junction Transistors (BJT): Physical structure of the BJT, circuit representation, transistor biasing, and transistor ratings. Fundamentals of Digital Electronics: Ideal logic gates, logic level definition and dynamic response of logic gates, logic gates examples. Signal Amplifiers: Concept of amplification, operational amplifier and its application as a filter, the BJT and MOSFET transistor as amplifiers, small signal behavior of the transistor. Basic Analog and Digital circuit elements, frequency response, signal generator, filters and waveform shaping circuits.

FENG 109 Introduction to Information Technology I

Introduction to computers and digital technology and culture. The role of computers in IT, issues of computers and crime, computers and work, general issues on the impact and control of computers. Structure and use of the Internet and applications in e-business, e-learning, e-governance, e-health. The basic foundations and functions of computer hardware and software. Introduction to common engineering application software. Spreadsheet for engineers. Introduction to MATLAB and its applications to engineering problem solving.

FENG 111 Basic Mechanics I

General principles of mechanics, methods of problem solution, and numerical accuracy. Force vectors and mathematical operations. Static Particles: Coplanar force on a particle, resultant of forces, resolution of forces, conditions for the equilibrium of a particle, Newton's first law, free-body diagram, forces in space. Force System Resultants. Statics of a rigid body and conditions for equilibrium. Centroids and centers of gravity

FENG 112 Introduction to Information Technology II – C Programming

History of the C language. Structure of the C Program. Variables Declarations: Global variables, type and range of variables, declaration of variables, scope of variables, reading and printing of variables. Constants Declarations. The C Operators: Arithmetic, Relational, Logical, and order of operation precedence. Conditional Instructions. Looping and Iterations. Arrays and Strings: Single and multi-dimensional. Functions: VOID function, Functions and Arrays, Function prototyping. Data Types: Unions, type casting, enumerated types, static variables. Pointers: pointers and variable, pointers and functions, pointers and arrays, arrays of pointers, multi-dimensional arrays and pointers, static initialization of pointer arrays, pointers and structures, common pointer pitfalls. Dynamic Memory Allocation and Dynamic Structures: MALLOC and SIZEOF and FREE, CALLOC and REALLOC, Linked Lists, sample full C program

FENG 113 Introduction to Engineering

History of engineering and technology, contemporary applications, and future directions of engineering. Professional development. Ghana Institution of Engineers and its role in engineering developments in Ghana. Various engineering disciplines and developmental trends

FENG 114 Basic Mechanics II

Branches of dynamics. Rectilinear Motion of Particles: Displacement, velocity, acceleration, uniformly accelerated motion, relative motion, dependent motions, and graphical methods. Curvilinear Motion of Particles: Displacement, velocity, acceleration, rectangular components, tangential and normal components. Kinetics of Particles: Newton's second law of motion, equations of motion. Work, Energy, Power and Efficiency: Work done by a force, springs, kinetic and potential energy, conservation of energy, principle of work and energy, power, efficiency. Impulse and Momentum: Impulse, linear and angular momentum, conservation of momentum, system of particles. Kinematics of Rigid Bodies. Introduction to Vibration: Undamped free vibration, undamped forced vibration, rotational vibration, energy method, damped free vibration, damped force vibration, electric analogue

FENG 117 Engineering Drawing I

Introduction to the history of drawing, drawing instruments, scales and lettering, drawing lines. Orthographic Projections: Points, lines and planes. Projections of points, lines and figures on planes. Intersections of lines and with figures. Intersections of lines with solids. Intersections of figures with planes. Determination of true lengths of line segments and angles of inclination of a line to the plane of projections through projections on planes, rotation of rabatment, projections of planes; Interpenetration of figures and solids. Developments: Surfaces, prisms, right pyramids, cylinders, cones. Isometric Drawings. Introduction to AutoCAD.

FENG 122 Internship First year attachment with industry.

FENG 124 Engineering Drawing II

Dimensioning: Lines and symbols, rules for dimensioning, dimensioning methods, dimensioning standard features, limits and tolerances, fit and allowances, notes and specification, surface texture. Sections and Conventions: Types of sections, section lining, conventional practices, conventional breaks. Working Drawings: Detail drawings, assembly drawings, part lists. Screw Threads and Fasteners: Thread representation, threaded assemblies, fasteners, keys, rivets. Applications of AutoCAD in engineering drawings.

FENG 126 Applied Electricity

Foundations of electricity: voltage, current, resistance; DC and AC signal representations, magnitude and phase components; Applications of AC and DC systems. Basics of Series and Parallel arrangements of circuits. Electricity Generation: Generation sources, Power generation process, transmission and distribution in Ghana. Conductors and Insulators: Power transmission and distribution conductors, sizes, choice of conductor sizes, fuses, insulator break-down. Transformers: principle of operation, transformer types and ratings, considerations for transformer selection. AC Circuits: Single and three-phase systems, voltage levels, and frequencies used in Ghana. Power Factor and its effect and correction, power in resistive and reactive AC circuits, active power, reactive power, and apparent power. Motors and Controls: Principles of operation of motors, control techniques for motors, motor types and applications. Electrical Safety: Importance of electrical safety, shock current, safe practices, common sources of hazards, safe circuit design and safe meter usage.

LANG 111 Academic Writing

Introduction to the quality use of language. Strategies for paragraph development. Study reading. Gathering and using information from Library and other sources. Integration of Information into essays. General style of writing.

Level 100 – Elective courses**FENG 115 General Chemistry**

Atomic Structure: The Schrödinger equation, quantum numbers, solution to the Schrödinger equation for one electron atom. Hund's Rule, Pauli's and Aufbau principles. Periodic properties of elements: Overview of general features of S-block, P-block and D-block elements. Thermochemistry: Heat and energy, heat of formation, Hess Law, estimation of bond energies. Acids and Bases: pH, strengths of acids and bases, buffers, salts, electrolytic solutions solubility and solubility products concept. Oxidation: Reduction reactions, standard electrode potential, electrochemical cell, concentration dependence of electrode potential, electrochemical series, corrosion, prevention of corrosion, electrolysis, and Faraday's laws

FENG 116 Biology

Molecular basis of cellular structure and functions (prokaryotic, eukaryotic). Bioelements. Biomolecules: carbohydrates, amino acids, lipids, nucleotides and nucleic acids (DNA, RNA), Chromosome structure, introduction to basic genetics, genes, gene action. Protein synthesis, gene splicing, genetic engineering. Brief coverage of major groups of (plant and animal) kingdoms and

their characteristics (morphological, anatomical). Brief coverage of animal body organization and plant body organization. Animal locomotory adaptations: the skeleton and muscles, locomotion in unicellular animals, snakes, mechanisms of bird flight, walking and running and locomotion in water. The construction and use of biological laboratory and field equipment: microscope, centrifuge, incubator, microtome, kymograph, insect traps, vertebrate traps (fishes, reptiles, birds, mammals), radio-tracking equipment, thermometers, thermohygrographs, etc.

FENG 118 Psychology

Introduction: What is Psychology, Brief history of psychology, goals of psychology, psychology and science, para-psychology and pseudo-psychology. Fields of Psychology: Basic, research, and applied psychology. Psychology and Environment: Psychological environment, physical/built environment, noise, crowding, etc Psychology and Industry: Motivation, man-machine systems, work and safety. Relevance of psychology to engineering. Attitude, perception, and engineering

Level 200 – Core courses

FENG 201 Mathematics III

Vector spaces and Subspaces: Linear independence and dependence of vectors, Basis and dimension, linear transformations and matrices, determinants, application to the solution of systems of linear equations

Eigenvalues and Eigenvectors. Sequences and Series: Evaluating limits of sequences, tests of convergence of finite series, power series; radius and interval of convergence, Maclaurin and Taylor series.

Improper integrals: Convergence, Gamma and Beta functions, Lagrange polynomials, finite differences, and least square approximation

FENG 202 Mathematics IV

Functions of Several Variables: Limits and continuity, partial differentiation, critical points and their classifications, increments and differentials, implicit differentiation, the chain rule, directional derivatives

Differential operators: The gradient, the divergence and the curl operators, line integrals, multiple integrals, integration of vector functions, Green's theorem, divergence and Stoke's theorem.

Differential Equations: First and Second order ordinary differential equations, series solutions, system of ordinary differential equations. Initial-value problems: Laplace transforms, partial differential equations, boundary-value problems, applications to strings and membranes, Fourier series and transforms

FENG 203 Data Structures and Algorithms (Prerequisite: FENG 112)

Background of data structures and algorithms, the need for data structures and algorithm, problems of engineering computational efficiency in programs, speed and memory trade-offs. Concepts of recursion, recursive descent parsers, back tracking method, some examples of simulations. Introduction to graphs, sorting, searching, and graph traversal. Graphs: Concepts of graphing, transitive closure, maximum flow, minimum distance, graph traversal, PERT diagrams, and spanning trees. Searching: Foundations of searching, sequential, binary, tree and hashing, balanced trees, B-trees. Sorting: Concepts of sorting, exchange, selection, tree, insertion, and merger. Trees: Concepts of trees, Huffman coding and other applications. Data Structures: Introduction to the concepts of stacks, hash tables, queues, and de-queues, abstract data types, implementation, arrays, pointers, linked lists, applications and implementations of some fundamental data structures. Memory allocation. Operations of Algorithms on data structures

FENG 206 Introduction to Software Engineering

Basic process of creating software systems such as requirement specifications, design, development, implementation, testing, maintenance, and software life cycle. Planning: Cost of development, constructive cost models, development time and cost models. Management: Organization and management of teams, staffing, directing, and controlling, program and project documentation,

documentation of software products.

Analysis and Design. Software Development. Design of User Interfaces. Software Metrics. Program Performance. Testing and Evaluation. Software Tools: Programming environments, program complexity, quality analysis tools, tracing tools, proliferers, debuggers, source code repository, test harnesses. Legal and Economic aspects of software production.

FENG 207 Digital Circuits (Prerequisite: *FENG 106*)

Concepts of Data Representation: Number systems, data organization, hexadecimal number systems, signed and unsigned numbers, ASCII character set. Arithmetic and Logical Operations on binary numbers, bits and strings. Boolean algebra. Combinational Logic: Introduction to Truth Tables, logic gates and networks, relations between electronic circuits and Boolean function, timing diagrams, signal race, half and full adders, subtractors, BCD adder and subtractors. Logic Circuits: Operation of transistors as simple switches, the NMOS logic gates, the CMOS and TTL logic gates, programmable logic devices (PLD), Karnaugh Map and concept of minimization. Multiplexer Circuits: Multiplexers and switching algebra operations, combinational circuit analysis and synthesis, combinational circuit minimization, timing hazards. Decoder and Encoder Circuits: Decoder circuits and operations, Encoder circuits and operations, code converters. Basic circuits for Latches, Clocked and Unclocked Flip-Flops (RS, D and JK). Data registers, shift registers, synchronous and asynchronous counters, divide-by-N counters, clocking considerations

FENG 211 Principles of Management

Nature of Management: Management defined, Management roles (interpersonal, informational, decisional), the management hierarchy (levels of management), management skills (technical, human, and conceptual)

Evolution of Management: Scientific management, administrative management and bureaucracy, the human factor in management, mathematics and management, contemporary theories. The Environment of Management: Internal and external. Management Functions: Planning and decision making, organizing (authority and responsibility, line and staff positions, span of management, departmentalization), directing (motivation, leadership, communication, etc), controlling.

FENG 212 Engineering Technology

Introduction to industrial safety, hygiene, and metrology. Standard systems and uses of conventional measuring instruments. Industrial Tour: Familiarization tour of mechanical engineering laboratories, equipment identification in the laboratories. Electrical wiring systems: Domestic and industrial set ups. Civil Works: Foundations, cement/sandstone mixes, steel reinforcement, concrete foundations and columns. Surveying: Land surveying, parallelism, use of theodolite for machine installation, Bench work: filling, making out tool grinding; Machine tools; drilling and shaping

FENG 214 Introduction to Economics

Introduction to economics, basic terminologies and definitions, the need for engineers to study economics

Micro-economics: The art and science of economics analysis, some tools of economic analysis, the market system (elasticity of demand and supply, consumer choice and demand, cost and production in the firm), market structures, pricing and government regulation. Macro-economics: Aggregate demand and aggregate supply, measuring economic aggregates and the circular flow of income, fiscal and monetary policy, international trade and finance, problems of developing countries

FENG 218 Internship (Prerequisite: *Level 200 standing*)

Second year attachment with industry.

CENG 201 C++ Programming (Prerequisite: *FENG 112*)

History of C++, ANSI C++, C++ programming environment and programming style. Extensions of C to C++. Creating of Files and Streams in C++, connecting and disconnecting. Arrays as parameter functions, sorting arrays, 2-dimensional arrays, dynamic arrays, automatic and dynamic variables, linked lists. Declaration of Pointers and Addresses and their usage. Functions and Procedural

Abstractions: User-defined functions, value and reference parameters, functions using value parameters, reference parameters, procedural abstraction and good programming style, splitting programs into different files. Basic concepts of recursion, mechanics of a recursive call, recursion and iteration, recursive data structures, recursive procedure for sorting. C++ extensions to Object-Oriented Programming: Creating basic classes and objects, constructors and destructors, inheritance, construction, destruction, and multiple inheritances. Polymorphism. Abstract Classes. Operator Overloading. A case study: Generic types (templates), shape and traversal, properties of singly linked lists, shape implementation, Iterator implementation and example usage

CENG 202 Digital Systems Design (*Prerequisite: FENG 106, FENG 112, FENG 207*)

Introduction to the VHDL tools for digital circuit design: assignment statements, selected signal assignment, conditional signal assignment, statement generation, concurrent and sequential assignment statement, process statement, case statement, the VHDL operator. Basic principles of digital circuits design: definition of a state diagram, state table, state assignment, derivation of next-state, output expressions, timing diagrams, generation of VHDL code, and synthesis of VHDL code, simulation and testing of the circuits. Physical design and its relation to logic synthesis. Design process of Synchronous Sequential Circuits: Block diagram development, design of combinational circuit, flip-flop selection, timing synchronization, design with CAD, synthesis of VHDL code, simulation and testing of the circuits. Design process of Asynchronous Sequential Circuits: Asynchronous behavior, analysis of asynchronous circuits, synthesis of asynchronous circuits, state reduction and assignment, hazards. System design using timing constraints. Testing of Logic circuits. Design Reuse

Level 200 – Elective courses

FENG 204 Environmental Science

Human and Nature. Introductory ecology. Electromagnetic/Spectrum. Ozone and Global warming
Natural resources. Population. Concept of Environmental pollution: Noise, air, land and water pollution
Impact of Engineering Projects on the Environment, and control measures; Environmental Laws and regulations in Ghana

FENG 205 Strength of Materials

Introduction: Basic concepts of material bonding, material structure and material defects
Properties of Materials: Mechanical properties, thermal properties, electronic and ionic conductivity of materials, dielectric and magnetic properties of materials. Simple stress and strain within elastic limit and thermal stress. Tensile bending and shear bending of beams. Torsion of circular shafts. Torsional stress and strain. Strength of solid and hollow shafts. Theories of failure. Compound stress-strain system (Mohr's stress and strain circles). Torsion of circular shafts Torsional stress and strain. Fatigue failure and Struts. Beams of small radius of curvature. Springs (helical, spiral and flat), Strain energy method (Castigliano's theorem). Bending under plastic conditions. Torsion under plastic conditions. Thin walled pressure vessels. Composite shafts

FENG 209 Thermodynamics

Fundamental concepts of thermodynamics. First and second Laws of Thermodynamics. Properties of Substances: Properties of pure, simple and compressible substances. Introduction to Gas and Vapor Power Cycles

FENG 216 Sociology

Sociology, its origin and main concerns. Sociology as a Science. Some basic concepts in Sociology, society, culture, norms, institutions, status and roles. Concept of social structure of the Ghanaian society. The land, people and their spatial distribution. The traditional world view. The family, kinship and lineage systems. Traditional religious beliefs and their social functions. The traditional economy: land tenure, modes of production and distribution. Chieftaincy: structure and function.

Modes of Socialization: The rites of passage. Health care practices

Level 300 – Core courses

FENG 300 Technical Report Writing

Preparing an outline. Technical Style. Use of abbreviations. Numbering of Headings. Documentation footnotes and alphabetical list of reference. Table and figures, Bar charts, graphs, curves. Organization charts and flow sheets. Drawing. Photographs. Case Study

FENG 302 Internship (Prerequisite: *Level 300 standing*)

Third year attachment with industry.

FENG 304 Statistics for Engineers (Prerequisite: *FENG 201, FENG 202, CENG 301*)

Probability functions axioms and rules, counting techniques, conditional probability, independence and mutually exclusive events. Discrete Random Variable: Expectation and variance, Binomial distribution, Hypergeometric distribution, Poisson distribution, relationship between Poisson and Binomial. Continuous Random Variable: Percentiles and cumulative distribution function, expectation and variance, uniform distribution, normal distribution, exponential distribution and other distributions. Joint Distributions.

Covariance and Correlation. Sampling Distributions: Distributions of statistics, central limit theorem, samples from normal distribution (t-distribution, X^2 distribution and F-distributions). Estimation: Common point estimators, interval estimators. Hypothesis Testing. Introduction to Regression Analysis. Engineering applications in quality control, process control, communication systems and speech recognition

CENG 301 Numerical Methods (Prerequisite: *FENG 101, FENG 112, FENG 201*)

Matrices and Vector operations, linear homogenous systems, Eigen-vectors and values. Numerical errors, absolute and relative errors, stability and convergence of numerical algorithms. Interpolation Methods: Lagrange polynomials, finite differences, least square approximation. Numerical solutions to Nonlinear Equations: Newton Raphson method, secant, false position, bisection, fixed point algorithm. Numerical Integration: Simpson's rule, trapezoidal rule, Newton-Cotes method. Numerical solutions to Ordinary Differential Equations: Taylor series method, Euler method, Runge-Kutta method. Numerical solutions to Partial Differential Equations: Second order quasi-linear equations, numerical solutions

CENG 304 Nonlinear Circuits (Prerequisite: *FENG 106, FENG 207, CENG 305*)

Introduction to diodes operation, large diode signal models, analysis of circuits with single and multiple diodes, full wave rectifiers, and smoothing with capacitors, DC and AC small signal equivalent circuit.

BJT Transistor and Circuits. MOS Logic Circuits: Digital circuit abstraction, operation and analysis of diode logic gates, inverters, MOS logic gates, delay and power delay calculation, concepts of ADC and DAC. Computer modeling of electronic components using SPICE. Operational Amplifier for signal processing, feedback, inverting and non-inverting, differentiator and integrator circuits, analog computation and concepts of analog neural networks. Filter Circuits and synthesis. CMOS Amplifiers. Signal processing circuits.

Energy processing circuits for linear regulator and switched power supplies.

CENG 305 Linear Circuits (Prerequisites: *FENG 201, FENG 202*)

Electric circuit elements and their relationships, Ohm's Law, Kirchhoff's current and voltage Laws, series and parallel circuits connections of circuit and analysis, voltage and current divider circuits. Loop and mesh circuit analysis methods. Network theorems: Superposition, Thevenin, and Norton. Operational Amplifier Circuit analyses. First order RL and RC circuits, circuit response with source free input, time delay and time constant, DC response, low pass and high pass response filters,

switching in RC and RL circuits. Second order RLC linear circuits, characteristic equation of RLC network, source-free and constant input response. Sinusoidal steady state analysis of circuits, steady state analysis using phasors. Introduction to linear system transform analysis techniques such as Laplace, Fourier, and z-transforms.

CENG 306 Digital Systems Engineering (Prerequisite: *FENG 106, FENG 207*
Co-requisite: *CENG 316*)

Introduction to digital system engineering problems and advances in digital systems. Wires: Electrical properties and transmission lines, lumped and distributed models of lines, lossy and lossless lines, and buses. Noise sources in digital systems, noise budget, crosstalk and inter-symbol interference. Signaling and signaling problems. References, isolation of supply noise from references, differential and pseudo-differential signaling, signaling over lumped media, low-voltage signaling, SRAM example, pulsed signaling, dealing with lead inductance, rise-time control and current shaping, signaling over lossy lines: on-chip RC lines, typical response, repeaters, overdriving. Timing. Clock distribution and clock distribution problems in on-chip and off-chip. Synchronization and synchronization problems. Synchronizer Design. Asynchronous Design. On-Chip and Off-Chip Power Design and Power distribution problems.

CENG 307 Programming Language Fundamental (Prerequisite: *FENG 112*)

Evolution of programming language from FORTRAN to modern languages such as Java, challenges and techniques involved in designing programming languages. Syntax and Semantics of programming languages. Sequence control of expressions and statement executions in programming languages. Data control and type checking. Run-time storage management. Introduction to other programming paradigms features and application. Assembly language programming and interfacing to higher-level languages: translation of high level language control structures into assembly code, assembly style loop structures, linear and non-linear table lookup techniques, loop control examples, subroutine parameter passing techniques, macros, conditional assembly, structured programming techniques.

CENG 308 Microelectronic Circuits (Prerequisite: *FENG 207, CENG 305*)

Introduction: microelectronics evolution, fabrication technologies, application devices, technological trends. Digital Electronics: ideal logic gates, logic levels, noise margin, response of logic gates, diode logic. Digital Circuits: CMOS inverters, rise and fall times, DC analysis of inverter, power dissipation, noise margin, CMOS NOR and NAND gates. Transmission Gates: NMOS and CMOS transmission gates and pass gates. Logic Circuits: Adders, multiplexers, and de-multiplexers. Memory Circuits: classification of memories, memory architecture, address decoders, RAM memory cells – SRAM cells, read/write circuitry, DRAM cells, ROM memory cells – ROM and PROM, EPROM and EEPROM. Single Stage Transistor Amplifiers: Common source amplifier, common gate amplifier, and source follower amplifier stages, amplifier characteristics using two-port equivalent circuits, current and voltage gains, input and output impedances, IC biasing schemes, feedback for bias stabilization. Multiple Stage Frequency Amplifiers: Differential amplifiers, Darlington pair and cascade amplifiers, trans-conductance amplifiers, trans-resistance amplifiers, voltage and current amplifiers, voltage and current buffers, methods of amplifier stage coupling.

CENG 309 Computer Architecture (Prerequisite: *FENG 112, FENG 207*)

The Pentium computer system structure and the major components of the computer hardware. Performance and evaluation of a computer system. Introduction to Instruction Set Architecture and issues with design, evaluation of the ISA for IBM 370 series, Intel 80 x 86, Pentium, and MMX. Description of MIPS ISA. ALU Design. Datapath Design and Control of single cycle and multiple cycle implementation. Pipelining and Control: basics of pipelining, pipelined MIPS datapath, pipeline hazards, performance evaluation, advanced techniques. Memory hierarchy systems and design. Input and Output devices and systems. Multiprocessor systems models and interconnection techniques.

CENG 311 Computer Communication Networks (Prerequisite: *FENG 109*)

History of networks, networks architecture, networking software and hardware. Data transmission principles. Networking Infrastructure: Routers, name servers, gateways and switching. Layering in

Networks. LAN and WAN Architecture Systems: Ethernet, FDDI, Token ring, ATM, Wireless network. Internetwork and Transport Protocol: Introduction to IPv4, IPv6, TCP, UDP and STMP, connection establishment, client-server interaction, congestion control, flow control. Internetworking: Global internet structure, naming conventions, IP addressing systems, IP assignment and configuration, network monitoring and traffic flow. Domain Name Systems (DNS). World Wide Web (WWW), Hypertext Transfer Protocol (HTTP), File Transfer Protocol (FTP).

CENG 313 Operating Systems (Prerequisite: *FENG 112*, Co-req: *CENG 305*, *CENG 307*)

Evolution of the modern operating system, services and characteristics of good operating systems. Structure of the Operating System – process manager, memory manager, device manager, file manager, and the kernel functions. Operating System Processes. Concurrent Programming. Storage Space Management and Allocation. File Management. Hardware Support Systems. Security and Protection.

CENG 315 Discrete Mathematical Structures (Prerequisite: *FENG 102*, *FENG 203*)

Foundations of logic, propositional logic, logical connectives, truth table, normal forms, validity, predicate logic and limitations, universal and existential quantifications. Proof Techniques: notion of implication, contradiction, structure of formal proofs, direct proofs, proof by counter example, proof by contraposition and contradiction, and mathematical induction. Recursion and Recurrence Relations: Concepts of recursion and recurrence, derivation of recurrence equations, initial condition, first order linear recurrence, constant coefficient recurrence, solution to a first order constant coefficient linear recurrence, iterating a recurrence. Relations, Functions and Sets. Introduction to Graph Theory. Permutations and Combinations: Counting arguments, combinational involving repetition, modeling combinational problems with recurrence relation, inclusion-exclusion principle, recurrence relations, generating functions

CENG 316 Signals and Systems (Prerequisites: *FENG 201*, *FENG 202*, *CENG 301*)

Introduction to difference equation representation and modeling of linear systems. Circuit analysis using complex notations, amplitude and phase data derivation. Signal representation. Time and frequency domain response of signals. Bode plot representation and conditions for Nyquist criterion. Sampling of continuous time signals and reconstruction, aliasing and spectral distribution of samples. Discrete time systems, Fourier series representation of discrete-time and continuous-time signals, Fast Fourier Transform (FFT) and spectral estimation.

CENG 318 Object Oriented Programming (Prerequisite: *FENG 203*, *CENG 201*)

Programming techniques in unstructured, procedural and modular programming, modular programming problems and strategies. Object-Oriented program development environment tools. Object-Oriented Structure and Development: classes, inheritance, encapsulation, polymorphism, class derivation, abstract classes, interfaces, static class members, object construction and destruction, namespaces, exception handling, function overloading and overriding, function name overload resolution, container classes, template classes, multiple threads and synchronization. Applications in artificial intelligence, database, and software design.

CENG 322 Data Communication Networks (Prerequisite: *CENG 311*)

Classification of communication networks, transmission of information, digital transmission. Switching in networks. Fundamentals of queuing theory. Data Routing: Intra and inter domain routing in networks. Routing Algorithms - centralized routing algorithms, distributed routing algorithms. Data Link Layer. Transport Layer. Application Layer. Data Networks Design: LAN and WAN Networks. Network Management. High-Speed Data Networks. Real-Time Traffic over Internet. Network Security. Electronic Commerce over Networks.

Level 400 – Core courses

CENG 400 Independent Project (Prerequisite: *Level 400 standing*)

Students work independently on original project under the direction of an approved advisor, make an oral presentation at annual conference, submit thesis.

CENG 404 Embedded Systems (Prerequisites: *CENG 202, CENG 307, CENG 313*)

Introduction to Embedded system and issues in system design using microcontrollers. Design concepts and evaluation of performance. Microcontroller architecture. Interfacing: CPU interfacing, memory interfacing, serial and parallel I/O interfacing, analog and digital interfacing. Safety and Reliability. Communication. Interrupt synchronization. Wireless networking. Embedded Operating System and micro-kernels for real-time applications. Real-time scheduling. Power management. Distributed algorithms. Case study with consumer electronics, sensor networks, etc

CENG 407 Communication and Control (Prerequisites: *CENG 308, CENG 316*)

Introduction to signals and noise, signal transmission and control systems. Communication Systems: coding, signal formatting for base band systems, modulation and demodulation, signal-to-noise ratio, error probability, channel and channel capacity, TDM and FDM techniques for signal multiplexing. Control Systems: Control principle, feed-back and feed-forward, control strategy, transient response, steady-state response, system types, PID controllers, tuning, gain and phase margin, system stability, rules for stability, introduction to controller design.

CENG 409 Artificial Intelligence (Prerequisites: *FENG 112, FENG 206, CENG 307*)

Introduction to artificial intelligence, design considerations, challenges and issues in artificial intelligence system design. Introduction to LISP programming. Blind and heuristic search concepts and techniques. Game playing and constraint propagation. Machine learning for classification and pattern recognition. Knowledge representation. Logical Reasoning systems. Uncertainty and Planning. Natural Language Processing. Vision: vision level and segmentation, constraint propagation and matching.

CENG 412 Advanced Computer Architecture (Prerequisites: *CENG 309, CENG 313*)

Performance and Cost: CPU performance benchmark, CPI analysis, analysis and cost of computer system. Instruction Set Architecture (ISA) Design: Stack accumulator, general register ISA, CISC and RISC ISA design, DSP ISA. Basic Pipelining. Advanced Pipelining: Instruction-Level Parallelism (ILP), compiling for ILP, dynamic branch prediction, superscalar pipelines, dynamic scheduling. VLIW Architecture: Memory hierarchies, basic caches, memory hierarchy performance, improving time, miss time and penalty, memory interleaving, bandwidth improvement, and virtual memory support. I/O Subsystems. Parallel Architectures. Message Passing Architectures. Shared memory Architectures. Cache Coherence. Synchronization. Convergence Architectures. Introduction to Parallel programming

CENG 419 Digital Signal Processing (Prerequisites: *CENG 301, CENG 316*)

Introduction to signals and properties. Discrete time signals and systems, z-transformation of discrete time systems, signal sampling and quantization. Transfer functions and frequency response of discrete time systems. Digital Filter Design: FIR filter design by windowing and frequency-sampling methods. IIR Filter Design based on Continuous time systems. 2-D DFT Processes. Applications in speech processing: Speech model and characteristics, short-time Fourier analysis and synthesis, linear predictive coding. Applications in Image processing: 2-D signals and systems, image coding, image enhancement, computed tomography.

CENG 429 Microprocessor Systems and Integration (Prerequisites: *CENG 202, CENG 307, CENG 308, CENG 309*)

Introduction: what microprocessors are and how they work, evolution of microprocessors, applications of microprocessors. Computer Arithmetic: binary, octal and hexadecimal conversion, bit

operations of addition, subtraction, division, rotation, shifting. Microprocessor Instruction Set Design. Assembly Language Programming. Microprocessor Architecture: Intel 8086 and family, operation modes, register structure, real and protected modes memory addressing, data addressing modes, program and stack memory addressing modes, instruction encoding. Intel 8086 Hardware: general specification, typical hardware structure, pin-out functionalities, clock generator, bus and latching, bus timing. Memory Interface: memory structure, memory cell types and their characteristics, memory design, address decoding, memory interface to data bus for 8 bits to 64 bits, error detection and correction. I/O System: basic I/O interface and system performance, serial and parallel interfacing, synchronous and asynchronous data transfer, I/O and CPU interface, I/O address decoding, I/O connection to CPU, and typical I/O interface. Interfacing Software: software development process and synchronization. Microcontroller system design case study with Motorola 68HC12 or Texas Instruments TMS320-series.

CENG 432 Database and Information Management (Prerequisites: *FENG 112, FENG 203, FENG 206*)

History of database and management systems, database access methods, security and current programs and applications. Database Design: Data models, relational model, relational algebra, SQL, relational management systems, theory of normal forms and database design, physical organization. Query Language: Language paradigms and database languages, user interfaces and graphical query languages, query optimization, data dictionary. Implementation of relational database kernel. Concurrency and security. Distributed database systems. Case study of commercial database languages and systems.

CENG 442 Digital Control Systems (Prerequisites: *CENG 316, CENG 407*)

Modeling and analysis of control systems, controller designs and design problems. Introduction to computers in Control systems. State representation in Control system. Signal sampling, quantization, reconstruction, and error effects in control systems. Open-loop systems. Closed-loop systems. System time response characteristics. Stability analysis techniques. Digital controller design. Pole assignment Design and State

Level 400 – Elective courses

FENG 401 Law for Engineers

Course discussions cover contracts (formation, performance, breach, and termination), corporations and partnerships, insurance, professional liability, risk management, environmental law, torts, property law, evidence and dispute resolution. The course emphasizes those principles necessary to provide engineers with the ability to recognize issues which are likely to arise in the engineering profession and introduces them to the complexities and vagaries of the legal profession.

FENG 402 Entrepreneurship

Entrepreneurial process. Evaluation opportunities: Analysis of new ventures, valuation techniques, intellectual property issues, product and market research. Legal forms of organizations. Accessing and acquiring resources of financing. Developing a Business plan. Managing Enterprises. Marketing. Organizational behavior. Exit Strategies.

CENG 414 Computer Graphics (Prerequisites: *CENG 201, CENG 318*)

Fundamentals of display techniques and graphics systems. Display devices, processors, software, introduction to Graphical Kernel System, Programmer's Hierarchical Interactive Graphics System. Representation of primitive objects. Representation of composite objects. Two-and three-dimensional transformations. Polygon mesh, spline surfaces, super-quadratics, fractal geometry, octrees, visualization of three-dimensional data sets, geometric transformations. Parallel and perspective projections, three-dimensional view volumes. Depth-buffer, scan-line, depth sorting, area subdivision, octree, and ray-casting methods. Hidden lines and surfaces. Shading and coloring. Interactive graphics and the user interface. Structure of graphics packages 2-dimensional viewing, structures and segments, hierarchical model, graphical user interfaces, interactive input methods. Animation

techniques. Color models.

CENG 415 Software Engineering (Prerequisites: *FENG 206, CENG 318*)

Introduction to software development principles, requirements, process, specification, design, implementation, testing, and maintenance. Role of System Analyst. Requirement Analysis. Process Models. Data Flow Models. Data Dictionaries. Properties of various normal form. Process logic description. Object-Oriented Analysis and Design and the roles of inheritance and polymorphism, class design, UML. Description of various types of case tools and programming workbenches, using a particular case tool. Introduction to Project Management: Project scope and boundaries, metrics, estimation, risk analysis, tracking, version control, managing resources (time, code and documentation, standards, source code). Case study involving use of the above techniques with appropriate case tools

CENG 422 VLSI Designs and Systems (Prerequisites: *FENG 202, CENG 207, CENG 304*)

Behavioral models and circuit simulation of digital systems. Design methodology. VHDL and Synthesis. Switches and Layouts: Switched base design, complex gates, layout technology, Euler path and registers. Circuit Design Issues: MOSFET models, delay models, hazards, metastability, synchronization, alternate logic structures, timing and clocking. Advanced Digital Issues: Logic optimization and technology mapping. Testing: Combinational tests, sequential test, scan design, ATPG tools in the Lab. Advanced Modules: ROM, PLA; advanced adders; barrel shifter; decoders.

CENG 423 Design and Analysis of Analog IC (Prerequisites: *FENG 202, CENG 207, CENG 304*)

Integrated circuit (IC) technology and MOSFET model. Transistor Amplifiers: Single transistor amplifiers, differential pair, large signal analysis, source degeneration, small signal analysis, common mode rejection ratio, offset voltage. Frequency response of amplifiers and gates, wideband amplifier design, method of circuit time constants. Current sources and mirrors. Operational Amplifiers. Analog Circuits: Trans-linear circuits, analog multipliers, voltage to current converters, tuned amplifiers, oscillators, voltage controlled oscillators, phase locked loops, simple DA and AD converter circuits.

CENG 424 Design and Analysis of Digital IC (Prerequisites: *FENG 202, CENG 207, CENG 304*)

Large signal and small signal device models. Second order effects and design rules. Digital circuit building blocks: CMOS inverters, buffers NAND Gates, CMOS pass gates, capacitance, delays rise-time and fall-times, high speed circuit design techniques, noise, noise margins buffers, clock drivers, fan-in, fan-out, level, conversion, input protection. Storage elements and sequential circuits. Circuit techniques for Arrayed architecture. Method of estimating energy consumption of CMOS inverters, buffers NAND gates, NOR gates, minimization of energy consumption. Timing Issues. Clocks. Memory architectures: SRAMS, DRAMS, EEPROMS, memory devices, sense amplifiers, etc.

CENG 433 Computer Vision and Robotics (Prerequisites: *CENG 316, CENG 407*)

Fundamentals of pattern-recognition and image-analysis techniques, low-level representation, intrinsic images, segmentation, texture and motion analysis, and representation of 2-D and 3-D shape. Vision System and components: camera, illumination, optical systems, computer interface, frame stores, structured lighting, software support. Vision Algorithm. Fundamentals of Robotic Systems: Mechanics of robots including kinematics, dynamics, and trajectories. Robot types, components and subsystems. Robot Position and Motion: Coordinates and transformations, coordinate frames, kinematics of position and inverse kinematics, kinematics of motion, an introduction to Robot statics and dynamics, mobile robots, task planning and programming, accuracy and repeatability. Sensors and Actuators and Control. Robot Application: Automated assembly, robotic work cell design, safety

CENG 434 Web Software Architecture

Introduction to web software architecture models and programming environments pertinent to developing web applications. Introduction to Programming in Java. Client-server Models. Architecture Development: Multi-tier software architecture, client-side scripting using JavaScript, server-side programming (servlets and JavaServer Pages), Component Reuse. Database Connectivity.

Web Servers

CENG 435 Computer Network Security (Prerequisite: *CENG 311*)

Security risk identification: Descriptive account of the value and cost of acquiring information, privacy and integrity, risk assessment and management, information flow and covert channels, malicious software, analysis of the threat to information security. Protection of computer systems: Coding and cryptography, authentication methods, capabilities, access list and protection domain, standards, principles of security audit and control methods, physical and electronic counter measures to minimize threats, legal factors, database and inference control, security kernels, verification methods. Modeling: Algorithm design, modeling and optimization of secure communication networks, introduction to principles of network management

CENG 436 Distributed Computing (Prerequisites: *FENG 206, CENG 311, CENG 316*)

Architectural Support: Messages vs. Remote procedure calls vs. Shared memory models. Structural Alternatives: Master-slave, client-server, fully distributed, cooperating objects. Coupling: Tight vs. Loose

Naming and Binding: Distributed file system, directory services. Verification, Validation, and Maintenance issues. Fault tolerance and reliability. Replication and avoidability. Security. Standards and protocols. Temporal concerns. Data coherence. Load balancing and scheduling. Scalability. Appropriate applications

CENG 437 Wireless Communication Systems (Prerequisites: *CENG 316, CENG 322, CENG 407*)

Introduction to wireless transmission, issues and challenges. System Design: Basic cellular systems and selection of parameters for system design. Multi-path Channels and modulation techniques. Wireless networking, base stations, mobile stations, airlink access, jamming, spoofing, signal intercept, wireless LANs, wireless modems, cellular radiotelephones, optical links, signal modeling, propagation modeling. Wireless Security: Introduction to physical layer and issues associated with security of the airlink interface.

CENG 438 Multimedia Systems (Prerequisites: *FENG 206, CENG 311, CENG 322*)

Fundamental concepts in multimedia systems. Resource management issues in distributed/networked multimedia systems. QoS routing and multicasting. Traffic shaping, Task and message scheduling, Internet QoS. Adaptive multimedia applications over the Internet. Operating system support for multimedia. Storage architecture and scalable media servers. Compression techniques, synchronization techniques, processor architectures for multimedia.

CENG 444 Digital Signal Processing System Implementation (Prerequisites: *FENG 207, CENG 316, CENG 419*)

Common DSP systems and functional elements. Discrete Fourier transforms, Fast Fourier Transform (FFT) and architecture for the FFT. Digital Filter Structures: Structures for FIR and IIR filters, cascade and parallel realization for higher order filters, introduction to the effect of finite word length. Architecture for signal processing: Computer architectures, implementation of bit-parallel, bit-serial, and digit-serial multiplier and adder structures, Harvard architecture and pipelining, general purpose DSP devices (T1 TMS320 family and Motorola DSP family ADSP2100 family), real-time FIR filtering using the general purpose DSP, FFT processing on a general purpose DSP

Graduation Requirements

To graduate from the Computer Engineering Department, a student must satisfy all requirements of the University, Faculty and the Department.

University Requirements

A student shall be deemed to have satisfied the requirements for graduation if:

- (i) She/he has satisfied all the General University requirements.
- (ii) She/he has accumulated the minimum number of credits required by the Faculty, including

both core and prescribed elective courses, namely, 144 credits.

- (iii) She/he has not have failed more than a total of 24 credits from the core courses and prescribed electives, provided that the failed grades are not lower than a “D”.
- (iv) She/he has submitted a report originating from a Project Work. The Report must be submitted for assessment before the date of the last paper in the second semester examinations. In default the candidate shall be asked to submit the Report the following semester and shall be treated as a repeat examination with all its implications.

Faculty Requirements

1. Student must pass a minimum of 6 credits out of the following courses: FENG 118 Psychology, FENG 211 Principles of Management, FENG 214, Introduction to Economics, FENG 216, Sociology, and FENG 401 Law for Engineers.
2. Student must take and pass FENG 402 Entrepreneurship.

Departmental Requirements

In addition to the University and Faculty requirements to graduate with a BSc Engineering (Computer Engineering) a student must take and pass the following courses

FENG 112	Introductions to Information Technology II (C Programming)
FENG 203	Data Structures and Algorithms
FENG 206	Introduction to Software Engineering
FENG 207	Digital Circuits
CENG 305	Linear Circuits
CENG 309	Computer Architecture
CENG 311	Computer Communication Networks
CENG 313	Operating Systems
CENG 400	Independent Project
CENG 407	Communication and Control
CENG 412	Database and Information Management
CENG 419	Digital Signal Processing
CENG 429	Microprocessor Systems and Integration

DEPARTMENT OF FOOD PROCESS ENGINEERING

FACULTY

S. Sefa-Dedeh , <i>BSc (Ghana) MSc PhD (Guelph)</i>	-	Professor/Dean
H. Mensah-Brown , <i>BSc (K'si), MSc (Ife), MBA (Ghana), DIC, PhD (London)</i>	-	Lecturer (Ag. Head of Department)
N. D.K. Asante , <i>BSc (K'si), MSc, PhD (UMIST)</i>	-	Lecturer
E. Sinayobye , <i>Dip (Eng), PhD (France)</i>	-	Lecturer
N. Sharon Affrifa , <i>BSc, MPhil (Ghana), PhD (Georgia)</i>	-	Part-time Lecturer
I.O.A. Hodgson , <i>BSc (K'si), MSc (B. Columbia), PhD (Loughborough)</i>	-	Part-time Lecturer
Kofi Manso Essuman , <i>BSc, MSc (Ghana)</i>	-	Part-time Lecturer
G.N. Laryea , <i>MSc (Ivanovo), PhD (Chungbuk, Korea)</i>	-	Part-time Lecturer

FOOD PROCESS ENGINEERING

Level 100 Courses

Core		
FENG 101	Mathematics I	4
FENG 102	Mathematics II	4
FENG 105	General Physics	3
FENG 106	Basic Electronics	3
FENG 109	Introduction to Information Technology I	2
FENG 111	Basic Mechanics I	3
FENG 112	Introduction to Information Technology II (C Programming)	2
FENG 113	Introduction to Engineering	1
FENG 114	Basic Mechanics II	2
FENG 115	General Chemistry	3
FENG 116	Biology	2
FENG 117	Engineering Drawing I	3
FENG 126	Applied Electricity	3
FENG 124	Engineering Drawing II	3
LANG 100	Academic Writing	2
Elective		
FENG 118	Psychology	2
FENG 122	Internship	1

Level 200 Courses

Core		
FENG 201	Mathematics III	4
FDEN 201	Fundamentals of Food Process Engineering	3
CENG 201	C++ Programming	3
FENG 202	Mathematics IV	4
FENG 204	Environmental Science	2
FENG 205	Strength of Materials	3
FENG 208	Fluid Mechanics 9	3
FENG 209	Thermodynamics	3
FENG 212	Engineering Technology	2
Elective		
FENG 206	Introduction to Software Engineering	3
FENG 207	Digital Circuits	3
FENG 211	Principles of Management	2
FENG 214	Introduction to Economics	3
FENG 216	Sociology	3
FENG 218	Internship (Industrial Practice II)	1

Level 300 Courses

Core		
FDEN 301	Fundamentals of Food Process Engineering	3
FDEN 302	Separation Processes	2
FDEN 303	Heat Transfer	3
FDEN 304	Electrical Machines & Power Distribution	3
FDEN 305	Thermodynamics II	2
FDEN 306	Engineering & Design of Food Process II	3
FDEN 307	Engineering & Design of Food Process I	3
FENG 300	Technical Report Writing	1
FDEN 312	Mass Transfer	3

FDEN 314	Physical and Chemical Properties of Food	3
FDEN 316	Environmental Eng. in Food Processing_	2
FDEN 318	Engineering Research Methods	1
FENG 300	Technical Report Writing	1
FENG 302	Internship (Industrial Practice III)	1

Elective

AENG 303	Machine Design	3
FDSC 301	General Microbiology	2
FDSC 303	Microbiology Lab	1
CENG 301	Numerical Methods	3
FENG 304	Statistics for Engineers	3

Level 400 Courses

Core

FDEN 400	Independent Engineering Study	3
FDEN 401	Food Plant Design & Economics	2
FENG 402	Entrepreneurship	3
FDEN 402	Engineering & Design of Food Process IV (Animal Products)	3
FDEN 403	Engineering Design	2
FDEN 404	Food Process Control	3
FDEN 405	Food Process/Product Development	2
FDEN 409	Engineering & Design of Food Process III (Plant Products)	3
FDEN 410	Food Packaging	2
FDEN 411	Professional Development Seminar	1
FDEN 412	Safety in Food Plants	1

Elective

FDSC 407	Quality Control in Food Processing	2
FDSC 421	Food Processing Plant Operations Sanitation	2
FENG 401	Law for Engineers	3
FDSC 416	Industrial Microbiology	2
FDSC 418	Food Microbiology	2
FDSC 422	Food Microbiology Practical	1

Course Descriptions and Prerequisites

FENG 101 Mathematics I

Set of Real Numbers, Indices, Logarithms and Surds. Concept of a function of a single variable, graphs of functions. Linear, quadratic and higher degree polynomial functions, Rational functions. Inequalities in one and two variables. Binomial theorem. Circular measure. Trigonometric functions. Exponential and logarithmic functions, function e^x ; hyperbolic functions. Complex numbers and their algebra. Vectors: addition, scalar multiplication, scalar products, vector product. Scalar and vector triple products. Geometrical applications: vector equations of lines and planes. Parametric representation of a curve; the circle and other conic sections.

FENG 102 Mathematics II

Limits and Continuity of a function of a single variable. Differentiation: Rules of differentiation, chain rule and parametric differentiation, differentiation of trigonometric functions and their inverses, exponential and logarithmic functions, higher order derivatives, Leibnitz's rule. Differentiability: Rolle's Theorem, mean-value theorem, approximate methods of solving equations (graphical and Newton-Raphson methods). Integration and its applications: Area under curve, volumes of solids of revolution. Numerical integration: Trapezium and Simpson's rules. Vector function of a single variable: Differentiation and integration of vector functions, kinematics of a single particle in motion. Newton's laws of motion, motion in a straight line and in a plane, projectiles and circular motion,

work, energy and power; impulse and momentum, moment of a force, couple, conditions for equilibrium of rigid bodies

FENG 105 General Physics

Vibrations: Simple harmonic motion, damped harmonic motion, forced harmonic motion. Waves: Wave types, wave phenomena – interference and diffraction. Electricity and Magnetism: Coulomb's law, electric field, Gauss's law, electric potential, current electricity – EMF, Kirchhoff's laws, DC circuits, Magnetic field: Bio-Savart's law, Ampere's law. Induction: Faraday and Lenz's law, AC circuits. Introductory Modern Physics: Bohr's atom, quantum theory of atom, electronic transitions, optical spectrum, X-rays, photo-electric effect, motion of charges in electric and magnetic fields

FENG 106 Basic Electronics

History of electronics from vacuum tubes to large scale integration, classification of electronic signals (digital, analog, role of A/D and D/A converters), electronic components, symbols and identification. Semiconductivity. Diodes and Diode Circuits: diode characteristics, model, and behavior in relation to circuits and analysis. Field-Effect Transistors and Circuits: MOSFET characteristics and model, biasing techniques, circuit symbol, analog MOSFET amplifier. Bipolar Junction Transistors (BJT): Physical structure of the BJT, circuit representation, transistor biasing, and transistor ratings. Fundamentals of Digital Electronics: Ideal logic gates, logic level definition and dynamic response of logic gates, logic gates examples. Signal Amplifiers: Concept of amplification, operational amplifier and its application as a filter, the BJT and MOSFET transistor as amplifiers, small signal behavior of the transistor. Basic Analog and Digital circuit elements, frequency response, signal generator, filters and waveform shaping circuits.

FENG 109 Introduction to Information Technology I

Introduction to computers and digital technology and culture. The role of computers in IT, issues of computers and crime, computers and work, general issues on the impact and control of computers. Structure and use of the Internet and applications in e-business, e-learning, e-governance, e-health. The basic foundations and functions of computer hardware and software. Introduction to common engineering application software. Spreadsheet for engineers. Introduction to MATLAB and its applications to engineering problem solving.

FENG 111 Basic Mechanics I

General principles of mechanics, methods of problem solution, and numerical accuracy. Force vectors and mathematical operations. Static Particles: Coplanar force on a particle, resultant of forces, resolution of forces, conditions for the equilibrium of a particle, Newton's first law, free-body diagram, forces in space. Force System Resultants. Statics of a rigid body and conditions for equilibrium. Centroids and centers of gravity.

FENG 112 Introduction to Information Technology II – C Programming

History of the C language. Structure of the C Program. Variables Declarations: Global variables, type and range of variables, declaration of variables, scope of variables, reading and printing of variables. Constants Declarations. The C Operators: Arithmetic, Relational, Logical, and order of operation precedence. Conditional Instructions. Looping and Iterations. Arrays and Strings: Single and multi-dimensional. Functions: VOID function, Functions and Arrays, Function prototyping. Data Types: Unions, type casting, enumerated types, static variables. Pointers: pointers and variable, pointers and functions, pointers and arrays, arrays of pointers, multi-dimensional arrays and pointers, static initialization of pointer arrays, pointers and structures, common pointer pitfalls. Dynamic Memory Allocation and Dynamic Structures: MALLOC and SIZEOF and FREE, CALLOC and REALLOC, Linked Lists, sample full C program.

FENG 113 Introduction to Engineering

History of engineering and technology, contemporary applications, and future directions of engineering. Professional development. Ghana Institution of Engineers and its role in engineering developments in Ghana. Various engineering disciplines and developmental trends.

FENG 114 Basic Mechanics II

Branches of dynamics. Rectilinear Motion of Particles: Displacement, velocity, acceleration, uniformly accelerated motion, relative motion, dependent motions, and graphical methods. Curvilinear Motion of Particles: Displacement, velocity, acceleration, rectangular components, tangential and normal components. Kinetics of Particles: Newton's second law of motion, equations of motion. Work, Energy, Power and Efficiency: Work done by a force, springs, kinetic and potential energy, conservation of energy, principle of work and energy, power, efficiency. Impulse and Momentum: Impulse, linear and angular momentum, conservation of momentum, system of particles. Kinematics of Rigid Bodies. Introduction to Vibration: Undamped free vibration, undamped forced vibration, rotational vibration, energy method, damped free vibration, damped force vibration, electric analogue.

FENG 117 Engineering Drawing I

Introduction to the history of drawing, drawing instruments, scales and lettering, drawing lines. Orthographic Projections: Points, lines and planes. Projections of points, lines and figures on planes. Intersections of lines and with figures. Intersections of lines with solids. Intersections of figures with planes. Determination of true lengths of line segments and angles of inclination of a line to the plane of projections through projections on planes, rotation of rabatment, projections of planes; Interpenetration of figures and solids. Developments: Surfaces, prisms, right pyramids, cylinders, cones. Isometric Drawings. Introduction to AutoCAD.

FENG 122 Internship

First year attachment with industry.

FENG 124 Engineering Drawing II

Dimensioning: Lines and symbols, rules for dimensioning, dimensioning methods, dimensioning standard features, limits and tolerances, fit and allowances, notes and specification, surface texture. Sections and Conventions: Types of sections, section lining, conventional practices, conventional breaks. Working Drawings: Detail drawings, assembly drawings, part lists. Screw Threads and Fasteners: Thread representation, threaded assemblies, fasteners, keys, rivets. Applications of AutoCAD in engineering drawings.

FENG 126 Applied Electricity

Foundations of electricity: voltage, current, resistance, DC and AC, AC waveforms, magnitude and phase, applications of AC and DC systems. Basic Series and Parallel circuits. Transformers: Principle of operations, transformer types, ratings, considerations for transformer selection. AC Circuits: Single and three-phase systems, voltage levels and frequencies used in Ghana, harmonics in power systems. Power Factor and its calculation and correction in power systems, power in resistive and reactive AC circuits, active power, reactive power, and apparent power. Motors and Controls: Principles of operation of motors, control techniques for motors, motor types and applications. Electricity Generation: Generation sources, Power generation process, transmission and distribution in Ghana. Conductors and Insulators: Power transmission and distribution conductors, sizes, choice of conductor sizes, fuses, insulator break-down. Electrical Safety: Importance of electrical safety, shock current, safe practices, common sources of hazards, safe circuit design and safe meter usage.

LANG 111 Academic Writing

Introduction to the quality use of language. Strategies for paragraph development. Study reading. Gathering and using information from Library and other sources. Integration of information into essays. General style of writing.

FENG 115 General Chemistry

Atomic Structure: The Schrödinger equation, quantum numbers, solution to the Schrödinger equation for one electron atom. Hund's Rule, Pauli's and Aufbau principles. Periodic properties of elements: Overview of general features of S-block, P-block and D-block elements. Thermochemistry: Heat and energy, heat of formation, Hess Law, estimation of bond energies. Acids and Bases: pH, strengths of

acids and bases, buffers, salts, electrolytic solutions solubility and solubility products concept. Oxidation: Reduction reactions, standard electrode potential, electrochemical cell, concentration dependence of electrode potential, electrochemical series, corrosion, prevention of corrosion, electrolysis, and Faraday's laws

FENG 116 Biology

Molecular basis of cellular structure and functions (prokaryotic, eukaryotic). Bioelements. Biomolecules: carbohydrates, amino acids, lipids, nucleotides and nucleic acids (DNA, RNA), Chromosome structure, introduction to basic genetics, genes, gene action. Protein synthesis, gene splicing, genetic engineering. Brief coverage of major groups of (plant and animal) kingdoms and their characteristics (morphological, anatomical). Brief coverage of animal body organization and plant body organization. Animal locomotory adaptations: the skeleton and muscles, locomotion in unicellular animals, snakes, mechanisms of bird flight, walking and running and locomotion in water. The construction and use of biological laboratory and field equipment: microscope, centrifuge, incubator, microtome, kymograph, insect traps, vertebrate traps (fishes, reptiles, birds, mammals), radio-tracking equipment, thermometers, thermohygrographs, etc.

FENG 118 Psychology

Introduction: What is Psychology, Brief history of psychology, goals of psychology, psychology and science, para-psychology and pseudo-psychology. Fields of Psychology: Basic, research, and applied psychology Psychology and Environment: Psychological environment, physical/built environment, noise, crowding, etc Psychology and Industry: Motivation, man-machine systems, work and safety. Relevance of psychology to engineering. Attitude, perception, and engineering

FDEN 201 Fundamentals of Food Process Engineering

Introduction to Food Process Engineering as the use of engineering and biological principles to the development of products, processes and systems that serve the needs of society. Flowsheeting Basics, types of diagrams, Material and Energy Balances. Precision and dimensional consistency in engineering calculations,. Overview of key food properties, introduction of concept of unit operations. The use of spreadsheets and process simulation software for engineering calculations. Seminar on the Food Industry in Ghana

FENG 201 Mathematics III

Vector spaces and Subspaces: Linear independence and dependence of vectors, Basis and dimension, linear transformations and matrices, determinants, application to the solution of systems of linear equations. *Eigenvalues and Eigenvectors*. *Sequences and Series*: Evaluating limits of sequences, tests of convergence of finite series, power series; radius and interval of convergence, Maclaurin and Taylor series. *Improper integrals*: Convergence, Gamma and Beta functions, Lagrange polynomials, finite differences, and least square approximation

FENG 202 Mathematics IV

Functions of Several Variables: Limits and continuity, partial differentiation, critical points and their classifications, increments and differentials, implicit differentiation, the chain rule, directional derivatives .

Differential operators: The gradient, the divergence and the curl operators, line integrals, multiple integrals, integration of vector functions, Green's theorem, divergence and Stoke's theorem. Differential Equations: First and Second order ordinary differential equations, series solutions, system of ordinary differential equations. Initial-value problems: Laplace transforms, partial differential equations, boundary-value problems, applications to strings and membranes, Fourier series and transforms

FENG 204 Environmental Science

Human and Nature. Introductory ecology. Electromagnetic/Spectrum. Ozone and Global warming Natural resources. Population. Concept of Environmental pollution: Noise, air, land and water

pollution. Impact of Engineering Projects on the Environment, and control measures; Environmental Laws and regulations in Ghana

FENG 205 Strength of Materials

Introduction: Basic concepts of material bonding, material structure and material defects. Properties of Materials: Mechanical properties, thermal properties, electronic and ionic conductivity of materials, dielectric and magnetic properties of materials. Simple stress and strain within elastic limit and thermal stress. Tensile bending and shear bending of beams. Torsion of circular shafts. Torsional stress and strain. Strength of solid and hollow shafts. Theories of failure. Compound stress-strain system (Mohr's stress and strain circles). Torsion of circular shafts Torsional stress and strain. Fatigue failure and Struts. Beams of small radius of curvature. Springs (helical, spiral and flat), Strain energy method (Castigliano's theorem). Bending under plastic conditions. Torsion under plastic conditions. Thin walled pressure vessels. Composite shafts

FENG 208 Fluid Mechanics

Introduction: nature of fluids; analysis of fluid behaviour; viscosity; surface tension and capillary effects. Fluid Statics: hydrostatic forces on submerged plane and curved surfaces; buoyancy and stability; Elementary Fluid Dynamics: static, dynamic and total pressure; energy line and hydraulic grade line. Fluid Kinematics: velocity and acceleration fields; control volume and system representations; Reynolds transport theorem. Control Volume Analysis: continuity equation; linear momentum and moment-of-momentum equations; energy equation; irreversible flow. Differential analysis of fluid flow: fluid element kinematics; conservation of mass; conservation of linear momentum; inviscid flow; plane potential flows. Similitude, dimensional analysis, and modeling: dimensional analysis; Buckingham Pi Theorem; common dimensionless groups; modelling and similitude. Flow in pipes: laminar and turbulent flow; fully developed laminar flow; fully developed turbulent flow; dimensional analysis of pipe flow; pipe networks; flowrate measurement. Flow over immersed bodies: drag and lift; friction and pressure drag; flow over flat plates, across cylinders and spheres. Open-channel flow: general characteristics: surface waves; energy considerations; uniform flow; gradually varied flow; rapidly varied flow; flow measurement. Turbo-machines: basic energy and momentum considerations; centrifugal pumps; dimensional parameters and similarity laws; axial-flow and mixed-flow pumps; fans; turbines; compressible flow turbomachines.

FENG 209 Thermodynamics

Fundamental concepts of thermodynamics. First and second Laws of Thermodynamics. Properties of Substances: Properties of pure, simple and compressible substances. Introduction to Gas and Vapor Power Cycles

FENG 212 Engineering Technology

Introduction to industrial safety, hygiene, and metrology. Standard systems and uses of conventional measuring instruments. Industrial Tour: Familiarization tour of mechanical engineering laboratories, equipment identification in the laboratories. Electrical wiring systems: Domestic and industrial set ups. Civil Works: Foundations, cement/sandstone mixes, steel reinforcement, concrete foundations and columns. Surveying: Land surveying, parallelism, use of theodolite for machine installation, Bench work: filling, making out tool grinding; Machine tools; drilling and shaping

FENG 218 Internship

Second year industrial attachment

CENG 201 C++ Programming

Refer to the Computer Engineering curriculum for course details and prerequisites.

