# GUIDELINES
*for*
# POSTGRADUATE STUDIES

**2019/2020**

# SCHOOL OF POSTGRADUATE STUDIES
## GENERAL REGULATIONS FOR POSTGRADUATE PROGRAMMES
## 2019/2020 ACADEMIC YEAR

## INTRODUCTION

This brochure is specially prepared to afford those who are interested in pursuing postgraduate studies at this University the opportunity of having a firsthand knowledge of programmes available and the regulations thereof.

## ENQUIRIES

All enquiries and/or applications for admission, etc, must be addressed to:

**The Secretary**
School of Postgraduate Studies
University of Mines and Technology
Post Office Box 237
Tarkwa, Western Region
Ghana.
Telephone: +233 (0) 3123 20935, (0) 3123 20324/20280 Ext. 228
Facsimile: +233 (0) 3123 20306
Email: SPS@umat.edu.gh

## BOARD OF SCHOOL OF POSTGRADUATE STUDIES

| | |
|---|---|
| Dean, School of Postgraduate Studies | - Chairman |
| Vice Dean | - Member |
| A representative from the Board of each Faculty not below the rank of senior lecturer | - Member |
| HODs of the students concerned | - Member |
| Faculty Officer of the School not below the rank of Assistant Registrar | - Secretary |

## FUNCTIONS OF BOARD OF POSTGRADUATE STUDIES

i. To give approval of candidatures, supervisors, coursework, theses topics, titles and synopses for higher qualifications based upon the recommendations from the Departmental and Faculty Boards.
ii. To recommend the appointment of Internal and External Examiners in respect of written papers, dissertations or thesis to the Academic Board based upon recommendations from the Departmental and Faculty Boards.
iii. To keep records of all Postgraduate students.
iv. To give provisional approval to postgraduate examination results upon recommendations from the Departmental and Faculty Boards.
v. To liaise with the Deans on postgraduate matters in their various Faculties.
vi. To establish, through the Dean of International Programme, and maintain links with Postgraduate Schools in other universities or institutions and promote exchanges of postgraduate students and staff engaged in postgraduate work between this University and other institutions.

# Table of Contents

# REASONS WHY YOU SHOULD OBTAIN POSTGRADUATE DEGREE AT UMaT

**UMaT is a top standards compliant public funded Engineering University in Ghana.** The University has the best student-teacher ratio in Engineering and Sciences in Ghana, best quality assurance system, competitive fees, attractive fee paying schedule, practical oriented programmes and modern Laboratory facilities.

The University has recently procured and installed world-class ultramodern Environmental Monitoring laboratory to enhance research as well as provide technical services and supports to industries and institutions ranging from Mining and Minerals, Materials, Environmental, forensic, Chemical, Agriculture, oil and Gas, Processing and allied industries. The laboratory facility hosts several major equipment such as Scanning Electron Microscope; Professional Metallurgical Microscopy; Gas Chromatograph-Mass Spectroscopy (GCMS); High Performance Liquid Chromatography (HPLC); UV VIS NIR spectrophotometer, Carbon/Sulphur Analyser, Mastersizer and Zetasizer; Atomic Absorption Spectroscopy and Flame photo meter, Portable XRF, Metalizers, Dust and Gas monitors. Amongst the several analyses that could be done by the laboratory are; Physico-chemical parameters of effluent/waste water, Soil nutrients and contaminants, Metals and heavy metal analyses, Mineralogical and chemical studies of ores (e.g., mineral abundances, Grain size , degree of liberation, Microstructure analyses of materials (e.g, steel balls, metals), BOD and COD determinations, Air Pollution, Airborne/Ambient Particulate studies, Dust characterisation, Flue gas Monitoring, Sewage effluent analyses, Landfill gas analyses, Vehicle Exhaust Gas Sampling, Analyses and Monitoring, tracking of organic and inorganic contaminants/components in the environment or samples.

- You can audit our modules without registering as a student. These will be credited to you if you register within 2 years.

# 1 INTRODUCTION

The University of Mines and Technology (UMaT) started in 1952 as the Tarkwa Technical Institute. In 1961, it was reorganised to become the Tarkwa School of Mines to train the required manpower for the mining and allied industries in Ghana. In 1976, the School was affiliated to the Kwame Nkrumah University of Science and Technology (KNUST) as a faculty of that University. It became the Western University College of KNUST in 2001. UMaT was established in November 2004 by an Act of Parliament (Act 677), with powers to confer its own degrees.

## 1.1 VISION STATEMENT

The vision of the University is to become a Centre of Excellence in Ghana and Africa for producing world-class professionals in the fields of mining, technology and related disciplines.

## 1.2 MISSION STATEMENT

The mission is to provide higher education in mining, technology and related disciplines, to promote knowledge through effective teaching and learning; to promote knowledge through active research and dissemination of information and to offer professional services through extension activities to the mining and allied industries.

## 1.3 CORE VALUES

Knowledge, Truth and Excellence

# 2 PROGRAMMES

## 2.1 DEGREES AND DIPLOMAS

All postgraduate programmes of study in the University may require coursework together with research work, leading to the award of the following:

- Postgraduate Diploma (PgD)
- Master of Science (MSc)
- Master of Philosophy (MPhil)
- Doctor of Philosophy (PhD)

Postgraduate Diploma programmes are offered by some Departments.

# 3 GENERAL REGULATIONS

## 3.1 APPLICATIONS AND PROCEDURE FOR ADMISSION

Applications for admission shall be made on a prescribed form obtainable on-line at www.umat.edu.gh, to which the completed form shall be returned not later than the 30th April preceding the academic year in which a candidate wishes to start the programme or any other approved deadline.

All candidates applying for admission to research programmes shall be required to submit (in about 700 and 2,000 words for MPhil and PhD respectively) an outline of proposed research.

Applications shall then be considered, in the first instance, by the appropriate Departmental Board. The Departmental Board shall satisfy itself of the suitability or otherwise of the candidate and the availability of resources for the successful completion of the candidate's work. Where an interview or a qualifying examination is required for determining the suitability or otherwise of an applicant, the Departmental Board shall decide the form of interview or qualifying examination and appoint a panel from its members to administer the interview or examination. The School of Postgraduate Studies shall be represented at such interview or examination.

The Head of Department shall submit to the School of Postgraduate Studies for its approval, a list of candidates recommended for admission together with:

(a) The pertinent extracts from the minutes of the Departmental Board meeting

(b) Statement on the nature of the programme

(c) Dissertation/thesis topic(s) and an outline of the proposed research (where applicable)

(d) Name(s) of proposed Internal Supervisor(s).

### 3.2 DESCRIPTION OF POSTGRADUATE STUDIES

Postgraduate studies shall be categorised under two main headings: namely, full-time and part-time.

A full-time study shall be completed within a maximum duration of twenty-four months from the date of commencement of the academic year in which the student was enrolled for a master's programme and thirty-six months for a doctorate programme. A full time student is one who is fully engaged in a programme of study and research throughout the entire duration of his/her programme.

A part-time study shall be completed within a maximum duration of thirty-six months from the date of commencement of the academic year in which the student was enrolled for a master's programme and forty-eight months for a doctorate programme.

These maximum durations may be extended by the Board, on the recommendation of the Supervisor through the Departmental and Faculty Boards, by periods not more than six months to a maximum of one year.

### 3.3 REGISTRATION OF PROGRAMMES

#### 3.3.1 Registration Process

(a) Students admitted to the Postgraduate programmes of this University shall register at their respective Departments and at the School of Postgraduate Studies at the beginning of each semester by filling in the appropriate forms prescribed for that purpose. The student shall plan his/her courses in consultation with his/her Supervisor.

(b) Full time students will be required to register a minimum of three (3) modules per semester.

(c) Students should register modules they intend to participate in by the third week of every semester.

(d) To be of good standing a part-time student must do, at least, three modules per annum.

(e) A student who is unable to register within the formal registration period on grounds of ill-health, shall on provision of a Medical Report issued or endorsed by the University Medical Officer, be allowed to register within ten days from the day of the closure of formal registration.

(f) In the event of the inability of such a student to register within the ten days stipulated in paragraph (e) above, he/she will be allowed a deferment for a semester. In a situation where the first semester courses are prerequisite for the second semester courses, the deferment shall be for the whole academic year (i.e. two semesters).

(g) There shall be no registration by proxy.

(h) In circumstances of force majeure the case shall be referred to the Vice Chancellor.

#### 3.3.2 Minimum Credits

The minimum number of credit hours required by a student to qualify for a Postgraduate degree shall be determined by the School of Postgraduate Studies/Department as indicated in Table 3.1:

Table 3.1: Minimum Credit Hours

| Programme | Course Work | Research* |
|---|---|---|
| Postgraduate Diploma | 24 | 9 |
| MSc | 24 | 18 |
| MPhil | 15 | 27 |
| PhD | - | 36 |

*The above credit hours for research are inclusive of seminar and theses.

*NB: A prospective applicant may participate in a module(s) within two (2) years prior to applying for a Postgraduate programme. The results of such a module(s) shall, upon request by the applicant, be credited to him/her upon admission.*

### 3.3.3 Penalties for Late Registration

A fine to be determined by the University shall be imposed for late registration. Formal registration ends on the last day of the period of registration.

### 3.3.4 Deferment of Programme

(a) A student could interrupt his/her programme for whatever reason for a maximum period of one year, but he/she must be granted permission by the Board of Postgraduate Studies through his/her Head of Department. Such a request for interruption of the programme shall normally be granted within the first four weeks of the start of the semester.

(b) A first year Postgraduate student shall not be allowed to defer his/her programme.

(c) However, a first year student may be granted permission to defer his/her programme on medical grounds on the recommendation of the University Health Authorities.

### 3.3.5 Change of Programme

Students are not normally allowed to change their programmes of study. A student who wishes to change his/her programme would have to re-apply for admission into the new programme and start from year one as a fresh student. It should be noted that admission into the new programme is not automatic. The applicant must meet the entry requirements of the new programme and compete with all other applicants for admission.

## 3.4 ACADEMIC CALENDAR

The semester periods shall be:

| | |
|---|---|
| First Semester | June to November |
| Second Semester | December to May |

## 3.5 COURSE DELIVERY ETHICS

### 3.5.1 Responsibilities of Lecturers

The Lecturer is expected to:

(a) Be punctual and regular at all lectures. Students should be informed well ahead of time for any justifiable and unavoidable absence.

(b) Prepare lecture material and provide information to students on relevant textbooks, journals and any other reading material which would promote effective teaching and learning.

(c) Use appropriate teaching and learning methods to ensure that the subject matter is effectively delivered and well covered in order to achieve the set objectives of the course.

(d) Conduct continuous assessment tests (quizzes, class tests, project work, assignments, etc.) and make all scores known to students.

(e) Conduct an end-of-module examination and submit a final score and grade for each student within four weeks after the examinations to the Dean of Postgraduate Studies and copy the Head of Department of the student(s) concerned.

(f) Continuously improve lecturing skills to generate students' interest and facilitate their understanding.

### 3.5.2 Responsibilities of Students

The student (learner) is required to:

(a) Be present and punctual at all scheduled lectures, laboratory sessions, field work, tutorials, quizzes and examinations for the course.

(b) Obtain prior permission from the lecturer for justifiable and unavoidable absence from class. In case of illness, it is the responsibility of the student to obtain a medical report certified by the UMaT Medical Officer for onward submission to the Department.

(c) Prepare well in advance for every lecture.

(d) Submit all assignments/test papers, etc. for the course in time.

(e) Bring to the notice of the lecturer anything that is not understood and ask for explanation.

(f) Ask for the results of any tests, assignments, laboratory work, etc. to be delivered in time.

(g) Assess the course lecturer at the end of the module.

*NB: A student who fails to present a registered seminar on an agreed date without permission shall pay a penalty of 20% of the seminar module fee before he/she shall be allowed to present at the next scheduled date.*

### 3.5.3 Thesis Supervisor

Every registered student of the University shall have a Thesis Supervisor(s) who shall mentor the student on academic issues at the beginning of the programme. The Supervisor shall guide the student in the thesis. It behoves on the student to seek academic advice from his/her Supervisor(s) when the need arises. Among the responsibilities of supervisors are to:

i. Ensure that the student is introduced to the facilities of the Faculty or School and the University that are relevant to the research and that he or she is fully aware of relevant Health and Safety regulations;

ii. Assist the student in defining the topic which is to be tackled in the course of the research. It is vital that this should give sufficient scope for investigation appropriate to the degree, but not be so large a topic that it cannot be mastered within the normal period of the candidature;

iii. Assist the student to clarify the research question(s) which the study seeks to address, and to establish details of the research programme, such as resources required and, where appropriate, the experimental design;

iv. Approve a timetable of work and endeavour to see that it is followed. Supervisors should emphasise to students that the University attaches great importance to the timely completion of research;

v. Conduct, with the student, a training needs analysis within the first semester of commencement of study and agree on a training plan;

vi. Agree on a supervisory programme with the student and arrange regular meetings with the student;

vii. Prepare regular reports on the student's progress. Ensure, in partnership with the student, that there are written records of formal supervisory meetings;

viii. Provide comments within a reasonable time on written work submitted by the student;

ix. Read and comment on the whole of the draft thesis prior to submission provided that it is made available by the student in reasonable time. It is essential that a timetable for submission of the draft thesis is agreed with the student in advance of the maximum time limit which allows the supervisor a reasonable length of time to carry out this duty and for the student to act on any comments received. Any planned periods of absence by the supervisor from the University should be taken into account; and

x. Submit recommendations for the appointment of Examiners to the Head of Department.

### 3.5.4 Class Attendance Policy

A student shall attend all lectures, seminars, workshop sessions and practicals prescribed for the modules for which he/she has registered as a pre-condition for writing an examination. Any student who absents himself/herself for a total of 30% or more of the time for lectures, tutorials and practicals of any module without proper permission shall be deemed not to have satisfied the attendance requirements for the module and shall not be allowed to take part in the end of module examinations of that module.

### 3.5.5 Board of Postgraduate Studies

The Board of Postgraduate Studies shall meet after every semester to consider the examination results, review the performance of students and make appropriate recommendations to the Academic Board.

### 3.5.6 External Examiners

(a) External Examiners shall be appointed by the Academic Board upon recommendations by Postgraduate, Faculty and Departmental Boards. External Examiners shall normally hold office for five (5) consecutive years. The External Examiner should show significant contribution in the area concerned.

(b) External Examiners shall be present for the conduct of oral examinations.

(c) External Examiners together with the internal examiners may recommend to the School of Postgraduate Studies that a candidate whose thesis is not up to the required standard be permitted to re-submit his/her thesis in a revised form within a specified period up to a maximum of six (6) months for oral examination.

(d) Where a candidate fails to pass the oral examination for the first time, External Examiners together with the Internal Examiners may advise that the candidate re-submits his/her thesis in a revised form within a specified period up to a maximum of 90 days for an oral examination.

(e) Where a candidate fails to pass the oral examination for the second time, External Examiners together with Internal Examiners may advise that the candidate re-submits his/her thesis in a revised form within a specified period up to a maximum of 90 days for the award of either an MPhil degree (for PhD) or Postgraduate Diploma (for MSc) if the candidate so wishes.

(f) External Examiners together with the Internal Examiners shall submit their recommendations to the Dean of Postgraduate Studies in the form of a joint report signed by both Internal and External Examiners with respect to the oral examination, and separate reports with regard to the thesis on the basis of prescribed criteria.

### 3.5.7 Academic Quality Assurance

UMaT pride itself in providing the learner with quality education. In view of this, the Planning and Quality Assurance Unit (PQAU) established in the University for the maintenance and continuous improvement of academic standards, conduct tracer studies, needs assessment for curriculum review process across the university. PQAU shall monitor and evaluate both instructional quality and student performance as well as organise seminars and training programmes towards academic quality improvement. The unit shall evaluate lecturers' performance based on peer and students' evaluation of the lecturers.

## 3.6 EXAMINATION RULES AND REGULATIONS

### 3.6.1 Duration of End of Module Examination

The time allowed for end-of-module examination is determined by the Course Lecturer but shall not be less than three hours.

### 3.6.2 Qualifications to Write UMaT Examinations

Candidates who qualify to write Examination shall:

(a) Be registered for the module and not have absented themselves for 30% or more of the total attendance for the module.

(b) Have continuous assessment marks for relevant subject areas.

(c) Show proof of payment for the module.

(d) Not have been rusticated from the University or deferred the programme.

### 3.6.3 Instructions to Candidates

(a) All examinations shall be conducted during the period that the module is being run and the Lecturer shall inform students about the venue(s) for all examinations.

(b) If it should become necessary for any changes to be made in the examination schedule, candidates shall be informed accordingly by the Course Lecturer.

(c) Candidates shall report at the Examination Room 15 minutes before the time fixed for the beginning of the Examination and on entering the Examination Room, candidates should occupy the places assigned to them by the Invigilator.

(d) No candidate shall enter the Examination Room more than thirty minutes after the start of an Examination.

(e) No candidate shall be allowed to leave the Examination Room until thirty minutes after the start of Examination.

(f) Candidates are to have in their possession their identity cards (either University or nationally recognised, as the case may be), since these will be checked by the Invigilators before candidates are allowed to take the Examinations.

(g) Candidates shall not take booklets, paper or written information of any kind to the Examination Room unless they are specifically permitted to do so.

(h) Candidates are to write their index numbers on the question papers and sign. Candidates shall not write their names on the answer booklet unless otherwise stated.

(i) Candidates may leave the Examination Room temporarily only with the express permission of the Invigilator.

(j) Any candidate leaving an Examination Room and intending to return shall be accompanied while outside by security personnel appointed for that purpose. Every necessary precaution shall be taken by the Invigilator, including physical search of the candidate, before he/she leaves the Examination Room and on his/her return. The maximum time the candidate can be away shall be indicated by the Invigilator.

(k) Smoking is not allowed in the Examination Room.

(l) Mobile phones, PDAs (e.g. MP3, MP4, iPad, etc), briefcases, software, etc are not allowed to be used by students in the Examination Room unless otherwise permitted.

(m) Each candidate shall search himself/herself and surrender any foreign material he/she may have inadvertently brought into the exams room.

(n) The University shall not be responsible for the safety of any item left outside the Examination Room.

(o) Programmable calculators are not allowed. However, scientific calculators may be allowed.

(p) There shall be no communication between candidates in the Examination Room except otherwise permitted. A candidate may borrow any material from a colleague during examination only with the express permission from the invigilator.

(q) At the end of each Examination session, candidates should not take away any used or unused answer booklet. In any case, no material supplied for the Examination shall be taken out without authorisation.

(r) Where a candidate infringes on the preceding regulations, Table 5.1 shall apply and such a candidate risks OUTRIGHT DISMISSAL from the University.

### 3.6.4 Absence from Examination

A Candidate who fails to write a paper, except on medical grounds, shall be deemed to have failed the Examination. In the case of absence from Examination due to ill-health, the candidate or someone acting on his/her behalf must submit a relevant medical certificate which must be received within 14 days after the date of the paper.

### 3.6.5 Examination Offences and Penalties

Examination offences, which shall be understood to mean any attempt on the part of candidates to gain an unfair advantage in Examinations, shall be investigated by the School of Postgraduate Studies (SPS). The Dean shall inform the Vice Chancellor about the incident and appoint a committee made up of a Head of Department as chairman, School of Postgraduate Examinations Officer, Supervisor of the Student and two student representatives, with the SPS Officer as the Secretary to investigate all reported cases of Examination Malpractice. Detailed reports shall be submitted to the Vice Chancellor not later than fourteen days after the Examinations. If found guilty, the appropriate penalty shall be meted out to the offender according to Table 3.2.

**Table 3.2 Offences and Penalties**

| Offence | Penalty |
|---|---|
| i. Leakage of Examination Questions/Mass Cheating | Cancellation of papers, dismissal of offenders involved and prosecution |
| ii. Possession of foreign materials such as notes, textbooks, prepared material or any other printed material related to the examination and likely to be used during examination, unless otherwise permitted by the Examiner. | Cancellation of the candidate's particular paper(s) and dismissal of offenders |
| iii. Irregular activities inside or outside the Examination Room. For example, tearing part of Question Paper/Answer Booklet, taking Question Paper/Answer Booklet outside the Examination Room during the examination, possessing programmable calculator or mobile phone, writing before commencement of work is officially announced, looking over other candidates' shoulders in order to cheat, persistently disturbing other candidate(s) or distracting their attention, writing after the examination has ended, etc. | Cancellation of the candidate's paper |
| iv. Collusion: receiving or giving assistance in any manner with another person(s). | Cancellation of the candidate(s) paper and dismissal. |
| v. Impersonation: writing the examination for another student or allowing any person to write the examination for him/her. | Dismissal and prosecution of candidates involved. |
| vi. (a) Verbal assault on invigilator inside or outside the Examination Room.<br>(b) Physical assault on Invigilator inside or outside the Examination Room | (a) Cancellation of the candidate's examination paper and rustication for two semesters.<br>(b) Dismissal and prosecution of the offender. |
| vii. (a) Copying from prepared notes (except in the case of Open Book or Take Home Examinations) or from a colleague's script during examination.<br>(b) Destroying materials suspected as evidence | Cancellation of the candidate's paper and dismissal |
| viii. Fabrication of data | Cancellation of candidate's results |
| ix. Plagiarism | Cancellation of candidate's long essay/ project/thesis |

### 3.6.6 Re-Marking of Examination Script

Students have a fundamental right to query how their scripts are marked if they feel very strongly that their results do not reflect their efforts. Students who request for re-marking shall go by the following procedure:

(a) They shall address their request for re-marking to the Vice Chancellor through the Head of Department and the Dean of SPS.

(b) They shall pay a fee to be determined by the University. However, the fee shall be refunded to the student if they are vindicated after the remarking of the paper. A student is deemed to have been vindicated where his/her new mark resulting from the re-marking is higher, by at least 5%, than the previous mark obtained.

(c) The request for re-marking shall be made within two weeks of the next semester.

### 3.6.7 Definitions

(a)Trail: A student trails a course when he/she Fails (F) to obtain a pass mark or is graded incomplete (I or I*).

(b) Incomplete (I or I*): A student is graded incomplete (I) for a course when he/she is unable to write an examination on grounds of ill-health and the medical report is acceptable, provided he/she has registered for the course. The student is graded incomplete (I*) if any of the Examiners assesses the thesis as not being up to the required standard. A student is also graded incomplete (I*) for a reason(s) other than above which is acceptable to the Academic Board.

(c) Fail: A student fails a course when he/she obtains a mark less than the approved pass mark or fails to write an examination after registration without any justification.

(d) Probation: A student shall be put on probation if he/she fails to:

i. Make progress in his/her programme for one academic year.

ii. Achieve a Cumulative Weighted Average (CWA) of at least 55% after two semesters.

(e) Withdrawal: A student shall be withdrawn from the programme for any of the following situations:

i. For lack of progress in his/her modules (i.e. if a part-time student fails to do at least three modules in one academic year or a full-time student fails to do at least three modules per semester).

ii. For failing to complete his/her programme by the maximum time limit allowed.

iii. For abandoning his/her programme of study.

iv. If a student is to be put on probation for a second time.

### 3.6.8 Requirements for Graduation

(a) Special Faculty Requirements: In addition to the general University Examination Regulations, students are expected to satisfy Faculty/Postgraduate Board requirements approved by the Academic Board.

(b) Graduation Requirements: In order to graduate, a student is required to:

i. have completed the prescribed number of credit hours in the modules specified for his/her programme of study.

ii. have achieved the minimum CWA: PhD/MPhil/MSc/PgD: 55%

iii. have satisfied any other requirements of the Department and Board of Examiners of the Faculty/School of Postgraduate Studies

(c) Degree Classification: The class of degrees for Postgraduate programmes shall be determined by the following Cumulative Weighted Averages:

Dinstinction: 80% or above

Pass : 55% or above and less than 80%

Fail : below 55%

(d) Date for Conferment: There shall be two dates of conferment of degrees for Postgraduate Students: the first in February and the second in June.

### 3.6.9 Grading System

(a) Grading Scale

The grading scale of the School of Postgraduate Studies is as shown in Table 3.3.

Table 3.3: UMaT Grading Scale for Postgraduate Programmes

| Module | Raw Score (%) | Interpretation |
|---|---|---|
| PhD/MPhil/MSc/PgD Course Work and MSc/ PgD Thesis | ≥50 | Pass |
| | < 50 | Fail (F) |
| | I or I* | Incomplete |
| PhD/MPhil Thesis | ≥55 | Pass |
| | < 55 | Fail (F) |
| | I or I* | Incomplete |

(b) Student Assessment

| | |
|---|---|
| Continuous Assessment | 30% |
| Class Attendance | 10% |
| End of Semester Examinations | 60% |
| | 100% |

### 3.6.10 Transcript

Transcripts shall be given to all students who successfully complete a programme of study at the University. Transcripts shall reflect all modules taken by the student and the grades obtained. Audited modules shall not be included in transcripts.

### 3.6.11 Academic Record

Academic records reflecting all modules and grades obtained are given upon request to students who have not completed their programme or are unable to obtain a degree after their period of study. If a student abandons a programme or is unable to complete the programme for any reason the academic record shall state so. Audited modules shall not be included in academic records.

### 3.6.12 Calculation of Cumulative Weighted Average

The following steps are to be taken:

(a) Multiply the percentage mark scored in each course by the course Credit to obtain the Weighted Marks.

(b) Add all the Weighted Marks calculated up to the end of the semester in question to obtain the Cumulative Weighted Marks.

(c) Add up all the corresponding Course Credits up to the end of the semester in question to obtain the Cumulative Credits

(d) Calculate the Cumulative Weighted Average (CWA) up to the end of the semester in question as follows:

CWA = (Cumulative Weighted Marks)/(Cumulative Credits). Examples:

**Tables 3.4 and 3.5 summarise the marks and calculation of weighted marks in the First and Second Semester respectively.**

| SN. | Module | Credits | Marks (%) | Weighted Marks (WMK) |
|---|---|---|---|---|
| 1 | GM 501 | 3 | 76 | 3 x 76 = 228 |
| 2 | GM 503 | 3 | 61 | 3 x 61 = 183 |
| 3 | GM 505 | 3 | 68 | 3 x 68 = 204 |
| 4 | GM 509 | 3 | 64 | 3 x 64 = 192 |
| | Total | 12 | | 807 |
| Total Semester Weighted Marks | | | | 807 |
| Total Credits for the Semester | | | | 12 |
| Semester Weighted Average (SWA) | | | | 807/12 = 67.25 |

| SN. | Module | Credits | Marks (%) | Weighted Marks (WMK) |
|---|---|---|---|---|
| 1 | GM 552 | 3 | 75 | 3 x 75 = 225 |
| 2 | GM 554 | 3 | 57 | 3 x 57 = 171 |
| 3 | GM 556 | 3 | 67 | 3 x 67 = 201 |
| 4 | GM 558 | 3 | 63 | 3 x 63 = 189 |
| 5 | GM 560 | 3 | 75 | 3 x 75 = 225 |
| 6 | GM 500 | 15 | 69 | 15 x 69 = 1 035 |
| | Total | 30 | | 2 046 |
| Total Semester Weighted Marks | | | | 2 046 |
| Total Credits for the Semester | | | | 30 |
| Semester Weighted Average (SWA) | | | | 2046/30 = 68.20 |
| Cumulative Weighted Marks up to the end of Semester Two | | | | (807 + 2 046) = 2 853 |
| Cumulative Credits up to the end of Semester Two | | | | (12 + 30) = 42 |
| CWA up to the end of Semester Two | | | | 2853/42 = 67.93 |

**NB: Calculation of CWA's for subsequent years shall be the same as illustrated above.**

# 4 REGULATIONS FOR HIGHER DEGREES

## 4.1 AIMS AND OBJECTIVES

(a) To train high level manpower and improve students' academic competence.

(b) To solve national/international problems with greater emphasis on solving national problems.

(c) To contribute to knowledge.

## 4.2 ADMINISTRATION OF POSTGRADUATE PROGRAMMES

Postgraduate programmes are administered by a network of persons, panels and committees/boards at various levels.

(a) The following structure outlines the Boards responsible for the administration of Postgraduate Studies at UMaT:

i. Departmental Board.

ii. Faculty Board.

iii. Board of Postgraduate Studies (hereinafter referred to as the Board).

iv. Academic Board.

(b) The composition and duties of the various Boards are as follows:

(i) **Departmental Board Composition**

The composition is as specified in the Statutes.

**Duties**

- Admission of suitable candidates into Postgraduate programmes in the Department.
- Dealing with matters relating to admission, registration of students, extension of studies, nomination of Supervisors and examinations.
- Nomination of panel of Examiners (Internal and External).
- Final assessment of students for graduation.
- Review of Postgraduate academic curriculum of the Department within approved regulations.

**(ii) Faculty Board Composition**

The composition is as specified in the Statutes.

**Duties**

- To consider Faculty Postgraduate matters and make recommendations to the Board
- To deal with matters initiated by it or referred to it by the Board or the Departmental Board
- To recommend to the Academic Board, through the Board, Internal and External Examiners for appointment
- To advise on regulations and syllabuses dealing with courses of study for Postgraduate degrees and other awards of the Faculty.
- To make recommendations to the Academic Board, through the Board, for the award of Postgraduate degrees (other than honorary degrees), diplomas, certificates, University fellowships, studentships, scholarships and prizes within the Faculty.

(iii) **Board of Postgraduate Studies**

The composition and duties are as specified in the Statutes.

(iv) **Academic Board**

The composition and duties are as specified in the Statutes.

## 4.3 PhD PROGRAMMES

The degree of Doctor of Philosophy (PhD) is awarded upon completion of an approved programme of study in which a candidate has made an original and significant contribution to knowledge.

### 4.3.1 Entry Requirements

(a) A candidate shall hold a Master's degree or its equivalent from a recognised institution and shall submit evidence of adequate training and ability to undertake the proposed programme.

(b) A candidate who does not hold a Master's degree shall first register for MPhil degree. If he/she proves himself/herself to be academically capable by the end of the first year of the programme, he/she may be permitted by the Board of Postgraduate Studies on the recommendation of the Department to register for the PhD degree. This registration shall be deemed retrospective from the date of the original registration of the Master's degree.

(c) A candidate who does not satisfy the requirements stated (a) and (b) above but is otherwise adjudged suitable may be admitted. For the purpose of assessing his suitability, such a candidate may be interviewed on the recommendation of the Department concerned.

(d) All foreign applicants must have proficiency in English language.

(e) Admission Letters issued to foreign applicants shall be valid for two years.

### 4.3.2 Duration of Programme

Subsequent to registration, the candidate shall pursue a full-time programme of study and research for at least two academic years, except that:

(a) A candidate fully engaged in advanced study and research for his/her degree, who before registration, was engaged in research to the satisfaction of the Department concerned, may be exempted from not more than one academic year.

(b) In special circumstances, the Department may recommend, that a candidate be allowed to spend not more than one academic year of his/her programme in advanced study and research at another institution, provided that this work can be supervised in a manner satisfactory to the Department and the Board.

(c) A member of the full-time academic staff of the University may be accepted as a part-time candidate. Where the Board is satisfied that a Senior Member has been engaged in research **evidenced by publication(s)**, he/she may submit a thesis on the research at any time without previous registration.

(d) In special circumstances, the Board on the recommendation of the Departmental and Faculty Boards concerned may accept as a part-time candidate a person who is not a member of the full-time staff of the University but is engaged in an occupation which, in its opinion, affords the candidate the opportunity to pursue his/her programme. In such a case the Board, on the recommendation of the Departmental and Faculty Boards, shall prescribe a minimum period for his/her programme, which in its opinion, having regard to the time he/she is able to devote to the programme prescribed by the appropriate Department, is equivalent to two academic years of full-time study.

(e) A full-time candidate shall complete his/her programme not later than thirty-six months from the date of commencement of the academic year in which the student was enrolled. A part-time candidate shall complete his/her programme not later than forty-eight months from the date of commencement of the academic year in which the student was enrolled.

(f) These maximum times may be extended by the Board, on recommendation of the Supervisor through the Departmental and Faculty Boards, by periods of not more less than six months to a maximum of twelve months. This period is termed as grace period.

(g) Thus a full-time PhD candidate has up to a maximum of four years to complete his/her programme and a part-time PhD candidate has up to a maximum of five years to complete his/her programme.

(h) Under very special circumstances a candidate who could complete the thesis in a maximum of one academic year after the grace period with the recommendation of the supervisor(s) could be made to repeat and pay double the fees (i.e. approved fees for final year students for that academic year, seminar fee, thesis defence fee) as may be required as he/she continues with his/her programme.

(i) Under no circumstances should a full-time PhD programme extend beyond five years.

(j) Under no circumstances should a part-time PhD programme extend beyond six years.

### 4.3.3 Course Work

(a) Course work may be required at the PhD level. A PhD student is required to make a minimum of 36 credits (30 credits for Thesis and six credits for two Seminars). Where a candidate is required to take courses, the credits earned shall be added. Research Methods (credit 0) shall be compulsory for all students at the PhD level.

(b) All examination results for the course work shall be considered by the Departmental and Faculty Boards, which in turn, shall make their recommendations to the Board not later than three months after the examination.

(c) The Dean of Postgraduate Studies shall call a meeting of the Board, at least once a semester, for the exclusive purpose of approving examination results, subject to the approval of the Academic Board.

(d) Any postgraduate course recommended by the supervisor taken from either within or outside the candidate's Department shall count and be included in his/her transcript.

### 4.3.4 Thesis

The thesis shall comply with the following conditions:

(a) The greater portion of the work submitted must have been done subsequent to the registration of the student as a candidate for the degree.

(b) The thesis shall be written in English.

(c) The thesis shall consist of the candidate's own account of his/her research, and be certified. It may describe work done in conjunction with the candidate's Supervisor, provided the candidate states clearly his/her share in the investigation, and that the Supervisor certifies this statement. Under no circumstances shall a paper written or published in the joint names of two or more persons be accepted as a thesis. Work done conjointly with persons other than the candidate's Supervisor shall be accepted as a thesis in special cases only. In such cases the approval of the Departmental, Faculty and Postgraduate Boards shall be given.

(d) Where a thesis is submitted without the approval of the Supervisor(s) or without previous registration by a full-time academic staff of the University (unsupervised thesis), the Head of Department in consultation with the Deans of the Faculty and the School of Postgraduate Studies, shall appoint a three-member Committee to certify the thesis prior to examination. The decision of the committee would be upheld with the respect accorded to a supervision committee or a supervisor. In the case of submission without the approval of the supervisor(s), this provision is applicable if the student is deemed to have made satisfactory progress in the last two semester of his/her thesis.

(e) A candidate shall not be permitted to submit a thesis which has been submitted elsewhere. Nonetheless, a candidate shall not be precluded, at the discretion of his/her Supervisor, from incorporating work which he/she has already submitted for a degree in this University or elsewhere, provided that he/she indicates in his/her thesis any work which has been so incorporated.

(f) Not later than six months before the date when he/she proposes to enter for the examination a candidate shall submit the title of his/her thesis to the appropriate Departmental and Faculty Boards for approval and submission to the Board. After the final title of the thesis has been approved it may not be changed except with the express permission of the Board on the recommendation of the Departmental and Faculty Boards.

(g) The thesis shall be submitted, accompanied by the prescribed form (obtainable from the School of Postgraduate Studies), not later than thirty-six months after the beginning of the programme. In the case of part-time students, this period shall be forty-eight months.

(h) At least FIVE typed or printed comb-bound copies of the thesis shall be submitted to the Board through the Head of Department. The paper size shall be A4 except for drawings and maps, on which no restriction shall be placed. Only one side of the paper shall be used with a margin of 3.05 cm on the left-hand side of the page. Top/Bottom/Right margins shall be 2.54 cm. The thesis shall be typed in either one and half or double line spacing with a maximum of 200 pages excluding appendices.

After the thesis has been approved it must be bound in a standard form as follows:

art vellum or cloth; overcast; edges uncut; lettered boldly up spine in gold (0.625 cm - 1.255 cm) degree, date, name. Black cover.

(i) One copy each of the theses that have been accepted for the award of a PhD degree shall be deposited at the University Library, the Department and the School of Postgraduate Studies.

(ii) The approved theses shall include indexing as the last pages of the bound theses.

(iii) The theses to be submitted to the school of postgraduate studies shall include:

a. the hard bound theses

b. electronic versions of the theses and extended abstract.

### 4.3.5 Seminar

All PhD candidate are required to present at least two seminars having direct relationship to their theses. The two seminars must be done before submission of the thesis. A candidate who fails to present a registered seminar on an agreed date without permission shall pay a penalty of 20% of the seminar module fee before he/she shall be allowed to present at the next scheduled date.

### 4.3.6 Publications

A PhD candidate shall publish at least two technical papers arising out of his/her work before graduation.

### 4.3.7 Progress Report

(a) Candidate's progress on thesis should be monitored through the use of progress report forms every semester (see Appendix 2). The forms shall be completed by each student and each Supervisor and submitted by the Supervisor(s) to the Head of Department at the end of every semester latest during the submission of undergraduate results. After consideration at the Departmental Board meeting, the Head of Department shall submit all the reports to the Dean of Postgraduate Studies through the Dean of his/her Faculty before Special Academic Board meeting to consider results for that semester.

(b) A candidate who fails to make satisfactory progress on his/her programmes (i.e. gets two consecutive unsatisfactory remarks from his/her Supervisor) shall be put on probation.

(c) A candidate who fails to make satisfactory progress on his/her programme for two academic years (i.e. gets four consecutive unsatisfactory remarks from his/her Supervisor) shall be withdrawn from the programme with the option to repeat and pay double the fees (i.e. approved fees for final year students for that academic year, seminar fee, thesis defence fee) as may be required as he/she continues with his/her programme.