FENG 206 Introduction to Software Engineering

Basic process of creating software systems such as requirement specifications, design, development, implementation, testing, maintenance, and software life cycle. Planning: Cost of development, constructive cost models, development time and cost models. Management: Organization and

management of teams, staffing, directing, and controlling, program and project documentation, documentation of software products. Analysis and Design. Software Development. Design of User Interfaces. Software Metrics. Program Performance. Testing and Evaluation. Software Tools: Programming environments, program complexity, quality analysis tools, tracing tools, profilers, debuggers, source code repository, test harnesses. Legal and Economic aspects of software production.

FENG 207 Digital Circuits (Prerequisite: FENG 106)

Concepts of Data Representation: Number systems, data organization, hexadecimal number systems, signed and unsigned numbers, ASCII character set. Arithmetic and Logical Operations on binary numbers, bits and strings. Boolean algebra. Combinational Logic: Introduction to Truth Tables, logic gates and networks, relations between electronic circuits and Boolean function, timing diagrams, signal race, half and full adders, subtractors, BCD adder and subtractors. Logic Circuits: Operation of transistors as simple switches, the NMOS logic gates, the CMOS and TTL logic gates, programmable logic devices (PLD), Karnaugh Map and concept of minimization. Multiplexer Circuits: Multiplexers and switching algebra operations, combinational circuit analysis and synthesis, combinational circuit minimization, timing hazards. Decoder and Encoder Circuits: Decoder circuits and operations, Encoder circuits and operations, code converters. Basic circuits for Latches, Clocked and Unclocked Flip-Flops (RS, D and JK). Data registers, shift registers, synchronous and asynchronous counters, divide-by-N counters, clocking considerations

FENG 211 Principles of Management

Nature of Management: Management defined, Management roles (interpersonal, informational, decisional), the management hierarchy (levels of management), management skills (technical, human, and conceptual) Evolution of Management: Scientific management, administrative management and bureaucracy, the human factor in management, mathematics and management, contemporary theories. The Environment of Management: Internal and external. Management Functions: Planning and decision making, organizing (authority and responsibility, line and staff positions, span of management, departmentalization), directing (motivation, leadership, communication), controlling.

FENG 214 Introduction to Economics

Introduction to economics, basic terminologies and definitions, the need for engineers to study economics Micro-economics: The art and science of economics analysis, some tools of economic analysis, the market system (elasticity of demand and supply, consumer choice and demand, cost and production in the firm), market structures, pricing and government regulation. Macro-economics: Aggregate demand and aggregate supply, measuring economic aggregates and the circular flow of income, fiscal and monetary policy, international trade and finance, problems of developing countries

FENG 216 Sociology

Sociology, its origin and main concerns. Sociology as a Science. Some basic concepts in Sociology, society, culture, norms, institutions, status and roles. Concept of social structure of the Ghanaian society. The land, people and their spatial distribution. The traditional world view. The family, kinship and lineage systems. Traditional religious beliefs and their social functions. The traditional economy: land tenure, modes of production and distribution. Chieftaincy: structure and function. Modes of Socialization: The rites of passage. Health care practices

FENG 300 Technical Report Writing

Preparing an outline. Technical Style. Use of abbreviations. Numbering of Headings. Documentation footnotes and alphabetical list of reference. Table and figures, Bar charts, graphs, curves Organization charts and flow sheets. Drawing. Photographs. Case Study

FDEN 301 Fundamentals of Food Process Engineering

Introduction to Food Process Engineering as the use of engineering and biological principles to the development of products, processes and systems that serve the needs of society. Flowsheeting Basics, Material and Energy Balances. Precision and dimensional consistency in engineering calculations,.

Overview of key food properties, introduction to unit operations. The use of spreadsheets and process simulation software for engineering calculations. Seminar on the Food Industry in Ghana

FDEN 302 Separation Process (Prerequisite: *FDEN 201 or FDEN 301*)

Staged separation processes and product recovery. Distillation and extraction in the food industry.

FDEN 303 Heat Transfer (Prerequisite: *FENG 202, FENG 208*)

Theory of transmission of heat by conduction, convection and radiation. Steady and unsteady state heat transfer and applications in food processing. Analogies between heat and momentum transport. Emphasis on mathematical modelling, solution techniques, and design.

FDEN 304 Electrical Machines and Power Distribution

Refer to *FENG 120* for course details and prerequisites.

FDEN 305 Thermodynamics II (Prerequisites: *FENG 202, FENG 209*)

The science of energy analysis from an engineering perspective. Forms of energy, transformations of energy and energy flows. Applications in biological and traditional engineering systems

FDEN 306 Engineering and Design of Food Process II

Principles and application of refrigeration and freezing to food systems. Thermal processing of foods; aseptic processing. Fermentations and fermentors. Design and analysis of enzymatic and microbial biological reaction systems. Food fermentations and control systems. Engineering application, design and analysis of processes based on these operations.

FDEN 307 Engineering and Design of Food Process I

Treatment of dehydration, size reduction, mixing and emulsification, filtration, centrifugation and evaporation, irradiation, agglomeration, membrane processes and instantisation Engineering application in food systems. Design and analysis of processing based on these operations. Practical assignments related to each unit operation.

FDEN 312 Mass Transfer (Prerequisite: *FENG 202*)

Applications of mass transfer in chemical engineering science, unit operations and separations. Fundamentals include diffusion and mass transport. Mass transfer applications- non-equilibrium separations including gas absorption and adsorption, membrane processes and devices and crystallization. Microscopic and macroscopic issues. Unsteady-state mass transfer; simultaneous heat and mass transfer-hot air drying, spray drying and freeze drying applications

FDEN 314 Physical and Chemical Properties of Food (Prerequisite: *FENG 115*)

Classification of foods. The microstructure, chemistry and physical properties of food commodities in relation to process design and quality assessment. Water, protein, carbohydrates, lipids, vitamins, enzymes and minerals in foods. Flavour, colour, browning reactions and functional properties of foods. Sensory properties of foods and evaluation.

FDEN 316 Environmental Engineering in Food Processing

Principles of environmental engineering; introduction to environmental pollution control; environmental impact assessment; industrial waste treatment and control; solid waste management.

FDEN 318 Engineering Research Methods

Engineering research methodology. Writing and presentation of food engineering thesis proposals. Grant proposals

FENG 302 Internship

Coordinated and planned work experience with cooperating industries and agencies.

Electives (Level 300)

FENG 304 Statistics for Engineers (Prerequisites: *FENG 201, FENG 202, CENG 301*)

Probability functions axioms and rules, counting techniques, conditional probability, independence and mutually exclusive events. Discrete Random Variable: Expectation and variance, Binomial distribution, Hypergeometric distribution, Poisson distribution, relationship between Poisson and Binomial. Continuous Random Variable: Percentiles and cumulative distribution function, expectation and variance, uniform distribution, normal distribution, exponential distribution and other distributions. Joint Distributions. Covariance and Correlation. Sampling Distributions: Distributions of statistics, central limit theorem, samples from normal distribution (t-distribution, X^2 distribution and F-distributions). Estimation: Common point estimators, interval estimators. Hypothesis Testing. Introduction to Regression Analysis. Engineering applications in quality control, process control, communication systems and speech recognition

FDSC 301 General Microbiology

Refer to the Food Science curriculum for course details and prerequisites.

FDSC 303 Microbiology Lab.

Refer to the Food Science curriculum for course details and prerequisites.

AENG 303 Machine Design

Refer to the Agricultural Engineering curriculum for course details and prerequisites.

CENG 301 Numerical Methods

Refer to the Computer Engineering curriculum for course details and prerequisites.

FDEN 400 Independent Engineering Study

Engineering design experience. Food process problem identification, formulation of proposals and execution. An independent study and design project (under supervision). Project will require submission of a written report and will include oral presentation of report.

FDEN 401 Food Plant Design and Economics (Prerequisite: *FDEN 201 or FDEN 301*)

Design systems for food processing. Process simulation or modelling for optimization purposes applied to food processing. Evaluation of food processing plant systems. Utilities and regulatory requirements. Relevant Food Laws. Social impact of the plant. Equipment design and evaluation. Methods of estimating costs of equipment, operating costs, and other financial evaluations for determining profitability

FDEN 402 Engineering and Design of Food Process IV – Animal Products

Animal foodstuffs and their conversion to value-added products. Milk, meat and poultry and eggs. Design of processes for industrial production

FDEN 403 Engineering Design

Fundamentals of engineering design. Identification of food processing problems and application of design principles to a supervised project. Evaluation of economics and other operational concerns of specific process.

FDEN 404 Food Process Control (Prerequisite: *FENG 202, FDEN 201 or FDEN 301*)

Basics of Monitoring and Control (objectives and types of control, social & economic issues of automation, applications in food processing). Instrumentation in the Food Industry (Instrumentation, and Monitoring, Measurement Devices/sensors and their selection, Data Capture: Data loggers, data historians, data visualisation). Dynamic modelling, Introduction to Automatic Control (Feedback and Feed Forward Control, Controller Tuning). Application to Batch and continuous Food Processing

FDEN 405 Food Process/Product Development

An independent study on the design or improvement of a food product and/or the process employed for producing the product (under supervision)

FDEN 409 Engineering and Design of Food Process III – Plant Products

Plant foodstuffs and their conversion to value-added products. Cereals, roots and tubers, oilseeds, fruits and vegetables, spice and essences. Design of processes for industrial production

FDEN 410 Food Packaging

An integrated presentation of the scientific and technical aspects of packaging foods. Principles of food packaging; functions of packaging; properties of packaging materials e.g. metal, glass, paper and plastics. The design, fabrication and applications of food packaging. Packaging of selected food products. Aseptic packaging, food package interactions, handling of packages and modified atmosphere packaging.

FDEN 411 Professional Development

Selected topics for the food process engineer. Engineering presentation and reporting.

FDEN 412 Safety in Food Plants (Prerequisite: *FDSC 421*)

Safety principles in food plant design and operations. Hazard evaluation procedures. Process Safety Management (PSM) and the food industry. Principles of Inherently Safer Designs (ISD). Laws and regulations on plant safety. Field evaluation of safety in the Ghanaian Food Industry.

FENG 402 Entrepreneurship (Prerequisite: FENG 211)

Entrepreneurial process. Evaluation opportunities: Analysis of new ventures, valuation techniques, intellectual property issues, product and market research. Legal forms of organizations. Accessing and acquiring resources of financing. Developing a Business plan. Managing Enterprises. Marketing. Organizational behavior. Exit Strategies.

Electives (Level 400)

FENG 401 Law for Engineers

Course discussions cover contracts (formation, performance, breach, and termination), corporations and partnerships, insurance, professional liability, risk management, environmental law, torts, property law, evidence and dispute resolution. The course emphasizes those principles necessary to provide engineers with the ability to recognize issues which are likely to arise in the engineering profession and introduces them to the complexities and vagaries of the legal profession.

FDSC 407 Quality Control in Food Processing

Refer to the Food Science curriculum for course details and prerequisites.

FDSC 416 Industrial Microbiology

Refer to the Food Science curriculum for course details and prerequisites.

FDSC 418 Food Microbiology

Refer to the Food Science curriculum for course details and prerequisites.

FDSC 421 Food Processing Plant Operations and Sanitation

Refer to the Food Science curriculum for course details and prerequisites.

FDSC 422 Food Microbiology Practical

Refer to the Food Science curriculum for course details and prerequisites.

Graduation Requirements

To graduate BSc Food Process Engineering, a student must satisfy all requirements of the University, Faculty and the Department.

University Requirements

A student shall be deemed to have satisfied the requirements for graduation if:

- (i) She/he has satisfied all the General University requirements.
- (ii) She/he has accumulated the minimum number of credits required by the Faculty, including both core and prescribed elective courses, namely, 144 credits.
- (iii) She/he has not have failed more than a total of 24 credits from the core courses and prescribed electives, provided that the failed grades are not lower than a “D”.
- (iv) She/he has submitted a report originating from a Project Work. The Report must be submitted for assessment before the date of the last paper in the second semester examinations. In default the candidate shall be asked to submit the Report the following semester and shall be treated as a repeat examination with all its implications.

Faculty Requirements

1. Student must pass a minimum of 6 credits out of the following courses: FENG 118 Psychology, FENG 211 Principles of Management, FENG 214, Introduction to Economics, FENG 216, Sociology, FENG 401 Law for Engineers.
2. Student must take and pass FENG 402 Entrepreneurship.
3. Student must have taken at least two out of the three Internship (Industrial practice) programmes one of which must be FENG 302 Internship III (Level 300).

Departmental Requirements

In addition to the University and Faculty requirements to graduate with a BSc Engineering (Food Process Engineering) a student must pass the following courses:

FENG 112 Introduction to Information Technology II (C Programming)
FDEN 201 (or FDEN 301) Fundamentals of Food Process Engineering
FDEN 302 Separation Processes
FDEN 303 Heat Transfer
FDEN 306 Engineering and Design of Food Process I,
FDEN 307 Engineering and Design of Food Process II
FDEN 402 Engineering and Design of Food Process III
FDEN 409 Engineering and Design of Food Process IV
FDEN 314 Physical & Chemical Properties of Food
FDEN 316 Environmental Engineering in Food Processing
FDEN 400 Independent Engineering Study
FDEN 401 Food Plant Design & Economics
FDEN 404 Food Process Control
FDEN 405 Food Process/Product Development
FDEN 412 Safety in the Food Plant

DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING

Level 100 Courses

	Core	
FENG 101	Mathematics I	4
FENG 115	<i>General Chemistry</i>	3
FENG 105	General Physics	3
FENG 117	<i>Engineering Drawing I</i>	3
FENG 109	Introduction to Information Technology I	2
FENG 111	Basic Mechanics I	3
FENG 113	Introduction to Engineering	1
LANG 100	Academic Writing	2
FENG 102	Mathematics II	4
FENG 126	Applied Electricity	3

FENG 106	Basic Electronics	3
FENG 124	<i>Engineering Drawing II</i>	3
FENG 112	Introduction to Information Technology II (C Programming)	2
FENG 114	Basic Mechanics II	2
FENG 116	Biology	2
FENG 122	Internship (Industrial Practice I)	1

Elective

FENG 118	Psychology	2
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Level 200 Courses

Core

FENG 201	Mathematics III	4
FENG 215	<i>Chemistry of Materials</i>	3
FENG 205	Strength of Materials	3
FENG 207	Digital Circuits	3
FENG 209	Thermodynamics	3
CENG 201	C++ Programming	3
FENG 202	Mathematics IV	4
FENG 204	Environmental Science	2
FENG 206	Introduction to Software Engineering	3
FENG 208	Fluid Mechanics	3
FENG 212	Engineering Technology	2

Elective

FENG 211	Principles of Management	2
FENG 214	Introduction to Economics	3
FENG 216	Sociology	3
FENG 218	Internship (Industrial Practice II)	1

Level 300 Courses

Core

MSEN 301	Ceramic Properties Lab. I	1
MSEN 311	Introduction to Ceramics	2
MSEN 313	Materials Analysis Techniques	3
MSEN 315	Structure, Bonding and Phase Equilibrium in Inorganic Solids (Structure of Materials)	3
MSEN 317	Mechanics of Ceramics	3
MSEN 319	Optical properties of Materials	3
FENG 300	Technical Report Writing	1
CENG 301	Numerical Methods	3
MSEN 302	Ceramic Processing Lab. II	1
MSEN 312	Powder Processing	2
MSEN 314	Chemical Processing of Ceramics	3
MSEN 316	Heat and Mass Transfer	3
MSEN 318	Ceramics Processing Principles	2
MSEN 322	Quantum Physics of Materials	3
FENG 302	Technical Report Writing	1
FENG 304	Statistics for Engineers	3
FENG 302	Internship (Industrial Practice III)	1

Elective

CENG 316	Signals and Systems	3
MSEN 325	Materials Science and the Future	2

Level 400 Courses

Core

MSEN 400	Design Project	3
MSEN 403	Composite Design and Fabrication	3
MSEN 405	Electroceramics	3
MSEN 407	Bioceramic Materials	2
MSEN 409	Refractories	2
MSEN 411	Science of Whitewares	2
MSEN 400	Design Project	3
MSEN 402	Non Destructive Evaluation and Failure Analysis	3
MSEN 404	Magnetic Ceramics	3
MSEN 406	Glass, Ceramics and Glass-Ceramic Materials	3
MSEN 408	Professional Development Seminar	1
MSEN 412	Superconducting Materials	2
FENG 402	Entrepreneurship	3

Elective

FENG 401	<i>Law for Engineers</i>	3
MSEN 413	Research	1
MSEN 415	Advanced Topics in Electroceramics	2
CENG 409	Artificial Intelligence	3
MSEN 414	Research	1
MSEN 416	Advanced Topics in Bioceramics	3
MSEN 418	Lasers	2
CENG 414	Computer Graphics	3

Course Descriptions and Prerequisites

FENG 101 Mathematics I

Set of Real Numbers, Indices, Logarithms and Surds. Concept of a function of a single variable, graphs of functions. Linear, quadratic and higher degree polynomial functions, Rational functions. Inequalities in one and two variables. Binomial theorem. Circular measure. Trigonometric functions. Exponential and logarithmic functions, function e^x ; hyperbolic functions. Complex numbers and their algebra. Vectors: addition, scalar multiplication, scalar products, vector product. Scalar and vector triple products. Geometrical applications: vector equations of lines and planes. Parametric representation of a curve; the circle and other conic sections.

FENG 102 Mathematics II

Limits and Continuity of a function of a single variable. Differentiation: Rules of differentiation, chain rule and parametric differentiation, differentiation of trigonometric functions and their inverses, exponential and logarithmic functions, higher order derivatives, Leibnitz's rule. Differentiability: Rolle's Theorem, mean-value theorem, approximate methods of solving equations (graphical and Newton-Raphson methods). Integration and its applications: Area under curve, volumes of solids of revolution. Numerical integration: Trapezium and Simpson's rules. Vector function of a single variable: Differentiation and integration of vector functions, kinematics of a single particle in motion. Newton's laws of motion, motion in a straight line and in a plane, projectiles and circular motion, work, energy and power; impulse and momentum, moment of a force, couple, conditions for equilibrium of rigid bodies

FENG 105 General Physics

Vibrations: Simple harmonic motion, damped harmonic motion, forced harmonic motion. Waves: Wave types, wave phenomena – interference and diffraction. Electricity and Magnetism: Coulomb's law, electric field, Gauss's law, electric potential, current electricity – EMF, Kirchhoff's laws, DC circuits, Magnetic field: Bio-Savart's law, Ampere's law. Induction: Faraday and Lenz's law, AC circuits. Introductory Modern Physics: Bohr's atom, quantum theory of atom, electronic transitions, optical spectrum, X-rays, photo-electric effect, motion of charges in electric and magnetic fields

FENG 106 Basic Electronics

History of electronics from vacuum tubes to large scale integration, classification of electronic signals (digital, analog, role of A/D and D/A converters), electronic components, symbols and identification. Semiconductivity. Diodes and Diode Circuits: diode characteristics, model, and behavior in relation to circuits and analysis. Field-Effect Transistors and Circuits: MOSFET characteristics and model, biasing techniques, circuit symbol, analog MOSFET amplifier. Bipolar Junction Transistors (BJT): Physical structure of the BJT, circuit representation, transistor biasing, and transistor ratings. Fundamentals of Digital Electronics: Ideal logic gates, logic level definition and dynamic response of logic gates, logic gates examples. Signal Amplifiers: Concept of amplification, operational amplifier and its application as a filter, the BJT and MOSFET transistor as amplifiers, small signal behavior of the transistor. Basic Analog and Digital circuit elements, frequency response, signal generator, filters and waveform shaping circuits.

FENG 109 Introduction to Information Technology I

Introduction to computers and digital technology and culture. The role of computers in IT, issues of computers and crime, computers and work, general issues on the impact and control of computers. Structure and use of the Internet and applications in e-business, e-learning, e-governance, e-health. The basic foundations and functions of computer hardware and software. Introduction to common engineering application software. Spreadsheet for engineers. Introduction to MATLAB and its applications to engineering problem solving.

FENG 111 Basic Mechanics I

General principles of mechanics, methods of problem solution, and numerical accuracy. Force vectors and mathematical operations. Static Particles: Coplanar force on a particle, resultant of forces, resolution of forces, conditions for the equilibrium of a particle, Newton's first law, free-body diagram, forces in space. Force System Resultants. Statics of a rigid body and conditions for equilibrium. Centroids and centers of gravity

FENG 112 Introduction to Information Technology II – C Programming

History of the C language. Structure of the C Program. *Variables Declarations*: Global variables, type and range of variables, declaration of variables, scope of variables, reading and printing of variables. Constants Declarations. *The C Operators*: Arithmetic, Relational, Logical, and order of operation precedence. Conditional Instructions. Looping and Iterations. Arrays and Strings: Single and multi-dimensional. Functions: VOID function, Functions and Arrays, Function prototyping. Data Types: Unions, type casting, enumerated types, static variables. *Pointers*: pointers and variable, pointers and functions, pointers and arrays, arrays of pointers, multi-dimensional arrays and pointers, static initialization of pointer arrays, pointers and structures, common pointer pitfalls. Dynamic Memory Allocation and Dynamic Structures: MALLOC and SIZEOF and FREE, CALLOC and REALLOC, Linked Lists, sample full C program

FENG 113 Introduction to Engineering

History of engineering and technology, contemporary applications, and future directions of engineering. Professional development. Ghana Institution of Engineers and its role in engineering developments in Ghana. Various engineering disciplines and developmental trends

FENG 114 Basic Mechanics II

Branches of dynamics. Rectilinear Motion of Particles: Displacement, velocity, acceleration, uniformly accelerated motion, relative motion, dependent motions, and graphical methods. Curvilinear Motion of Particles: Displacement, velocity, acceleration, rectangular components, tangential and normal components. Kinetics of Particles: Newton's second law of motion, equations of motion. Work, Energy, Power and Efficiency: Work done by a force, springs, kinetic and potential energy, conservation of energy, principle of work and energy, power, efficiency. Impulse and Momentum: Impulse, linear and angular momentum, conservation of momentum, system of particles. Kinematics of Rigid Bodies. Introduction to Vibration: Undamped free vibration, undamped forced

vibration, rotational vibration, energy method, damped free vibration, damped force vibration, electric analogue.

FENG 115 General Chemistry

Atomic Structure: The Schrödinger equation, quantum numbers, solution to the Schrödinger equation for one electron atom. Hund's Rule, Pauli's and Aufbau principles. Periodic properties of elements: Overview of general features of S-block, P-block and D-block elements. Thermochemistry: Heat and energy, heat of formation, Hess Law, estimation of bond energies. Acids and Bases: pH, strengths of acids and bases, buffers, salts, electrolytic solutions solubility and solubility products concept. Oxidation: Reduction reactions, standard electrode potential, electrochemical cell, concentration dependence of electrode potential, electrochemical series, corrosion, prevention of corrosion, electrolysis, and Faraday's laws.

FENG 116 Biology

Molecular basis of cellular structure and functions (prokaryotic, eukaryotic). Bioelements. Biomolecules: carbohydrates, amino acids, lipids, nucleotides and nucleic acids (DNA, RNA), Chromosome structure, introduction to basic genetics, genes, gene action. Protein synthesis, gene splicing, genetic engineering. Brief coverage of major groups of (plant and animal) kingdoms and their characteristics (morphological, anatomical). Brief coverage of animal body organization and plant body organization. Animal locomotory adaptations: the skeleton and muscles, locomotion in unicellular animals, snakes, mechanisms of bird flight, walking and running and locomotion in water. The construction and use of biological laboratory and field equipment: microscope, centrifuge, incubator, microtome, kymograph, insect traps, vertebrate traps (fishes, reptiles, birds, mammals), radio-tracking equipment, thermometers, thermohygrographs, etc.

FENG 117 Engineering Drawing I

Introduction to the history of drawing, drawing instruments, scales and lettering, drawing lines. Orthographic Projections: Points, lines and planes. Projections of points, lines and figures on planes. Intersections of lines and with figures. Intersections of lines with solids. Intersections of figures with planes. Determination of true lengths of line segments and angles of inclination of a line to the plane of projections through projections on planes, rotation of rabatment, projections of planes; Interpenetration of figures and solids. Developments: Surfaces, prisms, right pyramids, cylinders, cones. Isometric Drawings. Introduction to AutoCAD.

FENG 122 Internship

First year attachment with industry.

FENG 124 Engineering Drawing II

Dimensioning: Lines and symbols, rules for dimensioning, dimensioning methods, dimensioning standard features, limits and tolerances, fit and allowances, notes and specification, surface texture. Sections and Conventions: Types of sections, section lining, conventional practices, conventional breaks. Working Drawings: Detail drawings, assembly drawings, part lists. Screw Threads and Fasteners: Thread representation, threaded assemblies, fasteners, keys, rivets. Applications of AutoCAD in engineering drawings.

FENG 126 Applied Electricity

Foundations of electricity: voltage, current, resistance, DC and AC, AC waveforms, magnitude and phase, applications of AC and DC systems. Series and Parallel circuits. Transformers: Principle of operations, transformer types, ratings, considerations for transformer selection. AC Circuits: Single and three-phase systems, voltage levels and frequencies used in Ghana, harmonics in power systems. Power Factor and its calculation and correction in power systems, power in resistive and reactive AC circuits, active power, reactive power, and apparent power. Motors and Controls: Principles of operation of motors, control techniques for motors, motor types and applications. Electricity Generation: Generation sources, Power generation process, transmission and distribution in Ghana. Conductors and Insulators: Power transmission and distribution conductors, sizes, choice of conductor

sizes, fuses, insulator break-down. Electrical Safety: Importance of electrical safety, shock current, safe practices, common sources of hazards, safe circuit design and safe meter usage.

LANG 111 Academic Writing

Introduction to the quality use of language. Strategies for paragraph development. Study reading. Gathering and using information from Library and other sources. Integration of Information into essays. General style of writing.

FENG 118 Psychology

Introduction: What is Psychology, Brief history of psychology, goals of psychology, psychology and science, para-psychology and pseudo-psychology. Fields of Psychology: Basic, research, and applied psychology Psychology and Environment: Psychological environment, physical/built environment, noise, crowding, etc Psychology and Industry: Motivation, man-machine systems, work and safety. Relevance of psychology to engineering. Attitude, perception, and engineering

Core (Level 200)

FENG 201 Mathematics III

Vector spaces and Subspaces: Linear independence and dependence of vectors, Basis and dimension, linear transformations and matrices, determinants, application to the solution of systems of linear equations. Eigenvalues and Eigenvectors. Sequences and Series: Evaluating limits of sequences, tests of convergence of finite series, power series; radius and interval of convergence, Maclaurin and Taylor series. Improper integrals: Convergence, Gamma and Beta functions, Lagrange polynomials, finite differences, and least square approximation

FENG 202 Mathematics IV

Functions of Several Variables: Limits and continuity, partial differentiation, critical points and their classifications, increments and differentials, implicit differentiation, the chain rule, directional derivatives. Differential operators: The gradient, the divergence and the curl operators, line integrals, multiple integrals, integration of vector functions, Green's theorem, divergence and Stoke's theorem. Differential Equations: First and Second order ordinary differential equations, series solutions, system of ordinary differential equations. Initial-value problems: Laplace transforms, partial differential equations, boundary-value problems, applications to strings and membranes, Fourier series and transforms

FENG 204 Environmental Science

Human and Nature. Introductory ecology. Electromagnetic/Spectrum. Ozone and Global warming. Natural resources. Population. Concept of Environmental pollution: Noise, air, land and water pollution. Impact of Engineering Projects on the Environment, and control measures; Environmental Laws and regulations in Ghana

FENG 205 Strength of Materials

Introduction: Basic concepts of material bonding, material structure and material defects
Properties of Materials: Mechanical properties, thermal properties, electronic and ionic conductivity of materials, dielectric and magnetic properties of materials. Simple stress and strain within elastic limit and thermal stress. Tensile bending and shear bending of beams. Torsion of circular shafts. Torsional stress and strain. Strength of solid and hollow shafts. Theories of failure. Compound stress-strain system (Mohr's stress and strain circles). Torsion of circular shafts Torsional stress and strain. Fatigue failure and Struts. Beams of small radius of curvature. Springs (helical, spiral and flat), Strain energy method (Castigliano's theorem). Bending under plastic conditions. Torsion under plastic conditions. Thin walled pressure vessels. Composite shafts

FENG 206 Introduction to Software Engineering

Basic process of creating software systems such as requirement specifications, design, development, implementation, testing, maintenance, and software life cycle. Planning: Cost of development, constructive cost models, development time and cost models. Management: Organization and

management of teams, staffing, directing, and controlling, program and project documentation, documentation of software products. Analysis and Design. Software Development. Design of User Interfaces. Software Metrics. Program Performance. Testing and Evaluation. Software Tools: Programming environments, program complexity, quality analysis tools, tracing tools, profilers, debuggers, source code repository, test harnesses. Legal and Economic aspects of software production.

FENG 207 Digital Circuits (Prerequisite: *FENG 106*)

Concepts of Data Representation: Number systems, data organization, hexadecimal number systems, signed and unsigned numbers, ASCII character set. Arithmetic and Logical Operations on binary numbers, bits and strings. Boolean algebra. Combinational Logic: Introduction to Truth Tables, logic gates and networks, relations between electronic circuits and Boolean function, timing diagrams, signal race, half and full adders, subtractors, BCD adder and subtractors. Logic Circuits: Operation of transistors as simple switches, the NMOS logic gates, the CMOS and TTL logic gates, programmable logic devices (PLD), Karnaugh Map and concept of minimization. Multiplexer Circuits: Multiplexers and switching algebra operations, combinational circuit analysis and synthesis, combinational circuit minimization, timing hazards. Decoder and Encoder Circuits: Decoder circuits and operations, Encoder circuits and operations, code converters. Basic circuits for Latches, Clocked and Unclocked Flip-Flops (RS, D and JK). Data registers, shift registers, synchronous and asynchronous counters, divide-by-N counters, clocking considerations

FENG 208 Fluid Mechanics

Introduction: nature of fluids, analysis of fluid behaviour, viscosity, surface tension and capillary effects. Fluid Statics: hydrostatic forces on submerged plane and curved surfaces; buoyancy and stability; Elementary Fluid Dynamics: static, dynamic and total pressure; energy line and hydraulic grade line. Fluid Kinematics: velocity and acceleration fields; control volume and system representations; Reynolds transport theorem. Control Volume Analysis: continuity equation; linear momentum and moment-of-momentum equations; energy equation; irreversible flow. Differential analysis of fluid flow: fluid element kinematics; conservation of mass; conservation of linear momentum; inviscid flow; plane potential flows. Similitude, dimensional analysis, and modeling: dimensional analysis; Buckingham Pi Theorem; common dimensionless groups; modelling and similitude. Flow in pipes: laminar and turbulent flow; fully developed laminar flow; fully developed turbulent flow; dimensional analysis of pipe flow; pipe networks; flowrate measurement. Flow over immersed bodies: drag and lift; friction and pressure drag; flow over flat plates, across cylinders and spheres. Open-channel flow: general characteristics: surface waves; energy considerations; uniform flow; gradually varied flow; rapidly varied flow; flow measurement. Turbo-machines: basic energy and momentum considerations; centrifugal pumps; dimensional parameters and similarity laws; axial-flow and mixed-flow pumps; fans; turbines; compressible flow turbomachines.

FENG 209 Thermodynamics

Fundamental concepts of thermodynamics. First and second Laws of Thermodynamics. Properties of Substances: Properties of pure, simple and compressible substances. Introduction to Gas and Vapor Power Cycles

FENG 212 Engineering Technology

Introduction to industrial safety, hygiene, and metrology. Standard systems and uses of conventional measuring instruments. Industrial Tour: Familiarization tour of mechanical engineering laboratories, equipment identification in the laboratories. Electrical wiring systems: Domestic and industrial set ups. Civil Works: Foundations, cement/sandstone mixes, steel reinforcement, concrete foundations and columns. Surveying: Land surveying, parallelism, use of theodolite for machine installation, Bench work: filling, making out tool grinding; Machine tools; drilling and shaping

FENG 215 Chemistry of Materials

Crystal Chemistry: Nature of the crystalline state, symmetry and space lattices, binding of forces in the solid state, intermolecular forces, van der Waals forces. Molecular crystal, covalent crystals,

characteristics, properties, examples. Metals: Close-packing arrangements, structure of pure metals, bonding in metals, alloys, interstitial compounds. Ionic crystals: Structure of simple salts, effects of polarity, complex ions in crystals, introduction to silicates. Glasses structure and types, properties. Polymers structure, co-polymers, properties. Ceramics classification, structure and properties. Composites structure and properties.

FENG 218 Internship – Industrial Practice II (Prerequisite: *Level 200 standing*)
Second year attachment with industry.

CENG 201 C++ Programming
Refer to the Computer Engineering curriculum for course details and prerequisites.

Electives (Level 200)

FENG 211 Principles of Management

Nature of Management: Management defined, Management roles (interpersonal, informational, decisional), the management hierarchy (levels of management), management skills (technical, human, and conceptual). Evolution of Management: Scientific management, administrative management and bureaucracy, the human factor in management, mathematics and management, contemporary theories. The Environment of Management: Internal and external. Management Functions: Planning and decision making, organizing (authority and responsibility, line and staff positions, span of management, departmentalization), directing (motivation, leadership, communication), controlling.

FENG 214 Introduction to Economics

Introduction to economics, basic terminologies and definitions, the need for engineers to study economics. Micro-economics: The art and science of economics analysis, some tools of economic analysis, the market system (elasticity of demand and supply, consumer choice and demand, cost and production in the firm), market structures, pricing and government regulation. Macro-economics: Aggregate demand and aggregate supply, measuring economic aggregates and the circular flow of income, fiscal and monetary policy, international trade and finance, problems of developing countries

FENG 216 Sociology

Sociology, its origin and main concerns. Sociology as a Science. Some basic concepts in Sociology, society, culture, norms, institutions, status and roles. Concept of social structure of the Ghanaian society. The land, people and their spatial distribution. The traditional world view. The family, kinship and lineage systems. Traditional religious beliefs and their social functions. The traditional economy: land tenure, modes of production and distribution. Chieftaincy: structure and function. Modes of Socialization: The rites of passage. Health care practices

FENG 300 Technical Report Writing

Preparing an outline. Technical Style. Use of abbreviations. Numbering of Headings. Documentation footnotes and alphabetical list of reference. Table and figures, Bar charts, graphs, curves Organization charts and flow sheets. Drawing. Photographs. Case Study

FENG 302 Internship (*Pre-requisite: Level 300 standing*)
Third year attachment with industry.

FENG 304 Statistics for Engineers (*Prerequisite: FENG 201, FENG 202, CENG 301*)

Probability functions axioms and rules, counting techniques, conditional probability, independence and mutually exclusive events. Discrete Random Variable: Expectation and variance, Binomial distribution, Hypergeometric distribution, Poisson distribution, relationship between Poisson and Binomial. Continuous Random Variable: Percentiles and cumulative distribution function, expectation and variance, uniform distribution, normal distribution, exponential distribution and other distributions. Joint Distributions. Covariance and Correlation. Sampling Distributions: Distributions of statistics, central limit theorem, samples from normal distribution (t-distribution, X^2 distribution and F-distributions). Estimation: Common point estimators, interval estimators. Hypothesis Testing.

Introduction to Regression Analysis. Engineering applications in quality control, process control, communication systems and speech recognition

MSEN 301 Ceramics Properties Lab. I

Quantitative microscopy, image analysis, failure analysis. Electron microscopy, dielectric, ultrasonic, dynamic, mechanical and calorimetric methods for characterizing materials and their properties.

MSEN 302 Ceramic Processing Lab. (Prerequisite : MSEN 301)

MSEN 311 Introduction to ceramics

Examples of ceramic products and their processing. Crystal structures and structure of glasses. Imperfection in solids: non-stoichiometry, point defects, line defects, grain boundaries. Diffusion in ionic materials, phase diagrams, phase transformations, kinetics of solid state reactions, reaction between different solids, grain growth and sintering. Degradation of materials. Thermal, magnetic and optical properties. Economic, environmental and social issues of Materials Science and Engineering.

MSEN 312 Powder Processing (Co-requisite: MSEN 302, MSEN 318)

Ceramic powders from starting materials and chemicals. Traditional processing routes for ceramic powders. Novel processing routes for advanced materials. Bayer process for alumina powders. Characterization parameters (particle/agglomerate size and size distribution, shape and shape distribution, pore size and pore size distribution, specific surface area, density). Shape forming of ceramic materials and components, sintering and densification.

MSEN 313 Materials Analysis Techniques (Prerequisite: MSEN 301 Co-requisite: FENG 103, FENG 104)

Grain size measurements. X-ray diffraction. X-ray energy dispersive analysis (EDXA). X-ray wavelength dispersive analysis (WDS). X-ray photoelectron spectroscopy (XPS). Auger electron spectroscopy (AES). Secondary ion mass spectroscopy (SIMS). Thermal analysis: DTA, DSC, TGA. Imaging: Light Microscopy, Electron Microscopy (SEM, TEM), Atomic Force Microscopy, Scanning Acoustic Microscopy.

MSEN 314 Chemical Processing in Ceramics (Co-requisite: MSEN 302, MSEN 314)

Chemical principles involved in the synthesis of raw materials and the chemical fabrication techniques used in current industrial practice. Design of chemical processes is emphasized.

**MSEN 315 Structure, Bonding & Phase Equilibria in Inorganic Solids –
Structure of Materials (Prerequisite: FENG 103, FENG 104, FENG 209,
Co-requisite: MSEN 301)**

Bonding and intermolecular forces in inorganic solids. Crystal structure. Basic crystallography. Grouping of ions and Pauling's rules. Crystal imperfection. Oxide structures. Polymorphism. Ceramic phase equilibrium: Gibb's phase rule, two-component phase diagrams, three-component phase diagrams, non-equilibrium phases.

MSEN 316 Heat and Mass Transfer (Prerequisite: FENG 209, Co-requisite: MSEN 302)

Fundamentals of diffusion processes followed by discussion of ionic diffusion and ion exchange, gas diffusion, viscosity, ionic conductivity, dielectric relaxation and mechanical relaxation. Chemical durability and weathering in glasses, glass-ceramics and melts. Effects of both atomic structure and morphology will be discussed for each of the topics.

MSEN 317 Mechanics of Ceramics (Prerequisite: FENG 111, FENG 114, FENG 205, Co-requisite: MSEN 301)

Mechanics of deformable bodies with applications in the design of beams, columns, plates, shafts and membranes. Elastic moduli, yield strength, tensile strength, hardness, ductility, fast fracture, toughness, fatigue, creep deformation and fracture. Examples of mechanical design using ceramic materials in refractories, electroceramics and bioceramics.

MSEN 318 Ceramic Processing Principles (*Prerequisite: FENG 103, FENG 104*)

Fundamentals of processing, building on knowledge of heat and mass transfer. High temperature processing of materials - heat sources, solid state processing of powders and liquid state processing.

MSEN 319 Optical Properties of Materials (*Prerequisite: FENG 103, FENG 104, Co-requisite: MSEN 301*)

Diffuse and specular reflection, refraction, birefringence, scattering, dispersion, absorption (uv, visible and infrared), non-linear effects, anti-reflection coatings, radiation effects, origins of colour, infrared transmitting materials, and other basic optical phenomena. Production and application of optical materials including optical waveguides, fiber optics, lasers, photochromic glasses and other commercial optical materials.

MSEN 322 Quantum Physics of Materials (*Prerequisite: FENG 105*)

Development background in the basic Physics required to understand the behaviour of electrons in atoms, molecules and solids. Breakdown of classical Physics. Classical theory of thermal radiation. Planck's theory of thermal radiation. Photoelectric effect. Compton effect. Wave-particle duality. The uncertainty principle. Rutherford, Bohr Schrödinger equation. Expectation values. Eigen-functions. Solutions of Schrödinger free particle. Exclusion principle. Free electron theory. Specific heat. Electrical and thermal conductivity. Band theory.

CENG 301 Numerical Methods Refer to the Computer Engineering curriculum for course details and prerequisites.

Electives (Level 300)

MSEN 325 Materials Science and the Future

Survey of selected materials that have potential impact in the advanced economy of the future. Photonic materials, Materials for information storage, Smart materials, Biomedical materials, Materials for clean energy, Porous materials, Diamond and hard materials, New polymers, Surfaces and interfaces.

CENG 316 Signals and Systems

Refer to the Computer Engineering Curriculum for course details and prerequisites.

Core (Level 400)

MSEN 400 Design Project

An individual design project leading to submission of a project thesis. The results are also presented orally to faculty members and peers.

MSEN 402 Non Destructive Evaluation and Failure Analysis (*Prerequisite: MSEN 313*)

Important property parameters. Failure: origins of brittle and ductile fractures. Analysis of fatigue failure, fatigue and slips, creep failure, wear failure. Techniques: fractography, penetrant techniques, ultrasonic, radiographic, eddy current, potential drop and magnetic methods of non-destructive testing.

MSEN 403 Composite Design and Fabrication (*Prerequisite: MSEN 315, MSEN 317*)

Influence of materials, design and processing on composite properties. Details of state-of-the-art fabrication technology and performance of continuous fabric-reinforced composites. Approaches toward addressing composite materials limitations.

MSEN 404 Magnetic Ceramics (*Prerequisite: FENG 103, FENG 104, MSEN 315*)

Fundamentals of magnetism, magnetic properties (intrinsic and structure-sensitive). Crystallography of ferrites. Technology of ferrites; conventional and non-conventional processing techniques of sintering, microstructure control. Effect of additives. Applications of magnetic ceramics.

MSEN 405 Electroceramics (Prerequisite: FENG 105, FENG 106, FENG 207)

A survey of ceramics used for their electrical magnetic, optical and piezoelectric functions including discussion of their design, composition, critical properties, processing techniques and applications. Categories include insulators, ceramic superconductors, capacitors, resistors, gas sensors, thermistors, varistors, piezoelectric, magnetic and electro-optic ceramics.

MSEN 406 Glass, Ceramic and Glass-Ceramic Materials (Prerequisite: MSEN 315)

Glass compositions, raw materials, glass melting, furnace operation and glass-forming. Sheet, tubing and pressed ware. Glass product manufacture, glass-to-metal sealing, annealing and tempering, quality control, glass-ceramics, phase transformation, immiscibility, homogeneous and heterogeneous nucleation, crystal growth and industrial glass-ceramic processes.

MSEN 407 Bioceramic Materials (Prerequisite: FENG 103, FENG 104)

A survey of ceramic materials and devices used for repair and replacement parts in the human body. Emphasis on nature of the materials, the design and fabrication of devices, properties, applications and the problems associated with the introduction of foreign materials into the biological environment.

MSEN 408 Professional Development Seminar (Prerequisite: Level 400 standing)

Selected topics for the Materials Scientist.

MSEN 409 Refractories (Prerequisite: MSEN 315, MSEN 316)

Technical information on raw materials, processing, microstructure, properties and applications of the principal types of refractories and high temperature insulations. Engineering factors pertinent to the manufacture, processing and design of refractory and insulation systems. Refractory needs for design and application. Areas for research and development of materials for future applications

MSEN 411 Science of Whitewares (Prerequisite: MSEN 315, MSEN 318)

Science and technology of whitewares (primarily stonewares and porcelains). Mineralogy. Raw material characterization, mixing, rheology and plasticity. Forming processes, drying, firing, phase equilibria, thermal stress evolution, microstructure characterization, physical properties and glazing. The course provides the fundamental basis for analyzing problems encountered in whitewares production so that general knowledge can be used to solve specific problems.

MSEN 412 Superconducting Materials (Prerequisite: FENG 103, FENG 104, MSEN 315)

Superconductivity and its history, Meissner effect, Ginzburg-Landau theory, BCS theory, High-T_c superconducting materials and their applications.

FENG 402 Entrepreneurship

Entrepreneurial process. Evaluation opportunities: Analysis of new ventures, valuation techniques, intellectual property issues, product and market research. Legal forms of organizations. Accessing and acquiring resources of financing. Developing a Business plan. Managing Enterprises. Marketing. Organizational behavior. Exit Strategies.

Electives (Level 400)

FENG 401 Law for Engineers

Course discussions cover contracts (formation, performance, breach, and termination), corporations and partnerships, insurance, professional liability, risk management, environmental law, torts, property law, evidence and dispute resolution. The course emphasizes those principles necessary to provide engineers with the ability to recognize issues which are likely to arise in the engineering profession and introduces them to the complexities and vagaries of the legal profession.

MSEN 415 Advanced Topics in Electroceramics (Prerequisite: MSEN 405)

Electronic materials and integrated circuits. Crystalline defects and band structures of semiconductor materials, Diffusion (diffusion of doping atoms into Si, electric field effect, diffusion in

polycrystalline Si, diffusion in SiO₂). Ion implantation. Thermal oxidation of Si and chemical vapour deposition of insulating films. Metallization. Reaction kinetics. Heterostructures: transistor and lasers. Heteroepitaxy. Assembly and packaging of electroceramics.

MSEN 416 Advanced Topics in Bioceramics (Prerequisite: MSEN 407)

Structure, properties and clinical applications of alumina, zirconia, bioactive glass and glass-ceramics. Hydroxyapatite: structure and clinical applications. Calcium phosphate ceramics, pyrolytic carbon, radiotherapy glasses and bioceramic composites.

MSEN 418 Lasers

The Nature of Light: Waves, Photons. Atomic Structure: Excitation & De-excitation of Atoms. Emission of Light from an Atom. Behaviour of Solids. Conduction in Metals. Absorption and Emission of Light: Gaseous Light Sources, Emission from Solids. Amplification of Light: Population Inversion, Optical Resonant Cavity, Longitudinal and Transverse Cavity Modes. Processes of Laser Action. Properties of Laser Light. Types of Laser: Gas Lasers. Solid State Lasers. Semiconductor Lasers and Light Emitting Diodes. Applications of Lasers.

CENG 409 Artificial Intelligence

Refer to the Computer Engineering Curriculum for course details and prerequisites.

CENG 414 Computer Graphics

Refer to the Computer Engineering Curriculum for course details and prerequisites.

Graduation Requirements

To graduate with a BSc Engineering (Material Science and Engineering), a student must satisfy all requirements of the University, Faculty and the Department.

University Requirements

A student shall be deemed to have satisfied the requirements for graduation if:

- (i) She/he has satisfied all the General University requirements.
- (ii) She/he has accumulated the minimum number of credits required by the Faculty, including both core and prescribed elective courses, namely, 144 credits.
- (iii) She/he has not have failed more than a total of 24 credits from the core courses and prescribed electives, provided that the failed grades are not lower than a "D".
- (iv) She/he has submitted a report originating from a Project Work. The Report must be submitted for assessment before the date of the last paper in the second semester examinations. In default the candidate shall be asked to submit the Report the following semester and shall be treated as a repeat examination with all its implications.

Faculty Requirements

1. Student must pass a minimum of 6 credits out of the following courses: FENG 118 Psychology, FENG 211 Principles of Management, FENG 214, Introduction to Economics, FENG 216, Sociology, FENG 401 Law for Engineers.
2. Student must take and pass FENG 402 Entrepreneurship.
3. Student must have taken at least two out of the three Internship (Industrial practice) programmes one of which must be FENG 302 Internship III (Level 300).

Departmental Requirements

In addition to the University and Faculty requirements to graduate with a BSc Engineering (Material Science and Engineering) a student must pass the following courses

MSEN 301	Ceramic Properties Lab 1
MSEN 315	Structure, Bonding and Phase equilibrium in Inorganic Solids (Structure of Materials)
MSEN 302	Ceramic Properties Lab II

MSEN 312	Powder Processing
MSEN 316	Heat and Mass Transfer
MSEN 318	Ceramics Processing Principles
MSEN 400	Design Project
MSEN 403	Composite Design and Fabrication
MSEN 405	Electroceramics
MSEN 409	Refractories
MSEN 411	Science of Whitewares
MSEN 402	Non-Destructive Evaluation and Failure Analysis
MSEN 404	Magnetic Ceramics
MSEN 406	Glass, Ceramics and Glass-Ceramic Materials

12. FACULTY OF SCIENCE

Vacant	-	Dean
D.K. Asiedu , <i>BSc (Ghana), MSc, PhD (Okayama)</i>	-	Vice-Dean
F.T. Kisseh , <i>BA, MPA (Ghana)</i>	-	Assistant Registrar
S.N. Sarpong , <i>Dip Stats (Ghana)</i>	-	Principal Admin. Assistant

THE SCIENCES (AT LEVEL 100)

Subject to the General Regulations for admission of SSSCE candidates into undergraduate degree programmes in the University of Ghana, the following conditions shall apply to all candidates admitted into the Faculty of Science:

- i. Students shall be admitted to read one of the following programmes: ***Biological Sciences, Biomathematical Sciences, Mathematical Sciences, Physical Sciences or Earth Sciences***, in addition to prescribed courses in Language and Study Skills.
- ii. Students shall be selected, based on performance at Level 100, to Level 200 at the School of Allied Health Sciences. Those intending to read BSc Medical Laboratory or BSc Physiotherapy, shall take courses in Biological Sciences or Biomathematical Sciences (Chemistry option). Those intending to read BSc Radiology, shall take courses in Biological Science or Biomathematical Sciences (Physics option).
- iii. Biology at Level 100 shall not be a pre-requisite for Level 200 Biology.
- iv. For practical sessions students will require a white Laboratory Coat.

The detailed course structure shall be as follows:

A. BIOLOGICAL SCIENCES

BIOL 101	Interactions in Nature	2
BIOL 102	Genetics and Evolution	2
BIOL 103	Mammalian Physiologies	2
BIOL 104	Growths of Flowering Plants	2
EASC 104	Introduction to Earth Science	2
CHEM 101	General Chemistry	3
CHEM 102	General Chemistry II	3
CHEM 103	General Chemistry Practical I	1
CHEM 104	General Chemistry Practical II	1
PHYS 101	Practical Physics I	1
PHYS 102	Practical Physics II	1
PHYS 111	General Physics I	3
PHYS 112	General Physics II	3
FASC 101	General Mathematics I	3
LANG 111/112	Academic Writing	3
MATH 116*	General Mathematics II	3

****This is an elective course for Biological Science students who wish to offer an additional course Mathematics***

B. BIOMATHEMATICAL SCIENCES

A student may opt for any one of the following combinations:

Mathematics	Biology	Chemistry
Mathematics	Biology	Statistics/Computer Science
Mathematics	Biology	Physics
Mathematics	Biology	Psychology

Students must have a minimum pass of B3 in Elective Mathematics at the WASSSCE to offer

Mathematics (i.e. MATH 111, 112, 113 & 114). All Biomathematical Science students shall offer the following core courses and either Group A, B, C or D, depending on candidate's third subject.

	Core (24 Credits)	
BIOL 101	Interactions in Nature	2
BIOL 102	Genetics and Evolution	2
BIOL 103	Mammalian Physiology	2
BIOL 104	Growth of Flowering Plants	2
GEOL 104	Introduction to Earth Science	2
MATH 111	Algebra and Trigonometry	3
MATH 112	Calculus I	3
MATH 113	Vectors and Geometry	3
MATH 114	Algebra	3
LANG 111/112	Academic Writing	3
	Group A	
CHEM 101	General Chemistry	3
CHEM 102	General Chemistry II	3
CHEM 103	General Chemistry Practical I	1
CHEM 104	General Chemistry II	1
	Group B	
PHYS 101	Practical Physics I	1
PHYS 102	Practical Physics II	1
PHYS 113	Mechanics and Thermal Physics	3
PHYS 114	Electricity, Magnetism and Quantum Phenomena	3
	Group C	
COMP 101	Introduction to Computer Science I	3
COMP 102	Introduction to Computer Science II	3
STAT 101	Introduction to Statistics	3
STAT 102	Elementary Probability	3
	Group D	
PSYC 111	Element of Psychology	3
PSYC 112	Psychology of Adjustment	3
PSYC 113	Psychology for Everyday Living I	3
PSYC 114	Psychology for Everyday Living II	3

C. MATHEMATICAL SCIENCES

	Core	
COMP 101	Introduction to Computer Science I	3
COMP 102	Introduction to Computer Science II	3
MATH 111	Algebra and Trigonometry	3
MATH 112	Calculus	3
MATH 113	Vectors and Geometry	3
MATH 114	Algebra	3
GEOL 104	Introduction to Earth Science	2
STAT 101	Introduction to Statistics	3
STAT 102	Elementary Probability	3
LANG 111/112	Academic Writing	3

Electives

PHYS 101	Practical Physics I	1
PHYS 102	Practical Physics II	1
PHYS 113	Mechanics and Thermal Physics	3
PHYS 114	Electricity, Magnetism and Quantum Phenomena	3
PSYC 111	Element of Psychology	3
PSYC 112	Psychology of Adjustment	3
PSYC 113	Psychology for Everyday Living I	3
PSYC 114	Psychology for Everyday Living II	3

D. PHYSICAL SCIENCES

CHEM 101	General Chemistry	3
CHEM 102	General Chemistry II	3
CHEM 103	General Chemistry Practical I	1
CHEM 104	General Chemistry Practical II	1
MATH 111	Algebra and Trigonometry	3
MATH 112	Calculus I	3
MATH 113	Vectors and Geometry	3
MATH 114	Algebra	3
PHYS 101	Practical Physics I	1
PHYS 102	Practical Physics II	1
PHYS 113	Mechanics and Thermal Physics	3
PHYS 114	Electricity, Magnetism and Quantum Phenomena	3
GEOL 104	Introduction to Earth Science	2
LANG 111/112	Academic Writing	3

E. EARTH SCIENCES

EASC 100	Field Exercises and Excursions	1
EASC 101	Historical Geology	2
EASC 102	Geological Map Work	2
EASC 103	Physical Geology	3
EASC 105	Introducing Earth Science	1
EASC 106	Earth's Materials and Resources	2
CHEM 101	General Chemistry	3
CHEM 102	General Chemistry II	3
CHEM 103	General Chemistry Practical I	1
CHEM 104	General Chemistry Practical II	1
PHYS 101	Practical Physics I	1
PHYS 102	Practical Physics II	1
PHYS 113	Mechanics and Thermal Physics	3
PHYS 114	Electricity, Magnetism and Quantum Phenomena	3
MATHS 111	Algebra and Trigonometry	3
MATH 112	Calculus I	3
LANG 111/112	Academic Writing	3
FASC 101*	General Mathematics I	3
MATH 116*	General Mathematics II	3

*Students with grade lower than B3 in Elective Mathematics at the WASSSCE shall offer FASC 101 and MATH 116 in place of MATH 111 and MATH 112.

COURSE DESCRIPTIONS

BIOL 101 Interactions in Nature

Some fundamental concepts in Ecology: population, community, ecosystem, niche. Dominance, biosphere, environment and succession. Biotic ecological factors; energy flow; biological associations: mutualism, commensalism, parasitism, predation. Pollination mechanisms; social insects. Environmental issues

BIOL 102 Genetics and Evolution

Mendelism: monohybrid and dihybrid crosses. Genes and chromosomes. Nucleic acids and protein synthesis. Variation. Evidence and theories of evolution

BIOL 103 Mammalian Physiology

Nutrition; transport; respiration; excretion; reproduction; sensory physiology and co-ordination. Adaptations to the environment

BIOL 104 Growth of Flowering Plants

Seed dormancy and germination; growth and development; tropisms, photosynthesis; mineral nutrition. Photoperiodism. Adaptations to the environment.

GEOL 104 Introduction To Earth Science

Definitions (Earth Science and branches of Earth Science). The Solar system: Bodies that make up the Solar System. The Earth: Earth as a planet, Earth's shape and size, Earth's atmosphere and hydrosphere, Earth's Interior, Earth's forces (Gravity and magnetism). Minerals: Definition and Basic Properties. Rocks: Definition and Formation of Igneous, Sedimentary, and Metamorphic rocks. Weathering and Erosion. The rock cycle. Geologic time: Relative time, The Standard Geologic Column, Absolute Time and Radiometric Dating.

CHEM 101 General Chemistry

Atomic Structure, Bonding and Intermolecular Forces, Structure of Organic Molecules: Alkanes and Cycloalkanes, Alkenes, Alkynes, Stereochemistry.

CHEM 102 General Chemistry II

Equilibria in Aqueous Solutions, Redox Systems, Properties of Solutions, Systematic Inorganic Chemistry, Introduction to Stereochemistry, Aldehydes and Ketones.

CHEM 103 General Chemistry Practical I

Preparation of standard solutions; Dilutions; Simple volumetric exercises; Qualitative inorganic analysis (Anions), Purification of organic compounds.

CHEM 104 General Chemistry Practical II

Applications of volumetric analysis; pH determinations; Determination of solubility products; Qualitative inorganic analysis (Cations); Simple organic preparations.

PHYS 101 Practical Physics I**PHYS 102 Practical Physics II**

Basic laboratory experiments to expose students to handling various measuring instruments, how to handle data error analysis

PHYS 111 General Physics I (For students in the Biological Sciences only.)

Mechanics: Vectors and laws of Physics, Motion in one and two dimensions, Projectiles; Relative velocity Newton's laws of motion; Momentum; Force, types of forces, conservative force, Work, energy, Conservation laws. Moment of inertia; Rotational motion, Newton's law of gravitation; Gravitational potential.

Thermal Physics: Macroscopic & Microscopic definitions, Thermal equilibrium, Zeroth law of

thermodynamics & temperature, Heat and work, First law of thermodynamics and applications, Gas laws, specific heat capacities of ideal gas, Kinetic theory of gases

Vibrations and Wave: Simple Harmonic Motion, Damped & forced harmonic motion (Qualitative) Examples of Mechanical & Electrical Oscillations, Waves: Types of waves. Wave Phenomena: Interference, Young's double slit experiment, blooming of lenses, Diffraction, Diffraction grating, Doppler Effect.

PHYS 112 General Physics II (*For students in the Biological Sciences only.*)

Electricity: Electric charge and Coulomb's Law; Electric field intensity, Electric flux and Gauss's law; Electric potential energy, electric potential, Electric current, current density; Electromotive force, Ohms law and power, Kirchhoff's laws, Heating effect of current, Measuring instruments

Magnetism: Magnetic field: Force on moving charge; Magnetic effect of current, Biot-Savart's and Ampere's laws; Force on current-carrying conductor in magnetic field, Parallel conductors carrying current; Electromagnetic induction, magnetic flux, Faraday's and Lenz's laws; Eddy currents, AC series circuits: reactance, impedance, resonance, power and power factor, Electricity in the home and home appliances

Modern Physics: The origins of Quantum Physics, wave-particle duality, Photons, electrons, nucleus, atoms and molecules, Photoelectric effect, de Broglie wavelength, The Bohr atom and atomic spectra, Radioactivity, Fission and fusion. Applications of Nuclear Physics

PHYS 113 Mechanics and Thermal Physics

Properties of Vectors: Geometrical representation, Multiplication – dot product and cross product, The three – dimensional Cartesian co-ordinate system, Components of a vector, Direction Cosines, Linear Independence, Magnitude of a vector, Geometrical methods of vector addition, The sine rule and the cosine rule, Vectors in two dimensions

Linear Momentum: Conservation Law, Direct and indirect collisions, The co-efficient of restitution

Motion: Newton's laws, equations of motion, Motion in one dimension, Parametric equations of motion, Motion in two dimensions, Projectile motion, Relative velocity

Force: Addition of Forces, Equilibrium, Impulse, Tension and the motion of connected masses, Friction

Circular motion: Uniform circular motion, Motion in a vertical circle, the conical pendulum

Work and Energy: Work done by a constant force, Work done by a varying force, Work and kinetic energy, Work and potential energy, Conservation of energy, Conservative and non-conservative forces – definition and examples

Rotational motion: Centre of mass, Moment of inertia, Angular momentum, Rotational kinetic energy, Torque

Gravitation: Kepler's laws, The law of Universal gravitation, Gravitational potential energy, Escape velocity

Microscopic and Macroscopic Definitions: Thermodynamic systems, Simple systems, Closed systems, Open systems, Isolated systems, Thermodynamic properties, States Processes, Paths, Intensive and extensive quantities

Thermal Equilibrium: Temperature, Adiabatic walls, Diathermal walls, Thermometers and thermometric properties, Comparisons of thermometers, Thermometric scales and conversions, Zeroth law of thermodynamics

Work and Heat: Thermodynamic equilibrium – conditions, Chemical equilibrium, mechanical equilibrium, thermal equilibrium, Effects of conditions not satisfied, Change of state, Quasi-static processes, Work done, Work depends on path, Isothermal processes, Isobaric processes, Isochoric (isovolumetric) processes, Adiabatic processes

Heat: Concept of heat, Internal energy, Heat capacity, Specific heat, Heat flow (Conduction, Radiation, and Convection)

First law of thermodynamics: Cyclic processes, Non-cyclic processes, Nature of stored energy, First law and its implications under (i) Isothermal processes (ii) Isobaric processes (iii) Isochoric processes Application: Introduction to entropy

Gas Laws: Properties of an ideal gas, Charles Law, Boyle's Law, Gay Lussac Law, Kelvin

temperature scale (absolute temperature)

Kinetic theory of Gases: Assumptions, Force exerted on the walls of the container, Pressure, Equation of state, Molecular velocities: (i) Mean velocity (ii) mean square velocity (iii) root mean square velocity, Equipartition of Energy

PHYS 114 Electricity, Magnetism and Quantum Phenomena

Electric Charge and Electric Field: Electric charge, Conductors, insulators and induced charges, Coulomb's law, Electric field and Electric forces, Charge distributions, Electric dipoles

Gauss' Law: Charge and electric flux, Gauss' Law, Application of Gauss' Law

Electrical Potential: Electric potential energy and work, electric potential

Capacitance and Dielectrics: Capacitors (parallel plate capacitors, spherical, and cylindrical shaped capacitors) and dielectrics, Capacitors in series and parallel, Charging and discharging a capacitor, time constant, Energy storage in capacitors

Electric Current, Resistance and Direct-current circuits: Electric current, Resistivity and Resistance, Electromotive force and electric circuits, Energy and power in Electric circuits, Resistors in series and Parallel, Kirchoff's Rules, Electrical measuring instruments

Magnetic Field and Magnetic Forces: Magnetic field, Magnetic field lines and Magnetic flux, Motion of charged particles in a magnetic field, Electric and magnetic fields acting together – application to velocity selectors, Magnetic force on a current-carrying conductor, Force and Torque on a current loop (a magnetic dipole moment)

Sources of Magnetic fields: Magnetic field of a moving charge, Magnetic field of a current element, Magnetic field of a straight current-carrying conductor, Force between parallel conductors, Magnetic field of a circular current loop, Ampere's law and its applications, Magnetic materials

Electromagnetic Induction: Faraday and Lenz's laws, Motional electromotive force, Induced electric fields, Eddy currents, Displacement current and Maxwell's equations

Inductance: Mutual inductance, Self-induced inductance, Inductors and magnetic-field energy, R - L and L - C circuits, L - R - C series circuits

Alternating current: Phasors and alternating current, Resistance and reactance, L - R - C series circuit, Band-Pass filters, Power in alternating-current circuits, Resonance in alternating-current circuits, Transformer

Introduction to Quantum Physics: Blackbody radiation and Planck's hypothesis, Photo-electric effect, Compton Effect, Atomic spectra, Bohr's model of the hydrogen atom, Photon's and electromagnetic waves, Wave properties of particles

Quantum Mechanics: Double-slit experiment, Uncertainty principle, Probability density, Schrodinger equation, Particle in a square well potential (a particle in a box)

FASC 101 General Mathematics

LANG 111/112 Academic Writing

The main objective of the Academic Writing course is to equip students with the communication skills that would enable them to succeed in the academic discourse community. Thus students are taken through strategies for paragraph development, study reading, gathering and using information from library and other sources and integrating information into essays (i.e. summarizing as part of exposition and writing citations) all within the larger context of enhancing the quality of language use of students.

MATH 111 Algebra and Trigonometry

Indices, Logarithms and Surds. Concept of a function. Function of a real variable: domain and range; injective, surjective functions. Polynomial functions and equations. Rational functions and partial fractions. Inequalities in one and two variables. Arrangements and Selections. Sequences and series, use of recurrence relations; the binomial theorem, principle of induction. Polar coordinates and curves. Exponential and logarithmic functions.

Circular measure, the sine, cosine and tangent functions and their reciprocals, trigonometric identities and equations, inverse circular functions.

MATH 112 Calculus

Elementary treatment of limit of a function, continuity, differentiation, rules of differentiation. Applications of differentiation. Derivatives of rational functions, exponential and logarithmic functions, circular functions and their inverses. Approximate methods of solving equations: graphical methods and Newton-Raphson method.

Integration. Applications of integration; area under a curve, volumes of solids of revolution. Numerical

Integration: trapezium and Simpson's rules

Formation of ordinary ordinary equations, solutions of simple first order differential equations.

Partial differentiation.

MATH 113 Vectors and Geometry

Vectors: notion of a vector and algebra of vectors; the scalar product and the vector product, applications to geometry. Position vector of a point in a plane and in space. Direction and normal vectors of a line; equation of a line, equation of a circle, intersection of a line and a circle. Loci, parametric representation of a curve. The conic sections in a rectangular Cartesian form. The general equation of the second degree, general conic; line pairs, translation and rotation of axes, principal axes. Vector equations of lines and planes.

MATH 114 Algebra

Algebra of complex numbers, Argand diagram, modulus - argument form of a complex number. De Moivre's rule. Roots of unity; complex conjugate roots of a polynomial equation with real coefficients. Geometrical applications, loci in the complex plane. Elementary transformation from z-plane to the w-plane. Algebra of matrices and determinants (up to 3 x 3 matrices); applications to linear equations. Linear transformations and matrix representation of a linear transformation.

FASC 101 General Mathematics 1

Indices and Logarithms. Functions and their graphs, polynomial functions, circular functions, equations and inequalities in one variable. Arrangement and selections. Binomial expansion. Limit of a function, the derivative of a function and its applications. Integration as the inverse of differentiation. Integral of simple functions. The definite integral as an area. Applications to kinematics. Elementary numerical methods, the Newton – Raphson method.

MATHS 116 General Mathematics II

Complex numbers, polar coordinates. Conic sections. Vectors and matrices.

Further differentiation and integration, parametric differentiation, exponential and logarithmic functions and their derivatives, integration of rational functions. Ordinary differential equations, first order and second order differential equations (with constant coefficients). Introduction to partial differentiation.

PSYC 111 Element of Psychology

This course is designed to introduce students to the history, basic theories, research methods and principles of Psychology. It is aimed at laying the foundation for higher level courses in Psychology. At the end of the course, it is expected that students will have basic knowledge of some psychological theories and principles underlying behaviour and also be in the position to relate what they have learnt to issues of everyday life

PSYC 112 Psychology of Adjustment

This course is an introductory course in psychology which deals with everyday adjustment issues. Focus will be on the application of knowledge in psychology to life situations and the development of skills to handle such situations. Topics to be covered include understanding adjustment, intimate relationships, interpersonal communication, career development, stress and stress management, decision making, handling conflicts, and problems of adjustment among others. At the end of the course, students should be able to develop a greater understanding of themselves and skills they can use to facilitate adjustment in life.

PSYC 113 Psychology for Everyday Living I

This course deals with the applications of psychological principles, theories and research findings to everyday life. Its main objective is to demonstrate the relevance and practicality of psychology and thus bridge the gap between theory and practice. Topics to be covered include factors affecting learning and memory, stress and illness, lifestyles and health and careers and work. At the end of the course, students should be able to relate/apply topics covered to everyday life.

PSYC 114 Psychology for Everyday Living II

This course deals primarily with issues of everyday life. It employs psychological principles, theories and research findings in an attempt to explain and understand matters of everyday life. Its main objective is to demonstrate the relevance and applicability of psychology in the daily life of the individual and thus draw links between what students learn in the lecture halls and what they experience in real life. Specific topics to be covered include motivation and goal setting, community and diversity, assertiveness and leadership, problem solving and creativity.

COMP 101 Introduction To Computer Science I

Objective: The course is intended to introduce students to the importance of Computer Literacy and to show students how the computer affects daily life and how it will impact their future. Thus, students will be taught sufficient computer knowledge to prepare them for working and living in a computerized society. **Introduction to Computer Science:** Historical development of computer, introduction to computers and how they work. Advantages and disadvantages of the Electronic computer system. Digital computer and analog computer, hybrid computer, how they operate and their applications. Generations of computers (Mainframe, mini, micro) and their features. Data versus Information. Careers and jobs in the computer industry. Hardware and software of the computer system. **Computer Hardware:** Basic configuration/functional units of the computer system. Brief overview of the central processing unit (cpu), its main elements and their functions. Memory devices, memory organisation and memory measurements (gigabyte, megabyte, kilobyte etc.). Examples of input/output devices, different types of microcomputers: Desktop, Laptop, Notebook, Palmtop etc. **Computer software:** Differences between system and application software, computer program and programming languages – structured, object oriented techniques. Machine language, Assembly language, High Level Language. **Application of Computer:** - The use of computers for data processing, scientific experimentation and implementation. Electronic Legal Database, Computer in Medicine, Engineering. Solution of mathematical problems, statistical analysis, management and accounting information systems. Decision support system and expert system, artificial intelligence. **Data Representation:** Bits, bytes and word. Character representation. ASCII and EBCDIC notation. Number Systems – Binary, Octal, Decimal, Hexadecimal. Integer and floating representation, integer and floating arithmetic. Fundamentals of digital logic and Boolean algebra. **Problem solving by the digital computer:** Use of Algorithm and Flowcharts. Understand the need for sequence of logical steps in programming. Data types concepts of computer program using BASIC Language. **Social Context of Computing:** Computing – Blessing or curse to the society. Computer Ethics and Professionalism. Computer Security and privacy, Computer hazards and prevention, applying intellectual property laws to software piracy.

COMP 102 Introduction To Computer Science II

Applications Laboratory: The purpose of this course is to introduce students to the use of microcomputer operating systems software, the use of high level languages and some of the standard micro-computer applications software. **Programming in Basic:** Programming concepts. Basic statements. Running a basic program, control statements: program loops. Other useful features. Programming exercises.

STAT 101 Introduction to Statistics

Introduction to Statistics. The reduction and interpretation of data.

STAT 102 Elementary Probability

Introduction to basic concepts of Probability, Random event and Random variables. Probability Calculus and some univariate probability distributions.

EASC 100 Field Exercises and Excursions

Several one-day long trips to the field to reinforce geological and environmental concepts learned in class and laboratory. This may include visits to mine sites to observe the mining of the ore and environmental issues associated with the mining.

EASC 101 Historical Geology

Historical Geology deals with the events that took place all over the world, throughout time. The syllabus covers the following topics: the structure of the Earth, the origin of the Universe, the origin of the Earth, and origin of the elements; the tempo of Earth history: catastrophic and/or uniformitarian; age of the Earth; time, including the vastness of geologic time, relative dating, radioactivity and isotopic dating; Geological Time Scale; fossils and fossilization; recognition, correlation, and interpretation of strata; origin and evolution of life; changes in sea level and climate; the evolution of continents; the geological record: events in Precambrian, Palaeozoic, Mesozoic and Cenozoic eras.

EASC 102 Geological Map Work

This course is mainly concerned with the interpretation of geological maps and the relationship between the landscape and underlying rocks. It covers the recognition and interpretation of geological structures from maps.

EASC 103 Physical Geology

The course cover the following topics: minerals; volcanism and extrusive rocks; intrusive activities and origin of igneous rocks; weathering and soil; sediments, sedimentary rocks and structures; metamorphism, metamorphic rocks and hydrothermal rocks; the rock cycle; mass wasting; streams and landscape; groundwater; glaciers and glaciations; deserts and wind action; shorelines and coastal processes; crustal deformation and folds; faults; earthquakes; the Earth's interior; the ocean floor; plate tectonics; mountain building and the evolution of continents.

EASC 105 Introducing Earth Science

This course introduces Earth Science as a holistic and practical science. It covers the following topics: scientific information gathering in the Earth Sciences, classification of the Earth Sciences, the traditional Earth Science disciplines, the practicality and importance of Earth studies, and career opportunities in the Earth Sciences.

EASC 106 Earth's Materials and Resources

The course is made up of two parts. The first part concerns Earth's materials, including the atom, elements, compounds and minerals, crystallinity, the importance of silicate minerals, physical properties of minerals, and formation, identification and description of minerals and rocks. Earth Materials is a laboratory based, however, instead of dedicating a specific day of the week to laboratory work, the lecture and laboratory elements will be integrated. Everyday life and the fabric of modern civilization depend on using the Earth's physical resources: water to drink; fuel to burn; rocks and minerals to build roads and houses; metals for machinery, electronics, and communications. The second part of the course is about the occurrence, availability, exploitation and sustainability of these essential resources. It also consider their origins, how to find and extract them, and the environmental consequences of exploitation.

LEVEL 200 PROGRAMMES

The Level 200 programmes of study in the Faculty of Science have been grouped into five broad subject areas, namely:

- i. Biological Sciences*
- ii. Biomathematical Sciences*
- iii. Earth Sciences*
- iv. Mathematical Sciences*

v. *Physical Sciences*

Students offering Level 200 courses shall be admitted into any one of the above five subject areas. Students intending to read B.Sc. (Med. Sci.) at Level 300 shall take courses in the Biological Sciences or Biomathematical Sciences (Chemistry option) at Level 200, and any other courses prescribed by the Medical School (refer to Chapter 18, Section 3 of this Handbook).

Students admitted direct to Level 200 and who do not possess a pass in Advanced Level Mathematics will be required to take FASC 201: General Mathematics (same as FASC 101).

Faculty-based Courses at Level 300

All students in the Faculty of Science shall be required to take and obtain a minimum Grade C in FASC 300 (History and Philosophy of Science – 2 credits). Students offering Biological Science at Level 300, in addition to FASC 300, shall also be required to take and obtain a minimum of Grade C in FASC 310 (Computer Literacy – 2 credits).

Project at Level 400

All Level 400 Science students shall be required to undertake a PROJECT. Combined Major degree students may select the PROJECT from either of the two Departments.

LEVEL 200 COURSES

BIOLOGICAL SCIENCES OPTION

Core

BIOL 202	Introductory Cell Biology and Genetics	3
BIOL 203	Introductory Animal Biology	3
BIOL 204	Introductory Plant and Animal Ecology	3
CHEM 201	Practical Chemistry I	1
CHEM 211	Physical/Analytical Chemistry I	2
CHEM 231	Organic Chemistry I	2
PHYS 200	Practical Physics	1
PHYS 203	Properties of Matter and Vibrational Motion	3

Electives (select a minimum of 6 Credits per Semester)

BCHM 201	General Biochemistry I	2
BCHM 202	General Biochemistry II	3
BIOL 201	Introductory Plant Morphology	3
CHEM 202	Practical Chemistry II	1
CHEM 212	Physical/Analytical Chemistry II	2
CHEM 232	Organic Chemistry II	2
FDSC 201	Introductory Food Science	1
NUTR 201	Introductory Nutrition I	1
NUTR 202	Introductory Nutrition II	1
FASC 201	General Mathematics (same as FASC 101)	3
STAT 208	Introductory Statistics for Biologists	3
OCFS 212	Introductory Oceanography and Fisheries	2
PHYS 204	Electromagnetism & Modern Physics	3

BIOMATHEMATICAL SCIENCES OPTION

Core (26 Credits)

BIOL 201	Introductory Plant Morphology	3
BIOL 202	Introductory Cell Biology & Genetics	3
BIOL 203	Introductory Animal Biology	3
BIOL 204	Introductory Plant and Animal Ecology	3
MATH 211	Introduction to Algebraic Structures	3

MATH 212	Vector Mechanics	4
MATH 213	Calculus II	4
MATH 214	Calculus III	3

Electives (Select a minimum of 6 Credits per Semester from A or B or C or D)

Group A

BCHM 201	General Biochemistry I	2
BCHM 202	General Biochemistry II	3
CHEM 201	Practical Chemistry I	1
CHEM 202	Practical Chemistry II	1
CHEM 211	Physical/Analytical Chemistry I	2
CHEM 212	Physical/Analytical Chemistry II	2
CHEM 231	Organic Chemistry I	2
CHEM 232	Organic Chemistry II	2
NUTR 201	Introductory Nutrition I	1
NUTR 202	Introductory Nutrition II	1
OCFS 212	Introductory Oceanography and Fisheries	2
FDSC 201	Introductory Food Science	1
HIST 205	The History of Western Medicine in Ghana	3

Group B

STAT 201	Introductory Probability I (Pre-req. MATH 101, 103)	2
STAT 202	Data Analysis I (Pre-Req. STAT 203)	3
STAT 203	Elementary Statistical Methods	3
STAT 204	Introductory Probability II (Pre-Req. STAT 201)	3
STAT 206	Official Statistics	2
COMP 201	Information Systems	3
COMP 202	Programming Using Java	3
COMP 203	Computer Systems	2
COMP 204	File Organization	1
COMP 205	Principles of Programming	3
COMP 206	Data Structures	1

Group C

PHYS 201	Practical Physics III	1
PHYS 211	Introduction to Physics of Materials	2
PHYS 215	Electromagnetism I	2
PHYS 202	Practical Physics IV	1
PHYS 212	Oscillations and Waves	2
PHYS 216	Atomic Physics and Nuclear Physics I	2
OCFS 212	Introductory Oceanography and Fisheries	2

Group D

PSYC 211	Introduction to General Psychology	3
PSYC 212	Motivation and Emotion	3
PSYC 213	Biological Psychology	3
PSYC 214	Introduction to Experimental Psychology	3
EASC 208	Natural Hazards and Disasters	2
OCFS 212	Introductory Oceanography and Fisheries	2

MATHEMATICAL SCIENCES OPTION

Option I: Single Subject Major

Core

Choose one Subject

Mathematics

MATH 211	Introduction to Algebraic Structures	3
MATH 212	Vector Mechanics	4
MATH 213	Calculus II	4
MATH 214	Calculus III	3
STAT 201	Introductory Probability I	3
STAT 202	Introductory Probability II	3
STAT 203	Elementary Statistical Methods	3
COMP 201	Information Systems	3
COMP 202	Programming Using Java	3
COMP 203	Computer Systems	2
COMP 205	Principles of Programming	3

Computer Science

COMP 201	Information Systems	3
COMP 202	Programming Using Java	3
COMP 203	Computer Systems	2
COMP 204	File Organization	1
COMP 205	Principles of Programming	3
COMP 206	Data Structures	1
MATH 211	Introduction to Algebraic Structures	3
MATH 213	Calculus II	4

Statistics

STAT 201	Introductory Probability I (Pre-req. MATH 111, 112)	3
STAT 202	Data Analysis I (Pre-req. STAT 203)	2
STAT 203	Elementary Statistical Methods	3
STAT 204	Introductory Probability II (Pre-req. STAT 201)	3
STAT 206	Official Statistics	2
MATH 211	Introduction to Algebraic Structures	3
MATH 213	Calculus II (Pre-req MATHS 112)	4
COMP 201	Information Systems	3
COMP 202	Programming Using Java	3
COMP 205	Principles of Programming	3

Electives

Select courses from other subject areas to meet requirements. Seek advice from the Departmental Course Advisor before choosing other courses.

Option II: Combined Subject Major

Core

Choose any two subjects

Mathematics

MATH 211	Introduction to Algebraic Structures	3
MATH 212	Vector Mechanics	4
MATH 213	Calculus II	4
MATH 214	Calculus III	3

Computer Science

COMP 201	Information Systems	3
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COMP 202	Programming Using Java	3
COMP 203	Computer Systems	2
COMP 204	File Organization	1
COMP 205	Principles of Programming	3
COMP 206	Data Structures	1
MATH 211	Introduction to Algebraic Structures	3
MATH 213	Calculus II	4

Statistics

STAT 201	<i>Introductory Probability I (Pre-req. MATH 111, 112)</i>	3
STAT 202	<i>Data Analysis I (Pre-Req. STAT 203)</i>	2
STAT 203	<i>Elementary Statistical Methods</i>	3
STAT 204	<i>Introductory Probability II (Pre-Req. STAT 201)</i>	3

Physics

MATH 211	<i>Introduction to Algebraic Structures</i>	3
MATH 213	<i>Calculus II</i>	3
PHYS 201	<i>Practical Physics III</i>	1
PHYS 202	<i>Practical Physics IV</i>	1
PHYS 211	<i>Introduction to Physics of Materials</i>	2
PHYS 212	<i>Oscillations and Waves</i>	2
PHYS 215	<i>Electromagnetism I</i>	2
PHYS 216	<i>Atomic Physics and Nuclear Physics I</i>	2

Psychology

PSYC 211	Introduction to General Psychology	3
PSYC 212	Motivation and Emotion	3
PSYC 213	Biological Psychology	3
PSYC 214	Introduction to Experimental Psychology	3

Electives

Select courses from other subject areas to meet requirements. Seek advice from the Departmental Course Advisor before choosing other courses.

EARTH SCIENCES OPTION

Core

EASC 200	Geological Field Methods I	3
EASC 201	Practical Crystallography	1
EASC 202	Petrography	2
EASC 203	Geological Structures	2
EASC 204	Principles of Geochemistry	3
EASC 205	Stratigraphy and Sedimentation	3
EASC 206	Fundamentals of Geophysics	3
EASC 207	Optical Mineralogy	2
EASC 208	Natural Hazards and Disasters	2
EASC 212	Introduction to Paleontology	2

Electives (Select a minimum of 6 Credits per Semester)

EASC 280	Internship in Earth Science I	1
CHEM 201	Practical Chemistry I	1
CHEM 202	Practical Chemistry II	1
CHEM 211	Physical/Analytical Chemistry	2
CHEM 212	Physical/Analytical Chemistry II	2
PHYS 201	Practical Physics III	1
PHYS 202	Practical Physics IV	1

PHYS 211	Introduction to Physics of Materials	2
PHYS 212	Oscillations and Waves	2
PHYS 215	Electromagnetism I	2
PHYS 216	Atomic Physics and Nuclear Physics I	2
MATHS 213	Calculus II	4
MATH 214	Calculus III	3
GEOG 202	Geomorphological Processes and Land forms	3

PHYSICAL SCIENCES OPTION

Option I: Single Subject Major

Choose one Subject

Core

Physics

STAT 203	Elementary Statistical Methods	3
MATH 211	Introduction to Algebraic Structures	3
MATH 213	Calculus II	3
PHYS 201	Practical Physics III	1
PHYS 202	Practical Physics IV	1
PHYS 211	Introduction to Physics of Materials	2
PHYS 212	Oscillations and Waves	2
PHYS 215	Electromagnetism I	2
PHYS 216	Atomic Physics and Nuclear Physics I	2

Chemistry

CHEM 201	Practical Chemistry I	1
CHEM 202	Practical Chemistry II	1
CHEM 211	Physical/Analytical Chemistry I	2
CHEM 212	Physical/Analytical Chemistry II	2
CHEM 231	Organic Chemistry I	2
CHEM 232	Organic Chemistry II	2

Electives

Select courses from other subject areas to meet requirements. Seek advice from the Departmental Course Advisor before choosing other courses.

Option II: Combined Subject Major

Core

Choose two subjects

Physics

MATH 211	Introduction to Algebraic Structures	3
MATH 213	Calculus II	3
PHYS 201	Practical Physics III	1
PHYS 202	Practical Physics IV	1
PHYS 211	Introduction to Physics of Materials	2
PHYS 212	Oscillations and Waves	2
PHYS 215	Electromagnetism I	2
PHYS 216	Atomic Physics and Nuclear Physics I	2

Chemistry

CHEM 201	Practical Chemistry I	1
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CHEM 202	Practical Chemistry II	1
CHEM 211	Physical/Analytical Chemistry I	2
CHEM 212	Physical/Analytical Chemistry II	2
CHEM 231	Organic Chemistry I	2
CHEM 232	Organic Chemistry II	2

Mathematics

MATH 211	Introduction to Algebraic Structures	3
MATH 212	Vector Mechanics	4
MATH 213	Calculus II	4
MATH 214	Calculus III	3

Computer Science

COMP 201	Information Systems	3
COMP 202	Programming Using Java	3
COMP 203	Computer Systems	2
COMP 204	File Organization	1
COMP 205	Principles of Programming	3
COMP 206	Data Structures	1
MATH 211	Introduction to Algebraic Structures	3
MATH 213	Calculus II	4

Electives

Students may select courses from other subject areas to meet requirements

LEVEL 200 COURSES

COURSE DESCRIPTIONS

BIOL 201 Introductory Plant Morphology

Survey of the form of the vegetative and reproductive body of seed plants. Primary meristems and development of the primary vegetative body angiosperms; internal organization of the primary vegetative body and the relationship between structure and function of tissues; mechanism and importance of secondary growth in dicotyledons; brief survey of the relationship between structure and industrial uses of secondary tissues

BIOL 202 Introductory Cell Biology & Genetics

Basic cell physiology-bioelements, water, water in cells, method of expressing concentrations of solutions, osmotic phenomena, imbibition, biomolecules, carbohydrates, amino acids, proteins, lipids, nucleotides, nucleic acids, and the role of these in either cell biology and/or structure, enzyme action; photosynthesis, respiration and nitrogen metabolism. Basic principles of genetics; gene inter-actions, sex and inheritance; chemical basis of heredity; mutations, medical and biochemical genetics.

BIOL 203 Introductory Animal Biology

General survey of invertebrates and vertebrates with reference to form and function. Phylogeny, life-cycles. Morphological and physiological adaptations to ways of life.

BIOL 204 Introductory Plant & Animal Ecology

Basic principles of quantitative plants ecology; plant and animal life in West Africa. Introduction to description and classification of plant communities; climax v egetation; the West African environment; types of forest in West Africa. Basic concepts in plant and animal ecology; plant and animal communities and the biology of animal population.

BCHM 201² General Biochemistry I

² BCHM 201 is a prerequisite for BCHM 202 General Biochemistry II

Cell Structure & Function: Prokaryotes & eukaryotes; subcellular organelles (compartmentalization of cellular processes); the plant cell; the bacterial cell; the animal cell; unicellular & multicellular organisms; methods for studying the cell (cell disruption, fractionation). **pH and Buffer Solutions:** Definition of pH, the pH scale, buffer solutions & buffer capacity; the Henderson-Hasselbach equation in the preparation of buffers. **Chemistry and Functions of Biological Compounds:-** *Biomolecules:* monomers, polymers, macromolecules, supramolecules. Carbohydrates: mono-, di-, oligo- and polysaccharides, stereoisomerism, mutarotation, reactions of. Lipids: different types (fatty acids, triacylglycerols, phospholipids, sphingolipids, steroids, cholesterol, eicosanoids). Proteins: amino acids and protein structure, classification. Nucleic acids: Nitrogenous bases, nucleosides, nucleotides and nucleic acids. Vitamins and coenzymes. Enzymes: Properties & classification, cofactors & coenzymes, kinetics, effect of pH, temp., [S], [E] on enzyme-catalyzed reactions, Michaelis-Menten equation; regulation (activation & inhibition).

BCHM 202 General Biochemistry II

METABOLISM - Digestion of food:- *Carbohydrates:* glycolysis, substrate level phosphorylation; hexose monophosphate shunt; gluconeogenesis; synthesis of other carbohydrates from monomers (e.g. glycogen synthesis); fate of pyruvate in different organisms. The electron transport chain in mitochondria and ATP synthesis. *Lipids:* β -oxidation of fatty acids, fate of acetyl-CoA units (TCA cycle, ketone bodies, cholesterol); fatty acid biosynthesis. *Amino acids:* Oxidative deamination; decarboxylation; transamination; urea cycle; NH_3 assimilation (reductive amination, glutamate dehydrogenase); fate of carbon skeleton (glucogenic and ketogenic amino acids); metabolism of some individual amino acids. *Nitrogen fixation:* Conversion of nitrates, nitrites and gaseous N_2 to ammonia. **Metabolic diseases:-** *Nucleic acid replication and protein biosynthesis:* DNA replication, transcription and translation. Photosynthesis: Light trapping events; the energy conversion process (PSI & PSII); cyclic and non-cyclic photophosphorylation; carbon fixation (Calvin cycle, C_3 & C_4 plants).

CHEM 201 Practical Chemistry I

Basic techniques in volumetric and gravimetric analyses. Introduction to methods for preparing and purifying organic compounds.

CHEM 202 Practical Chemistry II

Applications of volumetric analyses; emf of simple cells; conductance; simple organic syntheses. Qualitative organic analyses.

CHEM 211 Physical/Analytical Chemistry I

Quantitative treatment of acids, bases, ampholytes, and buffer systems. Titration curves; choice of indicators. Complex ion equilibria; solubility products and precipitation. Treatment of errors; significant figures, precision and accuracy.

CHEM 212 Physical/Analytical Chemistry II

Electrolytic conduction; measurement of conductance, and its application to dissociation constants, solubility products, conductimetric titrations etc. Electrochemical cells; electrode potentials; measurement of emf, and its application to equilibrium constants, solubility products, pH etc.

CHEM 231 Organic Chemistry I

Stereoisomerism; optical activity. Various methods for the oxygenation of alkenes. Chemistry of alcohols and ethers; $\text{S}_{\text{N}}1$, $\text{S}_{\text{N}}2$, E-1 and E-2 mechanisms.

CHEM 232 Organic Chemistry II

The chemistry of Aldehydes, Ketones, Carboxylic acids. Carboxylic acid derivatives and Amines.

PHYS 200 Practical Physics

(For students in the Biological Sciences only)

PHYS 201 Practical Physics III

PHYS 202 Practical Physics IV

Laboratory experiments illustrating modern experimental techniques and error analysis

PHYS 203 Properties of Matter and Vibrational Motion

(For students in the Biological Sciences only)

Solids: Elastic and Plastic properties

Liquids: Laminar and turbulent flow; Bernoulli's principle, Viscosity; Brownian motion

Gases: Simple kinetic theory; Specific heats, Real and Ideal Gases, Laws of Thermodynamics, Diffusion

Circular Motion: Uniform Circular Motion; Centripetal Acceleration, Conical Pendulum, Forces on vehicles rounding a curve; Banking, Motion in a vertical circle, Motion of a satellite

Harmonic Motion: Definitions; Restoring force; Equations of Simple Harmonic Motion, Simple Pendulum; Mass attached to a spring; Angular Harmonic Motion; Electrical Oscillations; Energy in Simple Harmonic Motion, Damped Harmonic Motion – logarithmic, decrement, overdamped, underdamped and critical damping. Forced Oscillations, Resonance; Damped and Forced electrical oscillations

Waves: General characteristics, Interference, Diffraction, Resolution; Rayleigh's criterion; Resolving power; Resolution limit in optical instruments.

PHYS 204 Electromagnetism & Modern Physics

(For students in the Biological Sciences only.)

Magnetic materials: Ferromagnetism, Induced magnetism, Capacitance and dielectrics, N-type and P-type semiconductors Semiconductor diode, Solar Cells, Transistors, Transformers and Electric motors; Electrical appliances, Amplifiers, Measuring instruments: Oscilloscopes; Spectrometers; Electron microscopes, Transmission and Reception of Radio waves, TV cameras and receivers, Review of the structure of the atom; Quantisation laws; Exclusion principle; Emission and absorption of radiation; Photoelectric effect, Applications of radioactivity; Production and uses of X-rays, Radiation detectors; Isotopic masses; the Mass Spectrograph

PHYS 211 Introduction to Physics of Materials

Forces between atoms and molecules and their consequences; Elastic moduli – Young's, Shear, Bulk, Poisson ratio, non-elastic behaviour; Flow properties of fluids; Continuity equation, hydrostatic equation, Euler's and Bernoulli's equations, Kelvin's circulation theorem, Reynold's number.

PHYS 212 Oscillations and Waves

Simple, damped and forced oscillations; decay of oscillations, resonance; general properties of waves; waves in one dimension; superposition of waves; dispersion and group velocity; Doppler effect; waves in physical media; waves in two and three dimensions, circular and spherical wave fronts.

PHYS 215 Electromagnetism I

Gauss's law and its applications; electric field around conductors, electric field and potential gradient, Gauss's Law in dielectrics, magnetic fields, electromagnetic induction, inductors, self and mutual induction, L-R-C circuits; resonance; power and power factor; paramagnetism, ferromagnetic materials, hysteresis.

PHYS 216 Atomic Physics and Nuclear Physics I

The Bohr atom; atomic structure; line spectra and energy levels; x-ray production and scattering; Continuous spectrum. Structure and properties of the nucleus; binding energy and nuclear forces; Radioactivity – alpha, beta, gamma; fission and fusion

NUTR 201 Introductory Nutrition I

Major nutrients in foods and their food values: Carbohydrate, Proteins, Lipids, Vitamins and minerals; Breast feeding

NURS 202 Family Health Crisis Intervention II

The course is a continuation of NURS 201. Conditions of the cardiovascular and respiratory systems are discussed. Details of pathophysiology and psychopathology of more common diseases of the two systems are studied with specific medical, surgical, psychiatric, nutritional and nursing interventions bearing in mind, the reaction of people in different age groups. The nursing process approach is used to manage these conditions. Levine's theory of conservation of energy is applied.

NURS 203 Family Health Crisis Practical I

This course is a practical component of NURS 201. Students have six hours clinical experience weekly at the medical and surgical units. Lecturers, nurse technicians and preceptors supervise the students. Clinical conferences are organized to discuss the students' clinical experiences.

NURS 204 Family Health Crisis Practical II

This course is a practical component of NURS 202. Students have six hours clinical experience weekly at the medical and surgical units. The students work under the supervision of lecturers, nurse technicians and preceptors. Clinical conferences are organized to discuss the students' clinical experiences after each visit.

PSYC 211 Introduction to General Psychology

This course is designed to introduce students to Psychology as a discipline and a profession. The emphasis is on the history of psychology, the different orientations available in the field and the basics of research in psychology. The course will also look at two interesting areas in psychology namely, intelligence and social Behaviour. By the end of this course, students should know what psychology is, why it is important for them to study psychology and be adequately prepared for building up on their knowledge in higher levels of their study in psychology.

PSYC 212 Motivation and Emotion

This course is intended to introduce students to motivational causes of behaviour and the emotions experienced. Understanding motivation and emotion is fundamental to understanding human behaviour. Emphasis will be placed on the theories, sources and types of motivation and emotion. At the end of the course, students should be able to understand motivational causes of behaviour and the expression of emotions.

PSYC 213 Biological Psychology

This course examines the neurobiological bases of behaviour. The course will cover the nature of neurons and neuronal communication, the translation of the external world into internal perceptions (vision, hearing, touch, etc.) and the role of the nervous system in the cognition skills of thinking, learning, memory, and language.

PSYC 214 Introduction to Experimental Psychology

This course is designed to introduce students to the general principles of experimental research method. Emphasis will be placed on design, control of extraneous variables and ethics governing psychological research. At the end of the course, it is expected that students will be able to design simple experiment, identify flaws in basic design and control for extraneous variables.

MATH 211 Introduction to Algebraic Structures

Logic and proof. Set Theory. Cartesian products, binary relation, equivalence relation. The number system; from \mathbb{N} to \mathbb{Z} to \mathbb{Q} to \mathbb{R} , from \mathbb{R} to \mathbb{C} . Countability. Principle of finite induction. Axiomatically defined systems; groups, rings, integral domains and fields. Isomorphism of algebraic structures. Vector spaces, homomorphism of vector spaces.

MATH 212 Vector Mechanics

Vector functions of a scalar variable; differentiation and integration, Serret- Frenet formulae, differential equations of a vector function. Motion of a particle; kinematics, displacement, velocity and acceleration. Relative motion. Newton's laws of motion; concept of force, work, energy and

power. Impulse and momentum, conservation laws of energy and linear momentum. Rectilinear motion, resisted motion, harmonic and damped harmonic motion. Motion in a plane. The two-body problem, motion of a variable mass.

MATH 213 Calculus II

Function of a single variable. The first and second derivatives and their applications. Integration as a sum; definite and indefinite integrals; improper integrals. The logarithmic and exponential functions, the hyperbolic functions and their inverses. Techniques of integration including integration by parts, recurrence relations among integrals, applications of integral calculus to plane curves: arc length, area of surface of revolution. Pappus theorems, approximate evaluation of definite integrals. Ordinary differential equations: first order and second order linear equations (with constant coefficients).

MATH 214 Calculus III

Higher derivatives and applications. Leibniz's theorem and applications. Taylor's theorem. Maclaurin's and Taylor's expansions of some standard functions. Vectors, algebra of vectors and applications, vector functions. Functions of several variables, partial derivatives, Euler's theorem on homogeneous functions; gradients, directional derivatives, maxima and minima, constrained extrema, the method of Lagrange's multipliers. The gradient operator; curves, and surfaces, tangent planes and normal lines. The divergence and curl operators. Introduction to multiple integration.

MATH 216 Discrete Mathematics

Number Systems, elementary algorithms, recursion and iteration. Induction and recurrence relations. Generating functions, computational complexity. Analysis of algorithms. Combinatorics. Boolean algebras, logic and logic circuits. Graph theory and its applications.

HIST 205° The History of Western Medicine in Ghana

This course describes the pre-colonial and post-colonial systems of healthcare. It describes the laying of the foundations of Western Medical practice and the further development of the system since the country became politically independent. It emphasizes the changes that medical policy has undergone since the late 19th Century, the reasons and impact of these changes, the contributions of individual employees (Ghanaian and expatriate) to the present structure of the Medical Services, and the establishment of the Ghana Medical School. The course shall describe how several major diseases have been eradicated or tamed with reasons which explain the successes and failures.

STAT 201 Introductory Probability I (Pre-req. MATH 101, 103)

Introduction to the concepts of probability, Random Events, and Random Variables. The Probability Calculus, Univariate probability distributions.

STAT 202 Data Analysis I (Pre-Req. STAT 203)

The aim of this course is to give students practice in handling Large data Sets; specifically to provide opportunities for Descriptive and Exploratory Studies.

STAT 203 Elementary Statistical Methods

Bivariate Data Analysis. Elements of statistical inference.

STAT 204 Introductory Probability II (Pre-Req. STAT 201)

Bivariate Distributions. Moment Generating Functions; their properties and uses. Sampling distributions. Distributions associated with samples from a Normal population. The Weak Law of Large Numbers and the Central Limit Theorem. Applications.

STAT 206 Official Statistics

Purposes and Scope of Official Statistics. Structure and Work of the National Statistical System. Organisational, Methods and Practices of data collection and dissemination.

COMP 203 Computer Systems

Introduction to modern computer systems with emphasis on PC-systems. The hardware and peripherals that go to make a computer system. Interfacing devices and processing techniques. An overview of a modern computer system and its main components. Auxiliary and peripherals devices.

Types of computer and computer configurations: Micros, minis and mainframes – differences and similarities. Single user and multiuser PC-Systems. **Computer Hardware:-** Processor, input and output devices. Auxiliary storage devices: Tapes, floppy disks, and hard disks. Input devices: Keyboard, mouse, and how they work. Output devices: printers (dot matrix, daisy wheel, thermal, etc.) Plotters, video display units. Plotter video display units. **Installation of a computer:** Location, the physical environment and site preparation. Static electrical and power line interference's. Interfacing device: number and type of ports. Interconnecting Hardware and software. User interface – the need for operating systems; different operating systems. PC-systems: PC-DOS, MS-DOS, CPM, ETC. Single user and multi-user operating systems. **The processor:** Architecture and activities. Structure of a processor. Processor chips, address bus and memory capacity. Processing techniques: Batch and on-line processing, multi-user systems and networks. Distributed and centralized processing/Processing aids: Windows, Icons, Mouse and Pointers. Files, Directories and sub-directories. Organising files, Pathnames, filenames and extensions. File processing.

COMP 204 File Organization

The different file organisational methods available for tape, floppy diskettes, and disk packs and an appreciation of the methods suitable for particular application. File organisational methods: Random; Sequential; Indexed; Linked; partitioned; Inverted. File Access Methods: Random; Sequential; Direct Access; ISAM, VSAM. Operation on Files: Inquiry; Insertion; Deletion; Merge. Disks and their communications, with Computers; Channel; Control Units; Switching.

Record formats: Fixed variable; fixed blocked; variable blocked; undefined.

COMP 205 Principles of Programming

Operating System: Review of an operating system, files and their editing. Use of MS-DOS/UNIX.

Problem solving on a computer: Formulation of a problem; completeness of specification; algorithmic solution; top-down design; problem decomposition; Step wise refinement. Programming concepts: The elements of PASCAL: Comments, Data types, declaration, statement, expressions; control constructs; procedures and functions; input and output; arrays; pointer; records; file handling. Compilation and executing: Error messages, debugging techniques, testing, choice of test. Elements of programming style: Data structuring; documentation; maintenance.

COMP 206 Data Structures

This course is designed as an introduction to the relations (structures) among elementary data types occurring in user problems. The student learns how to represent and implement these data structures in a program and how to operate on these structure. The basic data types: Integer, real, Boolean and character. General concepts of abstract data structures. Arrays and Strings, and their representation in memory. One and two-dimensional arrays. Lists, vectors, tables, matrices. Static and dynamic structures. Linear structures: Pointers, stacks and queues. Sequential and linked lists. Circular lists. Non-linear data structures, diagraph and three traversals. Expression trees. Binary and applications. Compiling Techniques.

EASC 200 Geological Field Methods I

This is a practical field-based course consisting of: (i) Lecture/practical sessions on geological mapping techniques, construction and interpretation of geological maps and cross-sections, field safety and welfare, and field trip planning and organisation. (ii) 'live-in' field geological mapping providing 'hands-on' instruction in geological mapping techniques and data collection for preparation of geological maps and cross sections.

Details of the course content are as follows:

Semester I: Introduction to geological mapping; geological compass and field navigation; field use of compass to plot data; GPS in geological mapping; field mapping techniques; recording of field data; identification and description of sedimentary rocks in the field; identification and description of

sedimentary structures; collection and measurement of paleocurrent data; excursion briefing and organisation. Hands-on Exercises: scale calculation & conversion; measurement of a pace; plotting a grid from GPS coordinates; pace and compass closed traverse.

Inter-Semester Break: Field mapping, with supervision, in a sedimentary terrain (e.g., the Sekondian Group in the Sekondi/Takoradi area).

Semester II: Analysis and interpretation of data collected from the field. Preparation of geological maps and sections, and submission of Field Notebook. Hands-on Exercises: Analysis of structural and lithological data collected from the field. Preparation and digitization of geological maps and submission of Field Notebook. Preparation of a short report on the sedimentology of the studied formation.

EASC 201 Practical Crystallography

This is a practical course involving the essentials of geometrical crystallography and internal order of crystals. The detail syllabus is as follows: Essentials of geometrical crystallography: Crystal description, symmetry elements, crystal symmetry, crystallographic axes. Parameters, indices, crystallographic notation, principal laws geometric crystallography. Faces, forms, zones, crystal habit, measurement of crystal angles. Law of rational indices, classification of crystals, crystal systems, thirty-two crystal classes, spherical projection, stereographic projection, intergrowth of crystals. Essentials of Internal Order of crystals: Symmetry elements, space lattice, unit cell, space groups.

EASC 202 Petrography

This practical course covers the study of igneous, sedimentary and metamorphic rocks in hand specimen and thin sections. Concepts are illustrated by rock suites from Ghana and elsewhere.

EASC 203 Geological Structures

Definitions, types, elements, scales and classification of structures. Primary and secondary structures. Fundamental principles of structural geology; petrofabrics; structural analyses; significance of structural geology in geological mapping and mining.

EASC 204 Principles of Geochemistry

This course intends to familiarize students with the tools of geochemistry. These include the tools of thermodynamics, kinetics, aquatic chemistry, trace element geochemistry, and isotope geochemistry. The course is divided into three parts. Part I covers the theory and application of thermodynamics and kinetics to processes controlling the composition of natural waters, and basic mineral-water-atmospheric gas interactions. Part II covers trace elements in igneous processes, including Goldschmidt's classification of the elements and the geochemical periodic table, element partitioning between coexisting minerals, and trace element distribution during partial melting and crystallization. Part III presents an overview of radiogenic and stable isotope geochemistry.

EASC 205 Stratigraphy and Sedimentation

The course is divided up into three parts. The first part deals with the basic aspects of sedimentation and the formation of sedimentary rocks. This will provide the framework to interpret the processes of sedimentation responsible for forming different types of sedimentary rocks. The second part will look at the dominant types of environments where sediments are deposited to furnish the actualistic background to interpret ancient environments. The third part entails synthesizing sedimentologic and stratigraphic data to permit interpretations of Earth history.

Course outline: Sedimentary processes, environments and facies; properties and classification of sediments and sedimentary rocks; sedimentary textures and structures; stratigraphic nomenclature and the stratigraphic column; principles of stratigraphy. Laboratory work emphasizes the description and analysis of sedimentary rock bodies.

EASC 206 Fundamentals of Geophysics

This course is an introduction to basic principles of geophysics as applicable to exploration and environmental problems, and solid earth. Topics covered include general earth properties (size, mass, and moment of inertia), seismology (wave equation, P, S, and surface waves, seismic reflection and

refraction), gravity (gravity anomalies, rheology, flexure, geodesy, and geoid), magnetics (dipole field, paleomagnetism, and seafloor spreading), electrical, geophysical well logging, radioactivity and geochronology, and heat flow.

EASC 207 Optical Mineralogy

This course is designed to prepare students for the study of rocks in thin section (i.e. petrography). Topics to be covered include the elementary principles of crystal optics, familiarization with the microscope, the immersion method, isotropic, uniaxial, and biaxial optics, and the detailed study of rock-forming minerals in thin section. By the end of the course students should be able to readily identify the major rock-forming minerals in thin section. In addition students will learn how to find the necessary information to identify an unknown and perhaps never studied mineral. In order to accomplish the first two objectives, students will learn about the underlying concepts related to mineral behaviour in transmitted/polarized light and the use of the petrographic microscope.

EASC 208 Natural Hazards and Disasters

The course is divided into two parts. Part I involves natural disasters and their environmental impact and covers earthquakes, volcanoes, tsunamis, mass wasting, slope stability, floods, river management and human impact, subsidence, the greenhouse effect and ozone depletion. Part II provides an introduction to natural hazards. The lectures cover the following topics: hazards concept and context; spatial variability and human persistence; hazard forecasting and risk assessment; the perception of hazards and extreme events; experiencing hazards; adjustment to hazards; the human impact; and hazards: present and future prospect; disaster management in Ghana.

EASC 212 Introduction to Palaeontology

Brief introduction study of foraminifera, diatoms, coccoliths etc. Nature of the organism and geologic importance. Important index fossils, Environmental stratigraphy, environmental reconstruction and the earth science. Identification and sketching of some specimens of the phyla of organisms indicated above.

EASC 280 Internship in Earth Science I

Long vacation industrial attachment to a governmental or private sector institution/company. Credit is contingent on submission of a final report by student and an assessment report by industry.

DEPARTMENT OF BIOCHEMISTRY

FACULTY

S.T. Sackey , <i>BSc, MPhil (Ghana), PhD (Adelaide)</i> -	Associate Professor/ Head of Dept
F.K. Rodrigues , <i>BSc (Hons), MBA (Ghana), PhD (Leeds), CA(Int), FRSH (Lond)</i> -	Associate Professor
N. A. Adamafo , <i>BSc (Ghana), PhD (Monash)</i> -	Associate Professor
J. P. Adjimani , <i>BSc (KNUST), MSc (Brock), PhD (Utah State)</i> -	Senior Lecturer/
W. S. K. Gbewonyo , <i>MSc (Ghana), MA Th. (CTS) - PhD (Birmingham)</i> -	Senior Lecturer
Y. D. Osei , <i>MSc (Ghana), PhD (Tenn)</i> -	Senior Lecturer
W-P. Dorleku , <i>BSc MPhil (Ghana)</i> -	Lecturer
G.A. Awandare , <i>BSc, MPhil (Ghana)</i> -	Lecturer
A. Ocloo , <i>BSc (Ghana) PhD (Cambridge)</i> -	Lecturer
A.R. Aikins , <i>BSc, MSc (Ghana)</i> -	Lecturer
L.K.N Okine , <i>BSc (Ghana), PhD (Surrey)</i> -	Assoc. Professor/Part-Time

LEVEL 300 & 400 COURSES **BSc Single Major in Biochemistry**

BCHM 301 ³	Structure and Function of Biomolecules	2
BCHM 302 ⁴	Intermediary Metabolism	3
BCHM 303	Separation Methods	2
BCHM 304	Enzymology	2
BCHM 305	Analytical Techniques	2
BCHM 307	Practical Biochemistry I	3
BCHM 308	Practical Biochemistry II	3
BCHM 401	Protein Structure and Mechanism of Enzyme Action	3
BCHM 402	Biological Oxidation and Bioenergetics	2
BCHM 403	Molecular Biology I	3
BCHM 404	Biomembranes	2
BCHM 405	Practical Biochemistry III	3
BCHM 406	Integration and Control of Metabolism	2
BCHM 407	Practical Biochemistry IV	3
BCHM 409	Biochemistry of Hormones	2
BCHM 412	Research Project	6
CHEM 313	Physical Chemistry III: Thermodynamics	2
CHEM 331	Organic Chemistry III	1
CHEM 332	Organic Practical	2
CHEM 333	Organic Chemistry IV	1
CHEM 334	Organic Chemistry V (Aromatic chemistry)	2

Electives

GROUP A: Select a minimum of 5 credits

BIOL 315	Principles of Genetics	3
BOTN 312	Whole Plant Physiology	3
CHEM 314	Physical Chemistry IV	2
FDSC 301	General Microbiology	2
ZOOL 303	Comparative Animal Physiology	3
ZOOL 304	Parasitology and Public Health	3

GROUP B: Select a minimum of 6 credits

BCHM 411	Clinical Biochemistry	2
BCHM 413	Parasite Biochemistry	2
BCHM 414	Immunology & Immunochemistry	2
BCHM 415	Xenobiotic Metabolism	2
BCHM 416	Plant Biochemistry	2
BCHM 418	Insect Biochemistry	2
BCHM 422	Molecular Biology II	2
CHEM 411	Physical Chemistry V	2
CHEM 431	Organic Chemistry III	2
CHEM 432	Organic Chemistry VII (Natural Products)	2
CHEM 433	Organic Chemistry VIII	2
CHEM 451	Transition Metal Chemistry	3

BSc (Combined Major) in Biochemistry

Core (32 credits)

BCHM 301	Structure and Function of Biomolecules	2
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³ BCHM 301 is a prerequisite for BCHM 302 as well as ALL Level 400 Biochemistry courses

⁴ BCHM 302 is a prerequisite for BCHM 406 Integration and Control of Metabolism

BCHM 302	Intermediary Metabolism	3
BCHM 303	Separation Methods	2
BCHM 304	Enzymology	2
BCHM 305	Analytical techniques	2
BCHM 307	Practical Biochemistry I	3
BCHM 308	Practical Biochemistry II	3
BCHM 401	Protein Structure and Mechanism of Enzyme Action	3
BCHM 402	Biological Oxidation and Bioenergetics	2
BCHM 403	Molecular Biology I	3
BCHM 404	Biomembranes	2
BCHM 405	Practical Biochemistry III	3
BCHM 406	Integration and Control of Metabolism	2
BCHM 409	Biochemistry of Hormones	2

Biochemistry for Agriculture and Consumer Sciences

BCHM 201 ³	General Biochemistry I	2
BCHM 202	General Biochemistry II	2

³ *BCHM 201 is a prerequisite for BCHM 202 General Biochemistry II*

NB: REQUIREMENTS FOR GRADUATION

Undergraduates

- Candidate must have satisfied all University and Faculty requirements.
- Candidate must have taken ALL the Core Courses available to students in the Biological Sciences Group at Level 200, and those in the Biomathematical Sciences Group must have studied Chemistry as their third subject.
- FOR A BIOCHEMISTRY SINGLE MAJOR: candidate must have taken ALL Core Courses and Prescribed Electives of the “**Single Major in Biochemistry programme**”.
- FOR A COMBINED MAJOR WITH BIOCHEMISTRY: Candidate must have taken All Core Courses of the “**combined major Biochemistry programme**”. There are no prescribed electives in Biochemistry for such students.

COURSE DESCRIPTIONS

BCHM 201 General Biochemistry I

Cell Structure and Function. Prokaryotes & eukaryotes; subcellular organelles (compartmentalization of cellular processes); the plant cell; the bacterial cell; the animal cell; unicellular organisms & multicellular organisms; methods for studying the cell (cell disruption, fractionation).

pH and Buffer Solutions

Definition of pH, the pH scale, buffer solutions & buffer capacity; the Henderson-Hasselbach equation in the preparation of buffer solutions.

Chemistry and Functions of Biological Compounds

Biomolecules: monomers, polymers, macromolecules, supramolecules. Carbohydrates: **mono-, di-, oligo- and polysaccharides, stereoisomerism, mutarotation, reactive groups.** Lipids: **different types (fatty acids, triacylglycerols, phospholipids, sphingolipids, steroids, cholesterol, eicosanoids).** Amino acids & proteins: **Protein structure, classification, nutritional value.**

Nucleic acids: Nitrogenous bases, nucleosides, nucleotides and nucleic acids. Vitamins and coenzymes. **Enzymes.** Properties & classification, cofactors & coenzymes, kinetics (effect of pH, temp., [S], [E] on enzyme-catalyzed reactions, Michaelis-Menten equation); regulation (activation & inhibition).

BCHM 202 General Biochemistry II

Metabolism; digestion of food

Carbohydrates: glycolysis, substrate level phosphorylation; hexose monophosphate shunt; gluconeogenesis; synthesis of other carbohydrates from monomers (e.g. glycogen synthesis); fate of pyruvate in different organisms. The electron transport chain in mitochondria and ATP synthesis.

Lipids: β -oxidation of fatty acids, fate of acetyl-CoA units (TCA cycle, ketone bodies, cholesterol); fatty acid biosynthesis. **Amino acids:** Oxidative deamination; decarboxylation; transamination; urea

cycle; NH_3 assimilation (reductive amination, glutamate dehydrogenase); fate of carbon skeleton (glucogenic and ketogenic amino acids); metabolism of some individual amino acids. **Nitrogen fixation:** Conversion of nitrates, nitrites and gaseous N_2 to ammonia.

Metabolic diseases

Nucleic acid replication and protein biosynthesis: DNA replication, transcription and translation.

Photosynthesis: **Light trapping events; the energy conversion process (PSI & PSII); cyclic and non-cyclic photophosphorylation; carbon fixation (Calvin cycle, C_3 & C_4 plants).**

BCHM 301 Structure and Function of Biomolecules

Organization and order in living things: **Requirement of energy; organization of organic molecules in living cells; sub-cellular organelles and their functions; cell disruption and fractionation.**

Proteins: **Amino acids - basic structure, classification, acid/base properties, essential & non-essential; peptides; proteins - primary, secondary, tertiary and quaternary structure; classification and properties.** Carbohydrates: **Monosaccharides; stereoisomerism; other derivatives of monosaccharides; reducing sugars; common di- oligo- and polysaccharides (storage & structural).** **Lipids:** Classification; lipoproteins; glycolipids (ABO groups, cell-cell recognition, receptors etc.). **Nucleic Acids:** Nitrogenous bases, nucleotides, cyclic nucleotides; DNA and RNAs (brief review of replication, transcription, translation). **Other Biomolecules:** Porphyrins, antibiotics, alkaloids & inorganic ions.

BCHM 302 Intermediary Metabolism

Carbohydrates: Digestion of carbohydrates, glycolysis and fate of pyruvate in different organisms; tricarboxylic acid (TCA) cycle; pentose phosphate pathway and fate of reduced coenzymes; catabolism of monosaccharides other than glucose; gluconeogenesis, Calvin Benson cycle, Cori cycle, glyoxylate cycle; glycogenesis and glycogenolysis; regulation of carbohydrate metabolism; Diseases of carbohydrate metabolism.

Lipids: Digestion of triacylglycerols; the different lipases (lipoprotein lipase, hormone-sensitive lipase); fate of glycerol; beta-oxidation of fatty acids; fate of products (acetyl and propionyl CoA, ketone bodies, reduced coenzymes); synthesis of fatty acids triacylglycerol, cholesterol; regulation of metabolism.

Amino acids: Digestion of proteins, transamination, deamination and decarboxylation of amino acids and the fate of ammonia and carbon skeleton; metabolism of specific amino acids (aromatic and sulphur-containing amino acids); synthesis of amino acids; in-born errors of amino acid metabolism; regulation of metabolism.

Bioenergetics: Free energy and biochemical reactions (spontaneity, anabolic and catabolic reactions); metabolic reactions and ATP; energy of hydrolysis of ATP, ADP and phosphorylation products; ATP production (substrate level and oxidative phosphorylation); coupling reactions; uncoupling agents.

BCHM 303 Separation Methods

Centrifugation: Basic principles of sedimentation, RCF value, relationship between v , s and G . Centrifuges and rotors (types and uses). Preparative centrifugation: differential and density gradient; preparation of gradients, recovery and monitoring of fractionates. Analytical centrifugation: determination of relative molar mass (sedimentation velocity and equilibrium methods), purity and shape of macromolecules.

Chromatography: Partition coefficient and chromatographic systems. Basis of separation: adsorption and partition (polarity); ion-exchange (ionic nature), exclusion/gel (molecular size and shape). Principles and applications (HPLC, FPLC, GLC, TLC, Paper, Chromatofocusing and two-dimensional electrophoresis). Analytical aspects: retention time and volume, capacity ratio, peak resolution theoretical plates/plate height, peak capacity, internal and external standardization and analyte quantitation.

Electrophoresis: General principles. Low voltage thin sheets (paper, cellulose acetate, thin layer) and high voltage gels (agarose, polyacrylamide - native, gradient and SDS-PAGE). Applications; purity and molecular weight determination of proteins and nucleic acids, DNA sequencing. Isoelectric

focusing and isotachopheresis.

Demonstrations: Practical demonstrations of methods of separation.

BCHM 304 Enzymology

Introduction to Enzymes: Comparison of chemical and enzyme catalysis, Activation energy and transition state, Free energy change, Chemical equilibria, Active site, Substrate specificity, Enzyme classification

Factors affecting Enzyme Activity: Enzyme assays, linked or coupled enzyme assays, Reaction rate (V), Effect of [S], [E], T, pH on enzyme activity; coenzyme, prosthetic groups.

Enzyme Kinetics and Inhibition: Michaelis - Menten model, Graphical representation of data (eg. Lineweaver - Burk and Hanes plots)

Enzyme inhibition: Reversible (Competitive, noncompetitive, uncompetitive) and irreversible

Control of Enzyme Activity: Feedback regulation, allosteric enzymes, isozymes, covalent modification, activation, regulation of synthesis and breakdown (eg. lac operon, tryptophan biosynthesis).

Enzyme Purification: Cell disruption techniques, general purification strategy, enzyme assays, units of enzyme activity.

Industrial application of enzymes.

BCHM 305 Analytical Techniques

Data Handling: Significant figures, accuracy and precision, errors, different categories of data, tests of significance, choosing the right statistical test.

Ionic Environment, pH and Buffers in Cellular Metabolism: Ionic equilibrium, ionic strength; pH and buffer systems; biochemical relevance of pH.

Spectroscopic and Radioisotopic Techniques: Molecular spectroscopy; molecular fluorescence; infra-red, atomic, electron spin resonance and nuclear magnetic resonance spectroscopy, mass spectrometry, X-ray diffraction and radioisotopic techniques in biochemistry, radio/fluorescent labeling (RIA, scintillation counting), autoradiography ELISA.