(d) On the basis of work done in the course of the year, the Departmental and Faculty Boards may recommend for approval by the Board that a candidate continues or terminates his/her studies.

### 4.3.8 Supervision Committee

(a) For the supervision of a PhD thesis, a team of a minimum of two (2) and a maximum of three (3) Supervisors is recommended to serve as Supervision Committee. The principal Supervisor should be a Senior Lecturer (with a PhD) or above. A Lecturer with a PhD may serve on the committee. The Supervision Committee shall include the Internal Supervisor (s).

(b) Supervisors shall submit reports on the work of each student at the end of each semester on prescribed forms (see Appendix 2) to the Deans of the Faculty and Postgraduate Studies through the Head of the Department.

### 4.3.9 Assessment

- Written examination (where appropriate) and Seminars.
- Assessment of thesis, and
- Oral examination.
- The Pass marks for coursework and thesis are as shown in Table 4.1.
- The overall mark of the candidate in the Thesis shall be an average of the marks scored in the Thesis Assessment and Oral Examination.
- The candidate must have at least passes in both the Thesis Assessment and Oral Examination.

**Table 4.1: UMaT Grading Scale for PhD Programmes**

| Module | Raw Score (%) | Interpretation |
|---|---|---|
| Coursework | ≥50 | Pass |
| | <50 | Fail (F) |
| | I or I* | Incomplete |
| Thesis | ≥55 | Pass |
| | < 55 | Fail (F) |
| | I or I* | Incomplete |

(a) Two External Examiners and at least three Internal Examiners shall be appointed to examine the thesis. A panel of not less than five Examiners including the two External Examiners shall conduct the oral examination. Only Senior Lecturers (with PhD) and above may be appointed as Internal Examiners except where a Lecturer with PhD is a member of the Supervision Committee. The oral examination shall be public but only the Examiners shall examine the candidate.

(b) The panel for the oral examination shall be made up of the following:

| | |
|---|---|
| Dean of Postgraduate Studies or a representative | - Chairman |
| The Head of Department or a representative | - Member |
| Two External Examiners and at least three Internal Examiners | - Members |

(c) In recommending the appointment of an External Examiner for the purpose stated above, the Head of Department, in consultation with the Dean of the Faculty, shall submit to the Board an outline curriculum vitae of the proposed examiner based on a format obtainable from the School of Postgraduate Studies. The External Examiner should show significant contribution in the area concerned.

(d) (i) The Examiners may recommend to the School of Postgraduate Studies that the candidate whose thesis is not up to the required standard be permitted to re-submit his/her thesis in a revised form within a specified period up to a maximum of twelve (12) months for oral examination;

(ii) Subject to the provisions of Clause d (i), if a candidate's thesis is still not up to the required standard, the Examiners may advise that the candidate re-submits his/her thesis in a revised form within a specified period up to a maximum of 90 days for an oral examination towards the award of either a MPhil degree or Postgraduate Diploma if the candidate so wishes.

(iii) Where a candidate fails to pass the oral examination for the first time, the Examiners may advise that the candidate re-submits his/her thesis in a revised form within a specified period up to a maximum of 90 days for an oral examination towards the award of a PhD degree.

(iv) Where a candidate fails to pass the oral examination for the second time, the Examiners may advise that the candidate re-submits his/her thesis in a revised form within a specified period up to a maximum of 90 days for the award of either a MPhil degree or Postgraduate Diploma if the candidate so wishes.

(e) The panel shall submit its recommendations to the Dean of Postgraduate Studies in the form of a joint report signed by both Internal and External Examiners with respect to the oral examination, and separate reports with regard to the thesis on the basis of prescribed criteria. The appropriate copies of the approved thesis (with the necessary corrections) shall be submitted to the School of Postgraduate Studies through the Head of Department.

(f) A maximum period of 90 days shall be allowed for final corrections to the thesis.

(g) A full fee shall be paid for any oral examination.

### 4.3.10 Procedure for Award of a Degree

(a) After an oral examination, extracts from the Examiners' report shall be submitted to the Department concerned to enable the student make the necessary corrections in the thesis.

(b) The results of the course work and oral examinations shall be submitted to the Board through the Departmental

and Faculty Boards.

(c) The recommendations of the Board shall be submitted to the Academic Board for approval.

(d) Each successful candidate shall thereafter be awarded a certificate under the seal of the University at a Congregation of the University for that purpose.

### 4.4 MASTER'S PROGRAMMES

There are two levels of Master's programmes in the University: MSc and MPhil.

#### 4.4.1 Designation

(a) Master of Philosophy (MPhil) based on research with limited taught courses.

(b) Master of Science (MSc) based on a combination of taught courses and research.

#### 4.4.2 Entry Requirements

(a) A candidate shall hold a First Class or Second Class (Upper Division) honours degree, or its equivalent, in an appropriate field of study, from a recognised University.

(b) A candidate who does not satisfy the requirement stated in (a) but is otherwise adjudged suitable by the Departmental Board, may, where practicable, be interviewed as determined by the Departmental Board concerned.

(c) A candidate who has satisfactorily completed a Postgraduate Diploma programme may be considered for admission on the recommendation of the Departmental Board concerned.

(d) All foreign applicants must have:

i. Proficiency in English language.

ii. BSc First Class or Second Class (Upper Division) in an appropriate field of study, from a recognised University.

iii. A candidate who satisfies the requirement in (i) and not (ii) but is otherwise adjudged suitable by the Departmental Board, may, where practicable, be interviewed as determined by the Departmental Board concerned.

iv. A candidate who has satisfactorily completed a Postgraduate Diploma course may be considered for admission on the recommendation of the Departmental Board concerned.

v. Admission Letters issued to foreign applicants shall be valid for two years.

#### 4.4.3 Duration of Programme

A full-time programme leading to a Master's degree shall be not less than one academic year except that:

(a) In special circumstances, the Department may recommend that a candidate be allowed to spend not more than six months of his programme in advanced study and research at another institution provided that his work can be supervised in a manner satisfactory to the Departmental, Faculty and Postgraduate Boards.

(b) In special circumstances, the Board, on the recommendation of the Departmental and Faculty Boards concerned, may accept as a part-time candidate for the degree, any person who is engaged in an occupation, which in their opinion, affords the candidate the opportunity to pursue his/her programme. In such a case the Board on the recommendation of the Departmental and Faculty Boards shall prescribe a minimum period for the duration of his/her programme which in their opinion, having regard to the proportion of his/her time which he/she is able to devote to the programme prescribed by the appropriate Department, is equivalent to twelve months full-time study.

(c) A full time candidate shall complete his/her programme not later than twenty-four months from the date of commencement of the academic year in which the student was enrolled. A part-time candidate shall complete his/her programme not later than thirty-six months from the date of commencement of the academic year in which the student was enrolled.

(d) These maximum times may be extended by the Board, on recommendation of the Supervisor through the Departmental and Faculty Boards, by periods of not more than six months to a maximum of twelve months. This period is termed as grace period.

(e) Thus a full-time MPhil/MSc candidate has up to a maximum of three years to complete his/her programme and a part-time MPhil/MSc candidate has up to a maximum of four years to complete his/her programme.

(f) Under very special circumstances, a candidate who might have satisfied all the course work and could complete the thesis in a maximum of one academic year with the consent of his/her supervisor(s) could be made to repeat the final grace period with the option to pay double whatever fee that needs to be paid as he/she continues with his/her programme.

(g) Under no circumstances should a full-time MPhil/MSc programme extend beyond four years.

(h) Under no circumstances should a part-time MPhil/MSc programme extend beyond five years.

### 4.4.4 Course Work

(a) Course work is required of all Postgraduate programmes at the Master's level. A Master's student is required to make a minimum of 42 credits. Research Methods (credit 0) shall be compulsory for all **registered** students at the Master's level.

(b) The minimum credits shall comprise: Thesis (15 credits), Seminar (3 credits), Field Trip and Report (3 credits) and minimum of four core courses (12 credits) and three optional courses (9 credits) for MSc students; and Thesis (24 credits), Seminar (3 credits), Field Trip and Report (3 credits) and minimum of four core courses (12 credits) for MPhil students.

(c) A candidate registered for the MPhil degree shall be required to pass all Faculty core courses and may be required to take appropriate courses on the recommendation of the Supervisor and the Departmental Board concerned.

(d) Each module shall run for a maximum of two weeks (10 working days) duration; examination in any module shall be taken immediately after the completion of the module but not later than a week from the completion of the module.

(e) There shall be a minimum of forty (40) contact hours in each module.

(f) A prospective applicant may participate in a module(s) within two (2) years prior to applying for a Postgraduate programme. The results of such a module(s) shall, upon request by the applicant, be credited to him/her upon admission.

(g) Any graduate course taken from either within or without the candidate's Department on the recommendation of the Supervisor shall count and be included in his/her transcript.

(h) All examination results for the coursework shall be considered by the Departmental and Faculty Boards, which in turn, shall make recommendations to the Board not later than three months after the examination.

(a) The Dean of Postgraduate Studies shall call a meeting of the Board, at least once a semester, for the exclusive purpose of approving examination results of coursework, subject to the approval of the Academic Board.

### 4.4.5 Thesis

The thesis shall comply with the following conditions:

(a) The thesis shall be written in English.

(b) The thesis shall consist of the candidate's own account of his/her research and be so certified. It may describe work done in conjunction with the candidate's Supervisor, provided the candidate states clearly his/her share in the investigation, and that his/her statement is certified by the Supervisor. Under no circumstances shall a paper written or published in the joint names of two or more persons be accepted as a thesis. Work done conjointly with persons other than the candidate's Supervisor may be accepted as a thesis provided his/her contribution is at least 60%. In such cases the approval of the Departmental, Faculty and Postgraduate Boards shall be given.

(c) A candidate shall not be permitted to submit a thesis, which has been submitted elsewhere, but a candidate shall not be precluded, at the discretion of his Supervisor, from incorporating work, which he/she has already submitted for a degree in this university or elsewhere, provided that he/she indicates in his/her thesis any work which has been so incorporated.

(d) The candidate may submit subsidiary matter in support of his/her candidature any printed contributions to the advancement of his/her subject which he/she may have published independently or conjointly or any other supporting material. In the event of a candidate submitting subsidiary matter of a conjoint nature, he/she shall be required to state fully his/her share of such conjoint work.

(e) A provisional thesis topic shall be submitted through the Departmental and Faculty Boards within the first six months and the final topic before the last six months of the course. Within the last six months of the course any significant change in the thesis topic shall be submitted to the Board for approval.

(f) The thesis shall be submitted, accompanied by the prescribed form obtainable from the School of Postgraduate Studies, not later than the maximum duration for the programme.

(g) At least three typed or printed comb-bound copies of the thesis shall be submitted through the Head of Department to the Board. The paper size shall be A4 except for drawings and maps on which no restrictions are placed. Only one side of the paper shall be used with a margin of 3.05 cm on the left-hand side of the page. Top/Bottom and Right margins shall be 2.54 cm. The thesis shall be typed in either double or one and half line spacing and a maximum of 100 pages excluding appendices.

A thesis, which consists of a collection of excerpts or pamphlets, shall be bound in a similar cover. After the thesis has been approved, it must be bound in a standard form as follows:

- art vellum or cloth; overcast; edges uncut;
- lettered boldly up spine in gold (0.625 cm - 1.255 cm)
- degree, date, name. Dark blue cover.

(h) One copy each of the theses that have been accepted for the award of a Master's degree shall be deposited at the University Library, the Department and the School of Postgraduate Studies.

### 4.4.6 Seminar

Every MSc/MPhil student is required to present at least one seminar having direct relationship to his/her thesis. This must be done before submission of the thesis. A candidate who fails to present a registered seminar on an agreed date without permission shall pay a penalty of 20% of the seminar module fee before he/she shall be allowed to present at the next scheduled date.

### 4.4.7 Publications

Every MSc/MPhil student is encouraged to publish at least one paper having relationship to his/her thesis before graduation.

### 4.4.8 Progress Report

(a) Students' progress on thesis should be monitored through the use of progress report forms every semester (see Appendix 2). The forms shall be completed by each student and each Supervisor and submitted by the Supervisor(s) to the Head of Department at the end of every semester latest during the submission of undergraduate results. After consideration at the Departmental Board meeting, the Head of Department shall submit all the reports to the Dean of Postgraduate Studies through the Dean of his/her Faculty before Special Academic Board meeting to consider results for that semester.

(b) A MPhil/MSc student who fails to make progress in his/her thesis (i.e. gets two consecutive unsatisfactory remarks from his/her Supervisor) or fails to achieve a CWA of at least 55% after one year will be put on probation.

(c) A student who fails to make progress on his/her programme for two academic years (i.e. gets four consecutive unsatisfactory remarks from his/her Supervisor) will be withdrawn from the programme with the option to repeat and pay double the fees (i.e. approved fees for final year students for that academic year, seminar fee, thesis defence fee) as may be required as he/she continues with his/her programme.

(d) On the basis of work done in the course of the year, the Departmental and Faculty Boards may recommend for approval by the Board that a candidate continues or terminates his/her studies.

### 4.4.9 Supervision

(a) A Senior Member of the rank of Senior Lecturer and above is eligible to supervise an MSc/MPhil candidate, though more than one person is preferred. A Lecturer may serve as a co-supervisor. A Lecturer with a PhD is also eligible to supervise.

(b) Supervisors shall submit reports on the work of each student at the end of each semester on prescribed forms (see Appendix 2) to the Dean of Postgraduate Studies through the Head of the Department concerned.

### 4.4.10 Assessment

The examination for the award of MSc and MPhil shall include:

- Written examination (where appropriate)
- Assessment of thesis
- Oral examination
- The Pass marks for course work are as shown in Table 4.2.
- The overall mark of the candidate in the Thesis shall be an average of the marks scored in the Thesis Assessment and Oral Examination.
- The candidate must have at least passes in both the Thesis Assessment and Oral Examination.

**Table 4.2: UMaT Grading Scale for Master's Programmes**

| Module | Raw Score (%) | Interpretation |
|---|---|---|
| MPhil/MSc Course Work and MScThesis | ≥50 | Pass |
| | < 50 | Fail (F) |
| | I or I* | Incomplete |
| MPhil Thesis | ≥55 | Pass |
| | < 55 | Fail (F) |
| | I or I* | Incomplete |

(a) Not less than three Examiners, of whom at least, one shall be an External Examiner appointed by the Board, on the recommendation of the Departmental Board, shall examine the thesis. A panel of not less than three Examiners, including at least one External Examiner, shall conduct the oral examination.

(b) The panel for the oral examination shall be made up of the following:

- Dean of Postgraduate Studies or a representative - Chairman
- The Head of Department or a representative - Member
- One External Examiner and at least two Internal Examiners - Members

(c) When recommending the appointment of an External Examiner, the Departmental Board shall submit outline curriculum vitae of the proposed examiner based on a format obtainable from the Board.

(d) The panel shall submit its recommendations to the Departmental Board in the form of a joint report signed by both Internal and External Examiners with respect to the oral examination and separate reports with respect to the thesis, on the basis of prescribed criteria approved by the Board. These reports together with appropriate copies of approved theses with the necessary corrections shall be submitted to the School of Postgraduate Studies through the Departmental Board.

(e) In the case of the MSc degree, the components of the examination shall be coursework, thesis and oral examination. Candidates shall be required to pass in each component and the candidate's performance shall determine his/her success or failure. Fifty percent shall be pass for all courses, with fifty-five percent being the CWA for success or failure. A candidate who does not satisfy the Examiners at the oral examination shall not be recommended for the award of a degree, the standard of the thesis notwithstanding.

(f) For both MPhil/MSc degrees a candidate who does not pass the oral examination shall not be recommended for the award of a degree irrespective of the standard of his/her thesis. In such a situation, the candidate will have only one opportunity to re-submit himself for oral examination within a period of six (6) months. The candidate shall pass the Departmental core courses.

(h) (i) The Examiners may recommend to the School of Postgraduate Studies that the candidate whose thesis is not up to the required standard be permitted to re-submit his/her thesis in a revised form within a specified period up to a maximum of six (6) months for oral examination;

(ii) Subject to the provisions of Clause h(i), if a candidate's thesis is still not up to the required standard, the Examiners may advise that the candidate re-submits his/her thesis in a revised form within a specified period up to a maximum of 90 days for the award of Postgraduate Diploma if the candidate so wishes.

iii) Where a candidate fails to pass the oral examination for the first time, the Examiners may advise that the candidate re-submits his/her thesis in a revised form within a specified period up to six (6) months for oral examination.

iv) Where a candidate fails to pass the oral examination for the second time, the Examiners may advise that the candidate re-submits his/her thesis in a revised form within a specified period up to a maximum of 90 days for the award of a Postgraduate Diploma if the candidate so wishes.

#### 4.4.11 Procedure for the Award of a Degree

(a) After an oral examination, extracts from the Examiners' report shall be submitted to the Department concerned to enable the student make the necessary corrections in the thesis.

(b) The results of the course work and oral examinations shall be submitted to the Board through the Departmental and Faculty Boards.

(c) The recommendations of the Board shall be submitted to the Academic Board for approval.

(d) Each successful candidate shall thereafter be awarded a certificate under the seal of the University at a congregation of the University for that purpose.

### 4.5 POSTGRADUATE DIPLOMA PROGRAMMES

A Postgraduate Diploma is awarded on the basis of a programme of taught courses and a project work.

#### 4.5.1 Entry Requirements

The entry requirement shall be a Bachelor's degree or its recognised equivalent. In addition, candidates must satisfy the appropriate Departmental requirements.

#### 4.5.2 Duration of Programme

A programme leading to a Postgraduate Diploma shall be for a period of one academic year.

#### 4.5.3 Examinations

There shall be written and oral examinations. Practical examinations may also be given where appropriate.

#### 4.5.4 Registration

Candidates shall register in their Department and at the School of Postgraduate Studies at the beginning of each semester for courses in which they are to be examined.

#### 4.5.5 Examiners

(a) A panel comprising not less than three examiners, of whom at least one shall be an External Examiner, shall be appointed by the Board of Postgraduate Studies on the recommendation of the Departmental Board to assess the project work. When recommending the appointment of an External Examiner, the Departmental Board shall submit outline curriculum vitae of the proposed examiner based on a format obtainable from the School of Postgraduate Studies.

(b) A panel comprising not less than three members of whom at least one shall be an External Examiner shall be appointed by the Board on the recommendation of the Departmental Board to conduct the oral examination.

### 4.5.6 Assessment

Candidates shall be assessed in accordance with current university regulations. Results of the examinations shall be submitted by the Departmental Board to the School of Postgraduate Studies through the Faculty Board for approval, in the first instance, before being forwarded to the Academic Board for final approval.

### 4.5.7 Procedure for the Award of a Postgraduate Diploma

Each successful candidate shall be awarded the appropriate Postgraduate Diploma of the University, at a Congregation of the University assembled for that purpose.