BCHM 307 Practical I

Acid-Base Reactions: Titration; pH measurement; buffer preparation; determination of pK.

Separation Methods: Paper and gel electrophoresis; chromatography (Paper, TLC, column).

Determination of proteins: methods for protein estimation (Folin-Lowry, Biuret, Ultraviolet absorption); determination of amino acids (ninhydrin method); preparation, purification and standardization of proteins (serum proteins, cytochrome C)

Determination of carbohydrates: Estimation of glucose (Folin-Wu); isolation of glycogen, determination of rate of hydrolysis and chromatography of hydrolysis products.

Chemistry of lipids: Solubility; emulsification; determination of iodine number and acid value; separation of serum lipids.

BCHM 308 Practical II

A. Microbiology: Safety precautions; sterility; types of growth media (liquid, solid); identification and classification of microorganisms: morphology, Gram stain, biochemical tests; measurement of microbial concentrations; comparison of growth rate in differently constituted media; selective action of antibiotics.

B. Enzyme-catalysed reactions: Time course of reaction; effects of various factors on reaction rate: enzyme concentration, pH, temperature, substrate concentration, activators and inhibitors; enzyme specificity; protease activity in plant extracts (pineapple, pawpaw, banana); purification of enzymes from plant juice; use of enzyme as an analytical tool (eg. estimation of urea in urine).

BCHM 401 Protein Structure and Mechanism of Enzyme Action

Primary structure: amino acid composition of proteins, determination of amino acid sequence, importance of primary structure synthesis of peptides, covalent modification of polypeptides.

Secondary structure (regular arrangement of the polypeptide backbone): peptide bond and its structural implications; random polymers; Ramachandran Plot. Regular conformation of polypeptides; α -helix, β -pleated sheets, other helices (3_{10} -helix), super-secondary structures (coiled-coil α -helix). Examples: fibrous proteins; α -keratins, silk fibroin, collagen.

Tertiary structure (folded conformation of globular proteins): determination of protein structure by X-ray crystallography, evidence for folding, reverse turns (β -turns) super-secondary structures, domains, interiors and exteriors. Example: Myoglobin.

Quaternary structure (aggregation of globular proteins). Example: haemoglobin. Physical forces responsible for maintaining structure.

Protein-ligand Interactions: Binding sites of haemoglobin and myoglobin, binding of oxygen and carbon monoxide, micro-environment of the haem iron, the Hill Plot.

Allostery: interaction between binding sites. Theoretical models; the Mond-Wyman-Changeux (MWC) concerted mechanism, the Koshland-Nemethy-Filmer (KNF) sequential model. Allosteric properties of haemoglobin; molecular mechanism of cooperative binding of oxygen to haemoglobin, the Bohr effect, binding of 2, 3-bisphosphoglycerate (BPG).

Mechanism of Enzyme Catalysis: General acid-base catalysis and covalent catalysis. Catalysis by coenzymes; pyridoxal phosphate, thiamine pyrophosphate, ATP, coenzyme A, NAD(P)⁺, FAD/FMN. Structure and mechanism of action of selected enzymes. Examples; dehydrogenases, proteases, ribonuclease, lysozyme, glycolytic enzymes such as phosphofructokinase (PFK).

BCHM 402 Biological Oxidation and Bioenergetics

Principles of thermodynamics and their application to the energetics of the cell: Redox systems, electron donors and acceptors, redox couples, redox potentials, electromotive force, protonmotive forces.

The concept of high energy compounds: phosphoric acid anhydrides, phosphoric-carboxylic acid anhydrides, phosphoguanidines, enolphosphates and thiol esters; basis for the high standard free energy of hydrolysis; the central role of ATP; (phosphate) group transfer potentials; substrate-level phosphorylation; energetics of coupled reactions.

ATP synthesis: review of structure of mitochondrion and chloroplast; sources of energy; redox complexes for electron transport in mitochondria and in chloroplasts; establishment of proton gradients; coupling of ATP synthesis to dissipation of proton gradient; H⁺-ATPase; couplers (thermogenesis). ATP utilization for the performance of cellular work; active membrane transport and mechanical work such as muscle contraction.

BCHM 403 Molecular Biology I

Purine and pyrimidine biosynthesis: Regulation of biosynthesis. Structure and properties of nucleosides and nucleotides. Biosynthesis of deoxyribonucleotides; thymidylate biosynthesis. Salvage pathways.

DNA and chromosome structure: Evidence for DNA as carrier of genetic information. Primary and secondary (A, B and Z DNA) and tertiary structure of DNA. Elucidation of DNA structure. Watson and Crick double helix. Structural differences between RNA and DNA. Methods for sequencing DNA. Organisation of DNA in chromosomes, nucleosome structure.

DNA replication: Evidence for semi-conservative replication. DNA replicating enzymes. Directionality of replication.

Transcription: Mechanism of transcription (prokaryotic and eukaryotic). Features of a typical transcription unit. Characteristics of different types of RNA. Modification and processing RNA. Reverse transcription.

Control of gene expression: Inducible and repressible operons, (lac and trp operons).

The genetic code: Deciphering the code. Universality and degeneracy of the genetic code. Wobble hypothesis, colinearity of gene polypeptide.

Translation: Ribosome structure. Activation of Amino acids. Initiation, elongation and termination. Eukaryotic and prokaryotic. Post-translational modifications; Polysomes, inhibitors of protein synthesis.

Mutation: molecular basis of mutation. Point mutation – transitions, transversions, frameshift mutations. Side directed mutagenesis, Radiation induced mutation. Chemically induced mutation. DNA repair mechanisms.

Recombinant DNA and genetic engineering: Restriction endonucleases, Methods for recombinant DNA production, transformation, amplification, screening for cloned DNA.

BCHM 404 Biomembranes

Introduction: Membrane types and functions; chemical composition (lipids, proteins and carbohydrates); amphipatic nature of lipids (formatin of nimolayers, bilayers/liposomes, and micelles); actions of phospholipases (ether lipids).

Structure and properties: Models (Davson and Danielli, Singer and Nicolson); integral (glycophorin A, anion channel band 3, bacterio rhodopsia), lipid-anchored and peripheral (cytoskeleton of erythroid and non-erythroid cells) proteins; plasma membrane glycocalyx, antigenic properties (RBC M and N, blood group O, A and B); evidence for asymmetric, dynamic and fluid-like character of biomembranes; cell-cell recognition and fusion (eg flu virus and HIV infections); membrane biogenesis (synthesis and transport of membrane lipids).

Preparation and study: Physical, chemical and biochemical methods of study (lipid bilayer and vesicles of eukaryotic and prokaryotic cells).

Transport: Thermodynamics; modes (uniport, symport and antiport systems) and types (simple diffusion, passive-mediated, active, Na/K pump, co-transport – Na/glucose pump of kidney/intestine, galactose permease of *E. coli*, exocytosis and endocytosis); channels (ligand gated and voltage-gated) and pores; ionophores (valinomycin, gramicidin A and nigericin).

Signal transduction: Brief descriptions of adenylate cyclase and inositol phospholipid signaling pathways; growth factor activation of tyrosine kinase receptor.

BCHM 405 Practical Biochemistry III

Isolation, purification and characterization of biomolecules. Detection methods: electrophoresis, labeling, autoradiography, scintillation counting, immunoassays.

BCHM 406 Integration and Control of Metabolism

Regulatory enzymes and metabolic control: fine control (allosteric, substrate/product feed- back and feed-forward controls, covalent modification) and coarse control (induction and repression of enzyme synthesis).

Regulation of individual metabolic pathways: glycolysis, gluconeogenesis, glycogen metabolism (glycogenolysis and glycogenesis), Krebs cycle, lipogenesis and lipolysis, β -oxidation, ketogenesis, urea cycle, amino acid metabolism (glutamine synthetase) and nucleotide synthesis.

Integration of metabolism: Role of hormones; feed-fast cycle; running athlete; disease states (e.g. Diabetes); pregnancy and lactation; regulatory mechanisms; compartmentation; interorgan relationships; Cori, glucose-fatty acid, glucose-alanine cycles.

BCHM 407 Practical Biochemistry IV

DNA technology: Isolation, purification and manipulation of DNA; preparation of competent cells and transformation **Clinical/Biochemical Indices:** Determination of blood indices: Hb, glucose, triacylglycerols cholesterol and enzymes. **Determination of urine indices:** glucose, protein and cells.

BCHM 409 Biochemistry of Hormones

General Introduction: Coordination in multicellular organisms

Major Endocrine Glands: Hypothalamus, pituitary, adrenals, testes, ovaries, pancreas. Their secretions: feedback regulation, effects on target organs/tissues.

Mechanisms of Action of Hormones: Types of mechanism, relationship of binding to response, second messenger generation.

Regulation of [cAMP] by Hormones: Adenylate cyclase/phosphodiesterase reactions; role of G-proteins; activation/inhibition by hormones; mechanism of action of cAMP (cAMP – dependent protein kinase).

Regulation of cytoplasmic Ca²⁺ by hormones: Nature of intracellular Ca²⁺ pool: Ca²⁺ as a second messenger, interactions between Ca²⁺ and cAMP as messengers.

Phosphatidylinositol turnover and hormone action: Effects of hormones on metabolism of inositol phospholipids; relationship to Ca²⁺ mobilization.

Mechanism of action of steroid and thyroid hormones: Steroid hormone receptor; interaction with DNA.

Growth Factors and Eicosanoids: Peptide growth factors, prostaglandins, thromboxanes and leukotrienes.

BCHM 411 Clinical Biochemistry

Introductory practical clinical biochemistry: Laboratory investigations; specimen collection, analytical methods and standardization (calibration standards, precision, accuracy, sensitivity, specificity etc); review of analytical and separation methods used in clinical biochemistry for metabolites, ions and enzymes; report and result interpretation; reference values and factors affecting them. **Organ function disorders and tests:** gastrointestinal, liver, kidney, heart, pituitary, pancreas, thyroid, adrenal and gonadal. **Body fluid composition and abnormalities:** water and electrolyte balance, acid-base disorders and O₂ transport. **Disorders of metabolism** (in-born errors of metabolism): lipids, carbohydrates, amino acids, proteins, purines and porphyrins.

BCHM 412 Project II

Laboratory research on topical issues of scientific value, reported as a thesis.

BCHM 413 Biochemistry of Parasites

Pathophysiology of the following tropical parasitic diseases: Malaria, trypanosomiasis, filarasis, schistosomiasis and gastrointestinal worm infestations. Biochemistry of the causative parasites with emphasis on host-parasite interrelationships: Metabolic processes that can be utilized in chemotherapeutic attack of the parasites; biomembranes.

BCHM 414 Immunology and Immunochemistry

Defense systems: self and non-self; innate and acquired; cells and organs involved; humoral and cell-mediated. **Antigens:** Immunogenicity and antigenicity; chemical nature (bacterial, viral and synthetic). **Antibodies:** Structure and function of immunoglobulins; theories of antibody production; polyclonal antibody production; monoclonal antibody production (hybridoma technology). **Antigen-antibody interactions:** Agglutination and precipitation; immunoassays.

The complement system: components, activation (classical and alternative pathways); regulation.

Vaccines: Current methods for development. **Immune regulation and tolerance;** immuno-pathology (hypersensitivity, immunodeficiency, autoimmunity); transplantation immunology (mechanisms involved in tissue rejection). **Cytokines:** General properties; biological activities of selected cytokines. **Immunology of diseases of public health interest:** HIV/AIDS, Malaria, Schistosomiasis.

BCHM 415 Xenobiotic Metabolism

Pathways of xenobiotic metabolism; Phase I and II reactions. Enzymology and molecular mechanisms of xenobiotic metabolism; cytochrome P-450-dependent mixed-function oxidation reactions, microsomal flavin-containing monooxygenases, prostaglandin synthetase, reduction enzymes, epoxide hydrolase and conjugating enzymes. Factors affecting xenobiotic metabolism; internal and external. Pharmacological and toxicological aspects of xenobiotic metabolism - Pharmacological; activation and deactivation, changes in pharmacological response, drug uptake and distribution, enterohepatic circulation. Toxicological; metabolic activation (increased toxicity) - carcinogenesis, mutagenesis, teratogenesis, pulmonary, hepatic and renal toxicities. Deactivation (decreased toxicity). Balance between detoxifying and detoxifying pathways.

BCHM 416 Plant Biochemistry

Carbohydrates: germination of seeds with carbohydrate stores; storage carbohydrates (starch, sucrose and other reserve carbohydrates); structural carbohydrates (cellulose, hemicellulose, pectin);

the biosynthesis of carbohydrates. **Lipids:** germination of oil seeds, the glyoxalate pathway and gluconeogenesis; chemistry of plant lipids: cutins, suberins and waxes; fatty acid biosynthesis. **Nitrogen metabolism:** nitrogen fixation (dinitrogenase); nitrogen uptake and reduction. **Secondary metabolites:** Terpenes (the mevalonic acid pathway); phenolic compounds (the shikimic acid pathway); saponins, cardiac glycosides, cyanogenic glycosides and glucosinades and alkaloids; functions. **Photosynthesis:** Chloroplast structure; photoreceptors and transduction of light into chemical energy (the photosynthesis electron transport chain); carbon fixation; the C3, C2 and C4 cycles; CAM metabolism.

BCHM 418 Insect Biochemistry

Distinctive nature of insect metabolism. **Energy metabolism:** synthesis, storage mobilization, transport and utilization of fuels in flight. **Regulatory factors.** Insect hormones affecting growth and development – biochemical activities. Insect growth regulators. Insects and the external environment: biochromes, defensive substances and pheromones. **Insect control:** insecticides and their modes of action; detoxification mechanisms; insecticide resistance, synergists. New approaches to insect control.

BCHM 422 Molecular Biology II

Tools of DNA science: Agarose and polyacrylamide gel electrophoresis; Northern and Southern blots and hybridization analysis; Western blots and protein detection; PCR and RAPD, RFLP.

Purification and characterization of nucleic acids: Principles for extraction and purification; concentration and molecular weight determination; species differentiation (RNA/DNA, single/double stranded nucleic acids). **Modifying enzymes:** Restriction endonucleases; other nucleases (DNase, RNase); ligases; polymerases. **Recombinant DNA technology:** Cloning and expression vectors, recombinant molecules and transformation systems (prokaryotic and eukaryotic hosts); colony screening, plasmid isolation and characterisation; transduction and conjugation. **Nucleotide sequencing and mutagenesis:** Sequencing of end labeled DNA by base specific chemical cleavage (Maxam and Gilbert) and analysis of printed enzymatic synthesis (Sanger *et al*); deletion and insertion mutagenesis. **Applications:** Biotechnology, applications in agriculture, industry, human health & pharmaceuticals, waste management etc.

DEPARTMENT OF BOTANY

FACULTY

I.K. Asante , <i>MPhil PhD (Ghana)</i>	-	Associate Professor/Head
G.T. Odamtten , <i>MSc (Ghana) PhD (Wageningen)</i>	-	Professor
L. Enu-Kwesi , <i>MSc (Cape Coast) PhD (Waterloo)</i>	-	Associate Professor
G.K. Ameka , <i>MPhil PhD (Ghana)</i>	-	Associate Professor
A.A. Oteng-Yeboah <i>BSc (Gh.) PhD (Edinburgh)</i>	-	Associate Professor
Cecilia Amoah , <i>BSc (K'si) MSc (Ghana) PhD(Gh)</i>	-	Senior Res. Fellow (VBRP)
Elizabeth Acheampong , <i>BSc (Nott) PhD (Birm)</i>	-	Senior Lecturer
Carol M. Markwei , <i>MSc (Ghana) PhD (Cornell)</i>	-	Senior Lecturer
J.K. Adomako , <i>BSc MPhil (Ghana)</i>	-	Senior Lecturer
V.V. Vordzogbe , <i>BSc MPhil (Ghana)</i>	-	Lecturer
K.M. Essilfie , <i>Dip BSc Ed (UCC) MPhil (Ghana)</i>	-	Lecturer
Ebenezer Owusu , <i>BSc PhD (Ghana)</i>	-	Lecturer
Eureka Emefa Adomako , <i>BSc MPhil (Ghana)</i> <i>MPhil (Cambridge) PhD (Aberdeen)</i>	-	Lecturer
Mary F. Yankson , <i>BSc (K'si) MSc (UBC)</i>	-	Research Fellow (Assistant Director, Botanical Garden)
Ted Yemoh Annang , <i>BSc MPhil (Ghana) PhD(Gh)</i>	-	Research Fellow (VBRP)
S.S. Koranteng , <i>BSc (UCC) MPhil (Ghana)</i>	-	Research Fellows (VBRP)
Alex Asase , <i>BSc, Ph.D (Ghana)</i>	-	Lecturer
E. Laing , <i>BSc (Lond) PhD (Camb)</i>	-	Emeritus Professor

LEVELS 200, 300 & 400 COURSES***BSc Single Subject Major*****Core (50 credits)**

BIOL 201	Introductory Plant Morphology	3
BIOL 202	Introductory Cell Biology & Genetics	3
BIOL 203	Introductory Animal Biology	3
BIOL 204	Introductory Plant & Animal Ecology	3
BOTN 311	Vegetative Anatomy of Seed Plants	3
BOTN 312	Whole Plant Physiology	3
BOTN 313	Algae	3
BOTN 314	Taxonomy and Evolution of Seed Plants	3
BIOL 315	Principles of Genetics	3
BIOL 316	Environmental Zones of West Africa	3
BIOL 317	Biometry	2
BIOL 318	Aquatic Biology (Oceanography & Limnology)	3
BOTN 400	Project	6
BOTN 410	Language for Scientists	1
BOTN 411	Fungi and Lichens	3
BOTN 412	Bryophytes and Pteridophytes	3
BOTN 413	Cell Physiology (Plant Metabolism)	3
BOTN 414	Economic Botany	3
BOTN 415	Evolution	2
BOTN 422	Floral/Reproductive Biology	3

Electives

Selection should be made as follows in order to make a total minimum of 18 credits:

- i. Students are to select courses, preferably from one group of the following such that they have a minimum of 6 credits.*
- ii. For the Group G option, students should select additional courses from groups A to F to meet the required minimum credits.*

Group A:

BOTN 416	Physiology of Fungi	3
BOTN 417	Microbiology	3
BOTN 418	Plant Pathology	3

Group B:

BOTN 419	Advanced Taxonomy	3
BOTN 422	Floral/Reproductive Biology	3

Group C:

BOTN 424	Biometry	2
BOTN 425	Synecology	3
BOTN 426	Production Ecology	3
BOTN 427	Conservation and Environmental Studies	3

Group D:

BOTN 424	Biometry	2
BOTN 428	Molecular Genetics, Plant Breeding and Cytogenetics	3

BOTN 429	Population and Biometrical Genetics	3
Group E:		
BOTN 431	Cell Physiology (Plant Hormones)	3
BOTN 432	Whole Plant Physiology	3
Group F:		
BOTN 433	Fresh Water Biology	3
BOTN 434	Watershed Management and Conservation	3
Group G:		
BOTN 435	Advanced Plant Anatomy	4

BSc Combined Subject Major

(No Prescribed Electives are available for those doing projects in other Departments. Those doing projects in Botany may take some of the prescribed subjects upon consultation)

Core (53-59 credits)

BIOL 201	Introductory Plant Morphology	3
BIOL 202	Introductory Cell Biology & Genetics	3
BIOL 203	Introductory Animal Biology	3
BIOL 204	Introductory Plant & Animal Ecology	3
BOTN 311	Vegetative Anatomy of Seed Plants	3
BOTN 312	Whole Plant Physiology	3
BOTN 313	Algae	3
BOTN 314	Taxonomy and Evolution of Seed Plants	3
BIOL 315	Principles of Genetics	3
BIOL 316	Environmental Zones of West Africa	3
BIOL 317	Biometry	2
BIOL 318	Aquatic Biology (Oceanography & Limnology)	3
BOTN 400	Project	6
BOTN 410	Language for Scientists	1
BOTN 411	Fungi and Lichens	3
BOTN 412	Bryophytes and Pteridophytes	3
BOTN 413	Cell Physiology (Plant Metabolism)	3
BOTN 414	Economic Botany	3
BOTN 415	Evolution	2

LEVELS 200, 300 & 400 COURSES

BSc Single Subject Major

BIOL 201 Introductory Plant Morphology

Survey of the form of the vegetative and reproductive body of seed plants. Primary meristems and development of the primary vegetative body of angiosperms; internal organization of the primary vegetative body and the relationship between structure and function of tissues; mechanism and importance of secondary growth in dicotyledons; brief survey of the relationship between structure and industrial uses of secondary tissues.

BIOL 202 Introductory Cell Biology & Genetics

Basic cell physiology-bioelements, water, water in cells, method of expressing concentrations of solutions, osmotic phenomena, imbibition, biomolecules, carbohydrates, amino acids, proteins, lipids, nucleotides, nucleic acids, and the role of these in either cell biology and/or structure, enzyme action; photosynthesis, respiration and nitrogen metabolism. Basic principles of genetics; gene interactions, sex and inheritance; chemical basis of heredity; mutations, medical and biochemical genetics.

BIOL 203 Introductory Animal Biology

General survey of invertebrates and vertebrates with reference to form and function. Phylogeny, life-cycles. Morphological and physiological adaptations to ways of life.

BIOL 204 Introductory Plant & Animal Ecology

Basic principles of quantitative plant ecology; plant and animal life in West Africa. Introduction to description and classification of plant communities; climax vegetation; the West African environment; types of forest in West Africa. Basic concepts in plant and animal ecology; plant and animal communities and the biology of animal population.

BOTN 311 Vegetative Anatomy of Seed Plants

A theoretical and practical light-microscope study of the anatomy of vegetative parts of the seed plants, with some reference to economic importance of some of the tissues, and use of some of the anatomical features in taxonomy and phylogeny.

BOTN 312 Whole Plant Physiology

Treatment of biophysical concepts: plant water relations; absorption of water; transpiration; stomatal physiology; ion uptake; transport systems in plants; survey of phytohormones; brief coverage of dormancy, germination and growth, flowering and fruiting.

BOTN 313 Algae

Classification, structure and reproduction of the major algae divisions. Littoral zonation of the larger benthic algae and the factors affecting their distribution. Economic importance of algae, their use in agriculture and as food and feed source.

BOTN 314 Taxonomy and Evolution of Seed Plants

Comparative morphology and/or evolutionary trends in seed plants, with special reference to common seed plant families in Ghana. Basic principles of taxonomy to include classification, nomenclature and identification.

BIOL 315 Principles of Genetics

An introduction to the principles of genetics and chromosome cytology from the molecular aspects to population aspects, including applications of the principles in animal breeding, plant breeding and applied human genetics. Some of the practical techniques in formal genetics and cytogenetics are introduced.

BIOL 316 Environmental Zones of West Africa

General distribution of vegetation types in relation to climate and soils. Forest and savanna and their inter-relationships, Strand, mangrove, lagoon and montane vegetation types. Accra plains. Human ecology in these vegetation types. Introduction to quantitative ecology. Species diversity indices.

BIOL 317 Biometry

Description of methods used in biology or biometry. Sets. Representation of data. Basic experimental design. Basic statistical methods. Sampling. Systems approach. Report writing. Computers and data analysis survey methods

BIOL 318 Aquatic Biology (Oceanography & Limnology)

Water properties of biological importance. The seas: the open ocean and coastal waters. Factors determining water circulation. Effects of water circulation upon productivity. Pollution. Utilization and conservation. **Lakes:** Origins of lakes and their biological types. Factors determining water circulation. **Rivers:** Origins and water movement. Biotic communities, adaptations and distribution. **Phytoplankton:** Distribution including temporal and special changes in relation to physico-chemical and biological factors in the environment. **Estuaries:** Optical and physical properties; water movement. Dissolved substances. Mangrove swamps.

BOTN 400 Project

BOTN 410 Language for Scientists

BOTN 411 Fungi and Lichens

The course is designed to give students an understanding of the structure, including ultrastructure, reproductive processes and ecology of fungi. It will also bring to students an appreciation of fungal roles in agriculture, forestry and industry. In the treatment of lichens, emphasis will be laid on the structure, reproduction and the physiological relationship between the mycobiont and phycobiont components of Ascolichenes.

BOTN 412 Bryophytes and Pteridophytes

The life cycle of archegoniates. Classification of the bryophytes and pteridophytes. Morphology, anatomy and life cycle of representatives of the principal orders of bryophytes and pteridophytes. Water relations and ecology of bryophytes and pteridophytes. Evolution of thallus structure in the Hepaticae.

BOTN 413 Cell Physiology (Plant Metabolism)

Detailed coverage of the ultra structure and functions of the cell and cell organelles in relation to their chemical constituents; bio-energetics; enzyme classification and kinetics; photosynthesis; respiration; nitrogen metabolism.

BOTN 414 Economic Botany

The origins, distribution and ecology (botany and cultivation) of crop plants in Ghana. Ethnobotany. The elements of silviculture and forest utilization in Ghana (timber, fuel etc.)

BOTN 415 Evolution

The synthetic theory of evolution and its historical developments. Sources of variation. Selection and its types of selection. Polymorphisms. Speciation, isolating mechanisms. Hybridization and introgression. Evolution at the molecular level.

BOTN 416 Physiology of Fungi

This course is designed as a sequel to course Botn 411 to relate the functioning of the fungus to its structure. The course, therefore, covers the function of the fungus spore, growth and metabolism of the vegetative thallus and the physiology of reproduction. Discussions at relevant places of the course will include associations of fungi with other organisms other than parasitism. Attention will also be drawn to the involvement of fungi in agriculture, industry and human welfare.

BOTN 417 Microbiology

The course gives a general knowledge of microbiology, microorganisms and viruses. The emphasis is on their structure, physiology and ecological relationships and on the activities of interest to man that they carry out. Prokaryotic microorganisms and viruses will be more emphasized as the eukaryotes are extensively treated in other courses.

BOTN 418 Plant Pathology

This course is designed to give a wide approach to plant diseases caused by parasites (fungi, bacteria, nematodes and flowering plants) and viruses and by nutritional disbalance. Consideration of diseases caused by parasites and viruses will fall into four interrelated phases: aetiology, interaction of plant and pathogen, interactions of populations of plants and pathogens and environment, and control of plant diseases.

BOTN 419 Advanced Taxonomy

The taxonomic character, sources and uses. Chemotaxonomy. Modern methods in assessing relationships. Numerical taxonomy and cladistics.

BOTN 422 Floral/Reproductive Biology

Types of pollination; pollen and animals; nectar, nectaries and animals. Fertilization and changes in ovary and ovule Isolating mechanisms in flowers; limitations naturally placed on variations in populations. Place of floral biology in plant breeding.

BOTN 424 Biometry

Calculus: Differentiation. Matrix algebra (latent roots and latent vectors). Maximum likelihood of statistical estimation. Analysis of variance (Duncan's multiple range test). Factorial experiments. Correlation and regression. Multivariant methods. Use of the computer.

BOTN 425 Synecology

Description and measurement of vegetation and environment. Sampling methods; accuracy and significance tests. Species diversity; diversity indices. Spatial arrangement of organisms. Pattern. Association between species. Association analysis and other classificatory analyses. Ordination. Interpretation of taxonomic and ecological data by multivariate methods. Field collection of samples for the herbarium; field notes; Photography.

BOTN 426 Production Ecology

The ecosystem concept. Variations of ecosystem structure. Turnover of energy, organic matter, water, mineral nutrients in the ecosystem. Productivity of terrestrial ecosystem; control and measurement of primary and secondary productivity. Ecological mechanisms controlling distribution of plants and animals. Interaction between organisms; interaction between organisms and environment, Floral ecology.

BOTN 427 Conservation and Environmental Studies

Principles of conservation and plant and animal protection and their application to the West African environment. Management of renewable natural resources. Conservation of Plant Genetic Resources. Pollution of the Environment. Ghana's Environmental Action Plan. Environmental management for vector control; the Volta sand Weija experience. Climate change and other global environmental problems.

BOTN 424 Biometry

Calculus: Differentiation. Matrix algebra (latent roots and latent vectors). Maximum likelihood of statistical estimation. Analysis of variance (Duncan's multiple range test). Factorial experiments. Correlation and regression. Multivariant methods. Use of the computer.

BOTN 428 Molecular Genetics, Plant Breeding and Cytogenetics

Molecular Genetics: Haemoglobin variants in man. Genetic engineering and biotechnology, Recombinant DNA technology and its application in Biology, Medicine and Agriculture. **Plant Breeding:** Sex determination in plants. Incompatibility in flowering plants. Principles of plant breeding. **Cytogenetics:** Chromosome structure. Chromosomal aberrations. Karyotype evolution. Advanced topics in Meiosis. Cytogenetics of the Nucleolus.

BOTN 429 Population and Biometrical Genetics

History of population genetics. Hardy-weinberg law and its use, including cases of sex linkage and multiple alleles. Coefficient of inbreeding. Inbreeding: Mutation, Selection, Equilibria, Evolution of dominance. Polymorphism and balanced polymorphism. Chromosome frequencies and recombination, Polymorphism and multiple alleles. Alternative theories to natural selection.

History of biometrical genetics. Genotype-environment interaction. Scaling. Components of means: additive and dominant effects; interaction and heterosis. Components of variation. Interaction, Linkage. Randomly breeding populations. Dialleles, special races: sex linkage, maternal effects, haploids, polyploids. Number of effective factors. Concepts of biometrical genetics. Artificial selection experiments, and responses to selection.

BOTN 431 Cell Physiology (Plant Hormones)

Introduction to methods of studying phytohormones: extraction, isolation, identification and quantification; determination of sequence of amino acids in proteins; biosynthesis of amino acids, lignin and phytohormones including a brief treatment of their mode of action.

BOTN 432 Whole Plant Physiology

Growth, developmental and environmental physiology: dynamics of growth, detailed coverage of flowering and fruiting, regulation of organ longevity, senescence and death; introduction to the effects of light, temperature, water, pollution and climate change on plant growth and development; the physiology of plants under stress; biological clocks; allelopathy.

BOTN 433 Fresh Water Biology

Chemical aspects of rain water, ionic composition of lakes and rivers; oxygen, carbon dioxide and p^H and chemical stratification. Biological aspects: primary production, population dynamics and correlation with physico-chemical aspects. Pollution: effects of pollution on inland waters; eutrophication. Fresh water macrophytes: types/classification, zonation, biological adaptations of hydrophytes; succession; production. Algal physiology. Bacteria morphology and physiology. Aquatic fungi. Economic aspects of fresh water plants (micro-and macrophytes): aquatic weed problems including toxic algae; aquatic weed control; value of aquatic plants (algae and macrophytes); beneficial and harmful bacteria and fungi in fresh water.

BOTN 435 Advanced Plant Anatomy

Cell wall. Experimental plant Anatomy. Development and differentiation of the vascular system. Anatomy of reproductive structure of seed plants. Palynology. Embryology. Systematic anatomy of useful plant products: timber, fibres; seeds, latex, osmophores. Anatomy in plant identification, classification and phylogeny Anatomy in plant pathology. Forensic plant anatomy.

**DEPARTMENT OF CHEMISTRY
FACULTY**

V.K. Nartey , MSc (KNUST), PhD (Graz)	-	Associate Professor <i>(Head of Department)</i>
I. Addae-Mensah MSc (Ghana), PhD (Camb)	-	Professor
W.A. Asomaning , MSc (Ghana) D.Phil. (Sussex)	-	Associate Professor
W.R. Phillips , MSc (Ghana), PhD, DIC (Camb)	-	Associate Professor
M. Dakubu , BS, PhD (Lond)	-	Associate Professor
C.K. Akpabli , BSc (Educ) (Cape Coast), MSc (Ghana) PhD (CUNY)	-	Associate Professor
D. Carboo , DiplÖm Chem Dr. rer. Nat (Hamburg)	-	Associate Professor
F.L. Phillips BSc (Ghana), PhD (Lond)	-	Senior Lecturer
I.V. Oppong , BSc, MSc (Ghana), PhD (Alta)	-	Senior Lecturer
C.T. Beni , MSc (Merseburg), PhD (Tuebingen)	-	Senior Lecturer
A.K. Brimah , MSc, PhD (Hamburg)	-	Senior Lecturer
R. Kingsford-Adaboh , Dip. Ed, BSc (U.C.C.), MSc, PhD (Okayama)	-	Senior Lecturer
R.K. Akuamoah , MSc (Ghana), PhD (Newcastle)	-	Senior Lecturer
L.K. Doamekpor , MPhil (Ghana), PhD (Saga, Japan)	-	Lecturer
S.A. Asunka , MSc, MPhil (Ghana)	-	Lecturer
Dorcas Osei-Sarfo , MPhil, PhD (Ghana)	-	Lecturer
Augustine K. Donkor , BSc (KNUST), MSc, (Aus) PhD (Florida Gainesville)	-	Lecturer
Walter Affo , BSc (Ghana), PhD (Nottingham)	-	Lecturer
Kwaku Kyeremeh , BSc (Ghana), PhD (Aberdeen)	-	Lecturer
Mary Anti Chama , BSc, PhD (Ghana)	-	Assistant Lecturer
C.B.J. Semanhyia	-	Part-Time Lecturer

BSc (Cape Coast) MSc (Salford) MPhil (CNAA)

G. Duker Eshun Ph.D (Ghana)

-

Part-Time Lecturer

S.A. Dogbe, BSc (KNUST), MSc, (Man)

-

Part-Time Lecturer

L.H. Bobobee, BSc(\Hons)PGCE(UCC) MPhil (Ghana)

-

Part-Time Lecturer

LEVEL 200, 300 & 400 COURSES

BSc Combined Major Programme

Core (33 credits)

CHEM 201	Practical Chemistry I	1
CHEM 202	Practical Chemistry II	1
CHEM 211	Physical/Analytical Chemistry I	2
CHEM 212	Physical/Analytical Chemistry II	2
CHEM 231	Organic Chemistry I	2
CHEM 232	Organic Chemistry II	2
CHEM 313	Physical Chemistry Iii (Thermodynamics)	2
CHEM 331	Organic Chemistry III	1
CHEM 333	Organic Chemistry IV	1
CHEM 353	Structural Chemistry	2
CHEM 354	Inorganic Chemistry (Main Group Elements)	3
CHEM 371	Analytical Chemistry III	3
CHEM 411	Physical Chemistry V (Kinetics)	2
CHEM 413	Physical Chemistry Vii (Polymer Chemistry)	2
CHEM 431	Organic Chemistry VI	2
CHEM 451	Transition Metal Chemistry	3
CHEM 492	Industrial And Environmental Chemistry	2

Electives (A) {A minimum of FOUR (4) Credits}

CHEM 311	Practical Chemistry (Physical)	2
CHEM 332	Practical Chemistry (Organic)	2
CHEM 351	Practical Chemistry (Inorganic)	2
CHEM 372	Practical Chemistry (Analytical)	2

Electives (B) {A minimum of FOUR (4) Credits}

CHEM 400	Practical Project	6
CHEM 412	Physical Chemistry Vi (Surface Chemistry & Colloids)	2
CHEM 432	Organic Chemistry Vii (Natural Products)	2
CHEM 433	Organic Chemistry VIII	2
CHEM 472	Instrumental Methods Of Chemical Analysis	3

BSc Single Subject Major Programme

Core (60 credits)

CHEM 201	Practical Chemistry I	1
CHEM 202	Practical Chemistry II	1
CHEM 211	Physical/Analytical Chemistry I	2
CHEM 212	Physical/Analytical Chemistry II	2
CHEM 231	Organic Chemistry I	2
CHEM 232	Organic Chemistry II	2
CHEM 311	Practical Chemistry (Physical)	2
CHEM 313	Physical Chemistry Iii (Thermodynamics)	2
CHEM 314	Physical Chemistry IV	2
CHEM 331	Organic Chemistry III	1
CHEM 332	Practical Chemistry (Organic)	2

CHEM 333	Organic Chemistry IV	1
CHEM 334	Organic Chemistry V (Aromatic Chemistry)	2
CHEM 353	Structural Chemistry	2
CHEM 354	Inorganic Chemistry (Main Group Elements)	3
CHEM 371	Analytical Chemistry III	3
CHEM 351	Practical Chemistry (Inorganic)	2
CHEM 372	Practical Chemistry (Analytical)	2
CHEM 400	Practical Project	6
CHEM 411	Physical Chemistry V (Kinetics)	2
CHEM 412	Physical Chemistry Vi (Surface Chemistry & Colloids)	2
CHEM 413	Physical Chemistry Vii (Polymer Chemistry)	2
CHEM 431	Organic Chemistry VI	2
CHEM 432	Organic Chemistry Vii (Natural Products)	2
CHEM 433	Organic Chemistry VIII	2
CHEM 451	Transition Metal Chemistry	3
CHEM 472	Instrumental Methods Of Chemical Analysis	3
CHEM 492	Industrial And Environmental Chemistry	2
Electives (A) {a minimum of SIX (6) Credits}		
BCHM 301	Structure And Function Of Biomolecules	2
BCHM 304	Enzymology	2
BOTN 312	Whole Plant Physiology	3
BOTN 314	Taxonomy and Evolution of Seed Plants	4
BIOL 315	Principles of Genetics	3
GEOL 312	Introduction to Exploration Geochemistry	2
MATH 304	Differential Equations (Pre-requisite MATH 305)	3
MATH 305	Calculus Of Several Variables (Pre-requisite MATH 203)	3
FDSC 305	Physical Principles in Food Processing (Pre-req: PHYS 200, 203,204, BIOL 201-204, CHEM 201, 202, 211, 212, 231, 232)	3
FDSC 307	Principles of Food Preservation	1
NUTR 306	Food Analysis I (Pre-req: BIOL 201-204, CHEM 201, 202, 211, 212, 222)	2
PHYS 321	Mathematics For Physics	3
PHYS 324	Computing For Scientists	3
STAT 306	Design of Experiments (Pre-req. STAT 203)	3
Electives (B) {a minimum of FOUR (4) Credits}		
CHEM 414	Molecular Structure	2
CHEM 415	Symmetry And Point Groups	1
CHEM 416	Atomic Structure And Spectra	2
CHEM 417	Quantitative Molecular Orbital Theory	1
CHEM 418	Photochemistry	2
CHEM 419	Statistical Thermodynamics	2
CHEM 434	Alkaloids	2
CHEM 435	Steroids	2
CHEM 436	Terpenes	2
CHEM 437	Natural Oxygen Heterocycles	2
CHEM 438	Medicinal Chemistry	2
CHEM 439	Organometallic Chemistry	2
CHEM 452	Solid State Chemistry	2
CHEM 471	Nuclear And Radio-Chemistry	2
CHEM 473	X-Ray Crystallography	2
CHEM 474	Elements Of Forensic Chemistry	2
CHEM 491	Petroleum Chemistry And Technology	2
CHEM 493	Mineral Processing	2

CHEM 494	Textile Chemistry And Technology	2
CHEM 495	Pulp And Paper Chemistry And Technology	2

LEVEL 200, 300 & 400 COURSES

Prerequisites For Chemistry Courses

Level 300	Physical/Inorganic/Analytical	CHEM 211, 212
	Organic courses	CHEM 231, 232
	CHEM 314	CHEM 313
Level 400	CHEM 412	CHEM 313
	CHEM 431	CHEM 331
	CHEM 432, 433	CHEM 333
	CHEM 451	CHEM 354
	CHEM 472	CHEM 371

COURSE DESCRIPTIONS

CHEM 201 Practical Chemistry I

Basic techniques in volumetric and gravimetric analyses. Introduction to methods for preparing and purifying organic compounds.

CHEM 202 Practical Chemistry II

Applications of volumetric analyses; emf of simple cells; conductance; simple organic syntheses. Qualitative organic analyses.

CHEM 211 Physical/Analytical Chemistry I

Quantitative treatment of acids, bases, ampholytes, and buffer systems. Titration curves; choice of indicators. Complex ion equilibria; solubility products and precipitation. Treatment of errors; significant figures, precision and accuracy.

CHEM 212 Physical/Analytical Chemistry II

Electrolytic conduction; measurement of conductance, and its application to dissociation constants, solubility products, conductometric titrations etc. Electrochemical cells; electrode potentials; measurement of emf, and its application to equilibrium constants, solubility products, pH etc.

CHEM 231 Organic Chemistry I

Stereoisomerism; optical activity. Various methods for the oxygenation of alkenes. Chemistry of alcohols and ethers; S_N1 , S_N2 , E-1 and E-2 mechanisms.

CHEM 232 Organic Chemistry II

The chemistry of Aldehydes, Ketones, Carboxylic acids. Carboxylic acid derivatives and Amines.

CHEM 311 Practical Chemistry (Physical)

Experiments involving refractometry, potentiometry, conductimetry, spectrophotometry, and polarimetry; Adsorption Isotherms.

CHEM 313 Physical Chemistry Iii (Thermodynamics)

The Gas laws; grammar and vocabulary of thermodynamics; state variables and equations of state; the First, Second and Third Laws; Thermochemistry; Spontaneity and equilibria.

CHEM 314 Physical Chemistry IV

Applications of thermodynamics - Chemical potential and equilibria; Solutions and Colligative properties; Electrolytes and the Debye-Huckel theory; Electrochemical cells e.g. storage, photovoltaic cells; Electrolysis.

CHEM 331 Organic Chemistry III

Infra-red and Ultra-violet/visible spectroscopy

CHEM 332 Practical Chemistry (Organic)

Synthesis of organic compounds requiring basic skills such as heating under reflux, distillation, crystallisation, extraction, filtration, chromatography, melting point determination and spectroscopic (ir, uv) analysis.

CHEM 333 Organic Chemistry IV

Mechanisms of substitution and elimination reactions; Reactions of dienes; Addition polymers of monoalkenes and dienes.

CHEM 334 Organic Chemistry V (Chemistry of Carbanions & Aromatic Compounds)

Reactions of carbanions. Aromaticity; aromatic electrophilic and nucleophilic substitution of benzenes. The chemistry of phenol.

CHEM 351 Practical Chemistry (Inorganic)

Synthesis of inorganic complexes; analysis of inorganic complexes and materials; Flame-photometry; Use of ion-exchange resins.

CHEM 353 Structural Chemistry

Qualitative treatment of Valence bond, Molecular Orbital, VSEPR, and 3-Centre bonding theories. Structure and physical property relation-ships for ionic, covalent, molecular and metallic crystals; Defect structures and their properties.

CHEM 354 Inorganic Chemistry (Main Group Elements)

Chemistry of the main group elements, including the Noble gases and Zn, Cd, Hg.

CHEM 371 Analytical Chemistry III

Classical analytical chemistry, covering volumetric methods (including complexometric and non-aqueous solvent titrations); gravimetric methods; separation methods. Principles of chromatography, spectrophotometry. Sampling. Evaluation of analytical data.

CHEM 372 Practical Chemistry (Analytical)

Application of various analytical methods to specific problems.

CHEM 411 Physical Chemistry V (Kinetics)

General dynamics; reaction kinetics; catalysis; photochemical sources of energy for kinetic reactions.

CHEM 412 Physical Chemistry Vi (Surface Chemistry & Colloids)

Physical chemistry of surfaces; adsorption; catalytic behaviour. Colloids.

CHEM 413 Physical Chemistry Vii (Polymer Chemistry)

Functionality concepts and applications in industrial synthesis of polymers, with reference to e.g rubber, plastics, fibres, coatings and adhesives industries. Mechanism and kinetics of polymerisation; Co-polymerisation; relationship between structure and physio-chemical properties.

CHEM 414 Molecular Structure

Electrical and magnetic properties of molecules in relation to molecular structure and spectra - pure rotational, infra-red, Raman, electronic, nuclear magnetic resonance.

CHEM 415 Symmetry And Point Groups

Concept of symmetry and symmetry operations; point-group symmetry elements and determination of point-groups of molecules; simple applications.

CHEM 416 Atomic Structure And Spectra

Spectra of atoms in relation to their internal structure. Applications.

CHEM 417 Quantitative Molecular Orbital Theory

The Variation Principle and determination of Huckel Molecular Orbitals and their energies; free valency indices; charge densities etc. of molecules.

CHEM 418 Photochemistry

Laws of photochemistry. Interaction of light with atoms; primary photophysical processes of poly-atomic molecules; Photochemistry of carbonyl compounds and alkenes. Photochemical techniques.

CHEM 419 Statistical Thermodynamics

Complexions; Maxwell-Boltzmann statistics; partition functions; calculation of thermodynamic properties; heat capacities; entropy; equilibrium constants; application of spectroscopic data.

CHEM 431 Organic Chemistry VI

Mass spectroscopy (MS), NMR spectroscopy, and ESR spectroscopy. The use of uv, ir, MS, NMR (and ESR) in structure elucidation.

CHEM 432 Organic Chemistry Vii (Natural Products)

Natural Products - structure, reactions and synthesis of carbohydrates, amino acids and proteins, nucleotides and nucleic acids, oxygen heterocycles, alkaloids, terpenoids and steroids.

CHEM 433 Organic Chemistry VIII

The chemistry of polynuclear aromatics (e.g. naphthalene) and some heterocyclic compounds.. Rearrangements involving electron-deficient C, N, and O and electron-rich C. Neighbouring group participation.

CHEM 434 Alkaloids

Definition; methods of isolation and chemical tests; chemical analyses; importance of alkaloids as drugs.

CHEM 435 Steroids

Definition; classification and systematic nomenclature and structural studies; structural features and some chemical reactions of sterols, bile acids, hormones, and steroidal glycosides. Biosynthesis.

CHEM 436 Terpenes

Isoprene rule; classification, biosynthesis, structural elucidation, synthesis.

CHEM 437 Natural Oxygen Heterocycles

Classification; Chemistry, including structural elucidation of anthocyanins, flavonoid compounds and coumarins.

CHEM 438 Medicinal Chemistry

Definition of medicinal chemistry. Drugs: classification, action, chemistry, pharmacology. Drug development. Chemical carcinogens. Pesticides. Principles of drug quality control.

CHEM 439 Organometallic Chemistry

Definition and clarification. Preparation and reactions of the organometallic compounds of the Main Group elements, and of the d-block Transition elements; Organometallics as useful synthetic intermediates.

CHEM 451 Transition Metal Chemistry

Coordination chemistry. Chemistry of the transition and inner-transition metals.

CHEM 452 Solid State Chemistry

Preparative methods for solid (mainly inorganic) materials e.g. solid state reactions; vapour phase transport methods; ion-exchange and intercalation reactions; high pressure and hydrothermal methods, etc; Glass. Composite materials. Topochemical control of solid state organic reactions. Organic "metals" and "superconductors".

CHEM 472 Instrumental Methods Of Chemical Analysis

Measurement and instrumentation; resolution, sensitivity, selectivity, detection limit; Sample pre-treatment techniques. Detailed consideration and applications of some selected methods e.g. AAS, XRF, XRD, Neutron activation, voltammetric stripping analysis, HPLC, GLC etc.

CHEM 471 Nuclear And Radio-Chemistry

Qualitative and quantitative aspects of radioactive decay; some techniques in applied radiochemistry. Radiation chemistry.

CHEM 472 Instrumental Methods Of Chemical Analysis

Measurement and instrumentation; resolution, sensitivity, selectivity, detection limit; Sample pre-treatment techniques. Detailed consideration and applications of some selected methods e.g. AAS, XRF, XRD, Neutron activation, voltammetric stripping analysis, HPLC, GLC etc.

CHEM 473 X-Ray Crystallography

Interaction of x-rays with matter. Qualitative and quantitative aspects of x-ray powder diffraction methods. Introductory single-crystal structure analysis.

**CHEM 474 Elements Of Forensic Chemistry
(NEW - Syllabus being developed)**

CHEM 491 Petroleum Chemistry And Technology

The origin and chemistry of petroleum. Petroleum refinery - primary and secondary processes; quality assessment of some of the petroleum fractions. Petrochemicals.

CHEM 493 Mineral Processing

Physical and chemical properties of minerals. Some physical and chemical methods for processing minerals. One mining industry in Ghana.

CHEM 494 Textile Chemistry And Technology

Physical and chemical properties of raw materials; changes in these properties during preparation of yarns for weaving; treatment of fabric after weaving.

CHEM 495 Pulp And Paper Chemistry And Technology

The conversion of wood to paper with particular emphasis on the organic, physical and surface chemistries involved. Paper properties and uses.

BCHM 301 Structure And Function Of Biomolecules

Organization and order in living things: Requirement of energy; organization of organic molecules in living cells; sub-cellular organelles and their functions; cell disruption and fractionation. *Proteins:* Amino acids - basic structure, classification, acid/base properties, essential & non-essential; peptides; proteins - primary, secondary, tertiary and quaternary structure; classification and properties. *Carbohydrates:* Monosaccharides; stereoisomerism; other derivatives of monosaccharides; reducing sugars; common di- oligo- and polysaccharides (storage & structural). *Lipids:* Classification; lipoproteins; glycolipids (ABO groups, cell-cell recognition, receptors etc.). *Nucleic Acids:* Nitrogenous bases, nucleotides, cyclic nucleotides; DNA and RNAs (brief review of replication, transcription, translation). *Other Biomolecules: Coenzymes, porphyrins, antibiotics, alkaloids & inorganic ions.*

BCHM 304 Enzymology

Introduction to Enzymes: Comparison of chemical and enzyme catalysis, Activation energy and transition state, Free energy change, Chemical equilibria, Active site, Substrate specificity, Enzyme classification. *Factors affecting Enzyme Activity:* Enzyme assays, linked or coupled enzyme assays, Reaction rate (V), Effect of [S], [E], T, pH on enzyme activity; coenzymes, prosthetic groups. *Enzyme Kinetics and Inhibition:* Michaelis - Menten model, Graphical representation of data (eg. Lineweaver - Burk and Hanes plots) Enzyme inhibition: Reversible (Competitive, noncompetitive, uncompetitive) and irreversible. *Control of Enzyme Activity:* Feedback regulation, allosteric enzymes, isozymes, covalent modification, activation, regulation of synthesis and breakdown (eg. lac operon, tryptophan biosynthesis). *Enzyme Purification:* Cell disruption techniques, general purification strategy, enzyme assays, units of enzyme activity.
Industrial application of enzymes

BOTN 312 Whole Plant Physiology

Treatment of biophysical concepts: plant water relations; absorption of water; transpiration; stomatal physiology; ion uptake; transport systems in plants; survey of phytohormones; brief coverage of dormancy, germination and growth, flowering and fruiting.

BOTN 314 Taxonomy and Evolution of Seed Plants

Comparative morphology and/or evolutionary trends in seed plants, with special reference to common seed plant families in Ghana. Basic principles of taxonomy to include classification, nomenclature and identification.

BIOL 315 Principles of Genetics

An introduction to the principles of genetics and chromosome cytology from the molecular aspects to population aspects, including applications of the principles in animal breeding, plant breeding and applied human genetics. Some of the practical techniques in formal genetics and cytogenetics are introduced.

MATH 304 Differential Equations (Pre-requisite MATH 305)

The one-form in two and three dimensions; exact form, condition for integrability. Ordinary differential equations with variable coefficients; existence and uniqueness of solutions, the Wronskian. Methods of solution; reduction of order, variation of parameters, solution in series. [The Bessel, Legendre and hypergeometric series]. Fourier series. Partial differential equations; first order; classification of the second order; elliptic, parabolic and hyperbolic; separation of variables, initial/boundary value problems. Laplace transform method of solution of ordinary and partial differential equations.

MATH 305 Calculus Of Several Variables (Pre-requisite MATH 203)

Functions $f : \mathbb{R}^n \rightarrow \mathbb{R}$, $n \geq 2$: Limits, continuity, partial derivatives, differentials, chain rule, Euler's theorem on homogeneous functions, directional derivative. Implicit functions, functional dependence. Taylor's theorem, Extrema, critical points and their classification. Constrained extrema – the method of Lagrange multipliers. The gradient operator; curves and surfaces, tangent planes and normal lines. Differentiation under the integral sign. Functions $f : \mathbb{R}^n \rightarrow \mathbb{R}^m$, ($n, m \leq 3$): The derivative as a matrix: the chain-rule. The divergence and curl operators. Curvilinear coordinates; Inverse and implicit function theorems; functional dependence. Multiple integrals. Line, surface and volume integrals. Differential forms and the general Stokes' Theorem – Greens's, Stokes' and divergence theorems.

FDSC 305 Physical Principles in Food Processing (Pre-req: PHYS 200, 203,204, BIOL 201-204, CHEM 201, 202, 211, 212, 231, 232)

The laws of conservation of mass and energy – application in food processing. Fluid flow theory and applications. Unit operations in food processing such as dehydration, chilling and freezing, extrusion, size reduction, evaporation, mechanical separations and mixing. Traditional and modern applications of unit operations.

FDSC 307 Principles of Food Preservation

Problems of Food Spoilage. Agents and factors of Food Spoilage. Principles of Food preservation with particular reference to chemical preservation. Scientific and technological aspects of food preservation. Food quality and acceptance.

NUTR 306 Food Analysis I (Pre-req: BIOL 201-204, CHEM 201, 202, 211, 212, 222)

Sampling and sample preparation, glassware for laboratory analysis. Precision and accuracy, data reporting, report write-up. Principles behind food analysis methods. Comparative moisture analysis, ash, crude fat, crude protein and crude fiber analysis. Calorific value of foods. Determination of phosphorus, iron and calcium in foods.

PHYS 321 Mathematics For Physics

Calculus of functions of several variables, partial differentiation, total differential, Euler's theorem on homogeneous functions. Constrained and unconstrained extrema, multiple integrals. Jacobian, scalar and vector fields, line, surface and volume integrals. Vector operators, grad, div and curl. Gauss, Stokes and Green's theorems. Ordinary differential equations with variable coefficients; solution in series.

PHYS 324 Computing For Scientists

A course designed to introduce physics students to computer solutions of realistic physics problems such as moment of inertia, the energy of an object on a spring, resonance of a membrane.

STAT 306 Design of Experiments (Pre-req. STAT 203)

Basic concepts and principles of experimental Statistics. Analysis of Variance for standard experimental designs. The estimation of treatment Effects.

GRADUATION REQUIREMENTS:

- (a) *Candidates must have satisfied ALL University and Faculty requirements;*
- (b) *Candidates must have taken*
 - (i) *the Level 200 courses prescribed by the Physical, Biological or Earth Science programmes.*
 - (ii) *For a Combined Major with Chemistry:
all Core Courses and Prescribed Electives of the "Combined Major" Chemistry programme.*
 - (iii) *For a Chemistry Major:-
all Core Courses and Prescribed Electives of the "Single Subject Major" Chemistry programme.*
 - (iv) *an additional FOUR (4) Credits, EITHER from the Level 400 Chemistry Electives, OR, with prior approval from the Chemistry Department, from the Level 300 and/or Level 400 Courses of any of the Departments of the Faculty of Science.*

DEPARTMENT OF COMPUTER SCIENCE

FACULTY

E.B.B. Gyebi , BSc (K'si) MSc, MCP (South Bank, Lond)	-	Lecturer/Head of Dept
J.A. Aryeetey , BSc (K'si) MSc (Lagos)	-	Lecturer
Isaac Odoom , BSc (Ghana) MSc (Essex)	-	Lecturer
B.S-K. Wiredu BSc MSc PGCE (South Bank) MBA (Lond)	-	Lecturer
J.K. Ecklu , BSc MBA (Ghana)	-	Tutor
Matilda S. Wilson BSc (K'si) MBA (Gh) - MIS (Belgium) PGDAC (India)	-	Tutor
K.A. Debrah , BSc (K'si) MSc (UK)	-	Part-Time Lecturer
Owusu-Barfi , A. BSc (Ghana) MSc (Denmark)	-	Part-Time Lecturer
G.O. Canacoo , BSc (K'si) MSc (UK), MBCS	-	Part-Time Lecturer
C. Nartey , BSc (Caltech) MSc, PGCE (Sanford),	-	Part-Time Lecturer

**LEVELS 100, 200, 300 & 400 COURSES
BSc Single Subject Major**

Core (73 credits)		
COMP 101	Introduction to Computer Science I	3
COMP 102	Introduction to Computer Science II	3
COMP 201	Information Systems	3
COMP 202	Programming using Java	3
COMP 203	Computer Systems	2
COMP 204	File Organization	1
COMP 205	Principles of Programming	3
COMP 206	Data Structures	1
MATH 201	Algebra	3
MATH 203	Calculus II	3
COMP 301	Systems Analysis and Design	4
COMP 302	Databases	3
COMP 303	High Level Programming	4
COMP 304	Computer Organization & Assembly Language Programming	3
COMP 401	Operating Systems	4
COMP 402	Systems Programming	4
COMP 403	Computer Hardware	3
COMP 407	Compiling Techniques	3
PHYS 417	Analogue Electronics	3
PHYS 438	Digital Electronics	3
COMP 410	Project	8
COMP 411	Microprocessor Laboratory	1
STAT 201	Introductory Probability I (Pre-req. MATH 101, 103)	2
STAT 204	Introductory Probability II (Pre-Req. STAT 201)	3
Electives (Minimum of 25 credits)		
Group A: (Select at least 12 Credits)		
COMP 404	Microprocessor Interfacing	3
COMP 405	Simulation	3
COMP 406	Design and Analysis of Algorithms	3
COMP 408	Data Communications and Networking	3
COMP 409	Computer Graphics	3
COMP 412	Introduction to Expert Systems	3
MATH 311	Numerical Methods (Pre-requisite MATH 203)	3
Group B: (Select at least 12 Credits)		
MATH 302	Linear Algebra: (Pre-requisite MATH 201)	3
MATH 305	Calculus Of Several Variables (Pre-requisite MATH 203)	3
STAT 203	Elementary Statistical Methods	3
STAT 303	Statistical Methods I (Pre-req. STAT 204)	4
STAT 405	Regression Analysis(Pre-req. STAT 304, MATH 302)	3
STAT 406	Multivariate Methods (Pre-req. STAT 302, MATH 302)	3
ADMN 303	Computer Applications in Management	3
ECON 419	Operations Research I	3
ECON 422	Operations Research II	3
BSc Combined Major		
Core: 50 Credits		
COMP 101	Introduction to Computer Science I	3
COMP 102	Introduction to Computer Science II	3

COMP 201	Information Systems	3
COMP 202	Programming using Java	3
COMP 203	Computer Systems	2
COMP 204	File Organization	1
COMP 205	Principles of Programming	3
COMP 206	Data Structures	1
MATH 201	Algebra	3
MATH 203	Calculus II	3
COMP 301	Systems Analysis and Design	4
COMP 302	Databases	3
COMP 303	High Level Programming	4
COMP 304	Computer Organization & Assembly Language Programming	3
COMP 401	Operating Systems	4
COMP 402	Systems Programming	4
COMP 407	Compiling Techniques	3

Electives: (9 credits from below)

COMP 403	Computer Hardware	3
COMP 404	Microprocessor Interfacing	3
COMP 405	Simulation	3
COMP 406	Design and Analysis of Algorithms	3
COMP 408	Data Communications and Networking	3
COMP 409	Computer Graphics	3
COMP 412	Introduction to Expert Systems	3
PHYS 417	Analogue Electronics OR	3
PHYS 438	Digital Electronics	3
COMP 410	Project**	8

** COMP 410 is **core** to BSc students who offer project at the department.

LEVELS 100, 200, 300 & 400 COURSES
BSc Single Subject Major

Core (73 credits)

COMP 101 Introduction to Computer Science I

An introduction to computers and how they work. Types and Historical Development of Computers. **Data Representation:** Bits, bytes and words: Character representation. Number systems – binary, octal, hexadecimal integer and fractional representations, Signed and Unsigned numbers, 1's complement, 2's complement and Arithmetic Overflows. Integer and floating point arithmetic (IEEE standard 754 Floating point Formats). **Boolean Algebra:** Logic operations and Logic gates applications. **Computer Hardware:** Brief overview of the Central Processor, its main elements and their functions. Memory organisation. Input/Output devices. **Problem solving by digital computers:** Use of algorithms and flowcharts. The concept of a Computer Program. **Programming languages:** Machine language, Assembly language, Higher level languages; Compilers and interpreters. **Computer Applications:** The Internet, Computer use in the office, computer ethics etc.