## 5 GENERAL INFORMATION

### 5.1 SOCIAL AND SPORTING FACILITIES

The following facilities exist for the convenience of students:

- Community Service (Halls of Residence)
- Sports and Recreation
- Chaplaincy
- Health and Counseling Services
- Students' Union

### 5.2 THE ASSOCIATION OF GRADUATE STUDENTS (GRASAG)

(a) The Association, which embraces all Postgraduate students of the University, provides both social and academic facilities for its members. Membership is open to Postgraduate students pursuing approved courses of study and registered with the School of Postgraduate Studies.

(b) Further enquiries should be addressed to:

The President, GRASAG,
c/o School of Postgraduate Studies,
University of Mines and Technology (UMaT),
Tarkwa, Ghana.

### 5.3 COST/FEES

(a) Academic Facility User Fee as determined by Government.

(b) Module Fees shall be determined from time to time.

(c) Internet Connectivity Fee shall be charged per student per year. This fee is subject to change without notice.

(d) The examination fees shall be as determined from time to time by the University. Fees shall not be refunded, but in the case of justifiable unforeseen circumstances acceptable to the Board, fees may be transferred from one examination to the next.

(e) All fees must be paid into any of the following Account:

i) Account Name – Ecobank UMaT, SPS E-Collect Account
Account Number – 0193 0244 0251 0005, Bank - Ecobank, Branch – Tarkwa

ii) Account Name - University of Mines and Technology Foreign Account
Account Number – 0192 0844 0251 0004,
Bank - Ecobank Ghana Limited,
Swift Code - ECOCGHAC

**Payment of fees by cash is not acceptable** by the University.

All information pertaining to fees and other expenses may be obtained from:

The SPS Officer
University of Mines and Technology

P. O. Box 237

Tarkwa, Ghana

Further information on all the above must be addressed to the Registrar.

# DEPARTMENT OF GEOMATIC ENGINEERING

## 6 MASTER'S (MODULAR) PROGRAMME IN GEOMATIC ENGINEERING

### 6.1 TITLE OF PROGRAMME

The title of the programme is MSc/MPhil Programme (Modular) in Geomatic Engineering.

### 6.2 PROGRAMME OBJECTIVES

The main objectives of the programme are:

- To provide an avenue for practising Surveyors/Geomatic Engineers in the mining and other establishments to continue their education.
- To turn out competent postgraduates to meet the current demands of the Surveying/Geomatics industry.
- To produce competent postgraduates capable of pursuing careers in the minerals and allied industries, universities and research institutions.

### 6.3 ENTRY REQUIREMENTS

(a) The entry requirements for the Master's degree in Geomatic Engineering are:

i. Applicants must have BSc First Class or Second Class (Upper Division) in Geomatic or Geodetic Engineering or its equivalent in Earth Sciences and related Engineering programmes from a recognised university.

ii. Holders of UMaT Diploma in the Earth Sciences who hold senior positions in a relevant industry and have at least 5 years professional experience and proven ability in his/her discipline are eligible for admission.

iii. Foreign applicants with proficiency in English language who satisfy the requirements of (i) or (ii) above are eligible for admission after careful consideration of relevant documents.

iv. Applicants who have satisfactorily completed a Postgraduate Diploma programme may be considered for admission on the recommendation of the Departmental Board concerned.

### 6.4 PROGRAMME REQUIREMENTS

The Department offers two Master's Degree Programmes. These are:

i. MSc Geomatic Engineering Degree Programme

ii. MPhil Geomatic Engineering Degree Programme

a) Graduation Requirements

i. MSc Geomatic Engineering Degree

- A minimum of 48 credit hours is required for the award of MSc degree. This is made up of a minimum of nine (9) modules (at least 27 credit hours). A Graduate Seminar (3 credit hours) and Field trip & Report (3 credit hours) and a Thesis (15 credit hours)

ii. MPhil Geomatic Engineering Degree

- A student is required to do six (6) core modules outlined in Section 6.5a. In addition, he/she may audit modules recommended by the Supervisor to facilitate the student's research work. The candidate is also required to present at least one seminar.
- The successful defense of a thesis is required for the award of the award of the MPhil Degree in Geomatic Engineering. The thesis should be an embodiment of independent research conducted by a student under the guidance of a Supervisor on a significant problem in a chosen area of Geomatic Engineering.

b) Programme Duration

- Full Time: A maximum of 4 semesters for course work and Thesis work.
- Part Time: A maximum of 6 semesters.

### 6.5 PROGRAMME STRUCTURE

a) Core and Compulsory Modules

The MSc coursework comprises 6 core modules namely:

i. Geodesy (GM 504)
ii. Remote Sensing (GM 511)
iii. Digital Photogrammetry (GM 502)
iv. Geographic Information Systems (GM 507)
v. Global Navigation Satellite Systems (GM 510)
vi. Statistical Models (GM 509)

Research Methods (GM 521) is compulsory but does not earn any credit.

- In addition, a minimum of three (3) other modules must be selected by the candidate in consultation with his/her Supervisor. Introduction to Computer Applications is compulsory but a candidate may apply for exemption.
- Applicants without adequate Geomatics background will be required to register for the module in "Introduction to Geomatic Engineering". Field trips will be organised and all students will be required to participate in at least one of them. An essential requirement of the modules is that students devote the afternoons to tutorials, practicals or field trips.

**b) Content of Modules**

**The module to be run, credit hours and module numbers are as follows:**

| Course Number | Name of Course | Credit Hours |
|---|---|---|
| GM 261 | Introduction to Geomatic Engineering** | 0 |
| GM 351 | Introduction to Computer Applications* | 0 |
| GM 551 | Research Methods* | 0 |
| GM 500 | Thesis | 15 |
| GM 515 | Postgraduate Seminar | 3 |
| GM 553 | Operations Research | 3 |
| GM 554 | Mine Economic and Financial Evaluation | 3 |
| GM 555 | Statistical Models | 3 |
| GM 556 | Field Trip & Report | 3 |
| GM 557 | Environmental Management | 3 |
| GM 571 | Geographic Information System (GIS) | 3 |
| GM 572 | Digital Photogrammetry | 3 |
| GM 573 | Remote Sensing | 3 |
| GM 574 | Geodesy | 3 |
| GM 575 | Fleet Management | 3 |
| GM 576 | Environmental and Spatial Statistics | 3 |
| GM 577 | Land Administration and Information Systems | 3 |
| GM 578 | Global Navigation Satellite Systems | 3 |
| GM 579 | Shoreline Modelling and Prediction | 3 |
| GM 581 | Spatial Data Modelling for 3D GIS | 3 |
| GM 582 | Cartography | 3 |

| | | |
|---|---|---|
| GM 583 | Geographic Data for Resource Management | 3 |
| GM 584 | Principles of Mine Planning and Design | 3 |
| GM 585 | Geo-information for Disaster Risk Management | 3 |
| GM 586 | Geographic Information Management | 3 |
| GM 588 | Mine and Sub-Surface Surveying | 3 |
| GM 592 | Engineering Surveying | 3 |
| GM 594 | Application of GIS & Remote Sensing | 3 |
| GM 596 | Sustainability and Corporate Social Responsibility | 3 |

**Preparatory Module **Pre-requisite Module for non-Geomatic Engineers*

### GM 261 Introduction to Geomatic Engineering - Credits: 0

Digital levels. Digital theodolite. Modern surveying techniques: Classical positioning systems, Triangulation, and Trilateration. Engineering surveying. Modern positioning system: GPS, IPS and DPS.

### GM 351 Introduction to Computer Applications - Credits: 0

Introduction to PC. Basic hardware components of the PC. Operating systems software DOS. Operating systems hardware (Dosshell, Windows, File Managers and Utilities). Word processing. Data processing. Database. Graphics. Software installation and interfacing. Summary.

### GM 551 Research Methods - Credits: 0

Definition of research. Objectives of research. Motivation in research. Characteristics of research. Types of research. Problems in starting research. Definition of ethics and professionalism. How ethics and values intersect with professionalism. Ethical theory and applications: Branches of ethics, Classification of ethical theories, Standards of ethical conduct in science, Common ethical principles in science, Code of ethics for engineers. Fraud in Science. Choosing a research topic. Identification and sources of problem. Formulating hypothesis. Functions of literature review. References and Bibliography. Research designs and approaches. Principles of experimental designs. Sampling basics. Characteristics of a good sample design. Methods of data collection. Validity and Reliability of Data. Processing, anaysis and interpretation of data. Report writing: Significance of report writing. Papers and reports: Management reports, Proposals, Journal papers, Conference papers, Thesis. Format for presentation of thesis at UMaT: Structure and form of a thesis, Headings and numbering, Style and punctuation, Extra-linguistic material, Production of the thesis, Editing and revising, Assessment ( Seminars, Thesis)

### GM 500 Thesis - Credits: 15/24

An independent research work under the guidance of Supervisor(s) on a topic in the student's area of specialisation. A thesis embodying the results of the research will be presented to the Department after an oral defense. A panel will assess thesis.

### GM 515 Postgraduate Seminar

Credits: 3

Students will be required to make a minimum of one presentation on the progress and research underway in their areas of specialisation. The seminar will be assessed by a Departmental Panel. Postgraduate students are required to attend.

### GM 553 Operations Research

Credits: 3v

Nature of Operations research in mining, Linear, the simplex algorithm for integer & Goal programming, transportation and assignment problems, decision analyses, markov analysis, simulation, queuing models, inventory control models, production scheduling methods-CPM, dynamic programming.

### GM 554 Mine Economic and Financial Evaluation

Credits: 3

Nature of and requirements for mining projects. Time value of money and economic equivalence, estimation of revenue and cost. Investment allowance, Mine Taxation and royalties. Financial alternatives. Cash flow models and analysis, investment decision methods and criteria, sensitivity and risk analysis, mine feasibility study. Case studies.

### GM 555 Statistical Models

Credits: 3

Basic Statistical Procedures, Regression and Linear Models, Application of Multiple Regression, Statistical Inference and Modeling, Use of Transformation, Correlation and its Relationship with Regression

### GM 556 Field Trip & Report

Credits: 3

Field trip will be organized and students are required to participate in, at least, one of them. They are required to submit a written report and make oral presentation on it/them.

### GM 557 Environmental Management

Credits: 3

Environmental impacts of mining. Air quality/pollution. Air quality modeling: Water quality/ pollution, water quality modeling. Noise. Environmental aspects of ground vibrations and air blasts. Environmental impact assessment methodologies and practices. Ghana's Environmental Policy.

### GM 571 Geographic Information Systems (GIS)

Credits: 3

Introduction to GIS: Purpose of GIS, Representation of real world. Geographic information and spatial data types. Data processing systems. Determining and mapping position: Data quality, Spatial referencing, Measures of location, Error on maps, Satellite based position. Data entry and preparation. Spatial data analysis. Data visualisation: GIS and maps, The visualisation process, The cartographic toolbox, Map cosmetics and dissemination.

### GM 572 Digital Photogrammetry

Credits: 3

Fundamentals of digital image acquisition: sampling, quantization, resampling and error sources. Charge-Coupled Device (CCD) architecture, operation and error sources. Automated interior, relative and absolute orientation. Image matching techniques: signal-based, feature-based and relational, with emphasis on cross-correlation and least squares matching. Use of epipolar constraints in image matching. Multi-resolution analysis and image pyramids. Digital image rectification. Feature extraction.

### GM 573 Remote Sensing

Credits: 3

Concepts of digital remote sensing and energy interaction. Remote Sensing Platforms. Image statistics, display, preprocessing. Rectification of digital imagery. Digital image processing: Image processing, Image enhancement, and classification. Spectral and Spatial filtering. Thematic information extraction, change detection and accuracy assessment. Special sensors: Thermal, Hyperspectral and Microwave.

### GM 574 Geodesy

Credits: 3

Physical geodesy: potential theory, earth, reference and anomalous gravity field, measurement of gravity. Figure of the earth. boundary value problems. Geometrical and gravimetric geoid determination. Dynamic satellite geodesy. Satellite alimetry. Fundamentals of coordinates reference systems. Quality measures and integrity. Satellite Based Augmentation Systems (SBAS) and Ground Based Augmentation Systems (GBAS). Reference frames and coordinate transformations. Height systems. Earth rotation. Solid earth tides. Geodynamics: geodetic and geophysical setting, terrestrial reference frames.

### GM 575 Fleet Management

Credits: 3

General management principles and skills. Fleet and transport management. Definitions of fleet management. Objectives and costs of fleet management. Definition of customer service in a fleet environment. Vehicle management. Vehicle selection criteria. Own or contract analysis. Optimizing costs. Managing vehicle replacement. Vehicle specifications and inventory system. Preventive and corrective Maintenance. Workshop management. Manpower efficiency. Loss control/safety Management. Safety hazards in fleet and workshop Operations. Planning for and controlling safety. Transportation and distribution management. Tracking and monitoring vehicles. Selection of the best mode of transport. Structuring distribution routes. Managing the fleet organization. leading. Training and motivating the team. Budgeting and cost control. Key performance indicators. The balanced scorecard of fleet and transport. Performance evaluation and improvement. Action planning.

### GM 576 Environmental and Spatial Statistics

Credits: 3

Geostatistical interpolation methods: Semi variogram, Kriging (spatial prediction), Estimation problems. Spatial point processes: Simulation, Spatial sampling strategies. Processes in space and time. Statistical models and methods for spatially varying phenomena. Homogeneous/non homogeneous processes. Applications to ozone, climate data etc. Spatial models for grid data and inference. Extreme value methods: Crossing limits for air pollution, Changes in climate extremes, Time series with long range dependency.

### GM 577 Land Administration and Information Systems

Credits: 3

Concepts of land policy and land management and administration, process design. Simulation and management of workflows. Land dispute and adjudication. Cadastral and social tenure mapping. Value assessment and land use classification. Business administration. Planning and control. Financial management. Modelling of data, processes, stakeholder analysis, community participation, information system design, development, (re-) engineering, information management (legal aspects, authentication, pricing, costing), SDI concept and application (authentic registers).

### GM 578 Global Navigation Satellite Systems

Credits: 3

Principles and theory of satellite positioning. Space-base positioning systems (such as GPS and GLONASS). An overview of the theory and applications of satellite surveying: Artificial satellites, Satellite orbital motion, Kepler element. GNSS concepts and characteristics. GNSS measurement: Pseudoranging, Carrier phase measurement, GNSS time, Error sources and measurement accuracy, Mission planning. Position determination techniques: Single point and differential positioning, Static and kinematic, Post mission and real time processing. DGPS concepts. Using GPS for height determination. Reference datum and datum transformation. Integrating satellite data into local co-ordinate systems. Satellite orbits and GPS observables, Physical influence of GPS Survey, Ambiguity Resolution Techniques, GPS Positioning modes, GPS observation equations and Equivalence Properties, GPS application.

**GM 579 Shoreline Modelling and Prediction**

Credits: 3

The coastal environment. Oceanographic and geomorphologic factors influencing the coast: currents, waves, tides, sea-level rise due to climate change and anthropogenic intervention in coastal processes. Shoreline modelling techniques: the Erosion based approach and the recession based methods, Erosion based volumetric methods, application and limitation, Recession based methods (Bruun's rule; modified Bruun's rule; Beach slope, sea-level rise rate shoreline excursion method). The SCAPE model for shoreline modelling and prediction, (merits and limitations). Modelling shoreline and prediction using Multi variates regression analysis (Specification of variables; generation of the regression model, beta values determination and testing of model).

**GM 581 Spatial Data Modelling for 3D GIS**

Credits: 3

An overview of 3D GIS development. 2D and 3D spatial data representations. The fundamentals of geo-spatial modelling. The conceptual design. The logical design. Object-orientation of tins spatial data. The supporting algorithms. Applications of the model. The web and 3D GIS.

**GM 582 Cartography**

Credits: 3

GIS and cartographic visualisation. Data sources. Development and management of a cartographic database. Cartographic modeling and data analysis: Spatial, Temporal and Thematic comparisons. Terrain visualisation. Scientific Visualisation. The use of colour in non-temporal animations. Dynamic variables. Visualisation in GIS. Hypermaps. Rendering systems for interactive scientific visualisation. Definitions of terrestrial coordinate systems and reference frames. Coordinate transformations between geodetic datum: Molodensky, Bursa-Wolf. Map projection theory-conformity, differential geometry. Map projection types: Conical, Cylindrical, Azimuthal. Choosing optimal projections. Case studies of projections used in Ghana and overseas.

**GM 583 Geographic Data for Resource Management**

Credits: 3

Geographic data to information for resource management (extract and integrate spatial and non-spatial data from various sources and formats). Explore, analyze and interpret information contained in geographical data. Data obtained through sampling, statistic and cartographic visualization, descriptive and inferential statistics. Multi-Criteria Decision Analysis. Validity and reliability of results.

**GM 584 Principles of Mine Planning and Design**

Credits: 3

General mine planning and design principles. Surface mine planning and design. Underground mine planning and design. Siting of facilities. Risk analysis in Mine planning. Environmental control measure in mine planning. Sustainable use of mined land and closure planning.

**GM 585 Geo-information for Disaster Risk Management**

Introduction to Disaster Risk Management, Spatial Data for Risk Management, Spatial Multi-Criteria Evaluation, Risk Assessment, Hazard Assessment, Elements at Risk, Vulnerability Analysis, Risk Analysis, Risk Management.

**GM 586 Geographic Information Management**

Credits: 3

Concept of geo-information technology and management. Motivation for acquiring basic knowledge in technology. Presentation of basic terminology in management. Discussion of the challenges for land administration and national surveys in a changing technological and institutional environment. Presentation of examples of innovative approaches to Geospatial data infrastructures. Emerging concepts in linking objectives of Geo-spatial data policy, land policy and policy instruments (World Bank, UN and FAO policies). Data sources, acquisition, conversion

and processing. Data models, process models and databases (central/local). Electronic exchange and distribution of geo-information. Quality parameters and review procedures.

**GM 588 Mine and Sub-Surface Surveying**

Credits: 3

Mine surveying (Surface and Underground). Correlation of surface and underground surveys. Underground surveying methods. Underground traversing. Stope surveying (Cavity monitoring systems). Directional control for drives, raises and inclines. Survey of diamond drill bore holes.

### GM 592 Engineering Surveying

Credits: 3

Control networks for engineering projects: Methods used in determining horizontal control, Traversing, Triangulation, Trilateration, Intersection, Intersection, Resection and Satellite Position Fixing. Vertical controls-levelling Datum and principle of levelling. Inverted staffs. Trigonometric levelling methods. Deformation monitoring: Causes, Types and Importance and Analysis of deformation measurements. Underground surveys. Transfer of controls underground: Weisbach triangle method, Weiss quadrilateral method, gyro-theodolite method. Transfer of height underground: Digital Terrain Modelling- DTM generation, DTM representation as grid or TIN visualisation. Highway functional classification; Highway location survey. Geomatic design of highways: Cross-sectional elements, Factors affecting design, Horizontal alignment design and Vertical alignment design. Computer application in geometric design. Intersection design and control: Basic principles of grade-separated intersections. Pavement design: Pavement types and structure. Stresses and strain in pavement maintenance and management: Problem of highway maintenance, Defects in pavements and their causes, Road maintenance activities, Methods for measuring road condition and Pavement management systems.