COMP 102 Introduction to Computer Science II

This course is the continuation and practical component of COMP101 and covers the following areas:

Practical applications of switching theory: logic elements, Boolean algebra and Number systems;

Computer Hardware: Laboratory work on basic discrete and peripheral components of a computer system. Identifying and selecting the various hardware components like the hard disk, motherboard, memories, etc. for a computer system are introduced.

Computer Software: General overview of system software, programming languages and application software (the use of computers for data processing and generating information; computer aided design; communication; etc), operating system (importance, characteristics and types). **Problem**

solving by digital computers: the use of algorithms and flowcharts, computer programs.

COMP 201 Information Systems

This course provides an in-depth understanding of the concepts, principles and the practice of information systems. It covers topics relating to information system as strategic resource (strategic Information systems - SIS); trends towards information system intergration in user organizations; how the building blocks and design forces combine to form viable user-oriented information systems that meet the requirements and goals of the user organization.

Types of Information Systems: Transaction processing, Systems (TPS), Management Information Systems (MIS), Executive Information Systems (EIS), Dercision Support Systems (DSS), Expert Systems (ES), etc.

COMP 202 Programing using Java

Types of Programming Languages, Object Oriented Programming. Language Structure and Components. Java Fundamentals and Components. Programming styles and errors. Variables and Primitive Data Types, Reserved Key words, Arithmetic, Relational and Logical Operators.

Increment/Decrement Operators. Control Structures in Java Programming. Nested loops; Arrays; Classes; How to read data through keyboard and Files. Classes and Methods Creation of Classes, Methods and Objects. Methods Description, Instance Variables. Assessors and Mutator Method. Constructor Stack and Heap Memory. Creating and Testing Methods Classes and Methods. String Tokenizer. Recursive Method-Method Decomposition.

Inheritance – Subclasses Parent class Method/Constructor over loading Introduction to Applets

COMP 203 Computer Systems

Introduction to modern computer systems with emphasis on PC-systems. The hardware and peripherals that go to make a computer system. Interfacing devices and processing techniques.

Types of Computers and configurations; Computer Hardware: System Unit ,Input and Output devices, File and Secondary Storage, System and Application Software, Building a small computer system. **Computer Networks:** Computer Networks, Communication Technologies, Introduction to Internet Technologies, Processing Techniques and Data Transfer. **Computers and Society:** Social Impact, Cyber Crimes and Ethics.

Practice: Building a small computer system, System Configuration and Setup, Software Installations, Installing and managing a small Local Area Network.

COMP 204 File Organization

The different file organisational methods available for tape, floppy diskettes, and disk packs and an appreciation of the methods suitable for particular application. File organisational methods: Random; Sequential: Indexed: Linked: partitioned: Inverted. File Access Methods: Random; Sequential; Direct Access; ISAM, VSAM. Operation on Files: Inquiry; Insertion; Deletion; Merge. Disks and their communications, with Computers; Channel; Control Units; Switching.

Record formats: Fixed variable; fixed blocked; variable blocked; undefined.

COMP 205 Principles of Programming

This course introduces students to computer programming. Students will learn the fundamental concepts and terminology of software application development and develop skills in designing and writing simple computer programs. The course assumes no programming background and provides an overview of the software development process in addition to introducing important programming constructs and methodologies.

Introduction to Computer Programs: Software development process and fundamentals of computer software. **Using Data and Variables:** The fundamental concepts of variables and data types. **Using Program Logic:** This module introduces common programming constructs used in software **Using Procedures and Functions** The use of procedures and functions to create more modular computer programs. **Introduction to Developing a User Interface:** The design of user interfaces for software applications using for example, Microsoft Visual Studio.NET.

COMP 206 Data Structures

This course is designed as an introduction to the relations (structures) among elementary data types occurring in user problems. The student learns how to represent and implement these data structures in a program and how to operate on these structure. The basic data types: Integer, real, Boolean and character. General concepts of abstract data structures. Arrays and Strings, and their representation in memory. One and two-dimensional arrays. Lists, vectors, tables, matrices. Static and dynamic structures. Linear structures: Pointers, stacks and queues. Sequential and linked lists. Circular lists. Non-linear data structures, diagraph and three traversals. Expression trees. Binary and applications. Compiling Techniques.

MATHS 201 Algebra

Logical argument and concept of mathematical proof. Set theory, Cartesian products, binary relations, equivalence relations and mappings. Properties of real and complex numbers, principles of mathematical induction. Linear transformations and Matrices; applications to linear equations. Vector Algebra and geometrical applications. Introduction to group theory.

MATH 203 Calculus II

Function of a single variable. The first derivative and its applications. Higher derivatives and applications. Leibniz's theorem and applications. Taylor's theorem. Maclaurin and Taylor expansions of some standard functions. Integration as a sum; definite and indefinite integrals; improper integrals; the logarithmic and exponential functions, the hyperbolic functions and their inverses. Techniques of integration including integration by parts; recurrence relations among integrals; applications of integral calculus to plane curves: arc length, area of surface of revolutions. Pappus theorems, approximate evaluation of definite integrals; Ordinary differential equations; first order; second order (constant coefficients).

COMP 301 Systems Analysis and Design

This course seeks to apply object-modeling techniques to analyse the functional requirements for a system. Object-oriented design elaborates the analysis models to produce implementation specifications. The following three major areas will be covered: **Object-oriented systems:** objects, collaboration between objects, sending messages and calling functions. **Object-oriented Analysis:** The problem domain, concurrency, distribution, persistence, or how the system is to be built, use of UML class diagrams, the user-interface mock-up. **Object-oriented design:** technological or environmental constraints such as transaction throughput, response time, run-time platform, development environment, or programming language, mapping of the concepts in the analysis model into implementation classes and interface

COMP 302 Databases

This course will enable students gain expertise in developing database driven applications. Students would be able to understand the database concepts and how applications access data from database. Introduction to DBMS – What is DBMS, Its need, Areas where DBMS are used
Types of DBMS: Introduction to Hierarchical Model, Network and Relational Models, Object Oriented Databases RDBMS Concepts Data models (conceptual physical and logical), Data Integrity & Integrity Rules, Data Security, Different Views of ER Model, ER Diagrams, Class Diagrams, Flow Charts. Codd's 12 rules for a Relational database, Need for Normalization. Various normalization forms 1st normal form, 2nd normal form, 3rd normal form. Introduction to 4th BCNF, etc. Structured Query Language

COMP 303 High Level Programming

The typical features of a High Level procedural illustrated with the language adopted for COMP 205. Students should have the opportunity to do a substantial amount of programming in this course. Programming style and concepts of structured programming. Structures and syntax of statement. Advanced control structures and data types. Compounding of statements, conditions and data types. **Subprograms:** Functions and subroutines, procedures. String functions and string manipulations. Sequential and random file handling for data processing. Programming exercises in C++.

COMP 304 Computer Organization & Assembly Language Programming

The course is designed to provide knowledge of the execution of Machine Language and Assembly Language programs. **Introduction to Machine Architectures;** Instruction execution cycle; memory organisation. Intel 8086 and Motorola 68000 family of processors. Review of data representation and alphabetic codes; decimal numbers and their Binary, Octal, Hexadecimal and BCD equivalents. Basic logical operations. Data Manipulations. Definition of an Assembler, purpose of an Assembler program and its functions. Assembly Language Structure: addressing modes, instruction format, directives, instruction set and machine operation. **Writing assembly language programs using an assembler.**

COMP 401 Operating Systems

The operating system as an integral part of the computer system (hardware) is emphasized with particular reference to multi-user operating system environment.

Introduction to Operating System: Concepts and definitions, historical development, functions of an operating system. Single user vrs. Multi-user operating system, MS-DOS, CPM and UNIX **Concurrent Processes:** Processes and Process Synchronisation; **Memory Management:** Single user, multi programming, partitioned memory, relocatable memory, paging. Virtual memory, demand paging, segmenting, swapping and overlaying. **Processor management:** Processor scheduling levels and processor scheduling (Preemptive and Nonpreemptive scheduling, FIFO, Round Robin, SJF, SRT and HRN scheduling), multilevel feedback queues. **Device management:** management techniques, channels and control units, I/O traffic control, I/O scheduling, device handlers. **Information management:** Components of the File System, steps involved in a File access, Access control. Types of File Structures, Non-contiguous files, Storage Allocation strategies.

COMP 402 Systems Programming

To teach systems programming techniques and practices using systems programming exercise. Students write or amend a large programme to produce a working software product. Typically, this is an editor or a similar large piece of system software. **Introduction to systems programming language; Exercises on:** the implementation of a single interactive editor and interpreter, experience in interactive development of software and in the use of software development tools (text editor, compilers, programme debugging aids, etc), Production of reliable and maintainable software.

COMP 403 Computer Hardware

An introduction to the structure of a computer with emphasis on essential structure rather than detailed design. Introduction to digital computer and microprocessors. Description of basic structure of a computer and its features. LSI & VLSI CIRCUITS, PLA, PAL PLS.

The Central Processing Unit (CPU): Functions of the CPU. CPU communication with memory, instruction codes and data manipulations, stacks, jump and branch instructions. Arithmetic circuits, functions of the control unit. Concepts of microprogramming – Bit slices. **Storage system:** Basic characteristics of storage devices, semi-conductor storage systems, registers and memories, data transfer between registers.

Input/Output System: Characteristics of I/O devices and I/O Buses. I/O programming techniques, interrupts and direct memory access. System software, uses of loaders, Assembler, Compilers Debuggers and Simulation.

COMP 407 Compiling Techniques

The principles of compiler design as a basic for implementation of a high-level language. An introduction to the principles of interpreting and translator. The compilation process. Structure of a compiler, its phases and their functions. Lexical Analysis and its function. Token selection. Transition diagrams and finite Automata. Use of Regular Expressions to describe Lexical tokens. Design of token recognizers using transition diagrams and finite automata. **Parsing:** Function of a parser, one pars Use of context-free grammars to describe syntax. Derivations and parse trees construction of parsers. **Translation:** Syntax directed translation schemes. Intermediate code. Symbol

tables. Run-time organisation. Code generation. Optimization. **Error Handling:** Detection, reporting, recovery, and correction of errors. Lexical syntactic and semantic error-handling techniques. Interpreters and translator writing systems.

PHYS 417 Analogue Electronics

Cathode ray tube and the cathode ray oscilloscope. Elementary theory of semiconductor p-n junctions and diodes. Design of regulated power supply. Bipolar Junction Transistor amplifier; Field effect transistor. **Negative feedback amplifiers:** Positive feedback amplifiers and oscillators. Power amplifiers; Switching circuits. Operational amplifiers (linear applications only)

PHYS 438 Digital Electronics

Binary number systems. Basic logic gates. Boolean functions and truth tables. Combinational circuits. Design techniques using Boolean algebra. Karnaugh maps and logic array components Sequential Circuits. SR, JK and T-type flip-flops. Design of counters and registers. General design of sequential circuits using the concept of state machines.

STAT 201 Introductory Probability I (Pre-req. MATH 101, 103)

Introduction to the concepts of probability, Random Events, and Random Variables. The Probability Calculus, Univariate probability distributions

STAT 204 Introductory Probability II (Pre-Req. STAT 201)

Bivariate Distributions. Moment Generating Functions; their properties and uses. Sampling distributions. Distributions associated with samples from a Normal population. The Weak Law of Large Numbers and the Central **Limit** Theorem. Applications.

Electives (Minimum of 25 credits)

Group A: (Select at least 12 Credits)

COMP 404 Microprocessor Interfacing

The devices and techniques employed to link a computer system to the outside world. Interfacing and I/O organisation. Parallel and serial transfers, memory mapped and I/O program control. Pull up resistors, Tristate drivers, address decoding. **Interfacing and communication standards:** UARTS' Synchronous and Asynchronous communications. MODEMS and GPIB. Interrupt driven and polled interfaces. Direct Memory Access technique. **Laboratory:** Interfacing techniques of a computer to the outside world. Interfacing example using Assembler and High language programming techniques.

COMP 405 Simulation

An introduction to Simulation method and techniques using computers, illustrated with appropriate programs/algorithms. The concept of Simulation. Reasons for Simulation, Simulation problem and models. Planning computer simulation experiments. Continuous System Models, Use of Analog computers in system simulation. Continuous system simulation programs and their applications, (e.g. CSMP). **Discrete System Simulation:** Generation of Random numbers, pseudo-random numbers Uniform and non-uniform distribution. Application in Stochastic Simulation. Traffic flow, Traffic control, Inventory and storage systems. Simple (including multi-server) Queues and their simulation. Simulation Language.

COMP 406 Design and Analysis of Algorithms

A formal introduction to the nature of Algorithms and their use in the solution of a wide variety of problems by computer. Students should be able to write efficient programs for the implementation of many of these algorithms. Algorithms and problems solving. Characterization and description of Algorithms. Problems solvable by algorithms. Algorithms as transformations of strings. **Review:** Basic data structures – stacks, queues, lists, trees, etc. Algorithms for their implementation. **Sorting and searching:** Basic techniques of design and analysis of efficient algorithms for internal and external sorting, merging and searching. Recursive methods. **Graphs:** Concepts, definitions and properties. Algorithms for finding paths and spanning trees. Networks and critical paths. **Simulation Algorithms:** For discrete and continuous process – queues, storage and inventory problems and other

applications. Algorithms for numerical operations and process. Exercises on the development of algorithms for a selection of mathematical problems

COMP 408 Data Communications and Networking

The principles and techniques of computer network and communications with special reference to interconnections of PC networks and PCs to a host computer.

Types of Networks, Network Topologies: (Ethernet types: Bus, Star, Ring, Mesh), **Network transmission Media:** (Coaxial, Twisted Pair, Fibre-optic, Radio and Satellite), **Networking Hardware:** (Network Adapter Cards (NIC), Switches, Routers, Bridges and repeaters) **Data transmission:** Link level protocols, Communication and Transmission modes, Network Standards and the OSI Model. **Local Area and Wide Area Networks:** Design of Local Area Networks (Field measurements and drawings, media terminations (the use of colour codes) and connectivity; Network configurations (TCP/IP protocols and subnetting) **Sytem Security and Network Policies:** Encryption and Privicy, User rights and permissions

COMP 409 Computer Graphics

An introduction to the fundamental of a general purpose graphics system and its applications. Introduction to computer graphics. Basic interactive graphics programming. Graphics Hardware. Display System Organisation. Display devices and modes. Display file construction and structure. Graphic Primitives. Device initialization, viewpointing and windowing. Line Drawing, simple and symmetrical digital differential analysis (DDA). Arc and Circle generation DDA. Line and polygon clipping algorithms, curve plotting. **Transformations:** Projections and perspective views. Picture segmentation.

COMP 412 Introduction to Expert Systems

Aims of the course: Provide an overview of the Artificial Intelligence. (A.I.) field, to include both knowledge based systems and those which learn from experience. To give an appreciation of recent research land development work in this area. To introduce the students to relevant programming techniques. **Definition and principles of A.I:** Overview: Definitions and examples of A.I. establishing the importance of problem solving, knowledge representation and expert systems. **Problem Solving:** Search strategies, goal analysis, extensions to search (Adversaries etc.) Alternate approaches to problem solving eg. Production system. **Toward Expert System:** Introduction to logic, simple inference strategies, the use of probability. **Inside Expert System:** Architecture of expert, expert systems theory and practice, toolkits and shells. Comparison of commercially available products. **Knowledge Representation:** Introduction to semantic nets and frames, inference and inheritance strategies. The use of knowledge. **Machine Learning:** Review of paradigms e.g. induction heuristics, neural networks, evolutionary algorithms. Practical application. **Building Expert Systems:** Use of a High Level Language (PASCAL) and use of tools to aid program development e.g. Expert System Shells.

MATH 311 Numerical Methods (Pre-requisite MATH 203)

Numerical solutions of algebraic and trascendental equations, convergence of iteration schemes, Polynomial approximations, Gregory-Newton formula of interpolation, Operators, simultaneous linear equations, numerical integration, finite differences, solutions of ordinary differential equa-tions, prediction and correction, Runge-Kutta methods, solution of partial differential equations.

Group B: (Select at least 12 Credits)

MATH 302 Linear Algebra: (Pre-requisite MATH 201)

Vector spaces – linear dependence, bases; linear transformations, matrix representations, change of basis. Matrices – equivalence and similarity of matrices, rank and nullity; determinants. Systems of linear equations. Eigenvalues and eigenvectors, inner product, orthogonal bases and orthogonal transformations. Quadratic forms and diagonalisation.

MATH 305 Calculus Of Several Variables (Pre-requisite MATH 203)

Functions $f : \mathbf{R}^n \rightarrow \mathbf{R}, n \geq 2$: Limits, continuity, partial derivatives, differentials, chain rule, Euler's theorem on homogeneous functions, directional derivative. Implicit functions, functional dependence. Taylor's theorem, Extrema, critical points and their classification. Constrained extrema – the method of Lagrange multipliers. The gradient operator; curves and surfaces, tangent planes and normal lines. Differentiation under the integral sign.

Functions $f : \mathbf{R}^n \rightarrow \mathbf{R}^m, (n, m \leq 3)$: The derivative as a matrix: the chain-rule. The divergence and curl operators. Curvilinear coordinates; Inverse and implicit function theorems; functional dependence. Multiple integrals. Line, surface and volume integrals. Differential forms and the general Stokes' Theorem – Greens's, Stokes' and divergence theorems.

STAT 203 Elementary Statistical Methods

Basic introduction to "Statistics". The reduction and interpretation of data. Elements of statistical inference.

STAT 303 Statistical Methods I (Pre-req. STAT 204)

The first part of a two-semester Course providing a systematic development of the principles and methods of statistical inference, on a largely intuitive basis, with a minimum of mathematical theory. This part deals with the general nature of Statistical Problems, Statistical Models and Problems of Estimation.

STAT 405 Regression Analysis(Pre-req. STAT 304, MATH 302)

The methods of regression analysis extended to situations involving more than one predictor variables. Special emphasis on problems associated with the presence of several predictors.

STAT 406 Multivariate Methods (Pre-req. STAT 302, MATH 302)

Introduction to theory and methods of Multivariate Data Analysis; Estimation and Tests of Hypotheses, Profile Analysis, Multivariate Structure, Discriminant Analysis.

ADMN 303 Computer Applications in Management

The course is aimed at making students appreciate the application of computer-based tool to a particular line of work. Since businesses gather volumes of data/information, there is a need to computerizing the filing systems to help track numerous business activities and also help managers make quick and effective decisions. The course therefore focuses on capturing, storing, and accessing information with the help of a chosen database management software such as Access.

BSc Combined Major

Core: 50 Credits

COMP 101 Introduction to Computer Science I

An introduction to computers and how they work. Types and Historical Development of Computers.

Data Representation: Bits, bytes and words: Character representation. Number systems – binary, octal, hexadecimal integer and fractional representations, Signed and Unsigned numbers, 1's complement, 2's complement and Arithmetic Overflows. Integer and floating point arithmetic (IEEE standard 754 Floating point Formats) .**Boolean Algebra:** Logic operations and Logic gates applications. **Computer Hardware:** Brief overview of the Central Processor, its main elements and their functions. Memory organisation. Input/Output devices. **Problem solving by digital computers:** Use of algorithms and flowcharts. The concept of a Computer Program. **Programming languages:** Machine language, Assembly language, Higher level languages; Compilers and interpreters. **Computer Applications:** The Internet, Computer use in the office, computer ethics etc.

COMP 102 Introduction to Computer Science II

This course is the continuation and practical component of COMP101 and covers the following areas: **Practical applications of switching theory:** logic elements, Boolean algebra and Number systems; **Computer Hardware:** Laboratory work on basic discrete and peripheral components of a computer

system. Identifying and selecting the various hardware components like the hard disk, motherboard, memories, etc. for a computer system are introduced.

Computer Software: General overview of system software, programming languages and application software (the use of computers for data processing and generating information; computer aided design; communication; etc), operating system (importance, characteristics and types). **Problem solving by digital computers:** the use of algorithms and flowcharts, computer programs.

COMP 201 Information Systems

This course provides an in-depth understanding of the concepts, principles and the practice of information systems. It covers topics relating to information system as strategic resource (strategic Information systems - SIS); trends towards information system integration in user organizations; how the building blocks and design forces combine to form viable user-oriented information systems that meet the requirements and goals of the user organization.

Types of Information Systems: Transaction processing, Systems (TPS), Management Information Systems (MIS), Executive Information Systems (EIS), Decision Support Systems (DSS), Expert Systems (ES), etc.

COMP 202 Programming using Java

Types of Programming Languages, Object Oriented Programming. Language Structure and Components. Java Fundamentals and Components. Programming styles and errors. Variables and Primitive Data Types, Reserved Key words, Arithmetic, Relational and Logical Operators.

Increment/Decrement Operators. Control Structures in Java Programming. Nested loops; Arrays; Classes; How to read data through keyboard and Files. Classes and Methods Creation of Classes, Methods and Objects. Methods Description, Instance Variables. Accessors and Mutator Method. Constructor Stack and Heap Memory. Creating and Testing Methods Classes and Methods. String Tokenizer. Recursive Method-Method Decomposition.

Inheritance – Subclasses Parent class Method/Constructor over loading Introduction to Applets

COMP 203 Computer Systems

Introduction to modern computer systems with emphasis on PC-systems. The hardware and peripherals that go to make a computer system. Interfacing devices and processing techniques.

Types of Computers and configurations; Computer Hardware: System Unit ,Input and Output devices, File and Secondary Storage, System and Application Software, Building a small computer system. **Computer Networks:** Computer Networks, Communication Technologies, Introduction to Internet Technologies, Processing Techniques and Data Transfer. **Computers and Society:** Social Impact, Cyber Crimes and Ethics.

Practice: Building a small computer system, System Configuration and Setup, Software Installations, Installing and managing a small Local Area Network.

COMP 204 File Organization

The different file organisational methods available for tape, floppy diskettes, and disk packs and an appreciation of the methods suitable for particular application. File organisational methods: Random; Sequential: Indexed: Linked: partitioned: Inverted. File Access Methods: Random; Sequential; Direct Access; ISAM, VSAM. Operation on Files: Inquiry; Insertion; Deletion; Merge. Disks and their communications, with Computers; Channel; Control Units; Switching.

Record formats: Fixed variable; fixed blocked; variable blocked; undefined.

COMP 205 Principles of Programming

This course introduces students to computer programming. Students will learn the fundamental concepts and terminology of software application development and develop skills in designing and writing simple computer programs. The course assumes no programming background and provides an overview of the software development process in addition to introducing important programming constructs and methodologies.

Introduction to Computer Programs: Software development process and fundamentals of computer

software. **Using Data and Variables:** The fundamental concepts of variables and data types. **Using Program Logic:** This module introduces common programming constructs used in software **Using Procedures and Functions** The use of procedures and functions to create more modular computer programs. **Introduction to Developing a User Interface:** The design of user interfaces for software applications using for example, Microsoft Visual Studio.NET.

COMP 206 Data Structures

This course is designed as an introduction to the relations (structures) among elementary data types occurring in user problems. The student learns how to represent and implement these data structures in a program and how to operate on these structure. The basic data types: Integer, real, Boolean and character. General concepts of abstract data structures. Arrays and Strings, and their representation in memory. One and two-dimensional arrays. Lists, vectors, tables, matrices. Static and dynamic structures. Linear structures: Pointers, stacks and queues. Sequential and linked lists. Circular lists. Non-linear data structures, diagraph and three traversals. Expression trees. Binary and applications. Compiling Techniques.

MATHS 201 Algebra

Logical argument and concept of mathematical proof. Set theory, Cartesian products, binary relations, equivalence relations and mappings. Properties of real and complex numbers, principles of mathematical induction. Linear transformations and Matrices; applications to linear equations. Vector Algebra and geometrical applications. Introduction to group theory.

MATH 203 Calculus II

Function of a single variable. The first derivative and its applications. Higher derivatives and pplikations. Leibniz's theorem and applications. Taylor's theorem. Maclaurin and Taylor expansions of some standard functions. Integration as a sum; definite and indefinite integrals; improper integrals; the logarithmic and exponential functions, the hyperbolic functions and their inverses. Techniques of integration including integration by parts; recurrence relations among integrals; applications of integral calculus to plane curves: arc length, area of surface of revolutions. Pappus theorems, approximate evaluation of definite integrals; Ordinary differential equations; first order; second order (constant coefficients).

COMP 301 Systems Analysis and Design

This course seeks to apply object-modeling techniques to analyse the functional requirements for a system. Object-oriented design elaborates the analysis models to produce implementation specifications. The follwong three major areas will be covered: **Object-orientted systems:** objects, collaboration between objects, sending messages and calling functions. **Object-oriented Analysis:** The problem domain, concurrency, distribution, persistence, or how the system is to be built, use of UML class diagrams, the user-interface mock-up. **Object-oriented design:** technological or environmental constraints such as transaction throughput, response time, run-time platform, development environment, or programming language, mapping of the concepts in the analysis model into implementation classes and interface

COMP 302 Databases

This course will enable students gain expertise in developing database driven applications. Students would be able to understand the database concepts and how applications access data from database. Introduction to DBMS – What is DBMS, Its need, Areas where DBMS are used
Types of DBMS: Introduction to Hierarchical Model, Network and Relational Models, Object Oriented Databases RDBMS Concepts Data models (conceptual physical and logical), Data Integrity & Integrity Rules, Data Security, Different Views of ER Model, ER Diagrams, Class Diagrams, Flow Charts. Codd's 12 rules for a Relational database, Need for Normalization. Various normalization forms 1st normal form, 2nd normal form, 3rd normal form. Introduction to 4th BCNF, etc. Structured Query Language

COMP 303 High Level Programming

The typical features of a High Level procedural illustrated with the language adopted for COMP 205. Students should have the opportunity to do a substantial amount of programming in this course. Programming style and concepts of structured programming. Structures and syntax of statement. Advanced control structures and data types. Compounding of statements, conditions and data types. **Subprograms:** Functions and subroutines, procedures. String functions and string manipulations. Sequential and random file handling for data processing. Programming exercises in C++.

COMP 304 Computer Organization & Assembly Language Programming

The course is designed to provide knowledge of the execution of Machine Language and Assembly Language programs. **Introduction to Machine Architectures;** Instruction execution cycle; memory organisation. Intel 8086 and Motorola 68000 family of processors. Review of data representation and alphabetic codes; decimal numbers and their Binary, Octal, Hexadecimal and BCD equivalents. Basic logical operations. Data Manipulations. Definition of an Assembler, purpose of an Assembler program and its functions. Assembly Language Structure: addressing modes, instruction format, directives, instruction set and machine operation. **Writing assembly language programs using an assembler.**

COMP 401 Operating Systems

The operating system as an integral part of the computer system (hardware) is emphasized with particular reference to multi-user operating system environment.

Introduction to Operating System: Concepts and definitions, historical development, functions of an operating system. Single user vrs. Multi-user operating system, MS-DOS, CPM and UNIX **Concurrent Processes:** Processes and Process Synchronisation; **Memory Management:** Single user, multi programming, partitioned memory, relocatable memory, paging. Virtual memory, demand paging, segmenting, swapping and overlaying. **Processor management:** Processor scheduling levels and processor scheduling (Preemptive and Nonpreemptive scheduling, FIFO, Round Robin, SJF, SRT and HRN scheduling), multilevel feedback queues. **Device management:** management techniques, channels and control units, I/O traffic control, I/O scheduling, device handlers. **Information management:** Components of the File System, steps involved in a File access, Access control. Types of File Structures, Non-contiguous files, Storage Allocation strategies.

COMP 402 Systems Programming

To teach systems programming techniques and practices using systems programming exercise. Students write or amend a large programme to produce a working software product. Typically, this is an editor or a similar large piece of system software. **Introduction to systems programming language; Exercises on:** the implementation of a single interactive editor and interpreter, experience in interactive development of software and in the use of software development tools (text editor, compilers, programme debugging aids, etc), Production of reliable and maintainable software.

COMP 403 Computer Hardware

An introduction to the structure of a computer with emphasis on essential structure rather than detailed design. Introduction to digital computer and microprocessors. Description of basic structure of a computer and its features. LSI & VLSI CIRCUITS, PLA, PAL PLS.

The Central Processing Unit (CPU): Functions of the CPU. CPU communication with memory, instruction codes and data manipulations, stacks, jump and branch instructions. Arithmetic circuits, functions of the control unit. Concepts of microprogramming – Bit slices. **Storage system:** Basic characteristics of storage devices, semi-conductor storage systems, registers and memories, data transfer between registers.

Input/Output System: Characteristics of I/O devices and I/O Buses. I/O programming techniques, interrupts and direct memory access. System software, uses of loaders, Assembler, Compilers Debuggers and Simulation.

COMP 407 Compiling Techniques

The principles of compiler design as a basic for implementation of a high-level language. An introduction to the principles of interpreting and translator. The compilation process. Structure of a compiler, its phases and their functions. Lexical Analysis and its function. Token selection.

Transition diagrams and finite Automata. Use of Regular Expressions to describe Lexical tokens. Design of token recognizers using transition diagrams and finite automata. **Parsing:** Function of a parser, one pars Use of context-free grammars to describe syntax. Derivations and parse trees construction of parsers. **Translation:** Syntax directed translation schemes. Intermediate code. Symbol tables. Run-time organisation. Code generation. Optimization. **Error Handling:** Detection, reporting, recovery, and correction of errors. Lexical syntactic and semantic error-handling techniques. Interpreters and translator writing systems.

PHYS 417 Analogue Electronics

Cathode ray tube and the cathode ray oscilloscope. Elementary theory of semiconductor p-n junctions and diodes. Design of regulated power supply. Bipolar Junction Transistor amplifier; Field effect transistor. **Negative feedback amplifiers:** Positive feedback amplifiers and oscillators. Power amplifiers; Switching circuits. Operational amplifiers (linear applications only)

PHYS 438 Digital Electronics

Binary number systems. Basic logic gates. Boolean functions and truth tables. Combinational circuits. Design techniques using Boolean algebra. Karnaugh maps and logic array components Sequential Circuits. SR, JK and T-type flip-flops. Design of counters and registers. General design of sequential circuits using the concept of state machines.

STAT 201 Introductory Probability I (Pre-req. MATH 101, 103)

Introduction to the concepts of probability, Random Events, and Random Variables. The Probability Calculus, Univariate probability distributions

STAT 204 Introductory Probability II (Pre-Req. STAT 201)

Bivariate Distributions. Moment Generating Functions; their properties and uses. Sampling distributions. Distributions associated with samples from a Normal population. The Weak Law of Large Numbers and the Central **Limit** Theorem. Applications.

Electives (Minimum of 25 credits)

Group A: (Select at least 12 Credits)

COMP 404 Microprocessor Interfacing

The devices and techniques employed to link a computer system to the outside world. Interfacing and I/O organisation. Parallel and serial transfers, memory mapped and I/O program control. Pull up resistors, Tristate drivers, address decoding. **Interfacing and communication standards:** UARTS' Synchronous and Asynchronous communications. MODEMS and GPIB. Interrupt driven and polled interfaces. Direct Memory Access technique. **Laboratory:** Interfacing techniques of a computer to the outside world. Interfacing example using Assembler and High language programming techniques.

COMP 405 Simulation

An introduction to Simulation method and techniques using computers, illustrated with appropriate programs/algorithms. The concept of Simulation. Reasons for Simulation, Simulation problem and models. Planning computer simulation experiments. Continuous System Models, Use of Analog computers in system simulation. Continuous system simulation programs and their applications, (e.g. CSMP). **Discrete System Simulation:** Generation of Random numbers, pseudo-random numbers Uniform and non-uniform distribution. Application in Stochastic Simulation. Traffic flow, Traffic control, Inventory and storage systems. Simple (including multi-server) Queues and their simulation. Simulation Language.

COMP 406 Design and Analysis of Algorithms

A formal introduction to the nature of Algorithms and their use in the solution of a wide variety of problems by computer. Students should be able to write efficient programs for the mplementation of many of these algorithms. Algorithms and problems solving. Characterization and description of

Algorithms. Problems solvable by algorithms. Algorithms as transformations of strings. **Review:** Basic data structures – stacks, queues, lists, trees, etc. Algorithms for their implementation. **Sorting and searching:** Basic techniques of design and analysis of efficient algorithms for internal and external sorting, merging and searching. Recursive methods. **Graphs:** Concepts, definitions and properties. Algorithms for finding paths and spanning trees. Networks and critical paths. **Simulation Algorithms:** For discrete and continuous process – queues, storage and inventory problems and other applications. Algorithms for numerical operations and process. Exercises on the development of algorithms for a selection of mathematical problems

COMP 408 Data Communications and Networking

The principles and techniques of computer network and communications with special reference to interconnections of PC networks and PCs to a host computer.

Types of Networks, Network Topologies: (Ethernet types: Bus, Star, Ring, Mesh), **Network transmission Media:** (Coaxial, Twisted Pair, Fibre-optic, Radio and Satellite), **Networking Hardware:** (Network Adapter Cards (NIC), Switches, Routers, Bridges and repeaters) **Data transmission:** Link level protocols, Communication and Transmission modes, Network Standards and the OSI Model. **Local Area and Wide Area Networks:** Design of Local Area Networks (Field measurements and drawings, media terminations (the use of colour codes) and connectivity; Network configurations (TCP/IP protocols and subnetting) **System Security and Network Policies:** Encryption and Privacy, User rights and permissions

COMP 409 Computer Graphics

An introduction to the fundamental of a general purpose graphics system and its applications. Introduction to computer graphics. Basic interactive graphics programming. Graphics Hardware. Display System Organisation. Display devices and modes. Display file construction and structure. Graphic Primitives. Device initialization, viewpointing and windowing. Line Drawing, simple and symmetrical digital differential analysis (DDA). Arc and Circle generation DDA. Line and polygon clipping algorithms, curve plotting. **Transformations:** Projections and perspective views. Picture segmentation.

COMP 412 Introduction to Expert Systems

Aims of the course: Provide an overview of the Artificial Intelligence. (A.I.) field, to include both knowledge based systems and those which learn from experience. To give an appreciation of recent research and development work in this area. To introduce the students to relevant programming techniques. **Definition and principles of A.I:** Overview: Definitions and examples of A.I. establishing the importance of problem solving, knowledge representation and expert systems. **Problem Solving:** Search strategies, goal analysis, extensions to search (Adversaries etc.) Alternate approaches to problem solving eg. Production system. **Toward Expert System:** Introduction to logic, simple inference strategies, the use of probability. **Inside Expert System:** Architecture of expert, expert systems theory and practice, toolkits and shells. Comparison of commercially available products. **Knowledge Representation:** Introduction to semantic nets and frames, inference and inheritance strategies. The use of knowledge. **Machine Learning:** Review of paradigms e.g. induction heuristics, neural networks, evolutionary algorithms. Practical application. **Building Expert Systems:** Use of a High Level Language (PASCAL) and use of tools to aid program development e.g. Expert System Shells.

MATH 311 Numerical Methods (Pre-requisite MATH 203)

Numerical solutions of algebraic and transcendental equations, convergence of iteration schemes, Polynomial approximations, Gregory-Newton formula of interpolation, Operators, simultaneous linear equations, numerical integration, finite differences, solutions of ordinary differential equations, prediction and correction, Runge-Kutta methods, solution of partial differential equations.

Group B: (Select at least 12 Credits)

MATH 302 Linear Algebra: (Pre-requisite MATH 201)

Vector spaces – linear dependence, bases; linear transformations, matrix representations, change of basis. Matrices – equivalence and similarity of matrices, rank and nullity; determinants. Systems of

linear equations. Eigenvalues and eigenvectors, inner product, orthogonal bases and orthogonal transformations. Quadratic forms and diagonalisation.

MATH 305 Calculus Of Several Variables (Pre-requisite MATH 203)

Functions $f : \mathbf{R}^n \rightarrow \mathbf{R}, n \geq 2$: Limits, continuity, partial derivatives, differentials, chain rule, Euler's theorem on homogeneous functions, directional derivative. Implicit functions, functional dependence. Taylor's theorem, Extrema, critical points and their classification. Constrained extrema – the method of Lagrange multipliers. The gradient operator; curves and surfaces, tangent planes and normal lines. Differentiation under the integral sign.

Functions $f : \mathbf{R}^n \rightarrow \mathbf{R}^m, (n, m \leq 3)$: The derivative as a matrix: the chain-rule. The divergence and curl operators. Curvilinear coordinates; Inverse and implicit function theorems; functional dependence. Multiple integrals. Line, surface and volume integrals. Differential forms and the general Stokes' Theorem – Greens's, Stokes' and divergence theorems.

STAT 203 Elementary Statistical Methods

Basic introduction to "Statistics". The reduction and interpretation of data. Elements of statistical inference.

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The first part of a two-semester Course providing a systematic development of the principles and methods of statistical inference, on a largely intuitive basis, with a minimum of mathematical theory. This part deals with the general nature of Statistical Problems, Statistical Models and Problems of Estimation.

STAT 405 Regression Analysis(Pre-req. STAT 304, MATH 302)

The methods of regression analysis extended to situations involving more than one predictor variables. Special emphasis on problems associated with the presence of several predictors.

STAT 406 Multivariate Methods (Pre-req. STAT 302, MATH 302)

Introduction to theory and methods of Multivariate Data Analysis; Estimation and Tests of Hypotheses, Profile Analysis, Multivariate Structure, Discriminant Analysis.

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PHYS 438 Digital Electronics

Binary number systems. Basic logic gates. Boolean functions and truth tables. Combinational circuits. Design techniques using Boolean algebra. Karnaugh maps and logic array components Sequential Circuits. SR, JK and T-type flip-flops. Design of counters and registers. General design of sequential circuits using the concept of state machines.

DEPARTMENT OF GEOLOGY

FACULTY

T.M. Akabzaa, BSc, PhD (Ghana), MEng (McGill) - Senior Lecturer/Head of Dept

D.K. Asiedu , BSc (Ghana), MSc, PhD (Okayama)	- Associate Professor
B.K. Banoeng-Yakubo , MSc (Ife), BSc, MPhil, PhD (Ghana)	- Associate Professor
J. Manu , BSc, MBA (Ghana), MSc, PhD (Braunschweig)	- Senior Lecturer
M.A. Akoto , BSc (K'si), MPhil (Lond)	- Senior Lecturer
D. Atta-Peters , BSc, MPhil, PhD (Ghana)	- Senior Lecturer
E.K. Hayford , BSc (Bochem), MSc (Bonn), Dr rer nat (Berlin)	- Senior Lecturer
P.M. Nude , BSc, MPhil, PhD (Ghana)	- Lecturer
F.K. Nyame , BSc (Ghana), MSc, PhD (Okayama)	- Lecturer
T.E.K. Armah , BSc, MPhil, PhD (Ghana)	- Lecturer
J.M. Kutu , BSc, MPhil, PhD (Ghana)	- Lecturer
Yvonne A.S. Loh , BSc, MPhil (Ghana)	- Lecturer
P.A. Sakyi , BSc, MPhil (Ghana), MSc (DTU), PhD (Okayama)	- Lecturer
E Bondzie-Esiedu Ghartey , BSc (Ghana), MSc, DIC (Lond)	- Part-time Lecturer

Note: The new course structure replaces the old from the 2009/2010 academic year. The old structure will be phased out gradually beginning from 2009/2010. Students may consult the 2007-2009 handbook for courses offered under the old course structure.

LEVEL 100

Core		
EASC 100	Field Exercises and Excursions	1
EASC 101	Historical Geology	2
EASC 102	Geological Map Work	2
EASC 103	Physical Geology	3
EASC 105	Introducing Earth Science	1
EASC 106	Earth's Materials and Resources	2
CHEM 101	General Chemistry	3
CHEM 102	General Chemistry II	3
CHEM 103	General Chemistry Practical I	1
CHEM 104	General Chemistry Practical II	1
PHYS 101	Practical Physics I	1
PHYS 102	Practical Physics II	1
PHYS 113	Mechanics and Thermal Physics	3
PHYS 114	Electricity, Magnetism and Quantum Phenomena	3
MATHS 111	Algebra and Trigonometry	3
MATH 112	Calculus	3
LANG 111/112	Academic Writing	3

LEVEL 200

Core (23 Credits)		
EASC 200	Geological Field Methods I	3
EASC 201	Practical Crystallography	1
EASC 202	Petrography	2
EASC 203	Geological Structures	2
EASC 204	Principles of Geochemistry	3
EASC 205	Stratigraphy and Sedimentation	3
EASC 206	Fundamentals of Geophysics	3
EASC 207	Optical Mineralogy	2
EASC 208	Natural Hazards and Disasters	2
EASC 212	Introduction to Paleontology	2
Electives (Select a minimum of 6 Credits per Semester)		
EASC 280	Internship in Earth Science I	1
CHEM 201	Practical Chemistry I	1
CHEM 202	Practical Chemistry II	1

CHEM 211	Physical/Analytical Chemistry	2
CHEM 212	Physical/Analytical Chemistry II	2
PHYS 201	Practical Physics III	
PHYS 202	Practical Physics IV	1
PHYS 211	Introduction to Physics of Materials	2
PHYS 212	Oscillations and Waves	2
PHYS 215	Electromagnetism I	2
PHYS 216	Atomic Physics and Nuclear Physics I	2
MATHS 213	Calculus II	4
MATH 214	Calculus III	3
GEOG 202	Geomorphological Processes and Land forms	3

LEVEL 300

Core (26 Credits)

EASC 300	Geological Field Methods II	3
EASC 301	Introduction to Igneous and Metamorphic Petrology	3
EASC 302	Geology of Ghana	3
EASC 303	Soil Mechanics	3
EASC 304	Economic Geology	3
EASC 305	Fundamentals of Hydrogeology and Hydrology	2
EASC 306	Aerial Photo Interpretation	2
EASC 307	Environmental Geochemistry	2
EASC 308	Structural Geology and Tectonics	3
EASC 312	Introduction to Petroleum Geology	2

Electives (Select a minimum of 5 Credits per Semester)

EASC 311	Computer Applications in the Earth Sciences	3
EASC 313	Environmental Impact Assessment	2
EASC 314	Organic Geochemistry	2
EASC 315	Applied Geophysics	3
EASC 316	Mineral Economics	2
EASC 318	Earthquake Seismology and Disaster Risk Reduction	3
EASC 321	Environmental Pollution	2
EASC 380	Internship in Earth Science II	1

LEVEL 400

Core (14 Credits)

EASC 400	Project in Earth Science (<i>for non-Geology Option students</i>)	6
EASC 402	Statistical Methods in Earth Science	2
EASC 403	Remote Sensing and Geographic Information Systems	3
EASC 410	Project in Geological Field Mapping (<i>for Geology Option students</i>)	6
EASC 430	Field Exercises in Earth Science	1
EASC 440	Communication and Entrepreneurship in the Earth Sciences	2

Electives (Select minimum of 6 Credits per Semester from one Group)

Group A: Geology

EASC 411	Mineralogy	3
EASC 412	Current Topics in Earth Science	2
EASC 413	Igneous and Metamorphic Petrology	3
EASC 414	Sedimentary Petrology	3
EASC 415	Geochemistry and Cosmochemistry	3
EASC 416	Geology of Africa	3
EASC 418	Geochronology	2
EASC 425	Independent Research	3
EASC 445	Micropaleontology/Palynology	3

Group B: Water Resources Studies

EASC 412	Current Topics in Earth Science	2
EASC 421	Hydrology	3
EASC 422	Rural Water Supply	2
EASC 423	Hydrogeology	3
EASC 424	Water Quality and Hydrochemistry	2
EASC 425	Independent Research	3
EASC 427	Integrated Water Resources Management	2
EASC 428	Exploration Geophysics	3

Group C: Mineral Exploration and Management

EASC 412	Current Topics in Earth Science	2
EASC 425	Independent Research	3
EASC 428	Exploration Geophysics	3
EASC 431	Exploration Methods, Planning and Management	3
EASC 432	Exploration Geochemistry	3
EASC 433	Mineral Projects Feasibility Studies	2
EASC 434	Mining and the Environment	2
EASC 435	Geostatistical Ore Reserve Estimation	2

Group D: Petroleum Geoscience

EASC 412	Current Topics in Earth Science	2
EASC 414	Sedimentary Petrology	3
EASC 435	Geostatistical Ore Reserve Estimation	2
EASC 441	Basin Analysis	3
EASC 442	Petroleum Reservoir Geophysics	3
EASC 443	Basin Tectonics	3
EASC 444	Reservoir Engineering	2
EASC 445	Micropaleontology/Palynology	3

Group E: Engineering Geology

EASC 425	Independent Research	3
EASC 428	Exploration Geophysics	3
EASC 444	Reservoir Engineering	2
EASC 451	Rock Mechanics	3
EASC 452	Site Investigations	3
EASC 453	Bearing Capacity and Slope Stability Analysis	3
EASC 455	Geology of Civil Engineering Projects	3
EASC 456	Rocks as a Construction Material	2

Group F: Environmental Earth Science

EASC 412	Current Topics in Earth Science	2
EASC 415	Geochemistry and Cosmochemistry	3
EASC 421	Hydrology	3
EASC 424	Water Quality and Hydrochemistry	2
EASC 425	Independent Research	3
EASC 427	Integrated Water Resources Management	2
EASC 428	Exploration Geophysics	3
EASC 434	Mining and the Environment	2

NB: Students in one elective group can select courses from other groups to meet the required minimum credits.

COURSE DESCRIPTIONS

LEVEL 100

EASC 100: Field Exercises and Excursions

Several one-day long trips to the field to reinforce geological and environmental concepts learned in class and laboratory. This may include visits to mine sites to observe the mining of the ore and environmental issues associated with the mining.

EASC 101: Historical Geology

Historical Geology deals with the events that took place all over the world, throughout time. The syllabus covers the following topics: the structure of the Earth, the origin of the Universe, the origin of the Earth, and origin of the elements; the tempo of Earth history: catastrophic and/or uniformitarian; age of the Earth; time, including the vastness of geologic time, relative dating, radioactivity and isotopic dating; Geological Time Scale; fossils and fossilization; recognition, correlation, and interpretation of strata; origin and evolution of life; changes in sea level and climate; the evolution of continents; the geological record: events in Precambrian, Palaeozoic, Mesozoic and Cenozoic eras.

EASC 102: Geological Map Work

This course is mainly concerned with the interpretation of geological maps and the relationship between the landscape and underlying rocks. It covers the recognition and interpretation of geological structures from maps.

EASC 103: Physical Geology

The course cover the following topics: minerals; volcanism and extrusive rocks; intrusive activities and origin of igneous rocks; weathering and soil; sediments, sedimentary rocks and structures; metamorphism, metamorphic rocks and hydrothermal rocks; the rock cycle; mass wasting; streams and landscape; groundwater; glaciers and glaciations; deserts and wind action; shorelines and coastal processes; crustal deformation and folds; faults; earthquakes; the Earth's interior; the ocean floor; plate tectonics; mountain building and the evolution of continents.

EASC 105: Introducing Earth Science

This course introduces Earth Science as a holistic and practical science. It covers the following topics: scientific information gathering in the Earth Sciences, classification of the Earth Sciences, the traditional Earth Science disciplines, the practicality and importance of Earth studies, and career opportunities in the Earth Sciences.

EASC 106: Earth's Materials and Resources

The course is made up of two parts. The first part concerns Earth's materials, including the atom, elements, compounds and minerals, crystallinity, the importance of silicate minerals, physical properties of minerals, and formation, identification and description of minerals and rocks. Earth Materials is a laboratory based, however, instead of dedicating a specific day of the week to laboratory work, the lecture and laboratory elements will be integrated. Everyday life and the fabric of modern civilization depend on using the Earth's physical resources: water to drink; fuel to burn; rocks and minerals to build roads and houses; metals for machinery, electronics, and communications. The second part of the course is about the occurrence, availability, exploitation and sustainability of these essential resources. It also consider their origins, how to find and extract them, and the environmental consequences of exploitation.

LEVEL 200

EASC 200: Geological Field Methods I

This is a practical field-based course consisting of: (i) Lecture/practical sessions on geological mapping techniques, construction and interpretation of geological maps and cross-sections, field

safety and welfare, and field trip planning and organisation. (ii) 'live-in' field geological mapping providing 'hands-on' instruction in geological mapping techniques and data collection for preparation of geological maps and cross sections.

Details of the course content are as follows:

Semester I: Introduction to geological mapping; geological compass and field navigation; field use of compass to plot data; GPS in geological mapping; field mapping techniques; recording of field data; identification and description of sedimentary rocks in the field; identification and description of sedimentary structures; collection and measurement of paleocurrent data; excursion briefing and organisation. *Hands-on Exercises:* scale calculation & conversion; measurement of a pace; plotting a grid from GPS coordinates; pace and compass closed traverse.

Inter-Semester Break: Field mapping, with supervision, in a sedimentary terrain (e.g., the Sekondian Group in the Sekondi/Takoradi area).

Semester II: Analysis and interpretation of data collected from the field. Preparation of geological maps and sections, and submission of Field Notebook. *Hands-on Exercises:* Analysis of structural and lithological data collected from the field. Preparation and digitization of geological maps and submission of Field Notebook. Preparation of a short report on the sedimentology of the studied formation.

EASC 201: Practical Crystallography

This is a practical course involving the essentials of geometrical crystallography and internal order of crystals. The detail syllabus is as follows: *Essentials of geometrical crystallography:* Crystal description, symmetry elements, crystal symmetry, crystallographic axes. Parameters, indices, crystallographic notation, principal laws geometric crystallography. Faces, forms, zones, crystal habit, measurement of crystal angles. Law of rational indices, classification of crystals, crystal systems, thirty-two crystal classes, spherical projection, stereographic projection, intergrowth of crystals. *Essentials of Internal Order of crystals:* Symmetry elements, space lattice, unit cell, space groups.

EASC 202: Petrography

This practical course covers the study of igneous, sedimentary and metamorphic rocks in hand specimen and thin sections. Concepts are illustrated by rock suites from Ghana and elsewhere.

EASC 203: Geological Structures

Definitions, types, elements, scales and classification of structures. Primary and secondary structures. Fundamental principles of structural geology; petrofabrics; structural analyses; significance of structural geology in geological mapping and mining.

EASC 204: Principles of Geochemistry

This course intends to familiarize students with the tools of geochemistry. These include the tools of thermodynamics, kinetics, aquatic chemistry, trace element geochemistry, and isotope geochemistry. The course is divided into three parts. Part I covers the theory and application of thermodynamics and kinetics to processes controlling the composition of natural waters, and basic mineral-water-atmospheric gas interactions. Part II covers trace elements in igneous processes, including Goldschmidt's classification of the elements and the geochemical periodic table, element partitioning between coexisting minerals, and trace element distribution during partial melting and crystallization. Part III presents an overview of radiogenic and stable isotope geochemistry.

EASC 205: Stratigraphy and Sedimentation

The course is divided up into three parts. The first part deals with the basic aspects of sedimentation and the formation of sedimentary rocks. This will provide the framework to interpret the processes of sedimentation responsible for forming different types of sedimentary rocks. The second part will look at the dominant types of environments where sediments are deposited to furnish the actualistic background to interpret ancient environments. The third part entails synthesizing sedimentologic and stratigraphic data to permit interpretations of Earth history.

Course outline: Sedimentary processes, environments and facies; properties and classification of

sediments and sedimentary rocks; sedimentary textures and structures; stratigraphic nomenclature and the stratigraphic column; principles of stratigraphy. Laboratory work emphasizes the description and analysis of sedimentary rock bodies.

EASC 206: Fundamentals of Geophysics

This course is an introduction to basic principles of geophysics as applicable to exploration and environmental problems, and solid earth. Topics covered include general earth properties (size, mass, and moment of inertia), seismology (wave equation, P, S, and surface waves, seismic reflection and refraction), gravity (gravity anomalies, rheology, flexure, geodesy, and geoid), magnetics (dipole field, paleomagnetism, and seafloor spreading), electrical, geophysical well logging, radioactivity and geochronology, and heat flow.

EASC 207: Optical Mineralogy

This course is designed to prepare students for the study of rocks in thin section (i.e. petrography). Topics to be covered include the elementary principles of crystal optics, familiarization with the microscope, the immersion method, isotropic, uniaxial, and biaxial optics, and the detailed study of rock-forming minerals in thin section. By the end of the course students should be able to readily identify the major rock-forming minerals in thin section. In addition students will learn how to find the necessary information to identify an unknown and perhaps never studied mineral. In order to accomplish the first two objectives, students will learn about the underlying concepts related to mineral behaviour in transmitted/polarized light and the use of the petrographic microscope.

EASC 208: Natural Hazards and Disasters

The course is divided into two parts. Part I involves natural disasters and their environmental impact and covers earthquakes, volcanoes, tsunamis, mass wasting, slope stability, floods, river management and human impact, subsidence, the greenhouse effect and ozone depletion. Part II provides an introduction to natural hazards. The lectures cover the following topics: hazards concept and context; spatial variability and human persistence; hazard forecasting and risk assessment; the perception of hazards and extreme events; experiencing hazards; adjustment to hazards; the human impact; and hazards: present and future prospect; disaster management in Ghana.

EASC 212: Introduction to Palaeontology

Brief introduction study of foraminifera, diatoms, coccoliths etc. Nature of the organism and geologic importance. Important index fossils, Environmental stratigraphy, environmental reconstruction and the earth science. Identification and sketching of some specimens of the phyla of organisms indicated above.

EASC 280: Internship in Earth Science I

Long vacation industrial attachment to a governmental or private sector institution/company. Credit is contingent on submission of a final report by student and an assessment report by industry.

LEVEL 300

EASC 300: Geological Field Methods II

This is a practical field-based course consisting of: (i) Lecture/practical sessions on geological mapping techniques, and construction and interpretation of geological maps and cross-sections. (ii) 'live-in' field geological mapping providing 'hands-on' instruction in geological mapping techniques and data collection for preparation of geological maps and cross sections.

Details of the course content are as follows:

Semester I: GIS: geoid, latitude/longitude, UTM, national map grids. GPS: theory, satellites, GPS time. Cross-sections: selection, orientation, layout, construction; Igneous & metamorphic rocks in the field; Geological structures in the field; Excursion briefing and organisation.

Inter-Semester Break: Field mapping, with supervision, in an igneous/metamorphic terrain (e.g., the Togo Structural Unit in the Tsito – Peki – Ho area)

Semester II: Interpreting field data:- Geological history & compilation of a (schematic) rock relation diagram. *Hands-on Exercises:* Cross-section of field traverse. Analysis of structural data collected from the field. Preparation and digitization of geological maps and submission of Field Notebook and report.

EASC 301: Igneous and Metamorphic Petrology

This course covers the introduction to the origin and evolution of magmatic systems, and metamorphic systems and processes. Concepts are illustrated by rock suites from Ghana and elsewhere.

EASC 302: Geology of Ghana

This course covers the following: Introduction to the geology of the various geological units of Ghana:, i.e., Birimian, Tarkwaian, Voltaian, coastal sedimentary basins (Sekondian, Tano basin, Keta basin), Togo, Buem, and the Dahomeyan. Lithotectonic evolution of the geological units of Ghana; Metallogenesis; Theories on the evolution of the geology of Ghana.

EASC 303: Soil Mechanics

Soil classification; Practical importance of index properties; Principal types of soils; Size and shape of soil particles; Properties of very fine soil fractions; Mechanical analysis of soils: Bulk density; Unit weight; Atterberg limits:-Liquid limit; Plastic limit; Plasticity index; Liquidity index; Shrinkage limit; Sensitivity; Phase relationships. Clay-Silt-Sand-Gravel-Loess- Peat-Fills-Soil Admixtures. Total and effective stresses; Mohr-Coulomb failure criterion; Shear strength tests; Shear strength of sands; Shear strength of saturated clays; Shear strength of partially-saturated soils; Residual strength. Laboratory Work.

EASC 304: Economic Geology

The course covers the study of economic mineral deposits including industrial minerals and fossil fuels. Topics covered include: Ore bearing fluids; Classification of ore deposits; Primary sources of diamond; Hydrothermal precious metal deposits; Sedimentary ore deposits; Industrial minerals. May include field visits to selected ore and industrial mineral deposits in Ghana.

EASCS 305: Fundamentals of Hydrogeology and Hydrology

This course provides an overview of water on the planet and its interaction with geologic materials. The first part of the course describes surface water processes, including precipitation, evaporation, snow hydrology, and runoff processes. The second part of the course follows water as it moves to the subsurface as soil water and ground water. Lecture topics include properties of aquifers, principals of groundwater flow, regional groundwater flow, wells, basin development, and water quality management.

EASC 306: Aerial Photo Interpretation

Introduction, historical, photogeology, types of airphotos, problems of photographing, scale, three-dimensional vision, parallax- photogrametry, uses of aerial photos. Principles of aerial photo interpretation, colour & tone, texture, shapes & pattern, topography and man-made features. Drainage wadis. Photo interpretation of rocks, Quaternary deposits, geological structures, and geomorphological features. Morphometric analysis of drainage basins, drainage networks, order and pattern.

EASC 307: Environmental Geochemistry

The fundamental geochemical principles studied in EAES 204 are applied to the understanding of specific types of contaminants and contaminated environments: heavy metal contamination; landfills; pollutant transport in groundwater, environmental geochemistry of mineral deposits; acid mine drainage processes; geochemistry of radioactive waste disposal; and geochemistry of organic compound contamination.

EASC 308: Structural Geology and Tectonics

Descriptive, kinematic, and dynamic analysis of geologic structures; field identification of geological structures; types of deformation and related structures. Plate tectonics and relationship to the tectonic stresses affecting the earth. Detailed description of thrust systems and associated structures. Strike-slip faults and second order wrench structures. Extensional tectonics and continental rifts. Structural characteristics of continental rifts and the relationship between individual normal faults. Transfer zones between individual normal faults and between half grabens. Structural inversion.

EASC 311: Computer Applications in the Earth Sciences

Introduction to the basics of computer applications in the earth sciences. Introduction and use of various earth science related modeling and analytical programmes.

EASC 312: Introduction to Petroleum Geology

This course provides an overview of the importance of energy in our lives, the very significant role that fossil fuels like petroleum and coal have in supplying this energy, the environmental effects of producing, transporting, refining, using and burning these fuels, how petroleum is found and how wells are drilled to produce it, the conditions in nature required for petroleum formation and trapping, and the role that geologists and geophysicists have in petroleum exploration and production. *Course details:* concepts, terms, and history of petroleum and energy use in Ghana and the world; reservoir rocks and their fluids; drilling and logging of a well; the subsurface environment of sedimentary basins; generation and migration of petroleum; traps and seals.

EASC 313: Environmental Impact Assessment

Evolution of Environmental Impact Assessment (EIA) processes, the concept of sustainable development, national legislation on the environment and the EIA process. Identification and assessment of environmental impacts of development and their implication on overall decision-making process. Tools of impact assessment and mitigation: scoping studies, demographic, climatic, health, and ecological, social, economic impact assessment. Environmental management systems: environmental auditing and reporting. Land disturbance and reclamation, project decommissioning and. Case studies in mining and other geology environmental management.

EASC 314: Organic Geochemistry

This course focuses on organic carbon geochemistry and its use to solve problems of geological and environmental relevance. The subjects treated include organic carbon in space, the global carbon cycle, chemical composition of biogenic matter, sedimentology of organic matter, organic matter diagenesis, molecular fossils, geopolymers, generation and composition of fossil fuels, environmental organic geochemistry, and carbon stable isotope geochemistry.

EASC 315: Applied Geophysics

This course is a study of geophysical techniques applied to solving geoscience problems in resource exploration and development, natural hazards, and pollution control. The course is intended to be a practical, hands-on, field-oriented course on the applications of geophysics to these problems. For each topic, the development will proceed from basic principles (theory) through methodology and applications, to case studies. Applications will be emphasized; theory will be kept to essentials. The basic principles and operational procedures of each method will be presented, along with discussions of where the method is and is not applicable. Case studies will be included to illustrate applications.

EASC 316: Mineral Economics

This course provides an understanding of the broad aspects of the mineral industry, ore reserve classification and estimation, and project evaluation criteria. The course covers the following: uniqueness of the mining sector investment, mine taxation, ore reserve estimation, valuation, mineral projects evaluation and selection criteria, introduction to Ghana's mineral policy, and environmental considerations in mining sector management.

EASC 318: Earthquake Seismology and Disaster Risk Reduction

Lectures covers the following: earthquake seismology, earthquake mechanics, wave propagation, earth structure, instrumentation, interpretation of seismograms, focal mechanisms, faults, paleoseismology, seismotectonics, earthquake locations and magnitudes, etc. Earthquake hazard assessment including use of fault and earthquake history, strong ground motion, attenuation, and related information. Laboratory work will focus on the interpretation and analyses of digital earthquake data using digital and analog seismograms, analyses of local earthquake data on a workstation, plotting and interpretation of earthquake record sections, interpretation of paper record seismograms, and spectral analyses of strong ground motion records and probabilistic risk assessment.

EASC 321: Environmental Pollution

Definition of pollution; major categories and sources of air pollution; anthropogenic impacts. Dangers of some air and water pollutants, dangers of stratospheric ozone depletion and radon in indoor air; Types and effects of water pollution; Detecting pollution; Thermal pollution and thermal shocks; Damages of air pollution on human health, vegetation and building materials, control and monitoring of pollution; Acid rain and deposition; Air pollution control; Measurement of Air and Water pollution; Air and Water pollutant standards index from EPA and WHO. Status of water quality in developed and developing countries; Groundwater problems and ways to protect this resource; Human waste disposal.

EASC 380: Internship in Earth Science II

Long vacation industrial attachment to a governmental or private sector institution/company. Credit is contingent on submission of a final report by student and an assessment report by industry.

LEVEL 400

EASC 400: Project in Earth Science

Students do individual research work in their respective fields under the supervision of faculty members and present a report at the end of the academic year.

EASC 402: Statistical Methods in Earth Science

Techniques of probability and data analysis as applied to problems in the earth and environmental sciences. Topics include probability, data description, hypothesis testing, time series analysis, correlation and regression analyses, and multivariate methods. Laboratory work focuses on the use of statistical software packages for data analysis.

EASC 403: Remote Sensing and Geographic Information Systems

This course is of two parts. Part I introduces the principles and concepts of Remote Sensing (RS): a sophisticated technology of earth observation, which provides fundamental data for global environment investigation. In this part, students are introduced to environmental issues of Earth, principles of RS, satellites and sensors, RS imagery, data acquisition systems, digital image processing for RS imagery, and applications. Part II introduces the principles, concepts and applications of Geographic Information Systems (GIS): a decision support tool for planners and managers of spatial information. Database development, manipulation and spatial analysis techniques for information generation will be taught. Application of GIS in natural resource management, environment, civil engineering, etc, will be discussed through mini project and laboratory exercises.

EASC 410: Project in Geological Field Mapping

Integrated approach to examining geologic relationships in the field; deciphering geologic evolution of map regions through the collection and interpretation of geologic data. Students spend 3-4 weeks in the field to collect geological data for laboratory analysis, preparation of geological maps, cross sections and report writing.

EASC 411: Mineralogy

The course is divided into two parts. Part 1 comprises crystal chemistry, crystal growth, relationship between crystal structure and temperature, pressure, and composition (phase equilibria), x-ray crystallography and chemical analysis of minerals. Part 2 concerns detailed study of selected phase

systems, systematic and determinative mineralogy and analysis of some selected minerals.

EASC 412: Current Topics in Earth Science

Discussion of current research topics in earth and geoenvironmental sciences, in areas not covered in standard courses.

EASC 413: Igneous and Metamorphic Petrology

Advanced concepts in the origin and evolution of magmatic and metamorphic systems. Magma genesis and dynamics. Concept illustrated by rocks from Ghana and elsewhere.

EASC 414: Sedimentary Petrology

The purpose of this course is to give students a broad understanding of how sedimentary rocks form and how they evolve as they undergo burial. The course covers the following: origin, mineralogy and diagenesis of clastic and carbonate sedimentary rocks; quantitative analysis of sedimentary rocks; chemical and biochemical sedimentary rocks; interpretation of siliciclastic and carbonate sedimentary rocks.

EASC 415: Geochemistry and Cosmochemistry

This course discusses the Earth from geochemical perspective using the fundamental geochemical tools studied in *EAES 206*. It covers the following: Chosmochemistry: nucleosynthesis, meteorites, formation of the solar system and the planets; The Mantle and Core: composition of the earth's mantle and core, the "primitive mantle", magma ocean and mantle differentiation, mantle geochemical reservoirs; The crust: oceanic crust; crust-mantle interaction, continental crust, growth of the continental crust; Reactions at the earth's surface: weathering, soils, and stream chemistry; The oceans as a chemical system.

EASC 416: Geology of Africa

The course covers the following topics: Precambrian of Africa, Proterozoic cratonic basins and mobile belts, Palaeozoic Sedimentary Basins in Africa, Mesozoic – Cenozoic basins in Africa, the Atlas Belt.

EASC 418: Geochronology

The primary objective of this course is to provide a practical overview of principles and techniques used in geochronology. The theory, methodology and interpretation of the following dating techniques will be discussed: U-Th-Pb, Rb-Sr, Sm-Nd, Pb-Pb, K-Ar, Ar-Ar, and Fission track dating. Cosmogenic and fossil isotopes. The dating of Ghanaian rocks will also be discussed.

EASC 421: Hydrology

The course covers the following: the hydrological cycle, hydrometeorology and climate, hydrometric networks and catchment morphometry, precipitation measurements and analysis, evaporation measurements and analysis, soil moisture, river flow measurements and analysis, rainfall-runoff analysis, hydrographs. Hydrological instruments are introduced; students employ the instruments to make field measurements and perform a range of data analysis and exercises.

EASC 422: Rural Water Supply

The course is designed to incorporate various areas in water resources management including water as a resource, water resources of Ghana, Ghana's water policy, water supply options in Ghana; management, planning and implementation of rural water schemes. Basic principles and concepts in rural water supply, community interactions, developing a project strategy; Community Water supply policy of Ghana will also be taught. Topics such as finding, design, constructing and assessing groundwater, water quality aspects of rural water supply; rural water infrastructure, capacity building, community water supply options and innovations will also be taught. Case histories will be an integral part of the programme.

EASC 423: Hydrogeology

Groundwater and the hydrologic cycle, Groundwater resource evaluation, Well drilling methods, Well screens and methods of sediment size analysis, Water well design, Installation and removal of screens, Water well development, Well and pump maintenance and rehabilitation.

EASC 424: Water Quality and Hydrochemistry

Water quality standards. Hydrochemical behaviour of contaminants. Measurement of parameters. Hydrochemical sequences. Graphical methods and hydrochemical facies. Sources of contaminants. Contaminant transport. Hydrochemical behaviour of contaminants. Case study: Groundwater chemistry in crystalline terrain.

EASC 425: Independent Research

Individual study under supervision of a faculty member in areas not covered in standard courses. Each student presents an end of semester report on the research and presents an oral seminar on the research.

EASC 427: Integrated Water Resources Management

The course develops knowledge in climate dynamics, hydrology and surface water resources which actually link hydro-meteorological and hydrological processes together with the relationship between rainfall and hydrological measurements, the importance of groundwater resources in water resources management. Integrated water resources management designed to provide basic understanding of the principles, paradigms and methodologies in IWRM shall be treated along with water management and the environment and water quality management and the impacts of human activities on the ecosystem. Case studies involving the major river catchments shall be carried out.

EASC 428: Exploration Geophysics

Theory: Instrumentation, Survey procedures, data processing and interpretation. Methods: Seismic, Electrical (Resistivity, S.P. & I.P.), Electro-Magnetics, Gravity, Magnetics.

EASC 430: Field Exercises in Earth Science

The course includes several one-day long and one one-week field trips to landfill and mine sites. It introduces practical skills appropriate to the study of earth and environmental science. The course concentrates on interactions and feedbacks in the environment, including geology, landforms, soil types and water quality. These field studies are supported by laboratory sessions in which students analyze their observations and the data they have gathered from the field.

EASC 431: Exploration Methods, Planning and Management

The course covers: exploration programme design, reconnaissance exploration, detailed or follow-up exploration, sampling and assaying techniques, drilling techniques, project evaluation.

EASC 432: Exploration Geochemistry

The course covers the following: Geochemistry of the supergene environment; Supergene mineralization; Regolith geochemistry; Geochemical exploration: basic principles, drainage, soil and vegetation surveys Statistical treatment of geochemical data; Analytical methods.

EASC 433: Mineral Projects Feasibility Studies

The role of the feasibility study in the mine development decision process, organisation of the preliminary feasibility study, presentation of project material, mining methods, geological data, mineral processing, surface facilities/ infrastructure/environmental requirements, capital and operating cost, revenue estimation, mineral taxation and financial evaluation, sensitivity and risk analysis.

EASC 434: Mining and the Environment

Acid Mine Drainage; mineral resources in relation to renewable resources; environmental and health impacts of mineral extraction and processing; land degradation in relation to mining especially surface mining operations. Visits to mine sites to observe environmental issues associated with mining.

EASC 435: Geostatistical Ore Reserve Estimation

Review of statistical measures, outliers, and the desirable properties of an estimator. Basic concepts: regionalised variables, stationarity and intrinsic hypothesis. Variograms and structural analysis: calculation and interpretation experimental variograms and fitting theoretical models. Use of volume variance relationships. Estimation variance: sampling programs, optimal drill hole positions. Theory and practice of kriging: estimation at grid node and over block, total, and average grade. Recoverable reserves.

EASC 440: Communication and Entrepreneurship in the Earth Sciences

The course is divided into two parts. The purpose of Part I is to help students to communicate ideas better and to learn the skills of communicating geology. Topics include discussion and review of different kinds of geological publications such as theses, articles, survey articles, books, abstracts, etc. Writing exercises (dealing with content as well as language) will include the students' own CV's, abstracts, extended abstracts, and papers. Also included are oral presentation delivery, proposal development, content organization and audience perspective. The course consists of lectures, student presentations and constructive critiques that take place intensively over the 13-week course period. Part II teaches students the basic and foundational skills needed to start their own business in the geosciences. Using the fundamentals of economics, marketing, accounting and business organizations, students will develop a comprehensive business plan that includes sales, financial, and legal considerations for starting and operating a small business.

EASC 441: Basin Analysis

Introduction - scope, purpose and developments. Sedimentary basins. Regional and global stratigraphic cycles. Depositional systems and facies analysis. Data acquisition - measuring and recording surface and subsurface data. Data manipulation. Burial history. Selected case histories of sedimentary basins. Recognition of ancient sedimentary environments using a combination of wireline log responses, sedimentary structures and mineralogy. The construction of subsurface contour and facies maps, and isopach maps using borehole data.

EASC 442: Petroleum Reservoir Geophysics

The applications of geophysics in 2D and 3D mapping of geological structures. Reflection seismic acquisition. Seismic processing fundamentals and digital filtering. Interpretation of 2D and 3D seismic reflection data, including horizontal and vertical slices, presentation parameters, horizon autotracking, fault mapping, stratigraphic and structural interpretation, and reservoir evaluation. Reservoir aspects of seismic interpretation. Seismic stratigraphy.

EASC 443: Basin Tectonics

Basins in their plate-tectonic setting. Lithosphere behaviour and the mechanisms of basin formation. Key features of extensional, compressional and strike-slip basins. Testing tectonic models by stratigraphic analysis. Facies architecture of basins including: (i) tectonics and sedimentation (ii) sequence stratigraphy. The interaction between sea-level change, tectonics, climate and sediment supply in the final development of a basin-fill.

EASC 444: Reservoir Engineering

Basic petrophysical properties of reservoir rocks including porosity, permeability, fluid saturation, electrical conductivity, capillary pressure, and relative permeability; classification of oil and natural gas reservoirs; introduction to reserve estimation principles. Laboratory measurement of the reservoir rock characteristics mentioned above. Derivation of the general material balance equation. Application of the general material balance equation for determining initial oil in place and gas cap size and water influx constant under different drive mechanisms. Application of the general material balance equation for determining the initial gas in place for conventional gas reservoir.

EASC 445: Micropalaeontology/Palynology

Foraminifera; Ostracods; Conodonts; Diatoms; Palynology: Definition of palynology. Some application of palynology. Pollen & Spore; Dinoflagellates; Acritarchs; Practicals: Method of preparation of microfossil.

EASC 451: Rock Mechanics

Index properties of rocks; engineering characteristics of sedimentary, igneous and metamorphic rocks. Shear strength of planar discontinuities; Shearing on an inclined plane; Surface roughness; Shear testing on discontinuities in rock; Estimating joint compressive strength and friction angle; Shear strength of filled discontinuities and closely jointed rock masses; Testing closely jointed rock masses; Residual Strength; Schmidt Hammer Test. Rock Mass Classification and their importance in engineering works; Rock Quality Designation (RQD); Influence of clay seams and fault gouge; CSIR classification of jointed rock masses; NGI Tunneling Quality Index. Types of earth-moving Equipment; Borrow materials; Cuts in rocks and soils; cuts; Shallow Foundations; Foundations of alternate hard and soft strata; Free-draining materials; Roads and Highways; Earth dams; Canal works. Laboratory work.

EASC 452: Site Investigations

Site mapping; Test pit excavations and Logs; Borehole layout; Drilling methods and equipment: Wash borings; Rotary and percussion drilling in Soils; Auger Borings; Disturbed and Undisturbed sampling; In-situ tests: Shear vane tests; Standard Penetration Tests (SPT); Dynamic Cone Penetration Tests (DCPT); Static Cone Penetration Tests (STPT); Plate Loading Tests; Exploratory drifts and tunnels; Logs of Core Borings; Water sampling; Installation of piezometers. Application of geophysical surveys in site investigations. Interpretation of geophysical survey results and implications on engineering geological problems. Site investigation reports. Case studies; Field work.

EASC 453: Bearing Capacity and Slope Stability Analysis

Theory of bearing capacity cohesive and cohesionless soils and clays; Bearing capacity estimation from in situ tests; Estimation of bearing pressures by empirical methods, Foundation Types; Protection of foundations against attack by soils and groundwater. Slope failure types in soils, General methods of analysis in cohesive and cohesionless soils, End-of-construction and long-term stability. Plane failures; Wedge failure; Circular failure; Toppling failure; Application of Hemispherical Projections to Determine Failure Modes; Influence of a slope curvature upon stability; Surface protection of slopes; Control of rock falls; Monitoring and interpretation of slope displacements. Field visits.

EASC 455: Geology of Civil Engineering Projects

Urban geology, engineering geology of dams and tunnels, building cracking evaluation, ground treatment: stabilization, dewatering, grouting and rock bolting. Role of engineering geologist during construction of roads, houses, dams, tunnels, etc. In depth study using case studies of major civil engineering projects such as tunnels, motorways, dams, etc. Field visits.

EASC 456: Rock as a Construction Material

Explorations for quarries and aggregates for concrete, roads and highways, runways and railways; Explosives and blasting; Physical properties and Chemical reaction on aggregates in Concrete mixes; Sulphides and Organic Substances in Concrete; Pozzolan Materials; Sampling; Laboratory Work; Field visits.

DEPARTMENT OF MATHEMATICS

FACULTY

Margaret L. McIntyre , <i>BSc PhD (LaTrobe)</i> -	Senior Lecturer/Head of Dept
D.A. Akyeampong <i>BSc (Ghana) DIC PhD (Lond)</i> -	Professor
D. Adu-Gyamfi , <i>BSc (Ghana) PhD (Lond)</i> -	Senior Lecturer
J. De-Graft Mensah , <i>BSc (UCC) MSc (Trondheim)</i> -	Lecturer
Peter Acquaaah <i>BA, MPhil (Ghana)</i> -	Lecturer
Prince K. Osei <i>BSc, MPhil (Ghana)</i> -	Lecturer
Thomas Katsekor <i>BSc, MPhil (Ghana)</i> -	Lecturer
N.K. Kofinti , <i>BSc DIC PhD (Lond)</i> -	Associate Professor/Part-Time
J.S.G. Jackson , <i>BSc (London) MA (Cambridge)</i> -	Senior Lecturer/Part-Time

LEVEL 100 COURSES

Core		
MATH 111	Algebra & Trigonometry	3
MATH 112	Calculus I	3
MATH 113	Vectors & Geometry	3
MATH 114	Algebra	3
FASC 101	General Mathematics I	3
MATH 106	General Mathematics II	3

LEVEL 200, 300 & 400 COURSES

BSc. Single Subject Major

Core (70 Credits)		
MATH 211	Introduction to Algebraic Structures	3
MATH 212	Vector Mechanics	4
MATH 213	Calculus II	4
MATH 214	Calculus III	3
STAT 201	Introductory Probability I	3
STAT 202	Introductory Probability II	3
STAT 203	Elementary Statistical Methods	3
COMP 201	Introduction to Computer Science	3
COMP 202	Principles of Programming	3
COMP 210	Applications Laboratory	2
COMP 303	High Level Programming (for Science students)	3
MATH 331	Linear algebra	3
MATH 332	Abstract Algebra I	3
MATH 333	Analysis I	3
MATH 334	Analysis II	3
MATH 335	Ordinary Differential Equations	3
MATH 338	Topology I	3
MATH 400	Mathematics Project /Long Essay	6
MATH 421	Advanced Calculus	3
MATH 422	Integration Theory and Measure	3
MATH 425	Abstract Algebra II	3
MATH 427	Complex Analysis	3
Electives Group A (Select a Minimum of 9 credits)		
MATH 216	Discrete Mathematics	3
MATH 336	Multivariate Calculus and Partial Differential Equations	3
MATH 337	Classical Mechanics	3
MATH 339	Numerical Methods	3
MATH 341	Electromagnetic Theory I	3

MATH 342	Electromagnetic Theory II	3
MATH 344	Analytical Mechanics	3
MATH 346	Fluid Dynamics	3
MATH 348	Thermodynamics	3
MATH 352	Introduction to Field Theory	3
STAT 301	Probability Distributions	3
STAT 303	Multivariate Distributions	3

Electives Group B (Select a Minimum of 9 Credits)

MATH 423	Methods of Mathematical Physics	3
MATH 424	Calculus On Manifolds	3
MATH 426	Module Theory	3
MATH 428	Boundary Value Problems	3
MATH 429	Topology II	3
MATH 431	Differential Geometry	3
MATH 432	An Introduction to Functional Analysis	3
MATH 433	Introduction to Quantum Mechanics	3
MATH 434	Special Relativity	3
MATH 435	Statistical Mechanics	3
COMP 406	Design and Analysis of Algorithms	3

Electives Group C

Students may, with the approval of the Head of Department, choose not more than 9 credits from other relevant departments.

BSc COMBINED MAJOR

Core (35 Credits for Science, 34 Credits for Humanities)

MATH 211	Algebraic Structures	3
MATH 212	Vector Mechanics (Science)	4
MATH 213	Calculus II	4
MATH 214	Calculus III	3
MATH 216	Discrete Mathematics (Humanities)	3
MATH 331	Linear Algebra	3
MATH 332	Abstract Algebra I	3
MATH 333	Analysis I	3
MATH 334	Analysis II	3
MATH 335	Ordinary Differential Equations	3
MATH 421	Advanced Calculus	3
MATH 427	Complex Analysis	3

Electives Group A (Select a minimum of 6 Credits)

MATH 212	Vector Mechanics (Humanities)	4
MATH 216	Discrete Mathematics (Science)	3
MATH 336	Partial Differential Equations	3
MATH 337	Classical Mechanics	3
MATH 338	Topology I	3
MATH 339	Numerical Methods	3
MATH 344	Analytical Mechanics	3
MATH 352	Introduction To Field Theory	3
STAT 301	Probability Distributions (Non-Statistics majors)	3
STAT 303	Multivariate Distributions (Non-Statistics majors)	3

NB : STAT 301 and STAT 302 not available for students combining with Statistics

Electives Group B (Select a Minimum of 6 credits)		
MATH 422	Integration Theory and Measure	3
MATH 423	Methods of Mathematical Physics	3
MATH 424	Calculus On Manifolds	3
MATH 425	Abstract Algebra II	3
MATH 426	Module Theory	3
MATH 428	Boundary Value Problems	3
MATH 429	Topology II	3
MATH 431	Differential Geometry	3
MATH 432	An Introduction to Functional Analysis	3
MATH 433	Introduction to Quantum Mechanics	3

REQUIREMENTS FOR GRADUATION

- (a) Candidates must have satisfied all University and Faculty requirements.
- (b) Candidates must have taken:
 - (i) The Level 200 courses prescribed by the Mathematical, Physical, Earth Science or Bio-Mathematical programmes.
 - (ii) For Single Subject Mathematics:
all Core Courses and Prescribed Electives of the “Single Subject Major” Mathematics programme.
 - (iii) For a “Combined Major” mathematics:
all Core Courses and Prescribed Electives of the “Combined Major” programme.

COURSE DESCRIPTIONS

MATH 111 Algebra And Trigonometry

Indices, Logarithms and Surds. Concept of a function. Function of a real variable: domain and range; injective, surjective functions. Quadratic functions and equations, polynomial functions and equations. Rational functions and partial fractions. Inequalities in one and two variables. Arrangements and Selections. Sequences and series, use of recurrence relations; the binomial theorem, principle of induction. Polar coordinates and curves. Exponential and logarithmic functions. Circular measure, the sine, cosine and tangent functions and their reciprocals, trigonometric identities and equations, inverse circular functions.

MATH 112 Calculus I

Elementary treatment of limit of a function, continuity, differentiation, rules of differentiation. Applications of differentiation. Derivatives of rational functions, exponential and logarithmic functions, circular functions and their inverses. Approximate methods of solving equations: graphical methods and Newton-Raphson method. Integration. Applications of integration; area under a curve, volumes of solids of revolution. Numerical Integration: trapezium and Simpson’s rules. Formation of ordinary differential equations, solutions of simple first order differential equations. Partial differentiation.

MATH 113 Vectors And Geometry

Vectors: notion of a vector and algebra of vectors; the scalar product and the vector product, applications to geometry. Position vector of a point in a plane and in space. Direction and normal vectors of a line; equation of a line, equation of a circle, intersection of a line and a circle. Loci, parametric representation of a curve. The conic sections in a rectangular Cartesian form. The general equation of the second degree, general conic; line pairs, translation and rotation of axes, principal axes. Vector equations of lines and planes.

MATH 114 Algebra II

Algebra of complex numbers, Argand diagram, modulus - argument form of a complex number. De Moivre’s rule. Roots of unity; complex conjugate roots of a polynomial equation with real coefficients.

Geometrical applications, loci in the complex plane. Elementary transformation from z-plane to the w-plane. Algebra of matrices and determinants (up to 3×3 matrices); applications to linear equations. Linear transformations and matrix representation of a linear transformation.

FASC 101 General Mathematics I

Indices and Logarithms. Functions and their graphs, polynomial functions, circular functions, equations and inequalities in one variable. Arrangement and selections. Binomial expansion. Limit of a function, the derivative of a function and its applications. Integration as the inverse of differentiation. Integral of simple functions. The definite integral as an area. Applications to kinematics. Elementary numerical methods, the Newton – Raphson method.

MATH 116 General Mathematics II

Complex numbers, polar coordinates. Conic sections. Vectors and matrices. Further differentiation and integration, parametric differentiation, exponential and logarithmic functions and their derivatives, integration of rational functions. Ordinary differential equations, first order and second order differential equations (with constant coefficients). Introduction to partial differentiation.

MATH 211 Introduction To Algebraic Structures

Logic and proof. Set Theory. Cartesian products, binary relation, equivalence relation. The number system; from N to Z to Q to R , from R to C . Countability. Principle of finite induction. Axiomatically defined systems; groups, rings, integral domains and fields. Isomorphism of algebraic structures. Vector spaces, homomorphism of vector spaces.

MATH 212 Vector Mechanics

Vector functions of a scalar variable; differentiation and integration, Serret- Frenet formulae, differential equations of a vector function. Motion of a particle; kinematics, displacement, velocity and acceleration. Relative motion. Newton's laws of motion; concept of force, work, energy and power. Impulse and momentum, conservation laws of energy and linear momentum. Rectilinear motion, resisted motion, harmonic and damped harmonic motion. Motion in a plane. The two-body problem, motion of a variable mass.

MATH 213 Calculus II

Function of a single variable. The first and second derivatives and their applications. Integration as a sum; definite and indefinite integrals; improper integrals. The logarithmic and exponential functions, the hyperbolic functions and their inverses. Techniques of integration including integration by parts, recurrence relations among integrals, applications of integral calculus to plane curves: arc length, area of surface of revolution. Pappus theorems, approximate evaluation of definite integrals. Ordinary differential equations: first order and second order linear equations (with constant coefficients).

MATH 214 Calculus III

Higher derivatives and applications. Leibniz's theorem and applications. Taylor's theorem. Maclaurin's and Taylor's expansions of some standard functions. Vectors, algebra of vectors and applications, vector functions. Functions of several variables, partial derivatives, Euler's theorem on homogeneous functions; gradients, directional derivatives, maxima and minima, constrained extrema, the method of Lagrange's multipliers. The gradient operator; curves, and surfaces, tangent planes and normal lines. The divergence and curl operators. Introduction to multiple integration.

MATH 216 Discrete Mathematics

Number Systems, elementary algorithms, recursion and iteration. Induction and recurrence relations. Generating functions, computational complexity. Analysis of algorithms. Combinatorics. Boolean algebras, logic and logic circuits. Graph theory and its applications.

MATH 331 Linear Algebra

Linear combinations, generating vector spaces from subsets of a given vector space. Spanning sets. Subspaces, linear systems and solution spaces. Bases. Linear maps and their matrices. Composite linear

maps and matrices. Inverse linear maps. Range space, rank, kernel. Effect of change of basis on the matrix. Eigenvalues and eigenvectors. Diagonalisation of a linear operator. Diagonalizing matrices. Diagonalization theorem. Finding a basis of eigenvectors. An application: classification of plane linear maps. Symmetric maps, matrices and quadratic forms.

MATH 332 Abstract Algebra I

Introduction to number theory. Groups, subgroups. Cyclic groups and the division algorithm for \mathbb{Z} . Rings and their groups of units. Permutations and groups of symmetries. The Stabilizer-Orbit theorem. Lagrange's theorem. Classifying groups. Structural properties of a group. Cayley's theorem. Generating sets. New groups from old: direct products. Finite abelian groups. Homomorphism and isomorphism of groups, Isomorphism Theorems. Partitions and equivalence relations. Cosets and the proof of Lagrange's theorem.

MATH 333 Analysis I

Norm on a vector space. Open and closed balls in a normed vector space. Maps between normed vector spaces. From normed vector spaces to metric spaces. Continuity of maps between normed vector spaces (or metric spaces). Inequality form of the definition. The algebra of continuous functions. Bounded sets of real numbers; upper (lower) bound, least upper (greatest lower) bound, maximum (minimum). Limit of a sequence; uniqueness of limit, finite alterations, shifting sequences, linearity of limit and continuity via sequences. Subsequences. \liminf , \limsup . Theorems for real-valued sequences; products and quotients, preserving inequalities and the squeeze (sandwich) principle.

MATH 334 Analysis II

Series as the sequence of n 'th partial sums. Existence of limits; increasing (decreasing) sequences bounded above (below). Series with positive terms. Convergence tests. Absolute convergence. Cauchy sequence and completeness. Definition of integral and continuity as criterion for integrability. Sequences of functions. Pointwise and uniform convergence. Power series. The contraction mapping theorem and application. Real analysis. Proof of the fundamental theorem of calculus and of the major basic results involved in its proof: mean-value theorem, Rolle's theorem, maximum value theorem, intermediate value theorem.

MATH 335 Ordinary Differential Equations

Differential forms in \mathbb{R}^2 and \mathbb{R}^3 , exactness condition, and the condition for integrability. Linear first order and higher orders. Existence, independence and uniqueness of solutions, the Wronskian. Ordinary differential equations with variable coefficients. Methods of solution of ; reduction of order, variation of parameters, solution in power series, ordinary and regular singular points. Frobenius theorem. A brief discussion of Legendre and Bessel equations. Laplace Transforms, the use of Laplace transforms in solving initial-value problems. Applications.

MATH 336 Multivariate Calculus And Partial Differential Equations

The divergence and curl operators. Line integral, surface integral and volume integral. Green's theorem, Divergence theorem and Stokes' theorem: applications. Fourier series and Fourier Transforms. Orthogonal sets of functions. Partial differential equations: first order and second order with constant coefficients. Classification of second order partial differential equations; elliptic, parabolic and hyperbolic types. Initial and Boundary Value Problems. Method of separation of variables. Applications to Heat conduction, vibrating strings. One-dimensional wave equation. Laplace Equation.

MATH 337 Classical Mechanics

Motion under a central force. Non-inertial frames. Dynamics of a system of particles. Rigid body motion; rotation about a fixed axis. General plane motion, rigid bodies in contact, impulses.

MATH 338 Topology I

Topological spaces. T_0 - and T_1 - spaces. Euclidean topology on \mathbb{R} . Basis for a topological space. Second-countable spaces. Equivalent topologies. Subbasis. Product topology for the product of two topological spaces. Limit points, closure, density, separability. Connectedness. T_2 -spaces. Subspace topology. Homeomorphism. Continuity for maps between arbitrary topological spaces. Path-connected. Weierstrass intermediate value theorem and corollaries. Metric spaces. Metrizable. Continuity via convergent sequences. Cauchy sequence and completeness. Compactness Heine-Borel theorem in \mathbb{R} and its converse.

MATH 339 Numerical Methods

Error analysis. Rootfinding, 2 point methods, 1 point methods. Linear systems of equations, matrix algebra, pivoting. Analysis of associated algorithms. Iterative methods. Interpolation, polynomial approximation, divided differences. Initial-value problems, single methods, multistep method. Numerical Integration.

MATH 341 Electromagnetic Theory I

Scalar and vector fields, the grad, div and curl operators, orthogonal curvilinear coordinates. Electrostatics: Charge, Coulomb's law, the electric field and electrostatic potential, Gauss's law, Laplace's and Poisson's equations. Method of images, conductors in the electrostatic field. Dielectrics, the uniqueness and reciprocal theorem, energy of the electrostatic field. Potential theory. The steady flow of electricity.

MATH 342 Electromagnetic Theory II

Magnetostatics: Magnetic field of steady current, Biot-Savart law, Ampere's law, magnetic vector potential; magnetic properties of matter, dipoles, induced magnetism, permanent magnetism. Time-varying fields: Electromagnetic induction, Maxwell's equations, electromagnetic waves, Snell's law, Brewster's angle, wave guides.

MATH 344 Analytical Mechanics

General motion of a rigid body, Lagrangian mechanics; Euler-Lagrange equation, small oscillations. Hamiltonian mechanics; principle of least action, Hamilton's equation, Poisson brackets, Liouville's equation. Canonical transformations. Symmetry and conservation Laws.

MATH 346 Fluid Dynamics

Theory of perfect fluids; equation of continuity. Euler's equation of motion, Bernoulli's equation; irrotational motion, vorticity and circulation. Kelvin's circulation theorem; complex potential for two-dimensional incompressible irrotational motion; three-dimensional irrotational flow, the circle theorem and Blasius's theorem.

MATH 348 Thermodynamics

Origin of thermodynamics, thermodynamic variables. The Zeroth law, concept of temperature; the first law, internal energy, heat, enthalpy; applications. Statements of the 2nd law, entropy. Thermodynamic potentials; applications. The 3rd law.

MATH 352 Introduction To Field Theory

Straightedge and compass constructions, 3 famous impossibilities. Algebraic preliminaries: fields, rings and vector spaces. Polynomials, the division algorithm and the rational root test. Algebraic numbers and their polynomials. Monic polynomials of least degree, Extending fields. Towers of fields. Irreducible polynomials. Constructible numbers and fields. Proofs of the impossibilities. Transcendence of π and e . Residue rings and fields. Residue field isomorphism and proof. Extension: Other impossibilities, construction of regular polygons, solution of quintic equations, integration in closed form.

MATH 421 Advanced Calculus

Linear and affine maps between arbitrary normed vector spaces (or metric spaces). Limits and continuity. Spaces of linear maps. Tangency of maps and derivative as a linear map. Component-wise differentiation, partial derivatives and connection with Jacobian matrices in this setting. Convex sets in metric spaces. Generalisation of the mean value theorem. The inverse map theorem and the implicit function theorem.

MATH 422 Integration Theory And Measure

Generalisation of the Riemann integral (eg. Kurzweil-Henstock integral). Lebesgue integration. The class of KH integrable functions contains the class of Lebesgue integrable functions which contains the class of Riemann integrable functions. Convergence theorems in the classes of KH-/L- integrable functions. Measurability. Measure.

MATH 423 Methods Of Mathematical Physics

Calculus of variation. Special functions, gamma and beta functions, Legendre polynomials, Bessel functions, Hypergeometric functions. Generalised functions, the Dirac delta function. Sturm – Liouville equation, eigenvalues and eigenfunctions, Green’s functions. Integral equations.

MATH 424 Calculus On Manifolds

The notion of manifold, submanifold, differentiability of maps between manifolds, the tangent space, the tangent bundle and the tangent functor. Generalisation of the notion of tangent bundle to tangent vector. Exterior algebra, differentiable form on a manifold. Singular n-chains and integration of a form over a chain. Application to Stoke’s theorem.

MATH 425 Abstract Algebra II

Finite groups, Sylow theorems and simple groups. Composition series and the Jordan-Holder theorem. Direct and semi-direct products. Abelian groups, torsion, torsion-free and mixed abelian groups; finitely generated abelian group and its subgroups. p-groups, nilpotent groups, and solvable groups. Introduction to module theory

MATH 426 Module Theory

Modules, sub-modules, finitely generated modules and quotient modules, free modules. Homomorphism of modules and quotient modules. Reducible modules, Artinian and Noetherian modules. Exact sequence, projective modules, injective modules, Horn and duality of modules, cyclic modules. Tensor product, categories and functors, extension of modules.

MATH 427 Complex Analysis

Elementary functions of a complex variable z . Continuity and differentiability of $f(z)$. Definition of analyticity in a region. Cauchy-Riemann equations, harmonic functions. Path integrals: Cauchy’s theorem and integral formula, Taylor’s theorem, Liouville’s theorem and the fundamental theorem of Algebra. Maximum-modulus theorem, Laurent expansion, poles and essential singularities, residue theorem and applications. Conformal mapping, analytical continuation.

MATH 428 Boundary Value Problems

Elements of Hilbert space, distribution and Sobolev spaces; forms, operators and Green’s formula, abstract boundary value problems, coercivity; elliptic forms, Dirichlet- Neumann and mixed Dirichlet-Neumann problems; boundary value problems of the third and fourth types.

MATH 429 Topology II

Product spaces, finite, countable, arbitrary. Tychonoff’s theorem. Generalised Heine-Borel theorem. Cantor spaces. Countability and separation axioms in metrization theorems.

MATH 431 Differential Geometry

Review of vector functions of a single variable, arc length, curvature and torsion of a curve, Serret-Frenet formulae. Geometry of surfaces, curvature of a surface, the first and second fundamental forms;

the Christofel symbols; geodesics; parallel vector fields. Weingarten equations, curvatures; fundamental theorems of surfaces, surfaces of constant curvature. Introduction to manifolds; tangent vectors and tangent space, vector fields and Lie brackets, submanifolds, linear connections on manifolds; parallel vector fields and geodesics on a manifold with a linear connection, Riemannian manifold, distance and curvature.

MATH 432 An Introduction to Functional Analysis

Finite dimensional normed vector spaces and the family of continuous linear maps from a vector space into itself. Equivalent norms. Banach spaces. A comparison with infinite-dimensional normed vector spaces: Hamel and Schauder bases; separability Compact linear operators on a Banach space. Complementary subspaces and the open-mapping theorem. Closed Graph theorem. Hilbert spaces. Special subspaces of l_∞ and l_1 and the dual space. The completion of a normed vector space. Reflexive Banach spaces. Extension: Topology from a family of seminorms and locally convex spaces.

MATH 433 Introduction to Quantum Mechanics

Inadequacy of classical mechanics, postulates of quantum mechanics, the wave formalism. Dynamical variables and the operator concept, the Schrodinger equation in one-dimension; free particles in a box, single step and square well potentials. Orbital angular momentum. The 3-dimensional Schrodinger equation; motion in a central force field, the 3- dimensional square well potential, the hydrogenic atom. Matrix formulation of Quantum Mechanics. Heisenberg’s equation of motion, harmonic oscillator and angular momentum.

MATH 434 Special Relativity

Galilean relativity, postulates of special relativity; Lorentz transformations; Lorentz-Fitzgerald contraction, time dilation; 4 – vectors, relativistic mechanics; kinematics and force, conservation laws: decay of particles; collision problems, covariant formulation of electrodynamics.

MATH 435 Statistical Mechanics

Classical Statistical Mechanics: concept of phase space, the ensembles and applications to diatomic gases, the equipartition principle, heat capacities. Quantum statistics, the Maxwell- Boltzmann, Fermi-Dirac, and Bose- Einstein distributions; concept of density of states, magnetic and dielectric properties of materials.

DEPARTMENT OF NUTRITION AND FOOD SCIENCE

FACULTY

K. Tano-Debrah , BSc, MPhil (Ghana), PhD (Hiroshima)	-	Senior Lecturer/Head
S. Sefa-Dedeh , BSc (Ghana) MSc, PhD (Guelph)	-	Professor
Anna Lartey , BSc (Ottawa) MSc (Guelph) PhD (Davis)	-	Associate Professor
Esther O. Sakyi-Dawson , BSc, MPhil; (Ghana) PhD (Cornell)	-	Senior Lecturer
W.B. Owusu , BSc, MPhil (Ghana) MSc (Queen’s) ScD (Harvard)	-	Senior Lecturer
Agnes S. Budu , BSc, MPhil (Ghana), PhD (Cranfield)	-	Senior Lecturer
Matilda Steiner-Asiedu , BSc (Ghana), MPhil , PhD (Bergen), MPH (Brown)	-	Senior Lecturer
E.O. Afoakwa , BSc, MPhil (Ghana), Ph.D (Strathclyde)	-	Senior Lecturer
F.K. Saalia , BSc, MPhil (Ghana), PhD (Georgia)	-	Lecturer .
F. Vuvor , BSc, MPhil (Ghana)	-	Lecturer
Esi K. Colecraft , BSc (Cornell), MPhil (Penn State), DrPH (Alabama)	-	Lecturer
Goria Ethel Otoo , BSc (Ghana), PhD (Connecticut)	-	Lecturer
George Amponsah Annor , BSc, MPhil (Ghana)	-	Lecturer
E. Asibey-Berko , BSc (Ghana), PhD (Iowa State)	-	Professor *

G.S. Ayernor , BSc (Ghana), PhD (Reading)		Professor*
Betty Bediako-Amoa , BSc. (Ghana), PhD (Leeds)	-	Senior Lecturer*
W.A. Plahar , BSc, MPhil (Ghana), PhD (Wash. State)	-	Part-time
W.K. Amoa Awua , BSc, PhD (Ghana), MAppS (Australia)	-	Part-time
P. N-T Johnson , BSc (KNUST) PhD (Reading)	-	Part-time
EEK Takyi , BSc, MPhil (Ghana), MSc, PhD (Birmingham)	-	Part-time
Kwabena Frempong , BSc, MPhil (Ghana), EMBA (GIMPA)	-	Part-time
Isabella Mansah Agra BSc (KNUST), MPhil (Ghana)	-	Part-time

* Retired, on contract

B.Sc. NUTRITION

This programme is available only in Levels 300 and 400. Students who intend to graduate in BSc. (Nutrition Option) must have taken all the core courses from the Biological Sciences group at Level 200 to accumulate a total of 17 credits.

SINGLE SUBJECT MAJOR, NUTRITION

LEVEL 200 COURSES

NUTR 201	Introductory Nutrition I
NUTR 202	Introductory Nutrition II

LEVEL 300 & 400 COURSES

CODE	<i>Core Courses – Single Major (Nutrition)</i> COURSE TITLE	CREDIT
NUTR 301:	Nutrients and their Metabolism I Pre-req: BIOL 201-204, CHEM 201, 202, 211, 212, 221, 222	2
NUTR 302:	Nutrients and their Metabolism II Pre-req: NUTR 301	2
NUTR 303:	Nutritional Physiology Pre-req: BIOL 201 –204, CHEM 201, 202, 211, 212, 221, 222	2
NUTR 304:	Animal Experimentation Pre-req: NUTR 302	2
NUTR 305:	Nutritional Physiology Practicals Pre-req: NUTR 303	2
NUTR 306:	Food Analysis I Pre-req: BIOL 201 –204, CHEM 201, 202, 211, 212, 221, 222	2
BCHM 301:	Structure and Functions of Biomolecules	2
BCHM 302:	Intermediary Metabolism I	3
BCHM 305:	Analytical Techniques	2
BCHM 309:	Separation Methods	2
FDSC 309:	Biometry Pre-req: STAT 212	2
NUTR 400	Nutrition Project	6
NUTR 401:	Applied Nutrition	1
NUTR 402:	Food and Nutrition Policy	1
NUTR 403	Assessment of Nutritional Status Pre-req: NUTR 303	3
NUTR 404:	Nutrition of Vulnerable Groups Pre-req: NUTR 403, 407	1

NUTR 405:	Assessment of Nutritional Status of a Community I Pre-req: NUTR 403	3
NUTR 406:	Diet and Disease Pre-req: NUTR 302	1
NUTR 407:	Nutrient Needs Pre-req: NUTR 302	2
NUTR 408:	Human Energy Metabolism Pre-req: NUTR 302	1
NUTR 409:	Methods in Nutrition Research	1
NUTR 412:	Assessment of the Nutritional Status of a Community II, Pre-req: NUTR 302	2
NUTR 413:	Nutrient Needs Practicals NUTR 407	1
FDSC 412:	Food Additives and Toxicology	1

PRESCRIBED ELECTIVES SINGLE MAJOR, NUTRITION

LEVEL 300

Students are to take at least 4 credits per semester

<u>CODE</u>	COURSE TITLE	CREDIT
NUTR 310	Nutrition Internship	1
NUTR 312	History of Nutrition	1
NUTR 313	Nutrition, Sustainable Livelihood and Extension Foods and Social	2
NUTR 308	factors in Nutrition	1
FDSC 301:	General Microbiology	2
FDSC 303:	General Microbiology Practicals	2
AGEC 201:	Principles of Economics	3
FDSC 306	Plan Products Processing Technology	2
FDSC 308	Animal Products Processing Technology	2
FDSC 312:	Food Commodity Technology Practicals FDSC 306, 308	2
BCHM 307:	Practical I	3
BCHM 308	Practical II	3

ELECTIVES LEVEL 400- Single Major

Students are to take at least 4 credits per semester

<u>CODE</u>	COURSE TITLE	CREDIT
NUTR 411:	Human Growth and Body Composition NUTR 403	1
NUTR 414:	Nutrient Interrelationships NUTR 302	1
NUTR 416:	Quality Control for Laboratory and Field Data Collection	1
SOCI 201:	Basic Concepts in Sociology	3
FDSC 402:	Food Chemistry CHEM 231	2
FDSC 406:	Food Analysis II NUTR 306, CHEM 211, 231, BCHM 305	3

FDSC 413:	Food Laws and Regulations	1
FDSC 418:	Food Microbiology	2
FDSC 422:	Food Microbiology Practicals FDSC 418	2

REQUIREMENTS FOR GRADUATION

1. To graduate with a BSc. **Degree in Nutrition (Single major)** a student must pass the following:

Core: NUTR 301-306, 308, 401-409, 412, 413

FDSC 309, 412

BCHM 301, 302, 303, 305

Electives: Obtain at least 16 credits from the Prescribed Electives and satisfy all Faculty and University Requirements.

BSc. FOOD SCIENCE

This programme is available only in Levels 300 and 400. Students who intend to graduate in BSc (Food Science Option) must have taken all the core courses from the Biological Sciences group at Level 200 and accumulate 17 credits.

LEVEL 200 COURSES

FDSC 201	Introductory Food Science	2 Credits
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COURSES: LEVELS 300 & 400

CORE COURSES FOR SINGLE SUBJECT MAJOR: FOOD SCIENCE

CODE	COURSE TITLE	CREDIT
FDSC 301:	General Microbiology (Pre-req: BIOL 201-204)	2
FDSC 302:	Thermal processing of foods (Pre-req: PHYS 200, 203, 204; BIOL 201-204; CHEM 201, 202, 211, 212, 231, 232)	2
FDSC 303:	General Microbiology Practical (Pre-req: FDSC 301)	1
FDSC 304:	Thermal Processing Practicals (Pre-req: FDSC 302)	1
FDSC 305:	Physical principles in Food Processing (Pre-req: PHYS 200, 203, 204, BIOL 201-204; CHEM 201, 202, 211, 212, 231, 232)	3
FDSC 306:	Plant Products Processing Technology (Pre-req: BIOL 201-204, CHEM 201, 202, 211, 212, 231, 232)	2
FDSC 307	Principles of Food Preservation	1
FDSC 308:	Animal Products Processing Technology (Pre-req BIOL 201-204)	2
FDSC 309:	Biometry (Pre-req STAT 212)}	1
FDSC 312:	Food Commodity Processing Practicals (Pre-req FDSC 306, 308)	2
NUTR 301:	Nutrients and their Metabolism I (Pre-req BIOL 201-204, CHEM 201, 202, 211, 212, 222,	2
NUTR 302:	Nutrients and their Metabolism II (Pre-req NUTR 301)	2

NUTR 306:	Food Analysis I (Pre-req BIOL 201-204, CHEM 201, 202, 211, 212,222)	2
BCHM 301:	Structure and Functions of Biomolecules	2
BCHM 302:	Intermediary Metabolism I	3
FDSC 400:	Project	6
FDSC 402:	Food Chemistry (Pre-req CHEM 231)	2
FDSC 404:	Food Chemistry Practicals (Pre-req: CHEM 231, FDSC 402)	1
FDSC 405:	Sensory Analysis of Foods (Pre-req: FDSC 309 or Equivalent)	1
FDSC 407:	Quality Control in Food Processing (Pre-req: FDSC 309 or Equivalent)	2
FDSC 408:	Post-harvest Management	2
FDSC 413:	Food Laws and Regulations	1
FDSC 416:	Industrial Microbiology (Pre-req: FDSC 301)	2
FDSC 417	Food Packaging	1
FDSC 418:	Food Microbiology (Pre-req: FDSC 301, FDSC 303)	2
FDSC 419	Food Analysis II (Pre-req: NUTR 306, CHEM 211, 231, BCHM 305)	3
FDSC 421	Food Processing Plant Operations and Sanitation (Pre-req: FDSC 305)	2
FDSC 422:	Food Microbiology Practicals (Pre-req: FDSC 418)	1

Prescribed elective: LEVEL 300 (SINGLE MAJOR)
(students are to take *at least 4 credits* per semester)

CODE	COURSE TITLE	CREDIT
FDSC 310:	Food Science Internship	1
NUTR 303:	Nutritional Physiology (Pre-req: BIOL 201-204, CHEM 201, 202, 211, 212, 222)	2
NUTR 304	Animal Experimentation (pre-req: NUTR 302)	2
BCHM 303:	Separation Methods	2
BCHM 304	Enzymology	2
BCHM 305:	Analytical Techniques	2
OCFS 326	Aquaculture	2
FAPH 303	Introduction to Post-harvest and Crop losses	3
FDEN	Fundamentals of Food Process Engineering	2
ADMN 314:	Introduction to Human Resource Management	3
ADMN 324	Introduction to Production Management	3

Prescribed elective: LEVEL 400 (SINGLE MAJOR)
(students are to take *at least 4 credits* per semester)

CODE	COURSE TITLE	CREDIT
FDSC 411	Beverage and Sugar technology FDSC 306, FDSC 312	2
FDSC 412:	Food Additives and Toxicology	1
FDSC 415:	Food Irradiation	1
NUTR 402:	Food and Nutrition Policy and Planning	1
NUTR 407	Nutrient Needs (Pre-req: NUTR 302)	2
CHEM 492	Industrial and Environmental Chemistry	2
CHEM 495	Pulp and Paper Chemistry and technology	2
OCFS 427	Fish and Fisheries	2
ANIM 408	Meat Science and Meat Hygiene	3
FAPH 408	Micro-enterprise Development and Management	3

REQUIREMENTS FOR GRADUATION

2. To graduate with a BSc. **Degree in Food Science (Single major)** a student must pass the following:

Core: FDSC 301-306, 307, 308, 309, 312, 400-408, 413, 416, 417, 418, 419, 421, 422
NUTR 301, 302, 306,
BCHM 301, 302

Electives: Obtain at least 16 credits from the Prescribed Electives and satisfy **all** Faculty and University Requirement.

**BSc. NUTRITION combined with FOOD SCIENCE /
BSc. FOOD SCIENCE combined with NUTRITION**

This programme is available only in Levels 300 and 400. Students who intend to graduate in BSc (Nutrition/Food Science option) must have taken all the core courses from the Biological Sciences group at Level 200 and accumulate 17 credits.

LEVEL 300 & 400 COURSES
Core Courses – Combined Major (Nutrition-Food Science)

CODE	COURSE TITLE	CREDITS
NUTR 301	Nutrients and their Metabolism I	2
NUTR 302	Nutrients and their Metabolism II	2
NUTR 303	Nutritional Physiology	2
NUTR 305	Nutritional Physiology Practicals	2
NUTR 306	Food Analysis I	2
FDSC 301	General Microbiology	2

FDSC 302	Thermal processing of foods	2
FDSC 303	General Microbiology Practical	1
FDSC 304	Thermal processing of foods (Practical)	1
FDSC 305	Physical principles in Food Processing	3
FDSC 306	Plant Products Processing Technology	2
FDSC 308	Animal Products Processing Technology	2
FDSC 309	Biometry	1
BCHM301	Structure and Functions of Biomolecules	2
BCHM302	Intermediary Metabolism I	3
NUTR 403	Assessment of Nutritional Status	3
NUTR 405	Assessment of Nutritional Status of a Community I	3
NUTR 407	Nutrient Needs	2
NUTR 412	Assessment of the Nutritional Status of a Community II	2
NUTR 413	Nutrient Needs Practicals	1
FDSC 402	Food Chemistry	2
FDSC 404	Food Chemistry Practicals	1
FDSC 405	Sensory Analysis of Foods	1
FDSC 407	Quality Control in Food Processing	2
FDSC 418	Food Microbiology	2
FDSC 419	Food Analysis II	3
FDSC 422	Food Microbiology Practicals	1

**PRESCRIBED ELECTIVES COMBINED MAJOR
NUTRITION-FOOD SCIENCE**

LEVEL 300

Students are to take at least 4 credits per semester
(Preferable 2 each of nutrition and Food Science Courses)

CODE	COURSE TITLE	CREDITS
NUTR 304	Animal experimentation	2
NUTR 308	Foods and Social Factors in Nutrition	1
NUTR 310	Nutrition Internship	1
NUTR 312	History of Nutrition	1
NUTR 313	Nutrition, Sustainable livelihoods and Extension	2
FDSC 307	Principles of Food Preservation	1
FDSC 310	Food Science Internship	1
FDSC 312	Food Commodity Technology Practicals	2
BCHM 305	Analytical Techniques	2
BCHM 304	Enzymology	2
BCHM 307	Practical I	3
BCHM 308	Practical II	3
ADMN 324	Introduction to Production Management	3

**PRESCRIBED ELECTIVES COMBINED MAJOR
NUTRITION-FOOD SCIENCE**

LEVEL 400

**Students are to take at least 4 credits per semester
(Preferable a 2 each of nutrition and Food Science Courses)**

CODE	COURSE TITLE	CREDITS
NUTR 400	Nutrition Project	6
NUTR 402	Food and Nutrition Policy	1
NUTR 404	Nutrition of Vulnerable Groups	1
NUTR 409	Methods in Nutrition Research	1
NUTR 411	Human Growth and Body Composition	1
NUTR 414	Nutrient Interrelationships	1
NUTR 416	Quality Control for Laboratory and Field Data Collection	1
SOCI 201	Basic Concepts in Sociology	3
FDSC 400	Food Science Project	6
FDSC 401	Food Microbiology	2
FDSC 403	Food Microbiology Practicals	2
FDSC 413	Food Laws and Regulations	1
FDSC 411	Beverage and Sugar technology	2
FDSC 412	Food Additives and Toxicology	1
FDSC 415	Food Irradiation	1
FDSC 421	Food Processing Plant Operations and Sanitation	2
CHEM 492	Industrial and Environmental Chemistry	2

1. To graduate with a BSc. **Degree in Nutrition -Food Science (Double major)** a student must pass the following:

Core: NUTR 301-303, 305, 306, 400, 403,407,412, 413
FDSC 301-303, 305, 306, 308, 309, 312, 400, 402, 404, 405,
407, 418, 419, 422
BCHM 301, 302

Electives: Obtain at least 16 credits from the Prescribed Electives and satisfy **all** Faculty and University Requirements.

NUTRITION COURSE DESCRIPTIONS

NUTR 201 Introductory Nutrition I

Major nutrients in foods and their food values: Carbohydrate, Proteins, Lipids, Vitamins and minerals; Breast feeding

NUTR 202 Introductory Nutrition II

Food sources of nutrients, Food habits; Nutrition and disease; Population growth, Food production and nutritional status.

NUTR 301 Nutrients and their Metabolism I

(Prerequisites: BIOL 201-204; CHEM 201, 202, 211, 212, 221,222)

Classification, metabolism and physiological functions, effects of deficiencies and trends in the consumption of carbohydrate, protein, and fat. Food as a source of energy, energy expenditure, measurement and factors influencing energy expenditure. Carbohydrate, protein and fat inter-relationships in meeting energy requirements.

NUTR 302 Nutrients and their Metabolism II
(Prerequisites: NUTR 301)

Functions and distribution of minerals in the human body. Dietary sources, deficiency symptoms, human requirements for minerals. Role of trace elements in human nutrition and requirements. Landmarks in the discovery of vitamins, functions, metabolism, recommended intakes, dietary sources, effects of deficiencies of fat soluble and water soluble vitamins

NUTR 303 Nutritional Physiology
(Prerequisites: BIOL 201-204; CHEM 201, 202, 211, 212, 221,222)

The study of body systems associated with the delivery of food to the body. The structure of the digestive system in relation to its functions in digestion and absorption. Blood physiology: blood and other fluid compartments of the body in relation to the transfer of nutrients and metabolites. Excretion.

NUTR 304 Animal Experimentation in Nutrition (Prerequisites: NUTR 302)

Problems with human experimentation; advantages of animal experimentation; concerned societies and standards for animal experimentation; species of experimental animals; the experimental rat and disease; physical facilities for rat experimentation in Nutrition; rat models for human nutrition studies; effect of feeding different levels of protein; nitrogen balance; digestibility; effect of diet on body functions.

NUTR 305 Nutritional Physiology laboratory (Co-requisites: NUTR 303)

Laboratory experiments to illustrate the principles and techniques used in nutritional physiology. This course is to accompany lectures in Nutritional Physiology.

NUTR 306 Food Analysis I (Prerequisites: NUTR 302)

Sampling and sample preparation, glassware for laboratory analysis. Precision and accuracy, data reporting, report write-up. Principles behind food analysis methods. Comparative moisture analysis, ash, crude fat, crude protein and crude fiber analysis. Calorific value of foods. Determination of phosphorus, iron and calcium in foods.

NUTR 308 Foods and Social factors in Nutrition

Foods and food groups, nutrient contribution of foods, effects of processing and preparation methods on nutrient contents, utilization of foods in diets. Food habits and their influence on nutrition; ethnic diets. Population growth and resources.

NUTR 310 Nutrition internship

Practical experience for nutrition students to work with Governmental and Non-governmental organizations involved in Nutrition related activities. Report will be submitted for evaluation.

NUTR 312 The History of Nutrition

Pre-scientific ideas about foods; investigation of carbohydrates, fats and albuminous substances; food utilization, experiments with gelatin; pioneers in nutrition; animal nutrition; respiration and calorimetry; chemical analysis of foods; The discovery of vitamins; inorganic elements; fatty acids.

NUTR 313 Nutrition, Sustainable Livelihoods and Extension

The broad topic areas that will be covered in the course are: nutrition and livelihoods, malnutrition, food insecurity and livelihoods, role of extension in nutrition, qualitative assessment tools for understanding nutrition and food insecurity Issues within the sustainable livelihoods framework, and improving nutrition through behavior change.

NUTR 400 Project

A supervised individual investigation in Nutrition

NUTR 401 Applied Nutrition

Applied Nutrition programs, their implementation and evaluation; Effects of socio-economic factors

on nutrition. Urbanization and nutrition. Nutrition education and methods of delivery of nutrition information to the public. Role of national and International organizations in combating hunger and malnutrition.

NUTR 402 Food and Nutrition Policy

Types of Food and Nutrition policies (FNP); Food importation and prices, income and quality of life, economic factors; necessary information for formulating FNP, efforts towards developing FNP for Ghana. FNP of other countries; food security; right to food.

NUTR 403 Assessment of Nutritional status (Prerequisites: NUTR 303, 305, 301-302)

Indices used in assessing nutritional status of individual and groups in health and disease: dietary intakes, anthropometric measurements, biochemical assessment clinical and functional appraisal of nutritional status, vital statistics. Nutritional surveillance and growth monitoring.

NUTR 404 Nutrition of Vulnerable groups (Prerequisites: NUTR 403, NUTR 407)

Study of the nutritional requirements in pregnancy, lactation, infancy, childhood, adolescence and in the aged. Relationship between maternal diet and pregnancy outcome. Breast feeding, weaning, nutrition of premature infants Complementary feeding, Alternative feeding in special conditions.

NUTR 405 Assessment of Nutritional status of a community I (Field work)

Techniques used in assessing nutritional status using dietary, biochemical, clinical and anthropometric measurements. Field survey of a selected community using various assessment methods; application and dissemination of nutrition knowledge in the community.

NUTR 406 Diet and Disease (Prerequisite: NUTR 302)

A study of nutrition in the treatment and prevention of disease: Diabetes mellitus, protein-energy malnutrition, obesity, peptic ulcers, gout, hypertension, renal, cardiovascular diseases, cancer; Nutrition and dental health.

NUTR 407 Nutrient Needs (Prerequisite: NUTR 302)

Principles and methods of determination of nutrient needs; Proteins, amino acids, macro-minerals, trace elements, vitamins, fatty acids and fats.

NUTR 408 Human Energy metabolism (Prerequisite: NUTR 302)

Estimation of human energy requirements; concepts of energy balance, factors influencing energy balance in obesity. Adaptation to low energy intakes in man. Energy, work capacity and performance.

NUTR 409 Methods in Nutrition Research

Survey of physical, biochemical and physiological methods used in nutritional investigation, e.g. fluorometry, amino acid analysis, automated haematology

NUTR 411 Human Growth and Body Composition (Prerequisite: NUTR 403)

Effects of nutrition on growth and development, regulatory growth mechanisms, measurement of growth, reference standards in growth measurement. Influence of nutrition on body composition.