### GM 594 Application of Geographic Information System (GIS) and Remote Sensing (RS)

Credits: 3

Image enhancement and visualization. Image classification and Interpretation. Spatial data visualization. RS data interpretation for land resource inventory. RS and GIS for land resource change analysis. GIS tools for landscape analysis, GIS and RS for E.I.A.

### GM 596 Sustainability and Corporate Social Responsibility

i) The concept of sustainable development

The Brundtland report, three pillars of sustainable development, Resource curse,

ii) Corporate Social Responsibility (CSR)

Theories of CSR behaviour and disclosure, fairness, equality and corporate social responsibility, the Equator Principle, the business and environmental case for CSR

iii) Developing a corporation's place in the community

The socio-economic context and roles of corporations, companies and host communities, negotiation, communities and sustainable development, relocation, compensation, alternative livelihood issues

iv) Case studies from mining communities

Three (3) case studies on host community-company agitations/success stories and the learning points (The lecturer may invite people from the community relations outfit of nearby mines to share experiences).

## 7 DOCTOR OF PHILOSOPHY PROGRAMME IN GEOMATIC ENGINEERING

### 7.1 ENTRY REQUIREMENTS

- A candidate shall hold a Master's degree or its equivalent in earth science and related disciplines from a recognised institution and shall submit evidence of adequate training and ability to undertake the proposed programme.

- A candidate who does not hold a Master's degree shall first register for MPhil degree. If he proves himself/herself to be academically capable by the end of the first year of the programme, he/she may be permitted by the Board of Postgraduate Studies on the recommendation of the Department to register for the PhD degree. This registration shall be deemed retrospective from the date of the original registration of the Master's degree.
- A candidate who does not satisfy the requirements stated above but is otherwise adjudged suitable may be admitted. For the purpose of assessing his suitability, such a candidate may be interviewed on the recommendation of the Department concerned.

### 7.2 PROGRAMME DURATION

A candidate shall pursue full-time programme of study and research for at least two years, except that:

- A candidate fully engaged in advance study and research for his/her degree, who, before registration, was engaged in research to the satisfaction of the Department concerned, may be exempted for not more than one academic year.
- In special circumstances, the Department may recommend that a candidate be allowed to spend not more than one academic year of his/her programme in advanced study research at another institution, provided that his/her work can be supervised in a manner satisfactory to the Department and the School of Postgraduate Studies.
- A full-time candidate who is engaged in research for the degree shall present himself/herself for examination not later than three years from the date of his/her registration.
- A part-time candidate shall present himself/herself for examination not later than four years from the date of commencement of the academic year in which the student was enrolled.
- In special cases, an extension of these time limits may be granted on the recommendation of the Department.

### 7.3 AREAS OF RESEARCH

A candidate may be required to audit appropriate courses/modules and also submit a thesis under the supervision of an academic staff in any of the following areas of research:

a. GIS and Remote Sensing Applications
b. Fleet Management
c. Mine Planning and Design
d. Mine and Sub-Surface Surveying
e. Global Navigation Satellite System
f. Digital Photogrammetry
g. Engineering Surveys
h. Digital Image Processing

### 7.4 EMPLOYMENT OPPORTUNITIES

Students may make a career in the following Institutions:

a. Survey and Mapping Division
b. Ghana Highway Authority
c. Large and Small Scale Mining & Allied Companies
d. Construction and Irrigation Companies
e. Environmental Protection Agency
f. Cocoa Research Institute
g. The Navy
h. Forestry Commission
i. The University and other Tertiary And Research Institutions

j. Other Governmental and Non-Governmental Agencies

k. Water Resources Institutes

**Table 7.1 List of Academic Staff and Areas of Specialisation**

| NAME | Academic/Professional Qualification | Designation | Areas of Specialisation |
|---|---|---|---|
| Dr P. E. Baffoe | MSc (Moscow) AGIS, MFIG | HOD/Senior Lecturer | Digital Photogrammetry: Mine Surveys: Monitoring and Modeling of Noise Levels |
| Prof D. Mireku-Gyimah | DSc (KNUST), PhD, DIC (London), MSc (Mos Min Inst), CEng, MIMM, MSME, MNYAS, FGIG, FGA | Professor | Mine Design and Planning, Operation Research, Mine Economic and Financial Evaluation, Mineral Resource Estimation, Mine Feasibility Study and Environmental Impact Assessment, Social Corporate Responsibility. |
| Prof N. A. Amegbey | Dr Ing (TUBerlin), MSc (Pet Min Inst), FMVS, MGDMB, MSME | Professor | Environmental and Safety Engineering/Human Factor, Mining Regulations, Mine Environment, , Mine Ventilation Environmental Impact Assessment, Safety in Mines, Mining Regulations, Mine machinery. |
| Assoc Prof S. Al-Hassan | PhD (Wales), BSc,PgD (KNUST), MIMM | Assoc Professor | Mine Planning & Design, Surface & Underground mining Technology, Geostatistics, and Mineral Economics. Small Scale Mining. |
| Assoc Prof V. A. Temeng | PhD (Michigan), MSc (Zambia), BSc, PgD (KNUST),MGhIE | Assoc Professor | Materials Handling, Operation Research, Modelling and Simulation of Mine Production and Equipment Systems |
| Assoc Prof B. Kumi-Boateng | PhD (UMaT), MSc (KNUST), MSc (ITC); BSc (KNUST), Cert in Remote Sensing (UT), MASPRS | Assoc Professor | Land and Compensation Surveys; Geo-information Science for Environmental Systems Analysis & Management; Spatial Statistics; Carbon Mapping |
| Dr Mrs Cynthia Boye | PhD (Legon), PM (Netherlands), BSc (KNUST), MGhIS, MGhIE | Senior Lecturer | GIS and Applications; Shoreline Change Detection, Monitoring and Predictions; Feature Change Analysis; Cadastral and Engineering Surveys |
| Dr E. E. Duncan | PhD(Skudai), MSc (Glasgow), BSc (KNUST), GhIS, MFIG | Senior Lecturer | GIS (2D & 3D), GPS, Remote Sensing and Geodesy |
| Mr E. A. A. Kwesi | MPhil (KNUST), BSc, (KNUST) | Lecturer | GIS and Digital Cartography |
| Dr S. Mantey | PhD (UMaT), MPhil (Cambridge), BSc, (KNUST), Member, IEEE GRSS; Member, AARSE | Senior Lecturer | Remote Sensing and GIS in Environmental Systems Analysis, GPS Surveys |
| Dr M. S. Aduah | PhD (KwaZulu-Natal), MSc (Enschede), MSc (Lund), BSc (KNUST), Cert (Enschede) | Senior Lecturer | Geo-information Science for Environmental Modeling & Management |
| Dr Issaka Yakubu | PhD (UMaT), MPhil (UMaT), BSc (KNUST), Certificate (UT) | Senior Lecturer | GIS and Applications, Global Navigation Satellite Systems (GPS, GLONASS) and Applications, Engineering and Cadastral Surveying; Multi-Criteria Spatial Analysis; Disaster Risk Management and Environmental Assessment for Spatial Planning. |
| Dr N. D.Tagoe | PhD (Cape Town), MSc (Germany), BSc (KNUST) | Senior Lecturer | Digital Photogrammetry, Desktop and Web GIS, Remote Sensing |
| Dr Y. Y. Ziggah | PhD (China) MEng (China), BSc (KNUST) | Lecturer | Physical Geodesy, Satellite Geodesy |

# DEPARTMENT OF GEOLOGICAL ENGINEERING

## 8 MASTER'S (MODULAR) PROGRAMME IN GEOLOGICAL ENGINEERING

### 8.1 TITLE OF PROGRAMME

The title of the programme is MSc/MPhil Programme (Modular) in Geological Engineering.

### 8.2 PROGRAMME OBJECTIVES

Geologists today are looking for new and innovative ways of finding new ore deposits to meet the growing demands of society. Mineral exploitation is associated with environmental problems, and this poses a great challenge to the geologist who must find remedies to avoid ecological disaster as the industry expands.

The Geological Engineering programme recognises these facts and strives to develop new approaches within the framework of a sound quality education.

The Modular Master's Programme aims at producing motivated and highly qualified geologists/geological engineers who can be relied upon to identify and solve the numerous problems confronting the mineral and construction industries in Ghana and the West African sub-region. The programme also aims at providing a firm grounding in basic and advanced concepts and modern methods of mineral exploration, geotechnical engineering and hydrogeology.

It is structured to offer the possibility of continuing education thereby making it possible for practicing earth scientists and/or engineers in the industry to update and upgrade their knowledge and skills in the various areas of specialisation while still on the job. The main objectives of the programme are:

- To provide an avenue for practicing earth scientists in the mining and related industries to develop and update their knowledge and skills in mineral exploitation, geological engineering and hydrogeology.
- To turn out competent postgraduates with creative thinking and innovation by challenging them to identify and solve problems independently and/or collectively through research.
- To produce competent postgraduate students capable of advanced careers in the minerals and allied industries, universities and research institutions.

### 8.3 ENTRY REQUIREMENTS

a) The entry requirements for the Master's Degree in Geological Engineering are:

(i) Applicants must have BSc First Class or Second Class (Upper Division) or its equivalent in Earth Sciences and related Engineering programmes from a recognised university.

(ii) All other applicants who do not satisfy (i) above but have degrees in Engineering & Science may be eligible only after passing an interview.

(iii) Holders of the UMaT Diploma in the Earth Sciences who hold senior positions in a relevant industry and have at least 5 years professional experience with proven ability in their discipline are eligible for admission.

(iv) Foreign applicants with proficiency in English language who satisfy the requirements of (i) or (ii) above are eligible for admission after careful consideration of their relevant documents.

(v) Applicants who have satisfactorily completed a Postgraduate Diploma programme may be considered for admission on the recommendation of the Departmental Board concerned.

### 8.4 PROGRAMME REQUIREMENTS

The Department offers two Master's Degree Programmes. These are:

(i) MSc Geological Engineering Degree Programme

(ii) MPhil Geological Engineering Degree Programme

**a) Graduation Requirements**

i. MSc Geological Engineering Degree

- A minimum of 48 credit hours is required for the award of MSc Degree. This is made up of a minimum of nine (9) modules (at least 27 credit hours), Graduate Seminar (3 credit hours), Field trip and Report (3 credit hours) and Thesis (15 credit hours).

ii. MPhil Geological Engineering Degree

- A student is required to do six (6) core modules outlined in Section 8.5a. In addition, he/she may audit modules recommended by the Supervisor to facilitate the student's research work. The candidate is also required to present at least one seminar.
- The successful defence of a thesis is required for the award of the MPhil Degree in Geological Engineering. The thesis should be an embodiment of independent research conducted by a student under the guidance of a Supervisor on a significant problem in a chosen area of Geological Engineering.

**b) Programme Duration**

- Full-time: A maximum of four (4) semesters for coursework and thesis
- Part-time: A maximum of six (6) semesters.

## 8.5 PROGRAMME STRUCTURE

**a) Core and Compulsory Modules**

The MSc course work comprises 5 core modules namely:

- Operations Research (GL 553)
- Statistical Models (GL 555)
- Financial & Economic Evaluation (GL 554)
- Environmental Management (GL 557)
- GIS & Remote Sensing (GL 574)

In addition, a minimum of 4 other modules must be selected by the candidate in consultation with his/her Supervisor(s). Research Methods (GL 551) is compulsory but does not earn credit.

- Computer Applications is compulsory but a candidate may apply for exemption. Applicants without adequate background in geology will be required to register for the module in "Introductory Geology".
- Field trips will be organised and all students will be required to participate in at least one of them. An essential requirement of the modules is that students devote the afternoons to tutorials, practicals or field trips.

**b) Content of Modules**

**The modules to be run, credit hours and module numbers are as follows:**

| Course No. | Name of Course | Credit Hour |
|---|---|---|
| GL 261 | Introductory Geology** | 0 |
| GL 351 | Introduction to Computer Applications* | 0 |
| GL 551 | Research Methods* | 0 |
| GL 553 | Operations Research | 0 |
| GL 500 | Thesis | 15 |
| GL 515 | Postgraduate Seminar | 3 |
| GL 552 | Mineral Resource Evaluation | 3 |
| GL 554 | Economic & Financial Evaluation | 3 |
| GL 555 | Statistical Models | 3 |
| GL 556 | Field Trip & Report | 3 |
| GL 557 | Environmental Management | 3 |

| | | |
|---|---|---|
| GL 559 | Applied Rock Mechanics | 3 |
| GL 571 | Applied Hydrogeology | 3 |
| GL 572 | Mine Water Hydrology | 3 |
| GL 573 | Ore Deposit Geology | 3 |
| GL 574 | GIS and Remote Sensing | 3 |
| GL 575 | Mineral Exploration Geochemistry | 3 |
| GL 576 | Exploration Drilling and Sampling | 3 |
| GL 577 | Water Resources Management | 3 |
| GL 578 | Industrial Minerals | 3 |
| GL 582 | Groundwater Engineering | 3 |
| GL 584 | Mineral Exploration Geophysics | 3 |
| GL 586 | Advanced Ore Microscopy | 3 |

*** Preparatory Module, ** Pre-requisite Module for non-Geological Engineers**

### GL 261 Introductory Geology

Credits: 0

Basic Geological Concepts, Principles & Theories, Origin and Composition of the Earth, Geologic Time Scale, Formation & Properties of the various Rock Types I,Formation & Properties of the various Rock Types II, Plate Tectonics and Associated Features, Surficial Processes (Elements of Weathering, Geomorphology, etc.),Study of Geological Structures, Geologic Structures & their Effect on Rock/Soil Strength Parameters, Basic Concepts in Economic Geology & Mineral Exploration, Geologic Hazards and the Environment.

### GL 351 Introduction to Computer Applications

Credits: 0

Introduction to PC, Basic Hardware Components of the PC, Operating Systems Software DOS, Operating Systems Hardware (DOSshell, Windows, File Managers and Utilities), Word Processing, Data Processing, Database, Graphics. Software Installation and Interfacing, Summary.

### GL 553 Operations Research

Credit.: 0

Nature of Operations Research in Mining, Linear, the Simplex Algorithm for Integer & Goal Programming, Transportation and Assignment Problems, Decision Analysis, Markov Analysis, Simulation, Queuing Models, Inventory Control Models, Production Scheduling Methods – CPM, Dynamic Programming

### GL 500 Thesis

Credits: 15/24

An independent research work under the guidance of (a) Supervisor(s) on a topic in the student's area of specialisation. A bound thesis embodying the results of the research will be presented to the Department after an oral defence. A panel will assess this.

### GL 515 Postgraduate Seminar

Credits: 3

Students will be required to make at least one presentation on the progress and research underway in their areas of specialisation. The seminar will be assessed by a Departmental Panel. All Postgraduate students are required to attend the Seminar(s).

### GL 552 Mineral Resource Evaluation

Credits: 3

Introduction to Ore Resource Evaluation, Theory of Regionalised Variables, Statistical Theory and Applications, Quantifying the Criteria of Estimation, Variography, Practical Production and Modelling of Semi-Variograms, ID Regularisation of Variograms; Extension Variance and Estimation Variance, Practical- Application of Extension Theory to Block Resource Evaluation;Global Resource Estimation and Estimation Variance I, Global Resource Estimation, Optimal Estimation and Kriging II, Volume-Variance and Grade-Tonnage Relationship I,Volume-Variance and Grade-Tonnage Relationship II: Case Studies.

### GL 554 Economic & Financial Evaluation

Credits: 3

Nature of and Requirements for Mining Projects. Time Value of Money and Economic Equivalence, Estimation of Revenue and Costs, Investment Allowances, Mine Taxation and Royalties, Financing Alternatives, Cash Flow Models and Analysis, Investment Decision Methods and Criteria, Sensitivity and Risk Analysis, Mine Feasibility Study, Case Studies.

### GL 555 Statistical Models

Credits: 3

Basic Statistical Procedures I, Basic Statistical Procedures II, Regression and Linear Models I, Regression and Linear Models II, Application to Multiple Regression I, Application to Multiple Regression II, Application to Multiple Regression III, Statistical Inference & Statistical Modelling I, Statistical Inference & Statistical Modelling II, Use of Transformation, Correlation & its Relationship with Regression

### GL 556 Field Trip & Report

Credits: 3

Field trips will be organised and students are required to participate in, at least, one of them. They are required to submit a written report(s) and make oral presentation on it/them

### GL 557 Environmental Management

Credit.: 3

Environmental Impact of Mining (an Overview), Air Quality/Pollution, Air Quality Modeling, Water Quality/ Pollution, Water Quality Modeling, Noise, Environmental Aspects of Ground Vibrations and Air Blasts, Environmental Impact Assessment Methodologies, Environmental Impact Assessment Practices, Ghana's Environmental Policy

### GL 559 Applied Rock Mechanics

Credits: 3

Basic Concepts in Rock and Soil Mechanics, Rock and Soil Tests for Design Analysis (in-situ and Laboratory Testing of Rocks and Soils, Geotechnical Mapping and Rock Mass Classification, Stereograhic Projection Methods in Rock Mechanics, Groundwater, Seepage and De-watering Analysis, Stability of Soil and Rock Slopes, Design of Underground Excavations and Pillars, Foundations Design, Dam Foundations and Leach Pads, Site Investigation.

### GL 571 Applied Hydrogeology

Credits: 3

Evaporation, Precipitation, Runoff & Stream flow, Properties of Aquifers, Theory of Groundwater Flow, Applications of Groundwater Flow, Regional Groundwater Flow, Groundwater Geology, Water Chemistry, Exploration for Groundwater, Groundwater Modelling. Case Studies.

### GL 572 Mine Water Hydrology

Credits: 3

Mining and the Water Environment, Mine Water Chemistry. Hydrology and Mining, Physical Impacts of Mineral Extraction on Hydrological Systems, Hydrological Issues in Dewatering, Waste Rock Piles & Tailings Dams, Hydrology of Abandoned Mines & Rebound Processes, Hydrological Intervention in Mine Water Remediation, Treatment of Polluted Mine Waters, Case Studies I, Case Studies II.

### GL 573 Ore Deposit Geology

Credits: 3

Orthomagmatic Deposits, Disseminated & Stockwork Cu, Mo, W, & Sn Deposits, Stratified and Stratabound Deposits, Hydrothermal and Vein Deposits (Felsic Associates), Sedimentary Ore Deposits (Fe & Mn), Mineralisation in Space & Time, Tectonic Settings as Controls of Mineralisation, Geochemistry in Mineral Exploration, Isotopic Geology, Fluid Inclusion Studies.

### GL 574 GIS and Remote Sensing

Credits: 3

Photogrammetry & Introduction to Remote Sensing, GIS in Mineral Exploration, Spatial Data Models, Geological Applications of GIS, Data Base Management I, Data Base Management II, Spatial Interpolation I, Spatial Interpolation II, Image Processing I, Image Processing II

### GL 575 Mineral Exploration Geochemistry

Credits: 3

An overview of Geochemical Methods in Mineral Exploration, Sample Preparation & Geochemical Analysis, Drainage Sediment Geochemistry, Heavy Minerals in Exploration, Soil Geochemistry, Rock Geochemical Surveys, Biogeochemistry, Hydro- & Gas-Geochemistry, Analytical Chemistry, Geochemistry of Gold & Data Interpretation I & II.

### GL 576 Exploration Drilling and Sampling

Credits: 3

Introduction to Exploration Drilling, Diamond Drilling; Equipment and Techniques, Innovations in Diamond Drilling, Deflection & Orientation of Drill holes, Ore Sampling, Solution of Structural Problems in Drilling with Stereonet I, Solution of Structural Problems II, Solution of Structural Problems III, Sampling: Techniques, Sampling: Calculations/Projections.

### GL 577 Water Resources Management

Credits: 3

Water Resources Management, Groundwater Development, Sustainability & Water Budgets, Impacts of Groundwater Development on Basin Hydrogeology, Water Quantity and Water Hazard Issues, Mass Transport and Mass Transfer Processes in Groundwater, Water Quality, Water Contamination and Pollution, Attenuation of Contamination and Groundwater Remediation , Water Law, Meeting the Challenges of Water Sustainability

### GL 578 Industrial Minerals

Credits: 3

Introduction, Concepts, Geological Overview, Mining, Processing, Transportation, Marketing of IM's, Igneous Materials I, Igneous Materials II, Igneous Materials III, Presentation of Review Papers, Sedimentary Materials I, Sedimentary Materials II, Sedimentary Materials III/Metamorphic Materials I, Metamorphic Materials II, IM's of Ghana; Trends, Changes & the Future of IM's.

### GL 582 Groundwater Engineering

Credits: 3

Groundwater Structure Systems,Impacts of Groundwater on Basin Hydrology, Groundwater Modeling & Assessment I, Groundwater Modeling & Assessment II, Groundwater in Engineering Construction, Groundwater Instrumentation, Groundwater Monitoring Control and Cost, Groundwater Seepage and Mitigation, Groundwater in Site Investigation, Design of Groundwater Drainage Systems.

### GL 584 Mineral Exploration Geophysics

Credits: 3

Geophysics in Mineral Exploration, Regional Gravity and Aeromagnetic Surveys, Gamma Ray Spectrometry, Principles of EM Prospecting Methods, Airborne EM Methods I: "Input", Airborne EM methods II. "Helicopter EM", Ground-Based EM I: Frequency Domain, Ground-Based EM I: Time Domain, VLF EM, Induced Polarisation (IP) Method.

### GL 586 Advanced Ore Microscopy

Credits: 3

Introduction; the Ore Microscope, Physical Properties of Ore Minerals, Optical Properties of Ore Minerals, Applications of the Ore Microscope, Ore Textures, Textures of Ore & Gangue Minerals I, Textures of Ore & Gangue Minerals II, Textures of Ore & Gangue Minerals III, Ionic Sizes, Isomorphism, Polymorphism & Solid Solutions, Case Studies.

## 9 DOCTOR OF PHILOSOPHY PROGRAMME IN GEOLOGICAL ENGINEERING

### 9.1 ENTRY REQUIREMENTS

- A candidate shall hold a Master's degree or its equivalent in earth sciences and related disciplines from a recognised institution and shall submit evidence of adequate training and ability to undertake the proposed programme.
- A candidate who does not hold a Master's degree shall first register for MPhil degree. If he proves himself/herself to be academically capable by the end of the first year of the programme, he/she may be permitted by the Board of Postgraduate Studies on the recommendation of the Department to register for the PhD degree. This registration shall be deemed retrospective from the date of the original registration of the Master's degree.
- A candidate who does not satisfy the requirements stated above but is otherwise adjudged suitable may be admitted. For the purpose of assessing his suitability, such a candidate may be interviewed on the recommendation of the Department concerned.

### 9.2 PROGRAMME DURATION

A candidate shall pursue full-time programme of study and research for at least two years, except that:

- A candidate fully engaged in advance study and research for his/her degree, who, before registration, was engaged in research to the satisfaction of the Department concerned, may be exempted for not more than one academic year.
- In special circumstances, the Department may recommend that a candidate be allowed to spend not more than one academic year of his/her programme in advanced study research at another institution, provided that his/her work can be supervised in a manner satisfactory to the Department and the School of Postgraduate Studies.
- A full-time candidate who is engaged in research for the degree shall present himself/herself for examination not later than three years from the date of commencement of the academic year in which the student was enrolled.

- A part-time candidate shall present himself/herself for examination not later than four years from the date of commencement of the academic year in which the student was enrolled.
- In special cases, an extension of these time limits may be granted on the recommendation of the Department.

### 9.3 AREAS OF RESEARCH

A candidate may be required to audit appropriate courses/modules and also submit a thesis under the supervision of an academic staff in any of the following areas of research:

- Mineralogy, Petrology and Geochemistry
- Economic Geology
- Water Resources Management
- Mine Water Remediation
- Environmental Geology and Hydrogeology
- Geotechnical Engineering

### 9.4 EMPLOYMENT OPPORTUNITIES

There are employment opportunities in the following areas:

- Large and Small Scale Mining and Allied Companies
- Financial Institutions
- Construction Companies
- Environmental Protection Agencies
- Mines Department
- Minerals Commission
- The Universities and other Educational and Research Institutions
- Geological Survey Department
- National Energy Board
- Water companies
- Other Governmental and Non-governmental Agencies

**Table 8.1 List of Academic Staff and Areas of Specialisation**

| NAME | Academic/Professional Qualification | Designation | Areas of Specialisation |
|---|---|---|---|
| Assoc Prof M. Affam | PhD(UMaT), MSc, BSc (KNUST), MGhIG, MGhIE, MCIM | HOD/Assoc Professor | Rock and Soil Mechanics, Foundation Design and Exploration Techniques |
| Prof D. Mireku-Gyimah | DSc (KNUST), PhD, DIC (London), MSc (Mos Min Inst), CEng, MIMM, MSME, MNYAS, FGIG, FGA | Professor | Mine Design and Planning, Operation Research, Mine Economic and Financial Evaluation, Mineral Resource Estimation, Mine Feasibility Study and Environmental Impact Assessment. |
| Prof Newton Amegbey | Dr Ing (TUBerlin), MSc (Pet Min Inst), FMVS, MGDMB, MSME | Professor | Mine Ventilation, Environmental and Safety Engineering/Human Factors, Mining Regulations, Mine Machinery |
| Prof. J. S. Y. Kuma | PhD (Newcastle), MSc, PgD (Delft), BSc (Ghana), FGhIG, FASI, MIAH, MGhIG | Professor | Water Resource Assessment and Management, Mine Water Hydrology, Geophysics |
| Assoc Prof S. Al-Hassan | PhD (Wales), BSc,PgD (KNUST), MIMM | Assoc Professor | Mine Planning & Design, Surface & Underground mining Technology, Geostatistics, and Mineral Economics. |

| | | | |
|---|---|---|---|
| Assoc Prof V. A. Temeng | PhD (Michigan Tech.), MSc (Zambia), BSc, PgD (KNUST),MGhIE | Assoc Professor | Operation Research, Materials Handling, Mine Economic Evaluation, Mine Planning |
| Assoc Prof B. Kumi-Boateng | PhD (UMaT), MSc (ITC), MSc, BSc (KNUST) | Assoc Professor | Research Methods |
| Dr E. E. Duncan | PhD (Malaysia), MSc (Glasgow), BSc (KNUST), GhIS, MFIG | Senior Lecturer | Geographic Information Systems (GIS), Remote Sensing |
| Dr. A. Ewusi | PhD & MSc (Bransdenburg Tech Unv., Germany), BSc (KNUST) | Senior Lecturer | Groundwater Resource Assessment & Management, Groundwater Monitoring, Groundwater Modelling, Geophysics |
| Dr G. M. Tetteh | PhD, MPhil, BSc (Ghana), MGHIG | Senior Lecturer | Structural Geology and Petrology |
| Dr A. A. Annor | PhD & MSc (Bransdenburg Tech Unv., Germany), BSc (KNUST) | Lecturer | Groundwater Resource Assessment & Management, Groundwater Monitoring, Groundwater Modelling |

# DEPARTMENT OF MINING ENGINEERING

## 10 POSTGRADUATE DIPLOMA PROGRAMME (PgD) IN MINING ENGINEERING

### 10.1 ENTRY REQUIREMENTS

i) Applicants must have BSc First Class or Second Class in Mining Engineering, relevant Engineering or Earth Sciences from a recognised university.

ii) All other applicants who do not satisfy (i) above but have degrees in Engineering and Science are eligible only after an interview.

iii) Holders of the UMaT Diploma who have at least 3 years professional experience and with proven ability in their respective disciplines are eligible for admission.

iv) International applicants with proficiency in English language who satisfy the requirements of (i) or (ii) above are eligible for admission after careful consideration of relevant documents.

v) Applicants who have satisfactorily completed a Postgraduate Diploma programme may be considered for admission on the recommendation of the Departmental Board concerned.

### 10.2 PROGRAMME REQUIREMENTS

The Department offers a Postgraduate Diploma programme in Mining Engineering.

**a) Graduation Requirements**

i. Postgraduate Diploma in Mining Engineering Degree

- A minimum of 33 credit hours is required for the award of a Postgraduate Diploma degree. This is made up of a minimum of seven (7) modules (at least 21 credit hours), Postgraduate Seminar (3 credit hours), Field trip & Report (3 credit hours) and Thesis (6 credit hours).

**b) Programme Duration**

The duration of the programme is one year on full-time basis.

### 10.3 PROGRAMME STRUCTURE

The PgD programme requires that the candidate works on an identified project topic in any of the following mining disciplines:

- Environmental Engineering in Mining.
- Rock Mechanics.
- Geostatistics.
- Blasting and Fragmentation.
- Mineral Economics.
- Mine Management.
- Mine Design and Planning.
- Mine Mechanisation.
- Mine Economics & Financial Evaluation.
- Materials Handling.
- Each module runs for a maximum of two weeks (10 working days) duration; examinations in any module shall be taken within a week after completion of the module.
- There shall be a minimum of forty (40) contact hours in each module (4 hr/day).
- A prospective applicant may participate in a module(s) within two (2) years prior to applying for a Postgraduate programme. The results of such a module(s) shall, upon request by the applicant, be credited to him/her upon admission.

## 11 MASTER'S (MODULAR) PROGRAMME IN MINING ENGINEERING

### 11.1 TITLE OF PROGRAMME

The title of the programme is Master's Programme (Modular) in Mining Engineering.

### 11.2 PROGRAMME OBJECTIVES

Ghana possesses diverse mineral wealth ranging from major exploited minerals such as gold, diamond, manganese, bauxite, salt, sand and gravel, to less exploited minerals such as iron, limestone, copper, kaolin, oil and bitumen. In recent years, many investors have been attracted to the mineral industry in Ghana following the promulgation of favourable minerals and mining laws by the government. Several mining companies, both large and small scale, have been set up and a lot more have acquired prospecting licenses in this country. The viability of this growing industry and the future of Ghana depend largely on the ability of Mining Engineers to:

- Plan, design and evolve satisfactory solutions to the complex issues associated with mining.
- Operate the mines profitably in the face of the ever-changing global economic and social problems.
- Ensure that the mines are operated in an environmentally friendly manner.

The Modular Master's Programme in Mining Engineering is designed to produce highly qualified Mining Engineers capable of meeting the numerous challenges of the growing mineral industry in Ghana and elsewhere.

The programme aims at providing a firm grounding in basic and advanced concepts and modern methods of mining engineering as well as offering a selection of special courses related to developing areas of the subject, particularly those areas of importance to Ghana.

The programme is structured to offer the possibility of continuing education and therefore makes it possible for practicing engineers in the industry to update and upgrade their knowledge and skills in the various areas of specialisation while still on the job. The main objectives of the programme are:

- To provide an avenue for practicing engineers in the mining and related industries to continue their education.
- To turn out competent postgraduates to meet the current demands of the mineral industry.
- To prepare competent postgraduates for various research institutions.

## 11.3 ENTRY REQUIREMENTS

a) The entry requirements for the Master's Degree in Mining Engineering are:

i. Applicants must have BSc First Class or Second Class (Upper Division) in Earth Sciences or Engineering from a recognised University.

ii. All other applicants who do not satisfy (i) above but have degrees in Engineering & Science may be eligible only after passing an interview.

iii. Holders of UMaT Diploma who hold senior positions in a relevant industry and have at least 5 years professional experience with proven ability in their discipline are eligible for admission.

iv. Foreign applicants with proficiency in English language who satisfy the requirements of (i) or (ii) above are eligible for admission after careful consideration of relevant documents.

v. Applicants who have satisfactorily completed a Postgraduate Diploma programme may be considered for admission on the recommendation of the Departmental Board concerned.

## 11.4 PROGRAMME REQUIREMENTS

The Department offers two Master's Degree Programmes. These are:

i. MSc Mining Engineering Degree Programme; and

ii. MPhil Mining Engineering Degree Programme.

**a) Graduation Requirements**

**i. MSc Mining Engineering Degree**

- A minimum of 42 credit hours is required for the award of MSc degree. This is made up of a minimum of seven (7) modules (at least 21 credit hours), Postgraduate Seminar (3 credit hours), Field trip & Report (3 credit hours) and Thesis (15 credit hours).

**ii. MPhil Mining Engineering Degree**

- A student is required to do four (4) core modules outlined in Section 11.5a. In addition, he/she may audit modules recommended by the Supervisor to facilitate the student's research work. The candidate is also required to present at least one seminar.
- The successful defence of a thesis is required for the award of the MPhil Degree in Mining Engineering. The thesis should be an embodiment of independent research conducted by a student under the guidance of a Supervisor on a significant problem in a chosen area of Mining Engineering.

**b) Programme Duration**

- Full-time: A maximum of four (4) semesters for coursework and thesis
- Part-time: A maximum of six (6) semesters for coursework and thesis

## 11.5 PROGRAMME STRUCTURE

**a) Core and Compulsory Modules**

The MSc coursework comprises 4 core modules namely:

- Operations Research (MN 553)
- Statistical Models (MN 555)
- Environmental Management (MN 557)
- Mine Economic & Financial Evaluation (MN 554)

Research Methods is compulsory for all postgraduate students but does not earn any credits.

- In addition, a minimum of 3 other modules must be selected by the candidate in consultation with his/her Supervisor(s). Introduction to Computer Applications is compulsory but a candidate may opt for examination without taking the module in which case the fee is 20% of the module fee. Applicants without adequate mining background will be required to register for the module in "Introduction to Mining Engineering".

- Field trips will be organised and all students will be required to participate in at least one of them. An essential requirement of the modules is that students devote the afternoons to tutorials, practicals or field trips.

**The modules to be run, module numbers, module names and credit hours are as follows:**

| Module No. | Module Name | Credit |
|---|---|---|
| First Semester | | |
| MN 261 | Introduction to Mining Engineering** | 0 |
| MN 351 | Introduction to Computer Applications * | 0 |
| MN 551 | Research Methods | 0 |
| MN 553 | Operations Research | 3 |
| MN 555 | Statistical Models | 3 |
| MN 557 | Environmental Management | 3 |
| MN 559 | Applied Rock Mechanics | 3 |
| MN 571 | Explosives and Rock Fragmentation | 3 |
| MN 573 | Mine Mechanisation | 3 |
| Second Semester | | |
| MN 500/600 | Thesis | 15 |
| MN 552 | Mineral Resource Evaluation | 3 |
| MN 554 | Economics and Financial Evaluation | 3 |
| MN 556 | Field Trip and Report | 3 |
| MN 572 | Mine Management | 3 |
| MN 574 | Mineral Economics | 3 |
| MN 576 | Materials Handling | 3 |
| MN 578 | Environmental Engineering in Mining | 3 |
| MN 582 | Underground Mine Planning and Design | 3 |
| MN 584 | Surface Mine Planning & Design | 3 |

**Preparatory Module ** Pre-requisite Module for non-Mining Engineers*

### MN 261 Introduction to Mining Engineering

Credits: 0

Basic introduction to underground and surface mining terminologies. Description of various operations in underground and surface mining: drilling, blasting, mucking, supporting, stoping, ventilation, benching, stripping, reclamation, including technology and equipment. Introduction to small scale mining. Impact of mining on the environment.

### MN 351 Introduction to Computer Applications

Credits: 0

Introduction to PC. Operating System Software. Word Processing using MS Word. Spreadsheet software using MS Excel. Presentation Software using MS PowerPoint. Database Management System Software using MS Access.

### MN 551 Research Methods

Credits: 0

Definition of research. Objectives of research. Motivation in research. Characteristics of research. Types of research. Problems in starting research. Definition of ethics and professionalism. How ethics and values intersect with professionalism. Ethical theory and applications: Branches of ethics, Classification of ethical theories, Standards of ethical conduct in science, Common ethical principles in science, Code of ethics for engineers. Fraud in Science. Choosing a research topic. Identification and sources of problem. Formulating hypothesis. Functions

of literature review. References and Bibliography. Research designs and approaches. Principles of experimental designs. Sampling basics. Characteristics of a good sample design. Methods of data collection. Validity and Reliability of Data. Processing, anaysis and interpretation of data. Report writing: Significance of report writing. Papers and reports: Management reports, Proposals, Journal papers, Conference papers, Thesis. Format for presentation of thesis at UMaT: Structure and form of a thesis, Headings and numbering, Style and punctuation, Extra-linguistic material, Production of the thesis, Editing and revising, Assessment ( Seminars, Thesis)

### MN 553 Operations Research

Credits: 3

Nature of Operations Research in Mining. Linear, the Simplex Algorithm for Integer and Goal Programming. Transportation and Assignment Problems. Decision Analysis. Markov Analysis. Simulation. Queuing Models. Inventory Control Models. Production Scheduling Methods – CPM, PERT. Dynamic Programming.

### MN 515 Postgraduate Seminar

Credits: 3

Students will be required to make at least one presentation on the progress and research underway in their areas of specialisation. This will be assessed by a Departmental Panel. Postgraduate students are required to attend the seminar(s).

### MN 555 Statistical Models

Credits: 3

Basic Statistical Procedures. Regression and the Linear Models. Regression and the Linear Models. Application to Multiple Regression. Statistical Inference and Statistical Modelling. Use of Transformation; Correlation and its Relationship with Regression.

### MN 557 Environmental Management

Credits: 3

Environmental Impact of Mining (an Overview). Air Quality/Pollution. Air Quality Modeling. Water Quality/ Pollution. Water Quality Modeling. Noise. Environmental Aspects of Ground Vibrations and Airblasts. Environmental Impact Assessment Methodologies. Environmental Impact Assessment Practices. Ghana's Environmental Laws and Regulations.