NUTR 412 Assessment of Nutritional status of a community II

Analysis of data collected from field survey. Dietary, biochemical, clinical, socio-economic and anthropometric analysis using various computer software and laboratory techniques. Preparation of report.

NUTR 413 Nutrient Analysis practical (Prerequisite: NUTR 403, 405)

Laboratory on the techniques of determining nutrient needs and diagnosing nutrient deficiencies. Balance studies.

NUTR 414 Nutrient inter-relationships (Prerequisite: NUTR 302)

Inter-relationships among the macro and micro-nutrients; anti-vitamins and anti-metabolites. Concept

of nutritional adaptation.

NUTR 416 Quality Control for laboratory and Field data collection

General principles, setting up a quality control chart for the laboratory, Using the chart to identify questionable data; monitoring field data quality. Use of EPI-INFO computer software in data entry and analysis.

FOOD SCIENCE COURSE DESCRIPTIONS

- FDSC 201 Fundamentals of Food Science and Technology**
Characteristics, functioning and regulation of food industries (small, medium, large), Food constituents (desirable and undesirable), - their properties and function. Factors influencing food choices (food habits) and quality attributes of food, food deterioration and control, food and health issues, food science and technology.
- FDSC 301 General Microbiology (Prerequisites: BIOL 201-204)**
Historical foundations of Microbiology, Scope and relevance of microbiology. Major groups of microorganisms: Prokaryotes and Eukaryotes - Bacteria, Fungi, Viruses, Algae, Protozoa - Morphology, structure, taxonomy and reproduction; Importance of microorganisms; Methods used to study microorganism - Cultivation of microorganisms, Microscopy, Enumeration, Screening, isolation, characterization and identification, Preservation of cultures. Microbial nutrition, metabolism, and genetics. Microbial growth and its control.
- FDSC 302 Thermal Processing of Foods**
(Prerequisites: PHYS 200, 203, 204, BIOL 201-204, CHEM 201, 202, 211, 231, 232)
Applications of heat transfer processes in canning, pasteurization and aseptic processing. Process calculations to ensure microbiological safety and nutrition. Thermal processing equipment – design operation safety factors. Thermal processes and food preservations.
- FDSC 303 General Microbiology Practicals (Prerequisite: FDSC 301)**
.Laboratory methods for culturing and examining micro-organisms
- FDSC 304 Thermal Processing Practicals (Prerequisite: FDSC 302)**
Laboratory exercises in canning, pasteurization and aseptic process. Evaluation of quality of thermal processed foods including seam analysis. Applications to selected commodities
- FDSC 305 Physical Principles in Food Processing**
(Prerequisites: PHYS 200, 203, 204, BIOL 201-204, CHEM 201, 202, 211, 212, 231, 232)
The laws of conservation of mass and energy – application in food processing. Fluid flow theory and applications. Unit operations in food processing such as dehydration, chilling and freezing, extrusion, size reduction, evaporation, mechanical separations and mixing. Traditional and modern applications of unit operations.
- FDSC 306 Plant Products Processing Technology**
(Prerequisites: BIOL 201-204; CHEM 201, 202, 211, 212, 231, 232)
Physical, chemical, nutritional and other characteristics of cereals, legumes, roots and tubers, fruits, vegetables, spices and oil seeds. Plant material characteristics in relation to their functionality. Processing and preservation technologies of plant food commodities.

- FDSC 307 Principles of Food Preservation**
Problems of Food Spoilage. Agents and factors of Food Spoilage. Principles of Food preservation with particular reference to chemical preservation. Scientific and technological aspects of food preservation. Food quality and acceptance.
- FDSC 308 Animal Products Processing Technology (Prerequisites: BIOL 201-204)**
The characteristics of conversion of muscle to meat; Unconventional sources of animal foods – wildlife. Characteristics of fish and milk products. Industrial and traditional technologies for processing and preservation of fish and meat. Processing techniques or dairy products. Technology for processing of eggs. Public Health issues.
- FDSC 309 Biometry (Prerequisites: STAT 212)**
Statistical Applications for Nutrition and Food Science data analysis. Students t-test, Chi-square (χ^2), Analysis of variance, regression and correction. Non-parametric statistics. Introduction to the use of computer statistical packages.
- FDSC 310 Food Science Internship (10 week practical (Long vacation))**
Work experience in Food Industry in the practical application on Food Science. Seminar on report to be submitted.
- FDSC 312 Food Commodity Processing Practicals (Prerequisites: FDSC 306, 308)**
Practical course on processing food commodities.- cereals, legumes, roots and tubers, fruits and vegetables, oil seeds, fish , meat , dairy. Industrial visits and or processing demonstrations.
- FDSC 400 Project**
A supervised individual investigation in Food Science.
- FDSC 402 Food Chemistry (Prerequisites: CHEM 201, 202, 211, 212, 231, 232)**
Water in food systems. Chemistry of food proteins, lipids and carbohydrates and their significance on food processing and storage. The nature, occurrence and inhibition of enzymatic and non-enzymatic browning in foods. Flavour and colour chemistry.
- FDSC 404 Food Chemistry Practical (Prerequisite: FDSC 402)**
Laboratory experience in Food Chemistry. Protein, carbohydrate, lipids properties, colour and flavour measurement; analysis of browning systems.
- FDSC 405 Sensory Analysis of Foods (Prerequisites: FDSC 309 or equivalent)**
Food Quality assessment using sensory responses. Aroma, taste and texture of foods. Organisation of sensory evaluation laboratory – methods, data analysis.
- FDSC 407 Quality control in food processing (Prerequisites FDSC 309 or equivalent)**
Principles of quality control, quality assurance and Total quality management., Organisation of food industry quality assurance programmes, quality characteristics of foods and their measurement including development of specifications and standards of quality, sampling for quality control,. Statistical quality control processes and procedures including recording and reporting of data.
- FDSC 408 Post-harvest Management**
Food systems approach to waste of raw food materials. Post-harvest problems of perishables and durables. Food loss vectors and their control. Food storage structure – design and management. Introduction to loss assessment. Field visits and evaluations
- FDSC 411 Beverage and Sugar Technology**
Structure, chemical and physical composition of cocoa, coffee and tea. Methods of processing. Sugar crops and sugar processing technology.

- FDSC 412 **Food Additives and Toxicology****
 Survey of the types of additives used in the food industry. The control of additives in foods- legislation. The assessment of food additives for safety. The science of toxicology – toxins occurring naturally in foods.
- FDSC 413 **Food laws and Regulations****
 Standards and legislation; procedures; regulatory agencies; Codex Alimentarius. Legal issues in food science and nutrition
- FDSC 415 **Food Irradiation****
 Radionuclides and radiation, radiation detection and measurement, effects of radiation on living organisms, radiation preservation of foods, limitations of food irradiation, regulations and safety. Commercial aspects of food irradiation.
- FDSC 416 **Industrial Microbiology (prerequisites: FDSC 301 and FDSC 303)****
 Principles of industrial fermentation processes. Industrial microorganisms – their isolation, preservation and improvement. Brewing technology, production of enzymes, vitamins and antibiotics.
- FDSC 417 **Food Packaging****
 Food packaging materials: properties and uses. Aseptic and modified atmosphere packaging. Packaging of major food commodities. Safety issues in packaging.
- FDSC 418 **Food Microbiology (Prerequisites: FDSC 301, 303)****
 Historical development of food microbiology. Microorganisms in foods – sources and types. The ecology of foods- Microbial survival and growth in foods– Factors influencing the growth, death and survival of microorganisms in foods. Microbiology of specific food commodities. Impact of microbial growth in foods- Food spoilage, Food preservation and processing, Food-borne illnesses- Food Infections and Intoxications, Major food-borne diseases. Control of microbial growth in foods- Physical, chemical and biological methods, Quality assurance methods- Microbiological criteria, GMPs, GHPs, HACCPs.
- FDSC 419 **Food Analysis II (Prerequisites: NUTR 306)****
 Food Analysis laboratory practice. Chemical, physical and microscopical techniques for the analysis of food products. chemical analysis of water quality, analysis of selected processed foods.
- FDSC 421 **Food Processing Plant Operations and Sanitation (Prerequisite: FDSC 305)****
 Principles and practices. Organisation and management of plant operations. Plant layout and flow patterns. Plant and warehouse siting and design. Pilot operations and optimization.
 Cleaning operations; use of detergents and sanitizers, water use, waste disposal and pollution control; Public Health Acts and Regulations. Environment issues in food processing. Factory visits.
- FDSC 422 **Food Microbiology Practical (Prerequisite: FDSC 418)****
 Techniques in the analysis of microorganisms involved in food spoilage, food borne disease and food fermentations. Isolation, characterization and identification of food-borne microorganisms, Investigation of factors affecting survival and growth of microorganisms in foods, microbial examination of food commodities, Water quality analysis (MPN test)

DEPARTMENT OF OCEANOGRAPHY & FISHERIES

FACULTY

G. Wiafe , BSc (Ghana) MPhil (Newcastle) PhD (Ghana)	-	Senior Lecturer/Head of Dept.
P. K. Ofori-Danson , BSc Ed Mphil (UCC) PhD (Ghana)	-	Associate Professor
A. K. Armah , BSc MSc (Ghana) MSc (Newcastle)	-	Senior Lecturer
E. Nyarko , BSc (Ghana) MSc MPhil (Newcastle) PhD (Saga)	-	Senior Lecturer
F.K.E. Nunoo , BSc (Ghana) MSc MPhil (Newcastle) PhD (Ghana)	-	Senior Lecturer
A. M. Mensah , BSc (Ghana) MSc. MPhil (Newcastle)	-	Lecturer
S. D. Ababio , BSc MPhil (Ghana)	-	Lecturer
E. Lamptey , BSc MPhil (Ghana)	-	Lecturer
S. Addo , BSc MPhil (Ghana)	-	Research Fellow (VBRP)
D. K. Atsu , BSc MPhil (Ghana)	-	Research Fellow (VBRP)

The Department of Oceanography and Fisheries runs the following Level 200 course as an additional prescribed elective to the existing Biological and Biomathematical options at Level 200:

OCFS 212 Introductory Oceanography and Fisheries (2 credits)

Introduction to aquatic environment – streams, rivers, lakes, estuaries, seas and ocean basins. Aquatic resources – living and non-living. Physical processes in aquatic environment – waves, tides, currents, etc. The ocean as a natural sink. Fisheries in Ghana and its processes – aquaculture, artisanal and industrial.

LEVEL 300 COURSES

Combined Major

Core (20 Credits)

OCFS 311	-	Introductory Oceanography	2
OCFS 312	-	Marine Ecology	2
OCFS 313	-	Seamanship	1
OCFS 317	-	Marine Invertebrates and Vertebrates	2
OCFS 321	-	Ichthyology	2
OCFS 322	-	Fish Physiology	2
OCFS 326	-	Aquaculture	2
OCFS 332	-	Oceanography and Fisheries Practicals	2
OCFS 342	-	Field Course	3
BIOL 317	-	Biometry	2

Electives (Minimum of 16 Credits)

OCFS 314	-	Coastal Hydrology	2
OCFS 315	-	Introductory Coastal Geomorphology	2
OCFS 316	-	Introductory Marine Biogeochemistry	2
OCFS 318	-	Deep Sea Biology	1
OCFS 324	-	Biodiversity & Conservation	2
OCFS 325	-	River Fisheries	2
OCFS 327	-	Floodplain Fisheries	2
OCFS 328	-	Fish Diseases and pathology	2
OCFS 331	-	Introductory Limnology	2
OCFS 344	-	Behaviour of Aquatic Organisms	2

LEVEL 400 COURSES

Core (21 Credits)

OCFS 400	-	Dissertation	6
OCFS 411	-	Plankton Ecology	2
OCFS 413	-	Benthic Ecology	2
OCFS 416	-	Marine Pollution	2
OCFS 421	-	Fisheries Science	3
OCFS 423	-	Fishing Technology	2
OCFS 427	-	Fish & Fisheries of West Africa	2
OCFS 432	-	Oceanography and Fisheries Practicals	2

Electives (Minimum of 15 Credits)

OCFS 412	-	Advanced Marine Ecology (pre-req. OCFS 312)	2
OCFS 414	-	Marine Macroalgae (pre-req. BOTN 313)	2
OCFS 415	-	Coastal Management	2
OCFS 417	-	Coastal Ecosystems of West Africa	2
OCFS 418	-	Current Research in Oceanography and Fisheries	2
OCFS 419	-	Marine Affairs	1
OCFS 422	-	Post-harvest Fish Management (pre-req FDSC 307)	2
OCFS 424	-	Fisheries and Aquatic Wildlife Management	2
OCFS 425	-	Freshwater Ecology	2
OCFS 426	-	Advanced Aquaculture	2
OCFS 429	-	Fish Stock Assessment	2
OCFS 431	-	Remote Sensing Applications in Fisheries & Marine Science(pre-req GEOG 307)	2
OCFS 433	-	Marine Sedimentology	2
OCFS 434	-	Coastal and Ocean Dynamics	2
OCFS 441	-	Fish Genetics (pre-req BIOL 315)	2
OCFS 442	-	Applied Limnology	2

Graduation requirements

Candidates must have satisfied ALL University and Faculty requirements.

Candidates must have taken the Level 200 courses prescribed by the Biological, Physical or Earth Science programmes.

To graduate with BSc degree in Oceanography and Fisheries, the student must take the following:

- a. Core: ALL*
- b. Prescribed Electives: As indicated.*

COURSE DESCRIPTIONS

OCFS 311 Introductory Oceanography

Oceanography as interdisciplinary science – geological and geophysical oceanography, physical oceanography, chemical oceanography, biological oceanography. Origin of ocean basins. Theory of Global Plate Tectonics. Geological Structure of the Ocean basin. Ocean Evolution. Properties of seawater -Water, Air, and Ice, temperature, salinity, density and pressure in the oceans. Light and sound in seawater. The seawater solution. Seawater and the Global Cycle. Circulation patterns. The Atmosphere and the Ocean. Ocean currents. The North Atlantic Gyne. Global Fluxes and the deep circulation. Marine sediments - types of sediments, sediment distribution patterns and transport, control on sediment distribution patterns, stratigraphy. Marine environments – estuaries, inter-tidal area. Flora and Fauna of the oceans. Anthropogenic impacts- coastal degradation and pollution.

OCFS 312 Marine Ecology

The nature and global distribution of marine organisms and habitats.

Ecological concepts (individuals, populations, community, niche, biotope, ecosystems etc.). Ecology and structure of marine communities. Oceanic food webs and energy flows. Ecological relationships (predator-prey, parasitism, symbiosis, etc.). Global distribution of primary production, oceanic food web. Primary production in the ocean. Factors controlling primary production. Primary and Secondary Productivity of the sea. Measurement of productivity. Life history strategies (r- and K-selection, etc).

OCFS 313 Seamanship

Safety – first aid, fire fighting, dress code. Swimming, snorkeling and diving. Ropes and tackles. Technical equipment – handlead and line, anchor, cables and shackles etc. Boat skills (knots, splices, handling and operating outboard motors, etc.). Navigational aids. Elementary ship knowledge.

OCFS 314 Coastal Hydrology

Tidal Theories. Types of tide, Tidal current, Tide effects. Hydrology of estuaries and wetlands. Type of estuaries. Circulation patterns. Flushing time, Tidal land forms. Tidal exchanges – rivers and seas; rivers and aquifers, sub-surface flow into the sea. Hydrological cycles-precipitation, evapotranspiration, runoff, infiltration, subsurface movement of water, discharge of ground water.

OCFS 315 Introductory Coastal Geomorphology

Coastal classifications. Primary and Secondary Coasts; Rocky and Sand Beaches. Bays and embayant. Waves and wave-induced currents. Wave types (progressive, Tsunamis, internal and standing waves). Wave Phenomena: Wave effects. Coastal sediments. Sediments movements by currents. Beach profiling. Coastal sand dunes. Tidal landforms (mudflats and salt marshes). Cliffs and shore platforms. Coastal geomorphology and sea level. Coastal and shore line protection. Break waters.

OCFS 316 Introductory Marine Biogeochemistry

Physical chemistry of seawater. Redox chemistry of seawater – importance of oxygen, organic matter production and destruction, trace metals. Chemistry of marine sediments. Organic biogeochemistry – nitrogen and carbon cycles, origin of petroleum in marine environment. Drugs and other organic products from the sea.

OCFS 317 Marine Invertebrates and Vertebrates

Invertebrate taxonomy and systematics; morphology of major groups; Life cycles and larval forms; Skeletons and locomotion; Feeding ecology; Special topics. Vertebrate taxonomy, morphology and physiology of major groups (excluding fish); Reproduction and migration; Feeding ecology; Distribution and exploitation of marine mammals; Seabirds; Economic importance; Special topics.

OCFS 318 Deep Sea Biology

Zonation and distribution. Environmental characteristics. Physical environment of the deep sea. Organisms of the deep sea and their distribution. Adaptations of deep-sea organisms. Metabolic processes of deep-sea organisms. Transport of food to the deep oceans. Life in hydrothermal vents and cold seeps. Use of submersibles in sampling. The diversity gradient. Zoogeography, speciation and the origin of the deep-sea. Food resources, energetics and feed strategies. Mineral resources.

OCFS 321 Ichthyology

Fish origins and diversity. Classification and identification of fishes. Basic Fish anatomy- Gross external anatomy, skeleton, muscles, gills and gas bladders digestive tract, circulatory system, kidneys, reproductive glands-gonads, endocrine organs, nervous system. Structure and function of fish eye, inner ear and otolithic organs. Reproduction-modes of reproduction (oviparity, ovoviviparity, viviparity); reproductive diversity (hermaphroditic, anadromous, catadromous and amphidromous fishes), gametogenesis and oogenesis, fertilization and early development of fishes and metamorphosis, hatching, care of eggs and young. Sex differences. Growth- general characteristics of

organismic growth; determination of age and growth; Feeding- feeding adaptations, nutrient requirements for fish growth, feeding categories and adaptations. Movement- body form, swimming and movement through the water, muscle structure (red and white muscles) and fibre types. Fish migration-biological aspects of migration, types of fish migrations, methods of studying fish migrations.

OCFS 322 Fish Physiology

Internal environment and composition of body fluids. Sensory systems- visual pigments, mechanoreceptors and the lateral line organ, inner ear and otolith organs' gas bladder and sound detection, electroreception and chemoreception. Vascular transport and gaseous exchange-the heart and the cardiac cycle, respiratory organs, air-breathing fishes, transport of respiratory gases. Endocrine systems- pituitary hormones, non-pituitary endocrine functions. Digestion and absorption. Osmotic and ionic regulation water and salt balance_(chloride cells and the sodium pump), kidney structure and function. Euryhaline teleosts. Fish endocrinology.

OCFS 324 Biodiversity & Conservation

Principles of biodiversity and conservation. Patterns of species diversity. Indicators of Biodiversity. Conservation of aquatic resources – Protected areas, Heritage sites, Ramsar sites etc. Introduction to the Convention on Biological Diversity. Implementation of the Convention on Biological Diversity in Ghana. Resource valuation. Constitutional, institutional and legislative frameworks for biodiversity conservation in Ghana.

OCFS 325 River fisheries

Morphology of river systems- Form of river system, the morphology of the rhithron and potamon- the channels and floodplain. Hydrology of river systems –variability of flow regimes, velocity of flow, origin of flooding, water balance in floodplains. Chemistry- sediment load, nutrient spiralling, carbon and organic material, physico-chemical parameters. Primary production in rivers-river continuum concept, material of allochthonous origin, bacteria and other microorganisms, phytoplankton, higher vegetation (submerged, floating and floodplain meadows). Secondary production-benthos, neuston, vertebrates other than fish. Diversity of riverine fishes. Reservoir fisheries - the fishermen, fishing gear, preservation of fish. Management of river fisheries- regulation of access, increasing the catch capacity of fishermen, closed seasons, reserved waters, mesh regulations, banning of certain gears. Aquaculture in rivers.

OCFS 326 Aquaculture

Principles of aquaculture. Aquaculture systems and techniques – mono-and poly-culture, integrated culture. Pond siting, construction, stocking and maintenance. Pond management - control of aquatic plants, predators and diseases. Pond manuring. Feed formulation and feeding. Fish harvesting. Fish breeding. Water quality management. Mariculture. Aquaculture in cages, fishpens and net enclosures. State of aquaculture in Ghana.

OCFS 327 Floodplain Fisheries

Morphology and types of floodplains; Review of major floodplains in the world. Hydrology, chemistry and production of floodplains; Fish diversity appraisal for floodplain ecosystems; catch and effort and its relation with floods; Adaptations to extreme environmental conditions; Riverine fish migration; hatchling migration; fish gates or fish passes; Impact of other uses of floodplains (eg. Forestry, agriculture, urbanization, damming; terrestrial animals etc). Tools for fisheries analysis and management-holistic and analytical models.

OCFS 328 Fish Diseases and Pathology

Identification and diagnosis of fish diseases. Causative agents-bacteria, virus, parasites etc. Infections and diseases of fish in Africa- viral disease (lymphocystis), bacterial infections, epithelocystis, fungal infections (e.g. *Saprolegnia* and *Branchiomyces* infections), endoparasitic protozoa (blood infections e.g. Trypanosoma and Trypanoplasma), trematode worms, cestode worms, nematode worms, annelid worms (Hirudinea), crustacean copepods. Mortalities caused by environmental factors- dissolved

oxygen, production of toxins by algae, effect of low water temperature. Public health and fish consumption. Principles of therapy (disease control) in fish diseases- administration of baths, oral administration, pharmacology. Prophylaxis- antibiotics, risks and limitation in using chemicals for prophylaxy. Haematology of fishes- haemoglobin determinations, red cell counts. Fish pathology.

OCFS 331 Introductory Limnology

Water as an environment. Morphology of lakes and river basins. Physico-chemical properties of freshwater environments. Nutrient cycling. Eutrophication. Organic matter in aquatic ecosystems. Freshwater biota. Anthropogenic impacts – e.g. dams, sewage, pollution, overexploitation etc.

OCFS 332 Oceanography and Fisheries Practicals I

Relevant practicals on courses taught in first semester including identification and classification of marine invertebrates, vertebrates, plankton and benthos; sampling marine habitats; preservation of organisms; productivity measurement; use of oceanographic and fisheries equipment.

OCFS 342 Field Course

Field visits for practical exposure. Designing, planning and carrying out of an investigation into some aspect of Oceanography and Fisheries. Participation in a group work and responsibility for some aspect of the overall task for the group. This may involve laboratory activity. Submission of a report in the form of a scientific paper.

OCFS 344 Behaviour of Aquatic Organisms

Concepts of animal behaviour. Behavioural ecology (learning, stimuli, feeding, communication, courtship and mating, migration, protection, territoriality, social organization, orientation, rhythms, hormones and pheromones)

OCFS 400 Dissertation

A supervised individual investigation in oceanography or fisheries

OCFS 411 Plankton Ecology

Definition and division of plankton. General characteristics and systematics. Adaptation to pelagic life. Phytoplankton – general characteristics and systematic composition. Photosynthesis. Primary production. Micro-algal bloom. Zooplankton – general characteristics and systematic composition; vertical migration; secondary production, growth patterns, feeding ecology, Quantitative study of plankton - sampling and distribution. Adaptive mechanisms. Economic importance.

OCFS 412 Advanced Marine Ecology

Ecology of rocky and sandy shores. Competition, predation and patch dynamics. Intertidal and subtidal sediment communities. Physical and biological factors affecting community structure. Trophic relationship. Time series data and its analysis. Non-equilibrium models of communities. Chaos in marine systems. Anthropogenic impacts on the ocean. Mesopelagic and bathypelagic life.

OCFS 413 Benthic Ecology

Taxonomy and morphology of major benthic groups. Rocky shore habitat and fauna; feeding relationships. Littoral-sediment habitats and fauna. Sampling the benthos. Adaptive mechanisms in benthic habitats. Feeding ecology. Economic importance - drugs from benthos.

OCFS 414 Marine Macroalgae

Identification and systematics. Structure and reproduction of the major groups (green, brown and red macroalgae). Zonation and factors affecting their distribution. Marine plants and their production (sea grasses and mangroves). Culture. Economic importance. Algal blooms including harmful microalgae.

OCFS 415 Coastal Management

Introduction to the coastal zone and its resources. Principles of coastal zone management. Natural and anthropogenic impacts on the coastal zone. Sea level rise. Case studies on erosion, biodiversity loss,

ecotourism, pollution, fisheries degradation, and environmental impact assessment. Sectoral and integrated management.

OCFS 416 Marine Pollution

Definition of pollution. Sources and nature of marine pollution - oil pollution, radioactive and thermal waste, ocean dumping, domestic, industrial and agricultural waste, marine debris, beach fouling, etc. Eutrophication. Effects on individuals, communities and the marine ecosystem. Detecting pollution. Control and monitoring of pollution.

OCFS 417 Coastal Ecosystems of West Africa

Ecosystems of the coasts of West Africa - Estuaries, lagoons, wetlands, mangroves, shores (muddy, sandy and rocky), beach rocks etc. Distinguishing features of the coasts. Threats to ecosystems.

OCFS 418 Current Research in Fisheries and Oceanography

Acquaintance with current research in Oceanography through seminars, audio-visuals, article review etc. Experts in the subject will be invited to give presentations to students on selected topics. Acquaintance with current research in Fisheries through seminars, audio-visuals, article review etc. Experts in the subject will be invited to give presentations to students on selected topics.

OCFS 419 Marine Affairs International conventions (United Nations Convention on the Law of the Sea, Ramsar Convention, Biodiversity Convention, Marine Pollution Convention, Convention for International Trade in Endangered Species of the Wild -CITES etc.). FAO Code of Conduct for Responsible Fisheries. National policies on marine affairs. Legal and institutional framework-Fisheries Law of Ghana.

OCFS 421 Fisheries Science

Scope of Fisheries Science. Theory of fishing. Fishery resources and fish habitats. Environmental conditions of fish. Fish yield models- Surplus yield models, yield-per-recruit models, Biomass models, stimulation models. Factors limiting fish abundance. Bioenergetics. Contemporary issues – overfishing problem, bycatch and discards, etc. Fisheries management- management objectives and strategies, fisheries regulations. Catch quotas. Aquaria. Fisheries institutional framework and job opportunities.

OCFS 422 Post-harvest Fish Management

Principles of fish processing and preservation. Methods of fish processing and preservation by artisanal and industrial fisheries in the tropics. Types of fish product- chilled fish, dried fish, salting, smoking, fish oil, fish meal, fermented products. Fish handling, storage and effects of bumper harvest. Fish spoilage. Fish utilization. Fish by-products. Local and foreign markets for diversified fish products. Quality control and packaging.

OCFS 423 Fishing Technology

Basic terms, definitions and description of fishing gears. Fishing gear and methods (Traps, hook and lines, stationary nets, towed nets and dredges, surrounding nets, fish aggregation devices, destructive effects of fishing). The design of indigenous fishing gear. Types of fishing crafts and their operation. Maintenance of crafts and gears. Fish capture methods in artisanal and industrial fisheries. Electronic and acoustic fishing methods. Harmful fishing practices. Landing facilities.

OCFS 424 Fisheries and Aquatic Wildlife Management

Technical guidelines for fisheries management. Strategies for fisheries management – fishery and area closure, fish quotas, licensing, etc. Fishery regulation and policies. Exclusive Economic Zone (EEZ). Special conservation areas e.g. Marine protected areas, Ramsar sites, etc. Framework survey of fisherfolks and communities. Traditional management and Community-based management. Problems for the management of tropical multispecies stocks. State of world fisheries.

OCFS 425 Freshwater Ecology

Inland waters. Ecology and structure of lotic and lentic communities. Freshwater energetics. Ecological relationships (predator-prey, parasitism, symbiosis, etc.). Primary and secondary productivity (rivers, lakes, streams, ponds, etc.).

OCFS 426 Advanced Aquaculture

Feed formulation and feeding. Fingerling production. Constraints to production - biological, environmental and economic factors. Case study of culture of selected species. Ocean ranching. Environmental impacts of aquaculture developments. State of world aquaculture.

OCFS 427 Fish & Fisheries of West Africa

Fisheries Resources of West Africa other than fishes (molluscs, bivalves, gastropods, cephalopods, echinoderms, sea urchins, crustaceans). Diversity, occurrence and distribution of fishes. Types of fisheries (artisanal and industrial) in both marine and inland waters. Capture methods in the sub-region. Traditional and cultural practices in fishing communities. Role of women in the fishing industry. Exclusive Economic Zones (EEZ).

OCFS 429 Fish Stock Assessment

Abundance and distribution of fishes – length-frequency, length-weight and length-fecundity relationships. Condition Factor. Potential yield analyses. Fish population dynamics – growth, recruitment, mortality, cohorts, etc. Gear selectivity. Population models – Von Bertalanffy, Bhattacharya, biomass, dynamic pool, surplus, yield-recruit, etc. Stock assessment – effort, catch, Catch per unit of effort (CPUE), Analysis of catch, Maximum Sustainable Yield (MSY), Maximum Economic Yield (MEY). Introduction to Computer applications (e.g. FISAT Software). Fisheries monitoring-collecting length frequency data, collecting catch and effort data, measures of fishing effort, fishing power.

OCFS 431 Remote Sensing Applications in Fisheries & Marine Science

Mapping and inventory of coastal resources. Fish distribution and abundance. Aquaculture management. Pollution and water quality. Ocean conditions – Sea surface temperature, dissolved oxygen, turbidity, salinity, depth, wind, currents, waves etc. Sampling accuracy and limitations.

OCFS 432 Oceanography and Fisheries Practicals II

Relevant practicals on courses taught in the first semester.

OCFS 433 Marine Sedimentology

Origins of sedimentary material. Types and properties of sedimentary particles. General mechanisms of sedimentation. Formation of fossil fuels. Sedimentary environments – deltas, estuaries, littoral, shelf and deep sea.

OCFS 434 Coastal and Ocean Dynamics

Nearshore processes: waves, tides and currents. Sediment movement in the littoral zone. Shelf processes: ocean, local wind driven and tidal currents. Storm surges. Wave action; Upwelling. Deep sea processes: Coriolis effect. El Nino. La Nina. Ekman transport. Rossby and Kelvin waves. Turbidity currents and sediment transport. Equatorial upwelling. Hydrothermal vents. Seamounts and guyots.

OCFS 441 Fish Genetics

Principles of genetics. Inbreeding, hybridization and sex reversal. Biomolecules and triploidy. Gene transfer and chromosome manipulation. Gynogenesis and androgenesis. Mechanism of recombination – recent advances in genetic engineering.

OCFS 442 Applied Limnology

Biota and environmental conditions in inland waters. Biological self-purification. Prediction of water quality. Pollution capacity of inland waters. Reaction of water bodies to disturbances. Restoration of damaged water ecosystems – sewage and water treatments.

DEPARTMENT OF PHYSICS

G.K. Nkrumah-Buandoh

BSc. MPhil, Ph.D (Ghana) ICTP Dip. (Trieste)

R.D. Baeta, *MSc. (Gh.) MSc. Ph.D(Brist)C.Phys.F.Inst.P*

J.K.A. Amuzu, *MSc (Ghana) Ph.D (Camb)*

G.K. Tetteh, *BSc. (Lond) MSc PhD (Sask)*

E.K. Agyei, *BSc. (Lond) MSc PhD (McMaster)*

K.G. Adanu, *MSc. (Ghana) MSc (Brist) PhD (KNUST)*

R.Kwadjo, *MSc (Ghana) PhD (Camb)*

V.C.K. Kakane, *BSc (KNUST) MSc PhD (Ghana)*

A. Kuditcher, *BSc (KNUST), MSc PhD (Ann Arbor)*

M. Baidoe-Adeleye *MCE, BSc, MSc (Ilorin)*

A.F. Hughes *BSc. MSc. (Ghana) (Study Leave)*

A. Amankwah, *Dip. Ed. BSc (Cape Coast) MSc (Bremen)*

V.K. Kattah *BSc (KNUST)) MPhil (Ghana)*

A.A. Yankson *BSc. Dip. Ed (Cape Coast) MPhil (Ghana)*

M.N.Y.H. Egblewogbe *BSc MPhil (Ghana)*

G.B. Hagan, *BSc. MPhil (Ghana)*

J. Gbadago

- Senior Lecturer/Head of Dept.
- Professor
- Professor
- Professor
- Associate Professor
- Associate Professor
- Senior Lecturer
- Senior Lecturer
- Lecturer
- Lecturer
- Lecturer
- Lecturer
- Lecturer
- Lecturer
- Lecturer
- Lecturer
- Lecturer
- Lecturer(Part-Time)

Physical, Mathematical & Biomathematical Sciences

LEVEL 100

PHYS 101 - Practical Physics I

1 credit

PHYS 113 - Mechanics and Thermal Physics

3 credits

PHYS 102 - Practical Physics II

1 credit

PHYS 114 - Electricity, Magnetism and Quantum phenomena

3 credits

A. BSc Single Subject Major

LEVELS 200 - 400

Core (68 credits)

STAT 203 – Elementary Statistical Methods

3 credits

MATH 211 – Introduction to Algebraic Structures

3 credits

MATH 213 – Calculus II

3 credits

PHYS 201 – Practical Physics III

1 credit

PHYS 211 – Introduction to Physics of Materials

2 credits

PHYS 215 – Electromagnetism I

2 credits

PHYS 202 – Practical Physics IV

1 credit

PHYS 212 – Oscillations and Waves

2 credits

PHYS 216 – Atomic Physics and Nuclear Physics I

2 credits

PHYS 301 – Practical Physics V

1 credit

PHYS 311 – Mechanics and Fields

3 credits

PHYS 313 – Physics of Large Systems I

2 credits

PHYS 315 – Electromagnetism II

3 credits

PHYS 319 – Physics of Solids I

2 credits

PHYS 321 – Mathematical Methods

3 credits

PHYS 302 – Practical Physics VI

1 credit

PHYS 314 – Optics

3 credits

PHYS 322 – Quantum Physics I

3 credits

PHYS 324 – Special Relativity

2 credits

PHYS 326 – Computational Methods in Physics

3 credits

PHYS 400 – Project	6 credits
PHYS 413 – Physics of Large Systems II	2 credits
PHYS 417 – Electronics	4 credits
PHYS 419 – Physics of Solids II	2 credits
PHYS 416 – Nuclear Physics II	2 credits
PHYS 418 – Particle Physics	2 credits
PHYS 422 – Quantum Physics II	3 credits
PHYS 424 – Contemporary Physics	2 credits

ELECTIVES

LEVEL 300 (Select a minimum of 4 credits)

MATH 336 – Multivariate Calculus & Partial Differential Equations	3 credits
PHYS 331 - Physics of the Atmosphere	2 credits
PHYS 335 - Physics of the Ocean	2 credits
PHYS 332 - Principles of Applied Geophysics	2 credits
PHYS 334 - Principles and Applications of Neutron Activation Analysis	2 credits
STAT 306 – Design of Experiments	3 credits

LEVEL 400 (Select a minimum of 4 credits)

PHYS 425 - Energy Systems	2 credits
PHYS 431 - Principles of Radioactive Dating	2 credits
PHYS 433 - Physics for Audiology	2 credits
PHYS 435 - Physics of Telecommunications	2 credits
PHYS 437 - Introduction to Optometry	2 credits
PHYS 432 - Basic Meteorology	2 credits
PHYS 434 – Further Electronics	2 credits
PHYS 436 - Physics at the Nanoscale	2 credits
PHYS 438 - Introduction to Cosmology and Astrophysics	2 credits

B. Combined Major

LEVELS 200 - 400

CORE (47 credits)

MATH 211 – Introduction to Algebraic Structures	3 credits
MATH 213 – Calculus II	3 credits
PHYS 201 – Practical Physics III	1 credit
PHYS 211 – Introduction to Physics of Materials	2 credits
PHYS 215 – Electromagnetism I	2 credits
PHYS 202 – Practical Physics IV	1 credit
PHYS 212 – Oscillations and Waves	2 credits
PHYS 216 – Atomic Physics and Nuclear Physics I	2 credits
PHYS 301 – Practical Physics V	1 credit
PHYS 311 – Mechanics and Fields	3 credits
PHYS 315 – Electromagnetism II	3 credits
PHYS 302 – Practical Physics VI	1 credit
PHYS 314 – Optics	3 credits
PHYS 322 – Quantum Physics I	3 credits
PHYS 400 – Projects	6 credits
PHYS 417 – Electronics	4 credits

PHYS 416 – Nuclear Physics II	2 credits
PHYS 422 – Quantum Physics II	3 credits
PHYS 424 – Contemporary Physics	2 credits

ELECTIVES

LEVEL 300 (Select a minimum of 4 credits)

PHYS 313 – Physics of Large Systems I	2 credits
PHYS 331 - Physics of the Atmosphere	2 credits
PHYS 335 - Physics of the Ocean	2 credits

PHYS 324 – Special Relativity	2 credits
PHYS 332 - Principles of Applied Geophysics	2 credits
PHYS 334 - Principles and Applications of Neutron Activation Analysis	2 credits

LEVEL 400 (Select a minimum of 2 credits)

PHYS 425 - Energy Systems	2 credits
PHYS 431 - Principles of Radioactive Dating	2 credits
PHYS 432 - Basic Meteorology	2 credits
PHYS 434 - Further Electronics	2 credits

C. Biological Sciences

LEVEL 100

PHYS 101 - Practical Physics 1	1 Credit
PHYS 102 - Practical Physics 11	1 Credit
PHYS 111 - General Physics 1	3 credits
PHYS 112 - General Physics II	3 credits

LEVEL 200

PHYS 200 - Practical Physics	1 Credit
PHYS 203 - Properties of Matter and Vibrational Motion	3 credits
PHYS 204 - Electromagnetism & Modern Physics	3 credits

GRADUATION REQUIREMENTS

- (a) Candidates must have satisfied ALL University and Faculty requirements.
- (b) Candidates must have taken the Level 200 courses prescribed by the Physical, Biological or Earth Science programmes.
- (c) For a combined Major with Physics, the candidate must have taken all core courses and prescribed electives of the “Combined Major” Physics Programme.
- (d) For a Physics Major, the candidates must have taken all core courses and prescribed electives of the “Single Major Subject” Physics programme.

COURSE DESCRIPTIONS

PHYS 101 – Practical Physics I

Basic Laboratory experiments to expose students to handling various measuring instruments, and how to handle data error analysis.

PHYS 102 – Practical Physics II

Basic Laboratory experiments to expose students to handling various measuring instruments, and how to handle data error analysis.

PHYS 111: General Physics I ((For students in the Biological Sciences only.)

Mechanics: Vectors and laws of Physics, Motion in one and two dimensions, Projectiles; Relative velocity Newton's laws of motion; Momentum; Force, types of forces, conservative force, Work, energy, Conservation laws. Moment of inertia; Rotational motion, Newton's law of gravitation; Gravitational potential. **Thermal Physics:** Macroscopic & Microscopic definitions, Thermal equilibrium, Zeroth law of thermodynamics & temperature, Heat and work, First law of thermodynamics and applications, Gas laws, specific heat capacities of ideal gas, Kinetic theory of gases. **Vibrations and Wave:** Simple Harmonic Motion, Damped & forced harmonic motion (Qualitative) Examples of Mechanical & Electrical Oscillations, Waves: Types of waves. Wave Phenomena: Interference, Young's double slit experiment, blooming of lenses, Diffraction, Diffraction grating, Doppler Effect.

PHYS 112: General Physics II ((For students in the Biological Sciences only.)

Electricity: Electric charge and Coulomb's Law; Electric field intensity, Electric flux and Gauss's law; Electric potential energy, electric potential, Electric current, current density; Electromotive force, Ohms law and power, Kirchhoff's laws, Heating effect of current, Measuring instruments

Magnetism: Magnetic field: Force on moving charge; Magnetic effect of current, Biot-Savart's and Ampere's laws; Force on current-carrying conductor in magnetic field, Parallel conductors carrying current; Electromagnetic induction, magnetic flux, Faraday's and Lenz's laws; Eddy currents, AC series circuits: reactance, impedance, resonance, power and power factor, Electricity in the home and home appliances. **Modern Physics:** The origins of Quantum Physics, wave-particle duality, Photons, electrons, nucleus, atoms and molecules, Photoelectric effect, de Broglie wavelength, The Bohr atom and atomic spectra, Radioactivity, Fission and fusion. Applications of Nuclear Physics

PHYS 113: Mechanics and Thermal Physics

Mechanics:

Properties of Vectors: Geometrical representation, Multiplication – dot product and cross product, The three – dimensional Cartesian co-ordinate system, Components of a vector, Direction Cosines, Linear Independence, Magnitude of a vector, Geometrical methods of vector addition, The sine rule and the cosine rule, Vectors in two dimensions. **Linear Momentum:** Conservation Law, Direct and indirect collisions, The co-efficient of restitution. **Motion:** Newton's laws, equations of motion, Motion in one dimension, Parametric equations of motion, Motion in two dimensions, Projectile motion, Relative velocity. **Force:** Addition of Forces, Equilibrium, Impulse, Tension and the motion of connected masses, Friction. **Circular motion:** Uniform circular motion, Motion in a vertical circle, the conical pendulum. **Work and Energy:** Work done by a constant force, Work done by a varying force, Work and kinetic energy, Work and potential energy, Conservation of energy, Conservative and non-conservative forces – definition and examples. **Rotational motion:** Centre of mass, Moment of inertia, Angular momentum, Rotational kinetic energy, Torque. **Gravitation:** Kepler's laws, The law of Universal gravitation, Gravitational potential energy, Escape velocity

Thermal Physics:

Microscopic and Macroscopic Definitions: Thermodynamic systems, Simple systems, Closed systems, Open systems, Isolated systems, Thermodynamic properties, States Processes, Paths, Intensive and extensive quantities. **Thermal Equilibrium:** Temperature, Adiabatic walls, Diathermal walls, Thermometers and thermometric properties, Comparisons of thermometers, Thermometric scales and conversions, Zeroth law of thermodynamics. **Work and Heat:** Thermodynamic equilibrium – conditions, Chemical equilibrium, mechanical equilibrium, thermal equilibrium, Effects of conditions not satisfied, Change of state, Quasi-static processes, Work done, Work depends on path, Isothermal processes, Isobaric processes, Isochoric (isovolumetric) processes, Adiabatic processes. **Heat:** Concept of heat, Internal energy, Heat capacity, Specific heat, Heat flow (Conduction, Radiation, and Convection). **First law of thermodynamics:** Cyclic processes, Non-cyclic processes, Nature of stored energy, First law and its implications under (i) Isothermal processes (ii) Isobaric processes (iii) Isochoric processes .Application: Introduction to entropy.

Gas Laws: Properties of an ideal gas, Charles Law, Boyle's Law, Gay Lussac Law, Kelvin temperature scale (absolute temperature).

Kinetic theory of Gases: Assumptions, Force exerted on the walls of the container, Pressure, Equation of state, Molecular velocities: (i) Mean velocity (ii) mean square velocity (iii) root mean square velocity, Equipartition of Energy

PHYS 114: Electricity, Magnetism and Quantum Phenomena

Electricity:

Electric Charge and Electric Field: Electric charge, Conductors, insulators and induced charges, Coulomb's law, Electric field and Electric forces, Charge distributions, Electric dipoles. **Gauss' Law:** Charge and electric flux, Gauss' Law, Application of Gauss' Law. **Electrical Potential:** Electric potential energy and work, electric potential. **Capacitance and Dielectrics:** Capacitors (parallel plate capacitors, spherical, and cylindrical shaped capacitors) and dielectrics, Capacitors in series and parallel, Charging and discharging a capacitor, time constant, Energy storage in capacitors. **Electric Current, Resistance and Direct-current circuits:** Electric current, Resistivity and Resistance, Electromotive force and electric circuits, Energy and power in Electric circuits, Resistors in series and Parallel, Kirchoff's Rules, Electrical measuring instruments.

Magnetism:

Magnetic Field and Magnetic Forces: Magnetic field, Magnetic field lines and Magnetic flux, Motion of charged particles in a magnetic field, Electric and magnetic fields acting together – application to velocity selectors, Magnetic force on a current-carrying conductor, Force and Torque on a current loop (a magnetic dipole moment). **Sources of Magnetic fields:** Magnetic field of a moving charge, Magnetic field of a current element, Magnetic field of a straight current-carrying conductor, Force between parallel conductors, Magnetic field of a circular current loop, Ampere's law and its applications, Magnetic materials. **Electromagnetic Induction:** Faraday and Lenz's laws, Motional electromotive force, Induced electric fields, Eddy currents, Displacement current and Maxwell's equations. **Inductance:** Mutual inductance, Self-induced inductance, Inductors and magnetic-field energy, R - L and L - C circuits, L - R - C series circuits. **Alternating current:** Phasors and alternating current, Resistance and reactance, L - R - C series circuit, Band-Pass filters, Power in alternating-current circuits, Resonance in alternating-current circuits, Transformer

Quantum Phenomena:

Introduction to Quantum Physics: Blackbody radiation and Planck's hypothesis, Photo-electric effect, Compton Effect, Atomic spectra, Bohr's model of the hydrogen atom, Photon's and electromagnetic waves, Wave properties of particles. **Quantum Mechanics:** Double-slit experiment, Uncertainty principle, Probability density, Schrodinger equation, Particle in a square well potential (a particle in a box)

PHYS 200: Practical Physics

(For students in the Biological Sciences only)

PHYS 201 – Practical Physics III

PHYS 202 – Practical Physics IV

Laboratory experiments illustrating modern experimental techniques and error analysis.

PHYS 203: Properties of Matter and Vibrational Motion

(For students in the Biological Sciences only)

Properties Of Matter - Solids: Elastic and Plastic properties **Liquids:** Laminar and turbulent flow; Bernoulli's principle, Viscosity; Brownian motion. **Gases:** Simple kinetic theory; Specific heats, Real and Ideal Gases, Laws of Thermodynamics, Diffusion. **Vibrational Motion - Circular Motion:** Uniform Circular Motion; Centripetal Acceleration, Conical Pendulum, Forces on vehicles rounding a curve; Banking, Motion in a vertical circle, Motion of a satellite. **Harmonic Motion:** Definitions; Restoring force; Equations of Simple Harmonic Motion, Simple Pendulum; Mass attached to a spring; Angular Harmonic Motion; Electrical Oscillations; Energy in Simple Harmonic Motion, Damped Harmonic Motion – logarithmic, decrement, overdamped, underdamped and critical damping. Forced Oscillations, Resonance; Damped and Forced electrical oscillations. **Waves:** General characteristics,

Interference, Diffraction, Resolution; Rayleigh's criterion; Resolving power; Resolution limit in optical instruments.

PHYS 204: Electromagnetism & Modern Physics

(For students in the Biological Sciences only.)

Magnetic materials: Ferromagnetism, Induced magnetism, Capacitance and dielectrics, N-type and P-type semiconductors Semiconductor diode, Solar Cells, Transistors, Transformers and Electric motors; Electrical appliances, Amplifiers, Measuring instruments: Oscilloscopes; Spectrometers; Electron microscopes, Transmission and Reception of Radio waves, TV cameras and receivers, Review of the structure of the atom; Quantisation laws; Exclusion principle; Emission and absorption of radiation; Photoelectric effect, Applications of radioactivity; Production and uses of X-rays, Radiation detectors; Isotopic masses; the Mass Spectrograph

PHYS 211 – Introduction to Physics of Materials

Forces between atoms and molecules and their consequences; Elastic modulae – Young's, Shear, Bulk, Poisson ratio, non-elastic behaviour; Flow properties of fluids; Continuity equation, hydrostatic equation, Euler's and Bernoulli's equations, Kelvin's circulation theorem, Reynold's number.

PHYS 212 – Oscillations and Waves

Simple, damped and forced oscillations; decay of oscillations, resonance; general properties of waves; waves in one dimension; superposition of waves; dispersion and group velocity; Doppler effect; waves in physical media; waves in two and three dimensions, circular and spherical wave fronts.

PHYS 215 – Electromagnetism I

Gauss's law and it's applications; electric field around conductors, electric field and potential gradient, Gauss's Law in dielectrics, magnetic fields, electromagnetic induction, inductors, self and mutual induction, L-R-C circuits; resonance; power and power factor; paramagnetism, ferromagnetic materials, hysteresis.

PHYS 216 – Atomic Physics and Nuclear Physics I

Atomic Physics: The Bohr atom; atomic structure; line spectra and energy levels; x-ray production and scattering; Continuous spectrum. **Nuclear Physics I** :Structure and properties of the nucleus; binding energy and nuclear forces; Radioactivity – alpha, beta, gamma; fission and fusion

PHYS 301 – Practical Physics V

Laboratory experiments including those fundamental to modern physics and those illustrating modern experimental techniques. Students are introduced to Scientific Report writing and making references.

PHYS 302 – Practical Physics VI

Laboratory experiments including those fundamental to modern physics and those illustrating modern experimental techniques. Students are introduced to Scientific Report writing and making references.

PHYS 311 – Mechanics and Fields

Divergence and curl of a vector; Force Fields, conservative and non-conservative forces; gravitation; equipotential surfaces; gradient of a potential; Gauss's law and applications; central forces and applications to two-particle system; orbits; escape velocity; drag; motion with variable mass; statics of rigid bodies; rotating frames of reference; motion with respect to moving and rotating frames; moments of inertia; angular momentum; motion of a top; centrifuges; Coriolis forces; gyroscopic motion.

PHYS 313 – Physics of Large systems I

Laws of thermodynamics and applications, heat engines, heat pumps, entropy, thermal pollution and global warming, unavailability of energy, heat death, thermodynamic potentials – Gibbs functions, Helmholtz functions; and Free energy functions, phase change

PHYS 314 – Optics

Fermat's principle; phenomena of geometrical and physical optics; thick lenses; apertures; interference; diffraction; polarization of EM waves; double refraction; lasers; holography; fibre optics; optical instruments; resolution.

PHYS 315 – Electromagnetism II

General methods of solving electrostatic problems, methods of images, Laplace's equation, magnetic materials, magnetization, magnetic field intensity H , magnetic susceptibility, relative permeability, hysteresis, Maxwell's equations; derivation of the electromagnetic wave equation, its solutions, and some applications.

PHYS 319 – Physics of Solids I

Lattice translation vectors, symmetry operations; types of lattices; simple crystal structures; effect of deformation on crystals and their properties; crystal diffraction and the reciprocal lattice; Bragg's Law; experimental diffraction methods; reciprocal lattice vectors; Brillouin zones; structure and atomic form factors; Lattice vibrations; Lattice heat capacity; thermal conductivity.

PHYS 321 – Mathematical Methods

Vector and Tensor Analysis; Determinants, Matrices and Group Theory; Infinite Series; First Order Differential Equation; Functions of Complex Variables; Second Order Differential Equations; Special Functions - Bessel Functions, Gamma Functions, Beta Functions, Legendre Functions; Fourier Series; Partial Differential Equations; Integral Functions - Fourier Transform, Laplace Transform

PHYS 322 – Quantum Physics I

Principles of Quantum Physics; evidence of quantized energy states; Wave properties of particles; time-independent Schrödinger equation; interpretation of wave properties as probability amplitudes; superposed energy states; life times; uncertainty principle; moving wave packets; one dimensional scattering; potential wells and barriers; probability currents, Harmonic oscillator;

PHYS 324 – Special Relativity

Invariance of Physical Laws; relativity of time intervals; Relativity of length; Lorentz transformation; Doppler effect for electromagnetic waves; Relativistic momentum; Relativistic work and energy; Newtonian Mechanics and Relativity.

PHYS 326 – Computational Methods in Physics

Computational Physics definition; Types of computers and languages; Limits of computation (Application software like MATLAB, C, C++, Fortran, etc.); operators; basic syntax; library functions; graphics (output display); introduction to numerical methods/analysis; algorithms and flowcharts; solution of non-linear equations (simple quadratic equation, solution of equations by Newton-Raphson method, numerical integration); modelling physical processes e.g., motion of falling objects, projectile motion etc.

PHYS 331: Physics of the Atmosphere**The Atmosphere – an introduction (mainly descriptive)**

Origin and composition of the atmosphere; Distribution of constituents; Charged particles
Temperature distribution

Thermodynamics of water vapor and moist air

Thermodynamics of dry and moist air, stability; changes of phase and latent heat; Adiabatic processes, moisture variables; Thermodynamic diagrams (formation and use)

Radiation

Fundamental physics of atmospheric electricity, radiation laws; Solar and terrestrial radiation, applications, ozone hole, atmospheric energy transport; Global energy balance.

PHYS 332 Principles of Applied Geophysics

Magnetic surveying – principles, geomagnetic field, interpretations, instruments and applications

Electrical surveying – resistivity of rocks and minerals, current flow in the ground, methods, instruments, interpretation, applications

Induced polarization surveying – principles, measurements, field investigations, applications

Electromagnetic surveying – principles, detection of Electromagnetic fields, methods, interpretation and applications

Geophysical borehole logging – principles, natural gamma radiation logging, resistivity methods, self potential, temperature, calliper

Seismology

PHYS 334 - Principles and Applications of Neutron Activation Analysis**Irradiation facilities**

Neutron Sources; Nuclear Reactors Source; Isotopic Neutron Sources; Neutron Generator (Accelerator) Sources

Kinetics of activation

Irradiation Scheme (Conditions); Gamma Ray Spectrometry (Measurement of Gamma Rays)

Absolute Method; Relative (Comparative) Method; K_0 Method

Measurement and evaluation

Qualitative Analysis; Quantitative Analysis

Applications of neutron activation analysis

Environmental Studies - Pollution Studies; Forensic Investigations; Archaeological Studies, Biochemistry; Semiconductor Materials Studies; Geological Science; Soil Science; Epidemiology Studies

PHYS 335: Physics of the Ocean

Physical properties of the ocean and seawater, sound and light;

T-S forcing and conservation laws, Global T-S distribution; Equations of continuity and motion; Balance of forces; the effect of Earth's rotation; Ocean currents; Deep currents and general ocean circulation; Surface waves; Tides and long-period waves; Oceanographic instrumentation; El Nino.

PHYS 400 – Project

Students undertake a limited research project under supervision of a Senior Member. A final report is required. Students are expected to report on their findings at a departmental seminar.

PHYS 413 – Physics of Large systems II

Probability distribution functions; velocity distributions; distributions in phase space; transport phenomena; fluctuation; Statistical Mechanics; ensembles and distribution functions; entropy and ensembles; the micro-canonical ensemble; the canonical ensemble; Bose-Einstein statistics (black body radiation); Fermi-Dirac statistics (free-electron gas).

PHYS 416 - Nuclear Physics II

Nuclear models; nuclear reactions; nuclear fission and fusion; nuclear reactors

PHYS 417 – Electronics

Semiconductor Devices – diodes and applications; basic transistor circuits (BJTs; FETs, JFETs); Op-amps; combinational and sequential logic circuits; integrated circuits

PHYS 418 – Particle Physics

Elementary particles and their interactions; hadrons and electrons, spin and anti-particles, conservation laws, quark model, field particles, electro-weak theory, standard model, grand unification theory

PHYS 419 – Physics of Solids II

Free electron Fermi gas; Fermi distribution, heat capacity of an electron gas; electrical conductivity; motion in magnetic fields; Wiedemann – Franz law; Energy Bands; Bloch functions; weakly perturbing lattice potential; holes; effective mass; metals; insulators; semiconductors; semiconductor crystals; intrinsic carrier concentration; thermo-electric effects in semiconductors; semi metals; p-n junctions; solar cells and photovoltaic detectors.

PHYS 422 – Quantum Physics II

Mathematical tools for Quantum Mechanics – one particle wave function space; state space (Dirac notation); Representations in the state space; eigen value equations (observables); Postulates of Quantum Mechanics; General properties of angular momentum in quantum mechanics; particle in central potential (the hydrogen atom); elementary approach to the quantum theory of scattering by a potential; system of identical particles; electron spin; time independent perturbation theory.

PHYS 424 – Contemporary Physics

This course is at an introductory level, dealing with selected topics taken from Current Trends in Physics. It is aimed at motivating students in the subject, and ensuring a general literacy in the frontiers of Physics. Areas covered include recent advances in fields such as: Unification; General Relativity and Black Holes etc.

PHYS 425 – Energy Systems

Review of energy sources; conventional and non-conventional, renewable and non-renewable. Nuclear energy – fission, fusion, breeder reactors; solar energy – physical problems connected with conversion; technological problems and applications. Fossil fuels, hydro-power, wind power, tidal power; bio-chemical energy, Conservation and storage

PHYS 431 - Principles of Radioactive Dating

Radioactive decay, Types of radioactive clocks: decay clock accumulation clock Fundamental requirements of radiometric dating, Useful radioactive decay schemes Analytical techniques – fundamental mass spectrometry, Isotope dilution, analytical errors Typical radiometric dating methods – K-Ar, Ar⁴⁰/Ar³⁹, Rb-Sr, U-Pb, Sm-Nd Fission Track method of dating

PHYS 432: Basic Meteorology

Structure of the atmosphere; weather processes and weather systems, including climatic process. Data analysis, instruments, and weather system models, Global distribution of principal climatic elements with emphasis on physical causes

Physics of moist air; physics of aerosols; condensation of water vapor on aerosols; cloud physics
1D and 3D climate models, applications, global warming

PHYS 433 - Physics for Audiology

Introduction to audiology; Simple vibrators; Multi-mass vibrators; Waves in continuous media; Wave phenomena; Complex waves; Radiation of sound; Sound Pressure Level; Instrumentation; Critical Band and loudness; (Critical Band and consonance;) Hazards to hearing; Hearing annoyance; Architectural aspects; Classroom acoustics; Listening environments; Energy sources in speech; Vocal tract effects; Spectral characteristics of speech.

PHYS 434 - Further Electronics

Power amplifiers, Linear-Digital ICs, Feedback and Oscillator circuits, Comparators, Decoders, Encoders, Multiplexers, demultiplexers, flip-flops and related devices, Counters, Registers, State machines, Analog/Digital conversion, Memories and Processors

PHYS 435 - Physics of Telecommunications

Network theorems, Circuit theory, Transmission lines, Attenuators and filters, Low and high frequencies amplifiers, Oscillator circuits; Modulation, demodulation, and detection circuits, Noise, Transmission of information, Microphones and sound reproducers, Telephony, High frequency

transmission lines and waveguides, Ultra-high frequency devices, Wave propagation and aerials, Radio transmission systems, Microwaves and laser, Fiber optics

PHYS 436 - Physics at the Nanoscale

Carbon Nanotubes: Carbon allotropes; Synthesis and production techniques of carbon nanotubes
Physical properties of carbon nanotubes; Functionalisation, dispersion, separation, and characterisation of carbon nanotubes; Applications: Polymer- and metal- composites, X-ray tubes, Field emission displays (FED), transistors, sensors, etc.; Safety and risk

Nanocrystals: Classification; Types of nanocrystals; Wide-band gap semiconductor nanocrystals

Modification of physical properties from bulk crystal to nanocrystal; Methods of preparation

Hybrid materials; Applications – sensors, photovoltaics, luminescent devices, electronics, lasers

Theory: Quasiparticles: electrons, holes, excitons; Basic theoretical methods: effective mass approximation, adiabatic approximation, tight-binding approach; Electron states in confined dimensions; weak confinement, strong confinement.