### MN 559 Applied Rock Mechanics

Credits: 3

Basic Concepts in Rock and Soil Mechanics. Rock and Soil Tests for Design Analysis in-situ and Laboratory Testing of Rocks and Soils. Geotechnical Mapping and Rock Mass Classification. Stereograhic Projection Methods in Rock Mechanics. Groundwater, Seepage and De-watering Analysis. Stability of Soil and Rock Slopes. Design of Underground Excavating and Pillars. Foundation Design for Surface Structures. Dam Foundations and Leach Pads. Site Investigation for Surface Structures.

### MN 571 Explosives and Rock Fragmentation

Credits: 3

Drilling; Fragmentation Principles and Blasting Theory. Explosives; Criteria for Selecting Explosives. General Consideration of Geology and Rock Properties on Blast Design and Blast Results. Surface Design Bench Blast. Underground Blast Design Tunneling, Stoping, etc. Charge Loading, Blast Initiation and Delay Blasting. Environmental Effects of Blasting. Specialised Blasting Techniques. Blasting Economics and Benefits. Blast Performance Assessment.

### MN 573 Mine Mechanisation

Credits: 3

Introduction. Drilling Machines-Percussive Drills and Rotary Drills. Boring Machines, Raise Borers and Tunnel Borers. Boring Machines-Tunnel Borers and Blindhole Borers. Excavators - Front End Loaders (FEL). Load-Haul-Dump Machines. Haulage Trucks. Stationary Mine Machinery Pumps and Compressors. Hoists. Maintenance of Mine Machinery.

### MN 514 Underground Mine Planning and Design

Credits: 3

Scope of Underground Mine Design and Planning. Design Strategies. Long and Short Term Planning. Equipment Selection and Production Scheduling. Surface Facilities and Primary Development Layout. Design Consideration for Naturally Supported Mining Systems. Design Consideration for Artificially Supported Mining Systems. Design Considerations for Caving Mining Systems. Computer-Aided Underground Mine Design and Planning. Case Studies.

### MN 552 Mineral Resource Evaluation

Credits: 3

Introduction to Ore Resource Evaluation. Theory of Regionalized Variables. Statistical Theory and Applications. Quantifying the Criteria of Estimation. Variography, Practical Production and Modeling of Semi-Variograms. ID Regularization of Variograms. Extension Variance and Estimation Variance. Practical-Application of Extension Theory to Block Resource Evaluation. Global Resource Estimation and Estimation Variance. Optimal Estimation and Kriging. Volume-Variance and Grade-Tonnage Relationship. Case Studies.

### MN 554 Mine Economic and Financial Evaluation

Credits: 3

Overview of Mine Economic and Financial Evaluation. Time Value of Money and Economic Equivalence. Estimation of Revenue and Costs. Investment Allowances, Mine Taxation and Royalties. Financing Alternatives. Cash Flow Models and Analysis. Investment Decision Methods and Criteria. Sensitivity and Risk Analyses. Mine Feasibility Study. Case Studies.

### MN 556 Field Trip and Report

Credits: 3

Field trips will be organised and students are required to participate in at least one of them. They are required to submit a written report(s) and make an oral presentation on it/them.

### MN 572 Mine Management

Credits: 3

Introduction: Some developments in management thought, functions of mine managers. Managerial planning and decision-making. Principles of Organising, Organisational Structure Design and Analysis, Decentralisation and Delegation of Authority. Staffing – How to Select an Employee for the Job, Matching the Job with Employee Education, Training and Development. The Human Factor, Motivation and Leadership. Direct and Indirect Control Techniques, Management by Objectives, Exception and Delegation. Problems and Conflict Management. Case Studies.

### MN 574 Mineral Economics

Credits: 3

Introduction to Mineral Economics – Its Nature and Scope. Basic Micro and Macro-economics: Demand and Supply, Elasticity and its Applications, Market Structures, National Income, International Trade. Economics of the Mineral Industry: Mineral Demand, Mineral Supply, Applications to Mineral Market Instability. Pricing and

Trading in Minerals: Mineral Prices Determination, Efforts to Stabilize Mineral Prizes, Sources of Pricing Information, Mineral Trade.

### MN 576 Materials Handling

Credits: 3

Introduction to Aspects of Materials Handling in Mines. Materials and their Characteristics. Materials Handling Equipment. Haulage of Bulk Materials. Combined Haulage Systems. Transfer and Loading Stations Hoisting. Hydraulic Transport. Haulage Organisation.

### MN 578 Environmental Engineering in Mining

Credits: 3

Airflow through Subsurface Environments. Subsurface Ventilation Network. Subsurface Ventilation Simulation. Subsurface Climate Simulation. Human Thermoregulation Modelling. Thermal Stress Environments. Mine Waste Management. Environmental Management of Tailings. Rehabilitation of Mine Sites. Environmental Issues in Small Scale Mining.

### MN 584 Surface Mine Planning and Design

Credits: 3

Scope of Surface Mine Planning and Design. Definition of Surface Mine Planning and Design Parameters. Ultimate Pit Definition and Mining Systems. Equipment/Production Scheduling. Opening-up of a Surface Mine. Environmental Requirements of Surface Mining Planning and Design. Aspects of Computing to Mine Planning and Design. Aspects of Ore Reserve Modeling and Simulation of Mineral Extraction Systems. Computer-Aided Design Software Packages for Surface Mining Scheduling and Evaluation.

### MN 500 Thesis

Credits: 15/24

An independent research work under the guidance of a Supervisor(s) on a topic in the student's area of specialisation. A thesis embodying the results of the research will be presented to the Department and defended orally. A panel will assess the thesis.

## 12 DOCTOR OF PHILOSOPHY PROGRAMME IN MINING ENGINEERING

### 12.1 ENTRY REQUIREMENTS

- A candidate shall hold a Master's degree or its equivalent earth sciences and related disciplines from a recognised institution and shall submit evidence of adequate training and ability to undertake the proposed programme.
- A candidate who does not hold a Master's degree shall first register for MPhil degree. If he/she proves himself/herself to be academically capable by the end of the first year of the programme, he/she may be recommended to register for the PhD degree; this registration shall be deemed retrospective from the date of the original registration for the Master's degree.
- A candidate, who does not satisfy the requirements stated above but is otherwise adjudged suitable, may be admitted.

### 12.2 PROGRAMME DURATION

Subsequent to registration, the candidate shall pursue a full-time programme of study and research for at least two years, except that:

- A candidate fully engaged in advanced study and research for his/her degree, who, before registration, was engaged in research to the satisfaction of the Department concerned, may be exempted for not more than one academic year.

- In special circumstances, the Department may recommend that a candidate be allowed to spend not more than one academic year of his/her programme in advanced study research at another institution, provided that his/her work can be supervised in a manner satisfactory to the Department and the School of Postgraduate Studies.
- A Full-Time candidate who is engaged in research for the degree shall present himself/herself for examination not later than three years from the date of commencement of the academic year in which the student was enrolled.
- A Part-Time candidate shall present himself/herself for examination not later than four years from the date of commencement of the academic year in which the student was enrolled.

In special cases, an extension of these time limits may be granted on the recommendation of the Department.

### 12.3 AREAS OF RESEARCH

A candidate may be required to audit appropriate courses/modules and also submit a thesis under the supervision of an academic staff in any of the following areas of research:

- Environmental Engineering in Mining
- Rock Mechanics
- Geostatistics
- Blasting and Fragmentation
- Mineral Economics
- Mine Management
- Mine Design and Planning
- Mine Mechanisation
- Mine Economics & Financial Evaluation
- Materials Handling

### 12.4 EMPLOYMENT OPPORTUNITIES

There are employment opportunities in the following areas:

- Large and Small Scale Mining and Allied Companies
- Financial Institutions
- Construction Companies
- Environmental Protection Agencies
- Minerals Commission
- The Universities and other Educational and Research Institutions
- National Energy Board
- Other Governmental and Non-governmental Agencies

### 12.5 AVAILABLE RESOURCES

a) Academic Staff

**Table 12.1 List of Academic Staff and Areas of Specialisation**

| Name | Academic/Professional Qualification | Designation | Areas of Specialisation |
|---|---|---|---|
| Dr. G. Adjei | PhD (Havana), MSc (Mao), PgEd (Havana), Cert. in French Language (Mao), MCSG | Senior Lecturer | Mineral Processing, Industrial Minerals, Surface Mining |

| | | | |
|---|---|---|---|
| Prof D. Mireku-Gyimah | DSc (KNUST), PhD, DIC (London), MSc (Mos Min Inst), CEng, MIMM, MSME, MN-YAS, FGIG, FGA | Professor | Mine Design & Planning, Operations Research, Mine Economic & Financial Evaluation, Mineral Resource Estimation, Mine Feasibility Study and Environmental Impact Assessment |
| Prof Newton Amegbey | Dr Ing (TUBerlin), MSc (Pet Min Inst), FMVS, MGDMB, MSME | Professor | Mine Ventilation and Safety Engineering/ Human Factors, Mining Regulations, Mine Machinery |
| Assoc Prof S. Al-Hassan | PhD (Wales), BSc,PgD (KNUST), MIMM | Associate Professor | Mine Planning & Design, Surface & Underground Mining Technology, Geostatistics, Mineral Economics |
| Assoc Prof V. A. Temeng | PhD (Michigan Tech.), MSc (Zambia), BSc, PgD (KNUST),MGhIE | Associate Professor | Operations Research, Materials Handling, Mine Economics, Mine Planning |
| Assoc Prof B. Kumi-Boateng | PhD (UMaT), MSc (ITC), MSc, BSc (KNUST) | Associate Professor | Research Methods |
| Mr Emmanuel M. Buaba | MS. (Exeter), PgDip, BSc (KNUST) | Lecturer | Geotechnical Engineering, Mine Ventilation & Safety Engineering, Mine Machinery |
| Mr Bright Oppong Afum | MSc (Aberystwyth), BSc (KNUST) | Lecturer | Explosives & Blasting Technology, Environmental Monitoring & Analysis, Surface & Underground Mining Systems, Underground Mine Planning & Design, Mining Regulations |

# DEPARTMENT OF MINERALS ENGINEERING

## 13 MASTER'S (MODULAR) PROGRAMME IN MINERALS ENGINEERING

### 13.1 TITLE OF PROGRAMME

The title of the programme is Master's Programme (Modular) in Minerals Engineering.

### 13.2 PROGRAMME OBJECTIVES

Mineral resources contribute significantly to the economy of Ghana; providing employment and foreign exchange among others. This notwithstanding, the mining industry is faced with technical, environmental and social problems. The available ores are low grade and their mineralogical composition very complex, a situation that results in low recovery and generation of large volume of waste material. The latter presents a real environmental challenge, which undermines public trust for the industry. Furthermore, there are other mineral resources that are least exploited like industrial minerals and there is the need to train human resources for the processing of these minerals.

The programme is therefore designed to:

- Train and upgrade the knowledge of Mineral Engineers to cope with the ore complexities and their inherent environmental issues.
- Enhance the diversification and maximization of mineral processing in Ghana and elsewhere.
- Produce competent postgraduates capable of making a career in research and teaching.

## 13.3 ENTRY REQUIREMENTS

a) The entry requirements for the Master's Degree in Minerals Engineering are:

i. A BSc First Class or Second Class (Upper Division) or its equivalent in Applied Sciences and related engineering programmes.

ii. All other applicants who do not satisfy the requirements of (i) above but have degrees in Engineering & Science may be eligible only after passing an interview.

iii. Holders of UMaT Diploma in the Earth Sciences, who have at least five (5) professional experience with proven ability in their discipline are eligible for admission.

iv. Foreign applicants with proficiency in English language who satisfy the requirements of (i) or (ii) above are eligible for admission after careful consideration of relevant documents.

v. Applicants who have satisfactorily completed a Postgraduate Diploma programme may be considered for admission on the recommendation of the Departmental Board concerned.

## 13.4 PROGRAMME REQUIREMENTS

The Department offers two Master's Degree Programmes. These are:

i. MSc Minerals Engineering Degree Programme

ii. MPhil Minerals Engineering Degree Programme

**a) Graduation Requirements**

i) MSc Minerals Engineering Degree

- A minimum of forty-five (45) credit hours is required for the award of the MSc. Degree. This is made up of a minimum of four (4) compulsory and four other modules (at least 24 credits hours), Graduate Seminar (3 credit hours); Field Trip & Report (3 credits) and Thesis (15 credits).

ii) MPhil Minerals Engineering Degree

- A student is required to take four (4) compulsory modules outlined in Section 12.5a. In addition he/she may also take modules recommended by the Supervisor to facilitate his/her research work. The student is required also to present at least one seminar.
- The successful defence of a thesis is required for the award of the MPhil degree in Minerals Engineering. The thesis should be an embodiment of independent research conducted by the student under the guidance of a Supervisor(s) on a significant problem in a chosen area of Minerals Engineering.

**b) Programme Duration**

- Full-time: A maximum of four (4) semesters for coursework and thesis
- Part-time: A maximum of six (6) semesters.

## 13.5 PROGRAMME STRUCTURE

**a) Core and Compulsory Modules**

The MSc/MPhil course work comprises four core modules:

- Operations Research (MR 553)
- Statistical Models (MR 555)
- Economic & Financial Evaluation (MR 554)
- Environmental Management (MR 557)

Research Methods (MR 551) is compulsory but does not earn credit for all postgraduate students

- In addition, each MSc student will select four other modules in consultation with his/her Supervisor(s). Introduction to Computer Applications is compulsory but a candidate may apply for exemption. Applicants without adequate mineral engineering background will be required to register for the module in "Introduction to Minerals Engineering".
- Field trips will be organised and all students will be required to participate in at least one of them. An essential requirement of the modules is that students devote the afternoons to tutorials, practicals or field trips.

**b) Course Structure**

First Year: First Semester Modules

| Module No. | Module Title | Credit Hours |
|---|---|---|
| FIRST SEMESTER | | |
| MR 261 | Introduction to Minerals Engineering | 0 |
| MR 351 | Introduction to Computer Applications | 0 |
| MR 551 | Research Methods | 0 |
| MR 553 | Operations Research | 3 |
| MR 555 | Statistical Models | 3 |
| MR 571 | Mineralogy | 3 |
| MR 557 | Environmental Management | 3 |
| MR 573 | Mineral Particle Systems | 3 |
| MR 575 | Biotechnology in Minerals Engineering | 3 |
| MR 577 | Aqueous Processes in Minerals Engineering | 3 |
| MR 579 | Ferrous Metallurgy | 3 |
| SECOND SEMESTER | | |
| MR 572 | Industrial Minerals Beneficiation | 3 |
| MR 554 | Economic and Financial Evaluation | 3 |
| MR 574 | Precious Minerals Beneficiation | 3 |
| MR 576 | Mineral Process Design and Control | 3 |
| MR 578 | Mine Waste Management | 3 |
| MR 582 | Non-ferrous Metal Beneficiation | 3 |
| MR 584 | Rheology | 3 |
| MR 556 | Field Trip and Report | 3 |
| NOTE | | |
| MR 550 | MSc/MPhil Seminar | 3 |
| MR 500 | MSc/MPhil Thesis | 15 |
| MR 650 | PhD Seminar I | 3 |
| MR 660 | PhD Seminar II | 3 |
| MR 600 | PhD Thesis | 30 |

*** Preparatory Module** **** Preparatory Module for non-Mineral Engineers**

**c) Contents of Modules**

### MR 261 Introduction to Mineral Engineering (0)

Comminution & classification, concentration processes, leaching, purification and metal recovery.

### MR 351 Introduction to Computer Applications (0)

Introduction to PC, Basic hardware components of the PC, Operating systems software DOS, Operating systems hardware (DOSshell, Windows, File Managers and Utilities) Word Processing, Data processing, Database, Graphics, Software installation and interfacing and summary.

### MR 551 Research Methods (0)

Definition of research. Objectives of research. Motivation in research. Characteristics of research. Types of research. Problems in starting research. Definition of ethics and professionalism. How ethics and values intersect with professionalism. Ethical theory and applications: Branches of ethics, Classification of ethical theories, Standards of ethical conduct in science, Common ethical principles in science, Code of ethics for engineers. Fraud in Science. Choosing a research topic. Identification and sources of problem. Formulating hypothesis. Functions

of literature review. References and Bibliography. Research designs and approaches. Principles of experimental designs. Sampling basics. Characteristics of a good sample design. Methods of data collection. Validity and Reliability of Data. Processing, anaysis and interpretation of data. Report writing: Significance of report writing. Papers and reports: Management reports, Proposals, Journal papers, Conference papers, Thesis. Format for presentation of thesis at UMaT: Structure and form of a thesis, Headings and numbering, Style and punctuation, Extra-linguistic material, Production of the thesis, Editing and revising, Assessment ( Seminars, Thesis)

**MR 553 Operations Research (3)**

Nature of operational research in mining. The simplex algorithm, linear, integer and goal programming. Transportation and assignment problems. Decision analysis. Markov analysis. Simulation. Queuing models. Inventory control models. Production scheduling methods. CPM. Dynamic programming.

**MR 555 Statistical Models (3)**

Sampling theory and techniques. Basic statistical concepts in data analysis. Special distributions. Estimation theory. Testing hypothesis. Analysis of variance (ANOVA). Regression and correlation analyses. Introduction to multiple regression analysis. Mathematical expectations. Experimental design: the strategy of design, factorial experiments, screening design, Taguchi's robust method.

**MR 557 Environmental Management (3)**

Environmental Impacts of Mining (an overview). Air quality/pollution. Air quality modeling; water quality/ pollution; water quality modeling. Noise. Environmental aspects of ground vibrations and air blasts. Environmental impact assessment methodologies and practices. Ghana's Environmental Policy.

**MR 571 Mineralogy (3)**

Introduction to mineralogy of sulphides, oxides, carbonates and chlorides - with special reference to crystal structure. Mineral identification techniques; X-ray diffractometry, X-ray fluorescence, atomic absorption spectrophotometry, ore microscopy, etc. Isomorphism, texture of ores, gangue minerals and grain size defects. Basic laboratory work in ore microscopy. Application of mineralogy to process metallurgy; leaching, roasting, etc.

**MR 573 Mineral Particle Systems (3)**

Creation of particles; brittle fracture theory and review of theories of comminution, crushing and grinding circuit analysis, general method of producing fine powders. Characterization of particles; size analysis methods, evaluation of sizing, data-probability plots. Separation of mineral particles using physical and chemical properties. Agglomeration of particles; forces between microassemblies, technology of agglomeration.

**MR 575 Biotechnology in Mineral Engineering (3)**

Some basic concepts of microorganisms: their diversity, habitat, their physiology, metabolism, genetics and their influence on the environment. Nitrogen, carbon, phosphorous and sulphur cycles. The role of microorganisms in processes such as biofilm formation, biocorrosion, mineral leaching, acid rock drainage, biosorption, bioremediation of organic pollutants etc and manipulating environmental conditions to enhance or retard a given process.

**MR 577 Aqueous Processes in Mineral Engineering (3)**

Leaching reactions and methods, liquid/solid separation processes. Purification operations, solvent extraction, ion exchange and reverse osmosis, Metal recovery processes, precipitation, crystallization, electrolysis, etc. and carbon adsorption technology.