PHYS 437 – Introduction to Optometry

The propagation of light, Behaviour of light on reaching a new medium, Reflection and refraction at a plane surface, Internal refraction at plane surfaces, Prisms and optical fibres, Reflection and refraction at spherical surfaces, cylindrical and spherocylindrical lenses, Lenses, systems and Thick lenses, Aberration and image quality, the principles of optical instruments, the Eye as an optical instrument, Photometry, the application of fundamental optics to the human eye (Visual Optics) Holography, production and detection of polarised light, Plane, Circular and Elliptical polarisation

PHYS 438 – Introduction to Cosmology and Astrophysics

Modern view of the Universe, Astronomical nomenclature and conventions, Order of magnitude reasoning, Stars and Stellar evolution, Galaxies and Large-Scale structures
Relativistic Astrophysics and Cosmology

DEPARTMENT OF PSYCHOLOGY

B. Amponsah , BA (Ghana) M.Phil PhD (NTNU)	-	Senior Lecturer/Head
S.A. Danquah , BSc MSc (McGill) PhD (Wales)	-	Professor
J.Y. Opoku , BSc (Ghana) PhD (Aberd)	-	Associate Professor
A. Afrifa , BSc (Ghana) MA MPhil PhD (Col)	-	Senior Lecturer
R. Akuamoah-Boateng BA (Ghana) MA (NY) PhD (Cantab)	-	Senior Lecturer
Charity S. Akotia , BA (Ghana) MA (Laurier) PhD (Gh)	-	Senior Lecturer
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C. B. Wiafe-Akenteng , BA MPhil (Ghana)	-	Lecturer
A. Anum , BA MPhil (Ghana), PhD (Brock)	-	Lecturer
M.A. Asumeng , BA MPhil (Ghana)	-	Lecturer
Margaret Amankwah-Poku , BA MPhil (Ghana)	-	Lecturer
J. Osafo , BA MPhil (Ghana)	-	Lecturer
Angela A. Gyasi-Gyamerah , BA MPhil (Ghana)	-	Lecturer
Inusah Abdul-Nasiru , BA MPhil (Ghana)	-	Lecturer
Annabella Opare-Henaku BA (Ghana) MPhil (Bergen)	-	Lecturer
Sarah M. Adoo , BSc MSc (Ghana)	-	Part-Time Lecturer

Note: The new course structure replaces the old from the 2009/2010 academic year. The old structure will be phased out gradually beginning from 2009/2010. Students may consult the 2007-2009 handbook for courses offered under the old course structure.

LEVEL 100 COURSES

First Semester

CORE	CREDITS
PSYC 111 – Elements of Psychology	3
PSYC 113 – Psychology for Everyday Living I	3

Second Semester

CORE	CREDITS
PSYC 112 – Psychology of Adjustment	3
PSYC 114 – Psychology for Everyday Living II	3

LEVEL 200 COURSES

First Semester

CORE	CREDITS
PSYC 211 – Introduction to General Psychology	3
PSYC 213 – Biological Psychology	3

Second Semester

CORE	CREDITS
PSYC 212 – Motivation and Emotion	3
PSYC 214 – Introduction to Experimental Psychology	3

LEVEL 300 COURSES

First Semester

CORE	CREDITS
PSYC 313 – Statistics for Psychologists	3
PSYC 315 – Psychology of Personality	3
PSYC 317 – Developmental Psychology I	3

(The three core courses are compulsory for major and combined students)

ELECTIVES

PSYC 311 – Learning	3
PSYC 391 – Practicals in Learning	1

(Students minoring in Psychology must take any two courses which must earn them a minimum of 6 credits)

Second Semester

CORE	CREDITS
PSYC 322 – Cognitive Psychology I	3
PSYC 324 – Research Methods in Psychology	3
PSYC 392 – Practicals in Cognition I	1

(The three core courses are compulsory for major and combined students)

ELECTIVES

PSYC 316 – Abnormal Psychology	3
PSYC 318 – Developmental Psychology II	3
PSYC 326 – Psychological Tests and Measurement	3

(Students majoring, combining or minoring must take a minimum of 5 credits of the electives)

LEVEL 400 COURSES

First Semester

CORE

PSYC 421 – Cognitive Psychology II	3
PSYC 423 – Social Psychology	3
PSYC 491 – Practicals in Cognition II	1
PSYC 493 – Research Seminar	1

ELECTIVES

PSYC 425 – Introduction to Neuropsychology	3
PSYC 431 – Clinical Psychology	3
PSYC 433 – Educational Psychology	3
PSYC 443 – Atypical Development	3
PSYC 435 – Guidance and Counselling	3
PSYC 437 – Industrial Psychology	3
PSYC 427 – Health Psychology	3
PSYC 439 – Military Psychology	3
PSYC 441 – Psychology of Religion	3

Second Semester

CORE

PSYC 400 – Research Project	6
PSYC 422 – Psychology and National Development	3

ELECTIVES

PSYC 424 – Applied Social Psychology	3
PSYC 426 – Comparative Psychology	3
PSYC 432 – Community Psychology	3
PSYC 434 – Environmental Psychology	3
PSYC 438 – Organizational Psychology	3
PSYC 436 – Psycholinguistics	3
PSYC 442 – Sports Psychology	3
PSYC 444 – Political Psychology	3

COURSE DESCRIPTIONS

PSYC 111 Elements of Psychology

This course is designed to introduce students to the history, basic theories, research methods and principles of Psychology. It is aimed at laying the foundation for higher level courses in Psychology. At the end of the course, it is expected that students will have basic knowledge of some psychological theories and principles underlying behaviour and also be in the position to relate what they have learnt to issues of everyday life.

PSYC 112 Psychology of Adjustment

This course is an introductory course in psychology which deals with everyday adjustment issues. Focus will be on the application of knowledge in psychology to life situations and the development of skills to handle such situations. Topics to be covered include understanding adjustment, intimate relationships, interpersonal communication, career development, stress and stress management, decision making, handling conflicts, and problems of adjustment among others. At the end of the course, students should be able to develop a greater understanding of themselves and skills they can use to facilitate adjustment in life.

PSYC 113 Psychology for Everyday Living I

This course deals with the applications of psychological principles, theories and research findings to everyday life. Its main objective is to demonstrate the relevance and practicality of psychology and thus bridge the gap between theory and practice. Topics to be covered include factors affecting learning and memory, stress and illness, lifestyles and health and careers and work. At the end of the course, students should be able to relate/apply topics covered to everyday life.

PSYC 114 Psychology for Everyday Living II

This course deals primarily with issues of everyday life. It employs psychological principles, theories and research findings in an attempt to explain and understand matters of everyday life. Its main objective is to demonstrate the relevance and applicability of psychology in the daily life of the individual and thus draw links between what students learn in the lecture halls and what they experience in real life. Specific topics to be covered include motivation and goal setting, community and diversity, assertiveness and leadership, problem solving and creativity.

PSYC 211 Introduction to General Psychology

This course is designed to introduce students to Psychology as a discipline and a profession. The emphasis is on the history of psychology, the different orientations available in the field and the basics of research in psychology. The course will also look at two interesting areas in psychology namely, intelligence and social Behaviour. By the end of this course, students should know what psychology is, why it is important for them to study psychology and be adequately prepared for building up on their knowledge in higher levels of their study in psychology.

PSYC 212 Motivation and Emotion

This course is intended to introduce students to motivational causes of behaviour and the emotions experienced. Understanding motivation and emotion is fundamental to understanding human behaviour. Emphasis will be placed on the theories, sources and types of motivation and emotion. At the end of the course, students should be able to understand motivational causes of behaviour and the expression of emotions

PSYC 213 Biological Psychology

This course examines the neurobiological bases of behaviour. The course will cover the nature of neurons and neuronal communication, the translation of the external world into internal perceptions (vision, hearing, touch, etc.) and the role of the nervous system in the cognition skills of thinking, learning, memory, and language.

PSYC 214 Introduction to Experimental Psychology

This course is designed to introduce students to the general principles of experimental research method. Emphasis will be placed on design, control of extraneous variables and ethics governing psychological research. At the end of the course, it is expected that students will be able to design simple experiment, identify flaws in basic design and control for extraneous variables.

PSYC 311 Learning

This course basically deals with the psychology of learning and its application to everyday life situations. It covers the various types of learning (e.g. Pavlovian, Instrumental, observational and verbal learning). Specific topics that are taught include: reasons for using animals in research in learning, elements/features of classical and instrumental conditioning, use of reinforcement and punishment, learning principles and behaviour change. Others are cognitive learning, observational learning and various types of verbal learning. At the end of the course, students should be able to apply learning principles to their own life situations as well as that of others around them.

PSYC 313 Statistics for Psychologists

This course deals with statistics and the behavioural sciences. It delves into descriptive and inferential statistics, populations, samples, parameters, etc. furthermore, the concept of variability, strategy of inferential statistics, the normal curve and inferences about the means of two populations will also be discussed. One way analysis of variance, two way analysis of variance, parametric and non-parametric methods, chi square, Kruskal–Wallis H test, the Wilcoxon test and the rank-sum test will also be taught.

PSYC 315 Psychology of Personality

The course emphasizes the major personality theories, research and measurements of personality. It will explore the foundations of normally functioning individuals as well as problems. The topics will include definitions, psychodynamic, traits, cognitive, phenomenological/existential theories associated with personality development. The effect of folk stories, “Kweku Ananse” stories on personality development will be examined.

PSYC 316 Abnormal Psychology

This course is designed to introduce students to the psychology of abnormal behaviour. It explores the history, definitions and current status of abnormal behaviour. The topics include the five paradigms or theoretical models of psychodynamic trait, phenomenological, cognitive and behavioural approached to abnormal behaviour. It will examine research, abnormal patterns of functioning and methods of treatment.

PSYC 317 Developmental Psychology I

This course is concerned with understanding and explaining the changes that occur between conception and adolescence. Emphasis is placed on the major changes that occur in the physical, cognitive and the psychosocial domains and their implications for parents, educators, and helping professionals.

PSYC 318 Developmental Psychology II

This course examines basic themes in life-span development: the concept of adulthood, physical development including changes in sense organs, cardiovascular organs, sex, reproductive organs and their psychological consequences. Others are health, vitality and diseases, the process of ageing, cognitive and psychosocial development during adulthood, retirement and widowhood, culture and aging.

PSYC 322 Cognitive Psychology I

This course is to provide a survey of selected problem areas in cognitive psychology with emphasis on memory. Both experimental work and theoretical accounts of memory will be covered. Topics include structural and processing accounts of memory – how people acquire, store, transform, retrieve and communicate information.

PSYC 324 Research Methods in Psychology

The course is intended to provide the student with basic skills needed to conduct psychological research, develop critical thinking skills regarding research and gain the capacity to design and conduct research as well as writing research reports. Topics include an overview of the scientific approach to knowledge, definitions of basic concepts, types of scientific research, design, sampling, questionnaire construction, interviews and report writing.

PSYC 326 Psychological Tests and Measurements

This course of study is designed to expose students to the basic conceptual, theoretical, technical and methodological principles in the development, administration and interpretation of psychological measurements. It is essential that students who intend to offer this course have good background in Basic Statistics and/or Statistics for psychologists.

PSYC 391 Practicals in Learning

This course is the practical component of PSYC 311, and is compulsory for all students offering PSYC 311. Students are expected to participate in experiments based on the theories learned in PSYC 311 after which they submit a research report.

PSYC 392 Practicals in Cognition I

This course is the practical component of PSYC 322, and is compulsory for all students offering PSYC 322. Students are expected to participate in experiments based on the theories learned in PSYC 322 after which they submit a research report.

PSYC 400 Research Project

This course is research based and runs through the first semester to the second semester. Students are expected to select a topic of their own, conduct an empirical study on it, write a research report and submit to the Department.

PSYC 421 Cognitive Psychology II

The course builds up on Cognitive Psychology I and aims to acquaint the student with important theoretical principles and findings in cognitive psychology along with the methods by which this knowledge is acquired. Some of the areas of interest are sensation and perception, attention, visual imagery, thinking and reasoning, decision-making, problem solving, language and comprehension, individual and gender differences in cognition etc. Application of cognitive psychology to real-world settings and implications will be emphasised.

PSYC 422 Psychology and National Development

This course is designed to help students understand how psychology can be applied in various areas of national endeavours. The course will treat topics such as introduction to Psychology and National Development, Economic Psychology, Psychology and Health, Psychology and Entrepreneurship, Attitude and Attitude change, Sports Psychology, Psychology and Politics, Psychology and Law, Psychology and Crime Prevention, Psychology and Poverty alleviation.

PSYC 423 Social Psychology

This course focuses on the study of the social dimensions of human behaviour. Unlike other domains of psychology that focus mainly on the individual as the unit of analysis, social psychology examines behaviour in its social context. Students will be introduced to the main theories, research methods and major research findings in social psychology. Emphasis will also be placed on key concepts such as attribution, cognition, attitudes, social influence and many more. At the end of this course, students should be able to demonstrate an understanding of the basic principles of social influences on behaviour.

PSYC 424 Applied Social Psychology

This course will examine how the theories and principles of social psychology can be applied to major issues affecting contemporary societies. Topics to be covered include intergroup conflicts and their

management, the role of social psychology in the clinic and in politics and in the courtroom, and determinants of helping behaviour. Topical issues such as attitudes regarding sanitation and health will also be discussed. The course will be an interactive one, providing a forum to share ideas and discuss the strategies that students will develop based on the theories of social psychology.

PSYC 425 Introduction to Neuropsychology

This is a course that will introduce students to a general overview of the anatomy of the brain (both cortical and subcortical). The course is also designed to help students understand the functions of the structures of the brain with respect to human behaviour and diseases that are brain-related. The course will be in two parts. The first part is an overview of selected brain functions (e.g. perception, language, memory, attention, sensory/motor control, executive functions) in both normal functioning and brain damage syndromes. The second part of the course will review clinical assessment and rehabilitation issues.

PSYC 426 Comparative Psychology

Comparative psychologists study differences and similarities in the behaviour of animals of different species. The discipline pays particular attention to the psychological nature of humans in comparison with other animals. At the heart of this perspective is the notion that human beings, like other animals, have an evolutionary history that predisposes them to behave in ways that are uniquely adaptive for survival and reproduction. One of the aims of comparative psychology is to use insights gained from the study of psychological processes in different species of animals to add to our understanding of human psychology. Any way of achieving this aim must depend, to some extent, on understanding the evolutionary relationship between animals and man.

PSYC 427 Health Psychology

Health psychology focuses on the role played by psychological factors in the cause, development and consequences of health and illnesses. The objectives of this course are to expose students to some of the major theoretical and intervention issues in health/illness behaviours. The course will be based on a national health perspective, with the main emphasis on behavioural risk factors which constitute the main health problems in Ghana. Topics to be covered include stress and coping, HIV/AIDS, lifestyle diseases in Ghana and disease prevention and health promotion.

PSYC 431 Clinical Psychology

This is an introductory course designed for level 400 students. The course focuses on a thorough survey of the field, which does not go into all the details typically found in “graduate study only”. The topics explore the history of clinical psychology, including Ghanaian development of the field, its scope, functions and future perspective. The course also covers the latest developments in clinical research and techniques in health psychology, behaviour medicine, psychopathology and mental health.

PSYC 432 Community Psychology

This course is designed to help students develop a conceptual and pragmatic understanding of various issues and topics in community psychology. It introduces students specifically to the principles/philosophies of community psychology, community research and program evaluation, types and models of prevention, stress, coping and social support, psychological sense of community and reasons and strategies for social change. At the end of the course, students should be empowered to apply the principles/models of community psychology to social/community problems and to provide appropriate interventions.

PSYC 433 Educational Psychology

This course is designed to give insight into the problems of teaching and learning and to develop the necessary professional skills and competencies for prospective educationist/teachers to enable them effectively understand, predict and control the behaviour of learners in the educational process. To this end, the course should more importantly be perceived as an area of applied psychology rather than a unique subject matter.

PSYC 434 Environmental Psychology

This course aims at exploring the relationship between psychology and the environment with particular emphasis on how the latter influences human behaviour. The course, which is a seminar type, will take a critical look at the natural, the built as well as the psychological environment and how they influence behaviour. The course is thus aimed at creating awareness among students on the effects (with particular attention on the adverse one) the environment has over the quality of life and how to reduce and/or manage them. At the end of the course, it is expected that students should be able to identify environmental hazards and critically assess the effects of these hazards and how to control or manage them.

PSYC 435 Guidance and Counselling

This course is designed to provide an insight into guidance and counseling. Specific topics to be covered include the historical development of guidance and counseling, the counseling process, techniques of counseling, the therapeutic relationship, theory and practice of counseling, special problems in counseling and ethical issues in counseling.

PSYC 436 Introduction to Psycholinguistics

This course introduces students to the nature of language, the various processes that underlie comprehension and how we produce and acquire language. Specific topics to be covered include comprehension and utilization of sentences, language production, the representation of meaning, language and thought and second language learning and bilingualism.

PSYC 437 Industrial Psychology

This course is made up of Personnel Psychology and Engineering Psychology. It deals with how psychological principles, theories, concepts and methods are applied to shape individuals for effective job performance and to also design work, work environments, tools, machines and equipments to match human abilities and limitations. Some of the areas covered in this course are; Job Analysis, Personnel Selection, Training and Development human resource, Job evaluation, Job Design work schedules, Human Factors Engineering characteristics of the work environment, Employee Health, Safety and Accidents at the workplace.

PSYC 438 Organizational Psychology

This course deals with the application of psychological concepts, theories, methods and ideas to problem of organizations. The course is made up of organizational theory and organizational behaviour. Topics treated include: the nature of organizations, organizational structure, design of effective organizations, organizational development, organizational climate and culture, organizational change, organizational decline, organizational learning, group processes in organizations, employees work attitudes and motivation, communication in organization, conflicts in organizations and organizational commitment.

PSYC 439 Military Psychology

This course deals with selected topical issues in the military. These include leadership and group dynamics (unit identity, unit cohesion, morale and heroism), stress and combat performance, combat stress behaviours, combat misconduct stress behaviours, battle fatigue and post-traumatic stress disorders.

PSYC 441 Psychology of Religion

Psychology of religion deals with the application of psychological principles, theories and methods of research in studying religious behaviour, religious cognition, religious motivation, the role of religion in human life. The course draws on the contributions of other fields of psychology and focuses on the attitudes, values and experiences of people and their relationship with the supernatural. Topics to be covered include the emergence of psychology of religion, approaches to the study of psychology of religion, religious experience, religion and morality, and religion, coping and adjustment and functions of religion in adult life.

PSYC 442 Sports Psychology

This course focuses on the psychological and mental factors that relate to participation and performance in sport, exercise and physical activity and how these may improve personal development and well-being throughout the life span. Topics to be covered include an introduction to sports psychology, motivation and self-confidence in sports, aggression and violence in sports, leadership, cohesion and audience effects, relationships in sports and life skill training and transitions in sport.

PSYC 443 Atypical Development

This course deals with children's abnormalities in the general context of human development. Topics to be covered include mental retardation, social isolation syndromes, infantile autism, minimal brain dysfunction, childhood and adolescent schizophrenia, school phobia truancy, learning disabilities, academic underachievement and delinquent behaviour.

PSYC 444 Political Psychology

The course examines the psychological factors that explain political behaviour. Theories and researches in both Psychology and Political Science will be examined. Other relevant topics include personality approaches to understanding political leaders and voters, the role of socialization in the formation of political preferences, how voters process political information, form impressions of political candidates and make voting decisions. The role of stereotypes and how they affect the candidate evaluation process, the uses (and abuses) of persuasion in politics, the role of the mass media in politics, the effects of political advertising, attack campaigning, the role of the media in dictating how the public thinks and the role of women and minorities in politics will be discussed.

PSYC 491 Practicals in Cognition II

This course is the practical component of PSYC 421, and is compulsory for all students offering PSYC 421. Students are expected to participate in experiments based on the theories learned in PSYC 421 after which they submit a research report.

PSYC 493 Research Seminar

This course is for students who are offering PSYC 410 (Research Project). They are expected to verbally present their research proposals prior to going to the field for data gathering.

DEPARTMENT OF STATISTICS

FACULTY

Marjorie E. Danso-Manu , BA (Ghana) MSc (Lond) Ph.D (Ghana)	-	Senior Lecturer/Head of Dept
F.K. Atsem , BA (Ghana) MSc (S'ton) DPhil (Oxf)	-	Senior Lecturer
I. Baidoo , BS (UMASS) MS PhD (Arizona)	-	Lecturer
E.N.N. Nortey , BA MPhil (Ghana)	-	Lecturer
F.O. Mettle , B.Sc MPhil (Ghana)	-	Lecturer
A. Lotsi , B.Sc., Ghana; M.Sc. Kaiserslautern)	-	Lecturer
K. Doku-Amponsah BA(Ghana), MSc (Kaiserslautern)Ph.D(Bath)	-	Lecturer
R. Minkah BSc(Ghana), MSc(Uppsala)	-	Lecturer
I.G. Akar , MSc (Ghana) MSc PhD (SUNY)	-	Part-time Lecturer
S.A. Yeboah , BSc (Ghana) MSc FSS (UK)	-	Part-Time Lecturer
E. Amartey-Vondee , BSc (Ghana) MSc Csat (UK)	-	Part-Time Lecturer

LEVEL 100 COURSES

STAT 101	Introduction to Statistics	3
STAT 102	Elementary Probability	3

LEVEL 200, 300 & 400 COURSES

BSc (Single Subject) Major

Core (64 credits)

STAT 201	Introductory Probability I (Pre-req. MATH 111, 112)	3
STAT 202	Data Analysis I (Pre-Req. STAT 203)	2
STAT 203	Elementary Statistical Methods	3
STAT 204	Introductory Probability II (Pre-Req. STAT 201)	3
STAT 206	Official Statistics	2
MATH 211	Introduction to Algebraic Structures	3
MATH 213	Calculus II (Pre requisite MATHS 112)	4
COMP 201	Introduction to Computer Science	3
COMP 202	Principles of Programming	3
COMP 210	Applications Laboratory	2
STAT 301	Probability Distributions (Pre-req. STAT 201, 204)	3
STAT 302	Multivariate Distributions (Pre-req. STAT 301, MATH 331)	3
STAT 303	Statistical Methods I (Pre-req. STAT 204)	3
STAT 304	Statistical Methods II (Pre-req. STAT 303)	3
STAT 305	Sample Survey Methods	3
STAT 306	Design of Experiments (Pre-req. STAT 203)	3
STAT 310	Data Analysis II (Pre-req. STAT 202, 203)	3
MATH 331	Linear Algebra: (Pre-requisite MATH 211)	3
MATH214	Calculus III	3
STAT 403	Theory of Sampling (Pre-req. STAT 204)	3
STAT 404	Survey Organisation and Management (Pre-req. STAT 305)	3
STAT 405	Regression Analysis (Pre-req. STAT 304, MATH 331)	3

Electives: GROUP A (Select Minimum of 6 Credits)

STAT 401	Statistical Inference: Estimation (Pre-req. STAT 301, 303)	3
STAT 402	Statistical Inference: Tests of Hypotheses (Pre-req. STAT 301, 304)	3
STAT 406	Multivariate Methods (Pre-req. STAT 302, MATH 331)	3
STAT 407	Non-Parametric Statistics (Pre-req. STAT 303, 304)	3
STAT 408	Analysis of Experimental Designs (Pre-req. STAT 306)	3

Electives: GROUP B (Select Minimum of 9 Credits)

STAT 410	Statistics Project	6
STAT 411	Introduction to Stochastic Processes (Pre-req. STAT 301)	4
STAT 413	Population Statistics	4
STAT 414	Biometrics (Pre-req. STAT 301)	3
STAT 415	Actuarial Statistics I	3
STAT 416	Actuarial Statistics II	3
STAT 417	Economic and Social Statistics I (Pre-req. STAT 206)	3
STAT 418	Economic and Social Statistics II (Pre-req. STAT 407)	3
ECON 403	Econometrics I (Prerequisite: ECON 305 and 306)	3
ECON 404	Econometrics II (Prerequisite: ECON 305 And 306)	3
ADMN 332	Health Statistics and Information	3

Electives: Group C (Select Minimum of 6 Credits)		
MATH 333	Analysis I (Pre-requisite MATH 213).	3
MATH 334	Analysis II (Pre-requisite MATH 333)	3
MATH 335	Ordinary Differential Equations (Pre-requisite MATH 213)	3
MATH 422	Integration Theory and Measure	3
COMP 204	File Organisation	1
COMP 206	Data Structures	1
COMP 406	Design and Analysis of Algorithms	3
COMP 301	Systems Analysis	4
COMP 302	Databases and Information Systems	3
ADMN 439	Principles and Practice of Insurance	3

BSc Combined Major

Core (40 Credits)		
STAT 201	Introductory Probability I (Pre-req. MATH 111, 112)	3
STAT 202	Data Analysis I (Pre-Req. STAT 203)	2
STAT 203	Elementary Statistical Methods	3
STAT 204	Introductory Probability II (Pre-Req. STAT 201)	3
STAT 301	Probability Distributions (Pre-req. STAT 201, 204)	3
STAT 302	Multivariate Distributions (Pre-req. STAT 301, MATH 331)	3
STAT 303	Statistical Methods I (Pre-req. STAT 204)	3
STAT 304	Statistical Methods II (Pre-req. STAT 303)	3
STAT 305	Sample Survey Methods	3
STAT 306	Design of Experiments (Pre-req. STAT 203)	3
STAT 310	Data Analysis II (Pre-req. STAT 202, 203)	3
STAT 403	Theory of Sampling (Pre-req. STAT 204)	3
STAT 405	Regression Analysis(Pre-req. STAT 304, MATH 331)	3

Electives: (Minimum of 10 Credits)		
MATH 211	Algebraic Structures (Pre-req. Math 114)	3
MATH 214	Calculus III	3
COMP 201	Introduction to Computer Science	3
COMP 202	Principles of Programming	3
COMP 210	Applications Laboratory	2
STAT 206	Official Statistics	2
STAT 410	Statistics Project	6
STAT 401	Statistical Inference: Estimation (Pre-req. STAT 301, 303)	3
STAT 402	Statistical Inference: Tests of Hypotheses (Pre-req. STAT 301, 304)	3
STAT 404	Survey Organisation and Management (Pre-req. STAT 305)	3
STAT 406	Multivariate Methods (Pre-req. STAT 302, MATH 331)	3
STAT 407	Non-Parametric Statistics (Pre-req. STAT 303, 304)	3
STAT 408	Analysis of Experimental Designs (Pre-req. STAT 306)	3
STAT 411	Introduction to Stochastic Processes (Pre-req. STAT 301)	4
STAT 413	Population Statistics	4
STAT 414	Biometrics (Pre-req. STAT 301)	3
STAT 415	Actuarial Statistics I (Financial Statistics) (Pre-req. STAT 301)	3
STAT 416	Actuarial Statistics II (Pre-req. STAT 415, Recommended STAT 413)	3
STAT 417	Economic and Social Statistics I (Pre-req. STAT 206)	3
STAT 418	Economic and Social Statistics II (Pre-req. STAT 407)	3

LEVEL 100 COURSES

STAT 101 Introduction to Statistics

Introduction to Statistics. The reduction and interpretation of data.

STAT 102 Elementary Probability

Introduction to basic concepts of Probability, Random event and Random variables. Probability Calculus and some univariate probability distributions.

MATH 111 Algebra and Trigonometry

Indices, Logarithms and Surds. Concept of a function. Function of a real variable: domain and range; injective, surjective functions. Quadratic functions and equations, polynomial functions and equations. Rational functions and partial fractions. Inequalities in one and two variables. Arrangements and Selections. Sequences and series, use of recurrence relations; the binomial theorem, principle of induction. Polar coordinates and curves. Exponential and logarithmic functions. Circular measure, the sine, cosine and tangent functions and their reciprocals, trigonometric identities and equations, inverse circular functions.

MATH 112 Calculus I

Elementary treatment of limit of a function, continuity, differentiation, rules of differentiation. Applications of differentiations. Derivatives of rational functions, exponential and logarithmic functions, circular functions and their inverses. Approximate methods of solving equations: graphical methods and Newton-Raphson method. Integration. Applications of integration: area under curve, volumes of solids of revolution. Numerical Integration: trapezium and Simpson's rules. Formation of ordinary differential equations, solutions of simple first order differential equations. Partial differentiation.

MATH 114 Algebra II

Algebra of complex numbers, Argand diagram, modulus – argument form of a complex number. De Moivre's rule. Roots of unity; complex conjugate roots of a polynomial equation with real coefficients Geometrical applications loci in the complex plane. Elementary transformation from z-plane to the w-plane. Algebra of matrices and determinants (up to 3 x 3 matrices); applications to linear equations. Linear transformations and matrix representation of a linear transformation.

LEVEL 200, 300 & 400 COURSES

STAT 201 Introductory Probability I (Pre-req. MATH 101, 103)

Introduction to the concepts of probability, Random Events, and Random Variables. The Probability Calculus, Univariate probability distributions.

STAT 202 Data Analysis I (Pre-Req. STAT 203)

The aim of this course is to give students practice in handling Large data Sets; specifically to provide opportunities for Descriptive and Exploratory Studies.

STAT 203 Elementary Statistical Methods

Bivariate Data Analysis. Elements of statistical inference.

STAT 204 Introductory Probability II (Pre-Req. STAT 201)

Bivariate Distributions. Moment Generating Functions; their properties and uses. Sampling distributions. Distributions associated with samples from a Normal population. The Weak Law of Large Numbers and the Central **Limit** Theorem. Applications.

STAT 206 Official Statistics

Purposes and Scope of Official Statistics. Structure and Work of the National Statistical System. Organisational, Methods and Practices of data collection and dissemination.

MATH 211 Introduction To Algebraic Structures

Logic and proof. Set theory. Cartesian products, binary relation, equivalence relation. The number systems; from \mathbb{N} to \mathbb{Z} to \mathbb{Q} to \mathbb{R} , from \mathbb{R} to \mathbb{C} . Countability. Principle of finite induction. Axiomatically defined systems; groups rings, integral domains and fields. Isomorphism of algebraic structures. Vector spaces, homomorphism of vector spaces.

MATH 213 Calculus II

Function of a single variable. The first and second derivatives and their applications. Integration as a sum; definite and indefinite integrals; improper integrals. The logarithmic and exponential functions, the hyperbolic functions and their inverses. Techniques of integration including integration by parts; recurrence relations among integrals; applications of integral calculus to plane curves: arc length, area of surface of revolutions. Pappus theorems, approximate evaluation of definite integrals; Ordinary differential equations; first order; second order (constant coefficients).

MATH 214 Calculus III

Higher derivatives and applications. Leibniz's theorem and applications. Taylor's theorem. Maclaurin's and Taylor's expansions of some standard functions. vectors, algebra of vectors and applications, vector functions. Functions of several variables, partial derivatives, Euler's theorem on homogeneous functions; gradients, directional derivatives, maxima and minima, constrained extrema, the method of Lagrange's multipliers. The gradient operator: curves, and surfaces, tangent planes and normal lines. The divergence and curl operators. Introduction to multiple integration.

COMP 201 Introduction to Computer Science

An introduction to computers and how they work. The use of computers in Problem solving, Data Processing Information Management and other modern applications. Historical Development of Computers: Digital Computers and Analog Computers. How they operate and their different applications. Computer Hardware: Brief overview of Central Processor, its main elements and their functions. Memory organisation. Input/Output devices. **Problem solving by digital computers:** Use of algorithms and flowcharts. An algorithm as a sequence of logical steps. Examples of numerical and non-numerical algorithms. The concept of a Computer Program. Data Representation: Bits, bytes and words: Character representation. Number systems – binary, octal, hexadecimal integer and fractional representations. Integer and floating point arithmetic. **Software:** Programs, programming and programming languages. Machine language. Assembly language. Higher level languages; example, the need for programming in higher level languages. Compilers and interpreters. Application software. **Applications:** The use of computers for data processing, word-processing, scientific experimentation and instrumentation, solution of mathematical problems, statistical analysis, management and accounting applications. Databases and information system. Knowledge based systems.

COMP 202 Principles of Programming

Operating System: Review of an operating system, files and their editing. Use of MS-DOS/UNIX. Problem solving on a computer: Formulation of a problem; completeness of specification; algorithmic solution; top-down design; problem decomposition; Step wise refinement. Programming concepts: The elements of PASCAL: Comments, Data types, declaration, statement, expressions; control constructs; procedures and functions; input and output; arrays; pointer; records; file handling. Compilation and executing: Error messages, debugging techniques, testing, choice of test. Elements of programming style: Data structuring; documentation; maintenance.

STAT 301 Probability Distributions (Pre-req. STAT 201, 204)

Elementary Distribution Theory. Generating Functions. Sequences of random variables; the Central Limit Theorem and its applications.

STAT 302 Multivariate Distributions (Pre-req. STAT 301, MATH 302)

Introduction to Vector Random Variables. Distribution Concepts for Several random variables. Transformations of random vectors. Order Statistics. The multivariate Normal Distribution.

STAT 303 Statistical Methods I (Pre-req. STAT 204)

The first part of a two-semester Course providing a systematic development of the principles and methods of statistical inference, on a largely intuitive basis, with a minimum of mathematical theory. This part deals with the general nature of Statistical Problems, Statistical Models and Problems of Estimation.

STAT 304 Statistical Methods II (Pre-req. STAT 303)

Sequel to STAT 303. General Principles and Procedures of Hypothesis Testing. Parametric and Non-parametric Tests. Simple Linear Regression and Correlation Analysis. The Analysis of Frequency Data.

STAT 305 Sample Survey Methods

Basic Sample Survey procedures and Sample Designs. Estimation of population parameters. Sampling and Non-Sampling Errors.

STAT 306 Design of Experiments (Pre-req. STAT 203)

Basic concepts and principles of experimental Statistics. Analysis of Variance for standard experimental designs. The estimation of treatment Effects.

STAT 310 Data Analysis II (Pre-req. STAT 202, 203)

Summary Statistics for Multivariate Data. Data Presentation and Report Writing. Random Sample Selection. Discrete Analysis. Fitting and Testing Probability Models. Regression and Curve Fitting. Analysis of Experimental Data.

MATH 331 Linear Algebra: (Pre-requisite MATH 201)

Linear combinations, generating vector spaces form subsets of a given vector spaces. Spanning sets. Subspaces, linear systems and solution spaces. Bases Linear maps and their matrices. Composite linear maps and matrices. Inverse linear maps. Range space, rank, kernel. Effect of change of basis on the matrix. Eigenvalues and eigenvectors. Diagonalisation of a linear operator. Diagonalizing matrices. Diagonalization theorem. Finding a basis of eigenvectors. An application: classification of plane maps. Symmetric maps, matrices and quadratic forms.

MATH 336 Multivariate Calculus And Partial Differential Equations

The divergence and curl operators. Line integral, surface integral and volume integral. Green's theorem, divergence theorem and Stokes' theorem: applications. Fourier series and Fourier Transforms. Orthogonal sets of functions. Partial differential equations: first order and second order with constant coefficients. Classification of second order partial differential equations; elliptic, parabolic and hyperbolic types. Initial and Boundary Value Problems. Method of separation of variables. Applications to Heat conduction, vibrating strings. One-dimensional wave equation. Laplace Equation.

STAT 403 Theory of Sampling (Pre-req. STAT 204)

Analysis and comparison of various sampling schemes. Optimal designs.

STAT 404 Survey Organisation and Management (Pre-req. STAT 305)

Multisubject and specialized Socio-Economic Surveys. Household Survey. Planning, Design and Organisation. Error Control. Problems relating to Concepts, Definitions, Classification and Measurement.

STAT 405 Regression Analysis(Pre-req. STAT 304, MATH 302)

The methods of regression analysis extended to situations involving more than one predictor variable. Special emphasis on problems associated with the presence of several predictors.

Electives: GROUP A (Select Minimum of 6 Credits)

STAT 401 Statistical Inference: Estimation (Pre-req. STAT 301, 303)

The Theoretical basis of the methods of Point and Interval Estimation. Uniformly Minimum Variance Unbiased (UMVU) Estimation, and Maximum Likelihood Estimation.

STAT 402 Statistical Inference: Tests of Hypotheses (Pre-req. STAT 301, 304)

The Theory of Hypothesis Testing. Optimal tests. Uniformly Most Powerful Test. Likelihood Ratio and related procedures.

STAT 406 Multivariate Methods (Pre-req. STAT 302, MATH 302)

Introduction to theory and methods of Multivariate Data Analysis; Estimation and Tests of Hypotheses, Profile Analysis, Multivariate Structure, Discriminant Analysis.

STAT 407 Non-Parametric Statistics (Pre-req. STAT 303, 304)

Some Single Sample problems; the problem of location, The Sign Test, The wilcoxon signs Ranks test. Some Two-Sample Problems: The Chi-Square Test for Homogeneity, The Median Test, The Mann-Whitney-Wilcoxon Test. Chi-Square Tests of Independence. Some Users of Order Statistics Distributions under alternative Hypotheses.

STAT 408 Analysis of Experimental Designs (Pre-req. STAT 306)

Model specialication for single-factor and mult-factor designs. Main effects, specific effects and interactions. Estimation. Multiple Comparisons. Analysis of covariance.

Electives: GROUP B (Select Minimum of 9 Credits)

STAT 411 Introduction to Stochastic Processes (Pre-req. STAT 301)

Stochastic models in the natural and social sciences. Some discrete and continous time processes. Basic theory and Applications.

STAT 413 Population Statistics

Demographic Concepts and Measures. Collection and Evaluation of demographic data. Analysis of Demographic data. The Dynamics of Population change.

STAT 414 Biometrics (Pre-req. STAT 301)

Biological assay, Analysis of quantal responses. Agricultural and Clinical Trials. Sampling and Estimation of Biological Populations.

STAT 415 Actuarial Statistics I (Financial Statistics) (Pre-req. STAT 301)

Principles of time value of money. Concepts of Compound Interest and Discounting. Interest or Discount Rates. Compound Interest Functions. Investment Projects appraisals. Stochastic Interest Rate Models.

STAT 416 Actuarial Statistics II (Pre-req. STAT 415, Recommeded STAT 413)

Principles of simple life insurance and annuity contracts. Means and variances of payment under these contracts. Determination of expected present value and variances of benefits. Determination of net premiums and net premium policy values. Survival models.

STAT 417 Economic and Social Statistics I (Pre-req. STAT 206)

Statistics on Economic and Social Activities and Trends, and their uses. Methods and Sources of Data Collection. Indices and Indicators of Economic Activity. Indicators of Social Development and Living Standard.

STAT 418 Economic and Social Statistics II (Pre-req. STAT 407)

Introduction to the System of National Accounts (SNA). The System, its Accounts and their corresponding economic activities. Input-Output Tables. Social Accounting.

ECON 403 Econometrics I (Prerequisite: ECON 305 and 306)

The Meaning and Purpose of Econometrics: Econometrics of Demand. Econometric demand equations. Theory of the disturbance term. Cross-sectional analysis, and Engel curves.

Econometric Methods: Least Square (LS) Tests of original hypotheses, and analysis of residuals. A battery of statistical and economic tests of the economic and statistical hypotheses of the equation of relation; co-efficient of correlation, determination, variation; t-tests; test for randomness or serial correlation of the disturbances of graphing the residuals, and by the Durbin-Watson 'd' statistic. The general linear equation of relation with many variables estimated by classical least square, and using matrix methods. The sample error co-variance matrix of estimated parameters. Econometrics of the Firm and of Supply.

ECON 404 Econometrics II (Prerequisite: ECON 305 And 306)

Models Embodying Many Equations: Least squares bias in the estimation of parameters in simultaneous equations systems. Elementary methods of attaching this bias problem. Indirect Least Squares (ILS); Instrumental Variables (IV); Two Stage Least Squares (TL); Rules for testing identification. Laboratory exercise involves a simple three equation model of the economy of Ghana, in which one over-identified three variable equation is estimated by LS and TL. The TL result is put through all of the tests.

Miscellaneous Econometric Problems: Collinearity of explanatory variables. Delayed responses and lagged variables. Estimation when disturbances are serially correlated. Use of artificial or shift variable (dummy variables). Testing for change of structure -- the Chow Test.

Electives: Group C (Select Minimum of 6 Credits)

MATH 333 Analysis I

Norm on a vector space. Open and closed balls in a normed vector space. Maps between normed vector spaces. From normed vector spaces to metric spaces. Continuity of maps between normed vectors spaces (or metric spaces). Inequality form of the definition. The algebra of continuous functions. Bounded sets of real numbers; upper (lower) bound, least upper (greatest lower) bound, maximum (minimum). Limit of a sequences; uniqueness of limit, finite alterations, shifting sequences, linearity of limit and continuity via sequences. Subsequences. Lm inf, lim sup. Theorems for real – valued sequences; products and quotients, preserving inequalities and the squeeze (sandwich) principle.

MATH 334 Analysis II

Series as the sequence of n 'th partial sums. Existence of limits; increasing (decreasing) sequences bounded above (below). Series with positive terms. Convergence tests. Absolute convergence. Cauchy sequence and completeness. Definition of integral and continuity as criterion for integrability. Sequences of functions. pointwise and uniform convergence. Power series. The contraction mapping theorem and application. Real analysis. Proof of the fundamental theorem of calculus and of the major basic results involved in its proof: mean-value theorem, Rolle's theorem, maximum value theorem, intermediate value theorem.

MATH 335 Ordinary Differential Equations

Differential forms in R^2 and R^3 exactness conditions, and the condition for integrability. Linear first order and higher orders. Existence, independence and uniqueness of solutions, the Wronskian. Ordinary differential equations with variable coefficients. Methods of solutions of; reduction of order, variation of parameters solution in power series, ordinary and regular singular points. Frobenius theorem. A brief discussion of Legendre and Bessel equations. Laplace Transforms, the use of Laplace transforms in solving initial-value problems. Applications.

MATH 422: Integration Theory And Measure

Generalisation of the Riemann integral (eg. Kurzweil-Henstock integral). Lebesgue integration, The class of KH integrable functions contains the class of Riemann integral functions. convergence theorems in the classes of KH-/L- integrable functions, Measurability. Measure.

DEPARTMENT OF ZOOLOGY

FACULTY

D.O. Owusu , <i>BSc (Ghana) MSc (Kochi) Ph.D (Ehime) EMBA (Ghana)</i> -	Associate Professor/ Head of Department
Yaa Ntiamoah-Baidu , <i>BSc (Ghana) Ph.D (Edinburgh)</i> -	Professor/Dean, SRGS
C. Gordon , <i>BSc (Ghana) MSc (Ghana) PhD (London)</i> -	Associate Professor (VBRP)
D. A. Edoh , <i>BSc (KNUST) MPhil (KNUST) PhD (Basel)</i> -	Associate Professor
D. K. Attuquayefio , <i>BSc (Ghana) MSc (Aberdeen) PhD (Guelph)</i> -	Associate Professor/ Co-ordinator, Environmental Science Programme
D.N.D. Wilson , <i>BSc (Ghana) MSc- (Louisiana) PhD (Georgia)</i> -	Senior Lecturer
Millicent A. Cobblah , <i>BSc (Ghana) MPhil (Wales)</i> -	Senior Lecturer
L. Bimi , <i>BSc (Ghana) MPhil (Ghana) PhD (Ghana)</i> -	Senior Lecturer
Rosina I. Kyerematen , <i>BSc (Ghana) MPhil (Ghana) PhD (Bergen)</i> -	Senior Lecturer
G. A. Darpaah , <i>BSc (Ghana) MSc (Port Harcourt)</i> -	Research Fellow/VBRP
Regina D. Yirenya-Tawiah <i>BSc, (Ghana) M.Phil (Ghana) MPA (Maasricht)</i> -	Research Fellow (VBRP)
F. Gbogbo , <i>BSc (Ghana) MSc (Strathelyde)</i> -	Lecturer
G. Futagbi , <i>BSc (Ghana) M.Phil (Ghana)</i> -	Lecturer
L. H. Holbech , <i>BSc, MSc, Ph.D, (Copenhagen)</i> -	Lecturer
E. H. Owusu , <i>BSc (KNUST) PhD (Kent)</i> -	Lecturer
I. F. Aboagye , <i>BSc (Ghana) M.Phil (Ghana) M.Sc (Nottingham)</i> -	Lecturer
M. K. Billah , <i>BSc (Ghana) M.Phil (Ghana) Ph.D (Ghana)</i> -	Lecturer

LEVELS 200, 300 & 400 COURSES

BSc Single Subject Major

Core		
BIOL 201	Introductory Plant Morphology	3
BIOL 202	Introductory Cell Biology & Genetics	3
BIOL 203	Introductory Animal Biology	3
BIOL 204	Introductory Plant & Animal Ecology	3
CHEM 201	Practical Chemistry I	1
CHEM 231	Organic Chemistry I	2
CHEM 232	Organic Chemistry II	2
PHYS 203	Properties Of Matter And Vibrational Motion	3
ZOOL 301	Comparative Chordate Biology	3
ZOOL 302	General Entomology	3
ZOOL 303	Comparative Physiology	3
ZOOL 304	Parasitology and Public Health	3
BIOL 315	Principles of Genetics	3
BIOL 316	Environmental Zones of West Africa	2
BIOL 317	Biometry	2
BIOL 318	Introductory Oceanography & Limnology	3
ZOOL 401	Animal Behaviour	2
ZOOL 403	Environmental Physiology	3
ZOOL 405	Animal Ecology	3
ZOOL 409	Marine Biology	2
ZOOL 410	Project	6
ZOOL 411	Freshwater Zoology	2
ZOOL 413	Conservation Biology	2
ZOOL 415	Evolution	1

Electives

Group A:

Students will be required to take a minimum of 12 credits from Level 300 in Biochemistry, Botany, Chemistry, Nutrition and Food Science, Oceanography and Fisheries and Psychology. Students are required to seek advice from the Departmental Course Adviser before choosing their courses.

Group B:

A minimum of 12 credits to be taken from this section.

ZOOL 402	Applied Entomology	3
ZOOL 406	Vertebrate Biology	3
ZOOL 407	Population Ecology	3
ZOOL 408	Epidemiology of Parasitic Diseases	3
ZOOL 414	Oceanography	3
ZOOL 416	Fishery Biology	3
ZOOL 418	Limnology	3
ZOOL 422	Wildlife Management	3
ZOOL 424	Advanced Genetics (3 credits)	

BSc Combined Subject Major.

Core

BIOL 201	Introductory Plant Morphology	3
BIOL 202	Introductory Cell Biology & Genetics	3
BIOL 203	Introductory Animal Biology	3
BIOL 204	Introductory Plant & Animal Ecology	3
CHEM 201	Practical Chemistry I	1
CHEM 231	Organic Chemistry I	2
CHEM 232	Organic Chemistry II	2
PHYS 203	Properties Of Matter And Vibrational Motion	3
ZOOL 301	Comparative Chordate Biology	3
ZOOL 302	General Entomology	3
ZOOL 303	Comparative Physiology	3
ZOOL 304	Parasitology and Public Health	3
BIOL 315	Principles of Genetics	3
BIOL 316	Environmental Zones of West Africa	2
BIOL 317	Biometry	2
BIOL 318	Introductory Oceanography & Limnology	3
ZOOL 401	Animal Behaviour	2
ZOOL 403	Environmental Physiology	3
ZOOL 413	Conservation Biology	2
ZOOL 415	Evolution	1

Electives

Group A:

Students will be required to take a minimum of 12 credits from the Level 300 in Biochemistry, Botany, Chemistry, Nutrition and Food Science, Oceanography & Fisheries and Psychology. Students are required to seek advice from the Departmental Course Adviser before choosing their courses.

Group B: A minimum of 12 credits to be taken from this section.

ZOOL 402	Applied Entomology	3
ZOOL 404	Experimental Zoology	3
ZOOL 405	Animal Ecology	3
ZOOL 406	Vertebrate Biology	3
ZOOL 407	Population Ecology	3

ZOOL 408	Epidemiology of Parasitic Diseases	3
ZOOL 409	Marine Biology	2
ZOOL 410	Project	6
ZOOL 411	Freshwater Zoology	2
ZOOL 414	Oceanography	3
ZOOL 416	Fishery Biology	3
ZOOL 418	Limnology	3
ZOOL 422	Wildlife Management	3
ZOOL 424	Advanced Genetics	3

COURSE DESCRIPTIONS

BIOL 201 Introductory Plant Morphology

Survey of the form of the vegetative and reproductive body of seed plants. Primary meristems and development of the primary vegetative body angiosperms; internal organization of the primary vegetative body and the relationship between structure and function of tissues; mechanism and importance of secondary growth in dicotyledons; brief survey of the relationship between structure and industrial uses of secondary tissues.

BIOL 202 Introductory Cell Biology & Genetics

Basic cell physiology-bioelements, water, water in cells, method of expressing concentrations of solutions, osmotic phenomena, imbibition, biomolecules, carbohydrates, amino acids, proteins, lipids, nucleotides, nucleic acids, and the role of these in either cell biology and/or structure, enzyme action; photosynthesis, respiration and nitrogen metabolism. Basic principles of genetics; gene interactions, sex and inheritance; chemical basis of heredity; mutations, medical and biochemical genetics.

BIOL 203 Introductory Animal Biology

General survey of invertebrates and vertebrates with reference to form and function. Phylogeny, life-cycles. Morphological and physiological adaptations to ways of life.

BIOL 204 Introductory Plant & Animal Ecology

Basic principles of quantitative plants ecology; plant and animal life in West Africa. Introduction to description and classification of plant communities; climax v egetation; the West African environment; types of forest in West Africa. Basic concepts in plant and animal ecology; plant and animal communities and the biology of animal population.

CHEM 201 Practical Chemistry I

Basic techniques in volumetric and gravimetric analyses. Introduction to methods for preparing and purifying organic compounds.

CHEM 231 Organic Chemistry I

Stereoisomerism; optical activity. Various methods for the oxygenation of alkenes. Chemistry of alcohols and ethers; S_N1, S_N2, E-1 and E-2 mechanisms.

CHEM 232 Organic Chemistry II

The chemistry of Aldehydes, Ketones, Carboxylic acids. Carboxylic acid derivatives and Amines.

PHYS 203 Properties Of Matter And Vibrational Motion

(For students in the Biological Sciences only.)

1. Properties Of Matter

Solids: *Elastic and Plastic properties

Liquids: *Laminar and turbulent flow; Bernoulli's principle. *Viscosity; Brownian motion

Gases: *Simple kinetic theory; Specific heats. *Real and Ideal Gases. *Laws of Thermodynamics. *Diffusion

2. **Vibrational Motion**

Circular Motion: *Uniform Circular Motion; Centripetal Acceleration. *Conical Pendulum. *Forces on vehicles rounding a curve; Banking. *Motion in a vertical circle. *Motion of a satellite

Harmonic Motion: *Definitions; Restoring force; Equations of Simple Harmonic Motion. *Simple Pendulum; Mass attached to a spring; Angular Harmonic Motion; Electrical Oscillations; Energy in Simple Harmonic Motion. *Damped Harmonic Motion – logarithmic, decrement, overdamped, underdamped and critical damping. *Forced Oscillations, Resonance; Damped and Forced electrical oscillations

Waves: *General characteristics, Interference, Diffraction. *Resolution; Rayleigh's criterion; Resolving power; Resolution limit in optical instruments.

ZOOL 301 Comparative Chordate Biology

Systematics of the chordates; comparative biology of lower chordates; biology of agnathous vertebrates biology and evolutionary relationships of the vertebrates; comparative embryology of chordates.

ZOOL 302 General Entomology

The morphology, physiology, classification and ethology of insects and related terrestrial arthropods.

ZOOL 303 Comparative Physiology

Comparative physiology of nutrition and digestion; respiration and metabolism; respiratory proteins and body fluids, ionic, osmotic relations and excretion, excretory substances and pathways, excretory organs; muscles and muscular activity, nerves and nervous activity; the brain and sense organs; hormones and reproduction; the physiology of reproduction.

ZOOL 304 Parasitology and Public Health

Basic principles of parasitism, survey of important parasitic groups; detailed discussion of some parasites with emphasis on those of medical and economic importance; parasitic arthropods; bacterial and viral diseases (including leprosy) and their spread in the community; food hygiene; environmental hygiene, cancers and AIDS; organization of Public Health Laboratory services.

BIOL 315 Principles of Genetics

Introduction to the principles of genetic and chromosome cytology from the molecular to the population aspects, including applications of the principles in animal breeding, plant breeding and applied human genetics.

BIOL 316 Environmental Zones of West Africa

General distribution of vegetation types in relation to climate and soils. Forest and savanna and their inter-relationships. Strand, mangrove, lagoon and montane vegetation. Human ecology. The vegetation of the Accra Plains.

BIOL 317 Biometry

Statistics as a tool in biological research; quantitative methods in biology. Basic experimental design, sampling, representation of data; sets, matrices and basic statistical methods including different statistical software for data analyses. Field data collection and report writing.

BIOL 318 Introductory Oceanography & Limnology

Origins of seas, lakes and streams. Water – properties of biological importance. Factors determining water circulation; effects of water circulation upon productivity. Water pollution, utilization and conservation. Biotic communities: adaptation and distribution. Phytoplankton: distribution, including temporal and spatial changes in relation to physio-chemical and biological factors in the environment. Characteristics of fresh and estuarine water, life in freshwater and estuaries.

ZOOL 401 Animal Behaviour

Factors that affect behaviour of animals; analyses of complex behaviour patterns involved in activities like feeding, reproduction, sociality and migration.

ZOOL 402 Applied Entomology

Beneficial and harmful insects; principles and ecological basis of insect pest control; control methods; use of resistance and semiochemicals in control; integrated pest management; biology, control and management of insects of field crops, vegetable crops, tree crops and stored produce.

ZOOL 403 Environmental Physiology

Physiological adaptations of animals to the marine, freshwater and terrestrial environment; temperature and animals; water and animals: ionic and osmoregulation in aquatic animals, water balance in terrestrial animals; light and animals, water rhythms, seasonal cycles, light production in animals; adaptation to extreme environments; animals at high altitude, divers and hydrothermal vents.

ZOOL 405 Animal Ecology

The concept of the niche overlap and competition; ecological segregation; species diversity – measurement and examination of causes of diversity differences; ecological energetics – food chains, energy flow, ecological efficiencies, productivity; methods of assessing the diet and food intake; construction of food webs; methods of estimating production and construction of energy budgets; predator-prey relationships; introduction to population ecology.

ZOOL 406 Vertebrate Biology

Structural and physiological adaptations of vertebrates to their environments; snakes evolution, biology and toxicology; structural adaptations of birds for flight; mechanics of flight; migration; mammalian characteristics and their functional integration, social behaviour, nervous system; evolution of teeth, jaw and skull in vertebrates.

ZOOL 407 Population Ecology

Methods of estimating population density and size; absolute and relative measures; use of indices. Parameters of population dynamics; growth models; natural control and regulation of population sizes; predator-prey relationships; construction of life tables; key-factor analysis.

ZOOL 408 Epidemiology of Parasitic Diseases

History of epidemiology; the dynamic nature of scientific knowledge as a basis for the practice of epidemiology, objectives, method/tools; introduction to modelling, basic definitions; major parasitic disease systems of the tropics – their control and eradication; problems of control.

ZOOL 409 Marine Biology

The sea as an environment; marine plants and primary production; major groups of marine invertebrates – morphology, systematics, biology, life cycles, larva forms, pelagic and benthic life, ecology – structure of marine communities; special ecological areas – intertidal zones, hydrothermal vents, and deep sea habitats.

ZOOL 411 Freshwater Zoology

Composition, ecology and adaptation of invertebrates in lentic and lotic systems; plankton, neuston, benthos and aufwuchs; organisms in special environments; groundwater, swamps, and saline water; temporal and thermal waters; role of vertebrates in aquatic systems; pollution – effects of pollutants on aquatic systems and aquatic organisms; secondary production and energy flow.

ZOOL 413 Conservation Biology

Relation between biological and physical resources; principles of biodiversity conservation; indigenous conservation strategies and introduced management systems of ecosystems and wildlife; conservation of water catchment and soil; environmental pollution; Ghana's Environmental Action Plan; international conservation measures; international conservation treaties; climate change and global environmental problems and their effects on biodiversity.

ZOOL 414 Oceanography

The sea as an environment; water circulation and movement physics and chemistry of sea water; the sea bottom – intertidal, continental and deep sea bottom environments; estuaries – origins, types and characteristics; special inshore environments – lagoons, mangroves, coral reefs; resources of the sea – living and non-living from sea water and sea floor.

ZOOL 415 Evolution

History and concepts of evolution; Darwinism; processes of evolution; natural selection; evidence of evolution; interaction between species and co-evolution; strategies for adaptation and survival; social organization; biogeography.

ZOOL 416 Fishery Biology

Biological parameters of fish populations; gonadal maturation stages; ecology of fish species in Ghanaian waters; theory of fishing; fishery management methods; fishery aspect of water pollution; aquaculture; principles and culture techniques.

ZOOL 418 Limnology

Hydrology: measurement of stream flows and river channels, stream order; lake morphology; types of estuaries; physical aspects of the aquatic environment; thermal properties, light, water movements; chemical aspects of the aquatic environment; global geochemistry; ionic composition of rainwater, rivers, etc.; dissolved gases; nutrients and nutrient cycling; eutrophication; metals in the aquatic environment; environmental effects of dams.

ZOOL 422 Wildlife Management

Ecology of African game animals; methods of study; ecology of pastures cropped by game; habitat and harvest management; management techniques; population studies of wildlife animals: game census, wild animal population regulation; capture techniques; threatened species management; protected area system; wildlife conservation within and outside protected areas; wildlife utilization, domestication and ranching; Ghana's wildlife conservation policy; International Wildlife Laws.

ZOOL 424 Advanced Genetics

Molecular genetics; chromosome organization; variety of genetic systems as illustrated by micro-organisms; **Drosophila**, **Musca**, Lepidoptera, mosquitos, mammals including man; hydrocarbons for parasites and vector identification.

CALENDAR FOR 2009 - 2010 ACADEMIC YEAR

FIRST SEMESTER

Freshmen Report	-	Wednesday August 5- Saturday August 8, 2009
Orientation for Freshmen	-	Monday August 10 – Friday August 14, 2009
Continuing Students Report	-	Wednesday August 12, 2009
Registration ends for Freshmen/ Continuing Students	-	Monday August 17, 2009
Teaching Begins	-	Monday August 17, 2009
Deadline for Registration	-	Monday August 17, 2009
Deadline for Add/Drop of Courses	-	Friday September 4, 2009
Matriculation	-	Saturday September 5, 2009
Deadline for Departments to Submit Lists of Registered Students by Courses to Academic Affairs	-	Friday September 25, 2009
University Congregation (Science/ College of Agriculture and Consumer Sciences/ Business School/Law/ Engineering Sciences/Graduate School)-	-	Saturday November 7, 2009
Teaching Ends	-	Friday November 13, 2009
Revision Week	-	Monday Nov. 16 – Friday, November 20, 2009
First Semester Examinations	-	Monday Nov. 23 –Saturday, December 12, 2009
Inter-Semester Break	-	5 Weeks (Sat. Dec.12, 2009 - Fri., Jan. 15, 2010)

SECOND SEMESTER

Students report	-	Wed., January 13 – Monday, January 18, 2010
Teaching Begins	-	Monday, January 18, 2010
Deadline for Registration	-	Friday, January 22, 2010
Deadline for Add/Drop of Courses	-	Friday, February 5, 2010
Deadline for Departments to Submit Lists of Registered Students by Courses to Academic Affairs	-	Friday, February 26, 2010
<i>Aggrey-Fraser-Guggisberg Memorial Lectures</i>	-	<i>Wednesday, March 10 – Friday, March 12, 2010</i>
University Congregation (Arts/Social Studies/ Graduate School)	-	Saturday, March 13, 2010
Teaching Ends	-	Friday, April 16, 2010
Revision Week	-	Monday, April 19 – Friday, April 23, 2010
Second Semester Examinations	-	Monday, April 26 – Saturday, May 15, 2010
Second Semester Ends	-	Saturday, May 15, 2010
Long Vacation	-	13 Weeks (Sat., May 15 – Fri., August 13, 2010)