**MR 579 Ferrous Metallurgy (3)**

Iron ores of Ghana. Blast furnace ironmaking (theory, practice and applications. Coke reactivity index (CRI). Coke strength after reaction (CSR)). Alternative ironmaking processes. Steelmaking processes; basic oxygen

furnace (BOF), electric arc furnace (EAF) process. Physical chemistry of iron and steelmaking. Materials and energy balances. Energy requirements. Fuels and reducing agents for iron and steelmaking. Slag foaming (theory, applications and benefits). Application of waste polymers and biomass in iron and steelmaking technologies. Plasma reduction of metal oxides. Application of microwave energy in metal oxides reduction. Ferroalloys (FeMn, FeSi, FeTi, SiC, SiMn). Waste management (management and creation of values from ferrous slags).

### MR 554 Economic and Financial Evaluation (3)

Nature of requirements for mining projects. Time value of money and economic equivalence. Estimation of revenue and costs; investment allowances; taxation and royalties. Investment decision methods and criteria. Project cash flow and risk. Case study of project feasibility.

### MR 572 Industrial Minerals Beneficiation ( 3)

Production of salt (NaCl) from sea water, indigenous and commercial ponds. Uses of salt in the petrochemical and chemical industries. Production of limestone and cement manufacture. Beneficiation of diamond and kaolin. Heavy mineral sand; ilmenite, rutile, zircon, etc. Environmental issues of industrial mineral production.

### MR 574 Precious Minerals Beneficiation (3)

Types of gold ores; Alluvial, Free milling and Complex ores, Treatment processes, lixiviants for leaching of gold, pre-treatment processes for complex ores, pressure leaching, bacteria oxidation etc. heap leaching. CIL, CIP processes and Zinc precipitation, electrolysis and refining of gold. Environmental issues of tailings disposal; geochemistry of tailings and cyanide detoxification techniques. Platinum. Artisanal mining; environmental and social impacts, poverty alleviation and conflicts.

### MR 576 Mineral Process Design and Control (3)

Process flowsheet design; metallurgical accounting and process economics. Selection and sizing of equipment from test data; crushers, grinding mills, gravity concentration, hydrocylone and flotation cells. Process control and instrumentation.

### MR 578 Mine Waste Management (3)

Types of mine waste; waste rock and tailings. Impoundment structures; selection and design. Tailings deposition methods. Water Management, Sampling and analysis of tailings, Effluent treatment for environmental control and monitoring systems, Decommissioning, reclamation and covers. Case studies of cyanide-bearing tailings and acid rock drainage system.

### MR 582 Non Ferrous Metal Beneficiation (3)

Types of bauxite, The Bayer Process. Production of alumina from non-bauxite sources, Production of aluminium from alumina, Re-fining of aluminium. Types of copper ores and beneficiation methods; leaching with ammonia and sulphuric acid. Electrolysis and metal recovery. Environmental issues of bauxite, alumina and copper beneficiation. Types of manganese ores; Beneficiation on MnO2 and production of manganese compounds from MnCO3. Production of ferromanganese.

### MR 584 Rheology (3)

Introduction; importance of non-linearity; shear rate and shear stress relationship; range of shear rates; basic dimensions and units; importance of rheology; applications of rheology; operation of a rheometer; types of rheometers; determination of flow curves; inverse problems in rheometry; the couette problem; solving the couette problem; typical rheological behaviours; outlining a flow curve; elastic solids; viscous fluids; shear thinning/shear thickening; yield stress. Viscosity: introduction; fluid viscosity classifications; Newtonian and Non-Newtonian; pseudoplastic and dilatant; time-dependent and time-independent; thixotropic and rheopectic; yield stress and no yield stress; variables which affect viscosity; variation with shear rate; variation with temperature; variation with pressure; types of viscometers for measuring shear viscosity; viscoelastic structure and property of

suspensions; viscous modulus; elastic modulus; methods for measurement; statistical measurement (stress relaxation or creep test); dynamic measurement (oscillatory); suspension rheology and particle interaction; particle interaction forces; DLVO forces; Non-DLVO forces; structural hydration forces; hydrogen bonding; hydrophobic forces; steric/electrosteric forces; bridging forces; depletion forces; cementation forces; rheology-interfacial chemistry (particle zeta potential) relationship; mathematical models of shear yield stress-surface chemistry; elastic floc model; empirical power law; floc interaction; instrument for measuring interaction forces on individual particles; colloid probe microscopy using AFM; total internal reflectance microscopy (TIRM); surface forces instrument (SFA); laser tweezers; correlation of shear rheology and floc strength; gel formation mechanisms.

### MR 550 MSc/MPhil Seminar (3)

Each student will be required to make at least one seminar presentation on the progress of his/her thesis work. The presentation will be assessed by a Departmental Panel. All Postgraduate students are required to attend the seminar(s).

### MR 556 Field Trip and Report (3)

Field trips will be organised and students are required to participate in, at least, one of them and shall submit a written report for assessment.

### MR 500 MSc/MPhil Thesis (15/24)

An independent research work will be carried out by each student on a suitable topic which will constitute a thesis that will be assessed. An oral examination will be conducted on the thesis by a panel of Examiners.

## 14 DOCTOR OF PHILOSOPHY PROGRAMME IN MINERALS ENGINEERING

### 14.1 ENTRY REQUIREMENTS

- A candidate shall hold a Master's degree or its equivalent in earth science and related discipline from a recognised institution and shall submit evidence of adequate training and ability to undertake the proposed programme
- A candidate who does not hold a Master's degree shall first register for MPhil degree. If he/she proves himself/herself to be academically capable by the end of the first year of the programme, he/she may be recommended to register for the PhD degree; this registration shall be deemed retrospective from the date of the original registration for the Master's degree
- A candidate, who does not satisfy the requirements stated above but is otherwise adjudged suitable, may be admitted
- For the purpose of assessing his/her suitability, such a candidate may be interviewed or required to take an entrance examination, or both as directed by the School of Postgraduate Studies on the recommendation of the Departmental Board.

### 14.2 PROGRAMME DURATION

Subsequent to duration, the candidate shall pursue a full-time programme of study and research for at least two years, except that:

- A candidate fully engaged in advanced study and research for his/her degree, who, before registration, was engaged in research to the satisfaction of the Department concerned, may be exempted for not more than one academic year.
- In special circumstances, the Department may recommend that a candidate be allowed to spend not more than one academic year of his/her programme in advanced study research at another institution, provided that his/her work can be supervised in a manner satisfactory to the Department and the School of Postgraduate Studies.

- A Full-Time candidate who is engaged in research for the degree shall present himself/herself for examination not later than three years from the date of commencement of the academic year in which the student was enrolled.
- A Part-Time candidate shall present himself/herself for examination not later than four years from the date of commencement of the academic year in which the student was enrolled.

In special cases, an extension of these time limits may be granted on the recommendation of the Department.

### 14.3 AREAS OF RESEARCH

A candidate may be required to audit appropriate course (s)/modules and also submit a thesis under the supervision of an academic staff in any of the following areas of research:

- Mine Water Characterization
- Mine Water Management
- Aqueous Processes and Studies
- Water Quality
- Environmental Monitoring and Management
- Gold Benefication
- Biohydrometallurgy
- Environmental Biotechnology
- Geometallurgy
- Acid Mine Drainage
- Microwave Processing
- Plant Design
- Materials Engineering
- Industrial Waste Management

### 14.4 AVAILABLE RESOURCES

**a) Academic Staff**

The Department has qualified staff to manage the programme (see list of academic staff and their areas of specialisation)

**b) Equipment**

The Department has good laboratory facilities for physical mineral separation. Other facilities needed to run the programme can be accessed from allied industries and universities in the country.

**c) Reading Materials**

The Department and University libraries have relevant books and computer facilities. Students can use these facilities to access information.

### 14.5 EMPLOYMENT OPPORTUNITIES

There are employment opportunities in the following areas:

- The Universities and other Educational and Research Institutions
- Environmental Protection Agencies
- Financial Institutions
- Minerals Commission
- Large and Small Scale Mining and Allied Companies
- Other Government and Non-Governmental Organisations

**Table 14.1 List of Academic Staff and Areas of Specialisation**

| Name | Academic/Professional Qualification | Designation | Areas of Specialisation |
|---|---|---|---|
| Assoc Prof J. R. Dankwah | PhD (UNSW), MSc (NTNU), BSc (KNUST) | HOD/Associate Professor | Ferrous Metallurgy, Application of Waste Polymers into Metal Extraction, High Temperature Metallurgical Processes, Nonferrous Metallurgy, Electrometallurgy, Aqueous Processes, Solid Waste Management |
| Prof R. K. Amankwah | PhD (Queen's), MPhil, BSc (KNUST), MGhIE, MSME | Professor/Dean (FIMS) | Biohydrometallurgy, Environmental Biotechnology, Application of Microwaves in Mineral Extraction, Gold Ore Processing, Geometallurgy |
| Prof W. K. Buah | PhD (Leeds), MSc (Krivoy Rog Min. Inst), MGhIE | Professor/ Dean (SPS) | Mineral Processing, Waste Management, Pyrolysis - Gasification. |
| Assoc Prof G. Ofori Sarpong | PhD (Penn State), MSc, BSc (KNUST) | Associate Professor/Dean (FMRT) | Aqueous Processing of Precious Metals, Microbial-Mineral Interaction, Acid Mine Drainage Issues, and Small-Scale Gold Mining. |
| Dr J. J. K. Gordon | PhD (UMaT), MPhil, BSc (KNUST) | Senior Lecturer | Biotechnology, Mineral Processing |
| Prof D. Mireku-Gyimah | DSc (KNUST), PhD, DIC (London), MSc (Mos Min Inst), CEng, MIMM, MSME, MNYAS, FGhIG, FGA | Professor | Mine Design and Planning, Operation Research, Mine Economic and Financial Evaluation, Mineral Resource Estimation, Mine Feasibility Study and Environmental Impact Assessment. |
| Prof Newton Amegbey | Dr Ing (TUBerlin), MSc (Pet Min Eng Inst), FMVS, MGDMB, MSME | Professor | Mine Ventilation, Environmental and Safety Engineering/Human Factors, Mining Regulations, Mine Machinery |
| Assoc Prof V. A. Temeng | PhD (Michigan Tech.), MSc (Zambia), BSc, PgD (KNUST) | Associate Professor | Operation Research, Materials Handling, Mine Economic Evaluation, Mine Planning |
| Assoc Prof S. Al-Hassan | PhD (Wales), BSc, PgD (KNUST), MIMM | Associate Professor | Mine Planning and Design, Surface and Underground Mining Technology, Geostatistics, Mineral Economics |
| Assoc Prof B. Kumi-Boateng | PhD (UMaT), MSc (ITC), MSc, BSc (KNUST) | Associate Professor | Research Methods |
| Assoc Prof S. A. Ndur | PhD (New Mexico Tech), MSc (Moscow), MSME, MMMPSG, MSEGH | Associate Professor | Mine Waste Characterization, Mine Waste Management, Aqueous Processes and Studies, Water Quality, Environmental Monitoring and Management |

# DEPARTMENT OF PETROLEUM ENGINEERING

## 15 MASTER'S (MODULAR) PROGRAMME IN PETROLEUM ENGINEERING

### 15.1 TITLE OF PROGRAMME

The title of the programme is MSc/MPhil Programme (Modular) in Petroleum Engineering.

### 15.2 PROGRAMME OBJECTIVES

The main objectives of the programme are to:

- Train and upgrade the knowledge of Petroleum Engineers to cope with the complexities associated with Exploration and Production (E&P) of oil and gas and the related environmental issues.
- Enhance the diversification and competence of personnel in the fast-evolving technologies employed in petroleum exploitation.

- Produce competent postgraduates capable of making a career in industry, research and teaching.

## 15.3 ENTRY REQUIREMENTS

The entry Requirements for the Master's Degree in Petroleum Engineering are:

i. A BSc First Class or Second Class (Upper Division) or its equivalent in Petroleum Engineering or related engineering degrees from a recognised University.

ii. All other applicants who do not satisfy the requirements of (i) above but have petroleum-related degrees from a recognised University may be eligible after careful consideration of the background and relevant documents.

iii. International applicants with proficiency in English language who satisfy the requirements of (i) or (ii) above are eligible for admission after careful consideration of certificate(s), transcripts and relevant documents.

iv. All applicants who do not have Petroleum Engineering will, upon admission, be required to take and pass three (3) non-scoring introductory modules as a prerequisite for the main Petroleum Engineering modules. *A prospective applicant may participate in these modules within two (2) years prior to applying for the programme in Petroleum Engineering. The results will be credited to him/her upon admission.*

## 15.4 PROGRAMME REQUIREMENTS

The Department offers two Master's Degree Programmes. These are:

i. MSc Petroleum Engineering Degree Programme; and

ii. MPhil Petroleum Engineering Degree Programme.

**a. Graduation Requirements:**

**i. MSc Petroleum Engineering Degree**

- A minimum of forty-eight (48) credit hours is required for the award of the MSc. Degree. This is made up of a minimum of six (6) compulsory and three (3) other modules (at least 27 credits hours), Postgraduate Seminar (3 credit hours); Field Trip and Report (3 credits hours) and Thesis (15 credits hours).
- The successful defence of a thesis is required for the award of the MSc degree in Petroleum Engineering. The thesis should be an embodiment of independent research conducted by the student under the guidance of a Supervisor(s) on a significant problem in a chosen area of Petroleum Engineering.

**ii. MPhil Petroleum Engineering Degree**

- A minimum of forty-eight (48) credit hours is required for the award of the MPhil. Degree. This is made up of a minimum of six (6) compulsory modules (at least 18 credits hours), Graduate Seminar (3 credit hours), Field Trip & Report (3 credits hours), and Thesis (24 credits hours). In addition to the compulsory modules, MPhil student may take modules recommended by the Supervisor(s) to facilitate his/her research work.
- The successful defence of a thesis is required for the award of the MPhil degree in Petroleum Engineering. The thesis should be an embodiment of independent research conducted by the student under the guidance of a Supervisor(s) on a significant problem in a chosen area of Petroleum Engineering.

**b. Programme Duration**

- Full Time: A maximum of four (4) semesters for coursework and thesis
- Part Time: A maximum of six (6) semesters for coursework and thesis

## 15.5 PROGRAMME STRUCTURE

Each module runs for a maximum of two weeks (10 working days) duration for a minimum of forty (40) contact hours, and examinations in any module shall be taken within a week from completion of the module.

Research Methods is compulsory for all postgraduate students but does not earn any credits. Introduction to Computer Applications is compulsory but a candidate may opt for examination without taking the module. Applicants without adequate petroleum engineering background will be required to register for the *introductory modules.*

**a. Introductory Modules**

The following modules are mandatory for students without Petroleum Engineering background and are prerequisite for the graduate modules in Petroleum Engineering.

- Introduction to Reservoir Engineering (PE 471)
- Introduction to Drilling Engineering (PE 473)
- Introduction to Production Engineering (PE 475).

**b. Core and Compulsory Modules**

The following modules are compulsory for MSc and MPhil students:

- Applied Computational Methods (PE 571)
- Petroleum Economics and Management (PE 576)
- Advanced Reservoir Engineering (PE 573)
- Environmental Management in Petroleum Industry (PE 574)
- Advanced Drilling Engineering (PE 575)
- Advanced Production Engineering (PE 572).

Field trips and Report will be organised, and all students will be required to participate in at least one of them.

**The modules to be run, module numbers and names, and credits hours are as follows:**

| Module No. | Module Name | Credit(s) |
|---|---|---|
| **First Semester** | | |
| PE 351 | Introduction to Computer Application* | 0 |
| PE 471 | Introduction to Reservoir Engineering** | 0 |
| PE 473 | Introduction to Drilling Engineering** | 0 |
| PE 475 | Introduction to Production Engineering** | 0 |
| PE 551 | Research Methods* | 0 |
| PE 571 | Applied Computational Methods | 3 |
| PE 573 | Advanced Reservoir Engineering | 3 |
| PE 575 | Advanced Drilling Engineering | 3 |
| PE 577 | Applied Petroleum Rock Mechanics | 3 |
| PE 579 | Advanced Natural Gas Engineering | 3 |
| PE 581 | Horizontal Well Technology | 3 |
| PE 583 | Applied Petrophysics | 3 |
| **Second Semester** | | |
| PE 556 | Field Trip and Report | 3 |
| PE 572 | Advanced Production Engineering | 3 |
| PE 574 | Environmental Management in Petroleum Industry | 3 |
| PE 576 | Petroleum Economics and Management | 3 |
| PE 578 | Offshore Drilling Technology | 3 |
| PE 582 | Advanced Reservoir Modelling & Simulation | 3 |
| PE 584 | Improved Recovery Methods | 3 |
| PE 586 | Well Test Analysis | 3 |
| PE 588 | Multi-phase Flow in Pipes | 3 |
| PE 592 | Advanced Well Logging | 3 |
| PE 594 | Petroleum Refinery Operations | 3 |
| **Modules Taken Either Semesters** | | |
| PE 500 | MSc/MPhil Thesis | 15/24 |

| | | |
|---|---|---|
| PE 550 | MSc/MPhil Seminar | 3 |
| PE 600 | PhD Thesis | 30 |
| PE 650 | PhD Seminar I | 3 |
| PE 660 | PhD Seminar II | 3 |

* Non-scoring Module/Preparatory Module (Those proficient in Computing are allowed to take an exam instead of taking the module); ** Pre-requisite/Introductory Module for non-Petroleum Engineers

**PE 351 Introduction to Computer Application – Credits: 0**
Introduction to PC; Operating System Software; Word Processing using MS Word; Spreadsheet software using MS Excel; Presentation Software using MS PowerPoint; Database Management System Software using MS Access.

### PE 471 Introduction to Reservoir Engineering – Credits: 0

Gas reservoirs, Reservoir (GCR): phase diagram, performance. Undersaturated Oil Reservoirs FVF. Compressibility, Gas cap and water drive reservoirs. Generalized material balance equation. Water influx, MER, diffusivity equation. Fluid flow in reservoirs: Darcy's Law. Zonal damage. Deliverability. Displacement of oil and gas. Permeability. Buckly-Leverett. Oil recovery by internal gas drive. PI decline. Stratified reservoirs. Sweep efficiency.

### PE 473 Introduction to Drilling Engineering – Credits: 0

Basic properties of rocks. Function and composition of drilling equipment. Drilling Fluids, Formation Pressure: Prediction of pore pressures and fracture gradients. Drill string and Bits, Casing and Cementing operations, Directional drilling and deviation control, Fishing operations, Pressure control and Drill stem testing. Offshore drilling, Drilling economics and Well Planning.

### PE 475 Introduction to Production Engineering – Credits: 0

Inflow performance relationship. Vertical two-phase flow. Horizontal two-phase flow. Choke/Bean performance. Performance of flowing well and its design. Principles of gas-lift. Gas-lift valve mechanics. Continuous and Intermittent gas-lift design. Principles of chamber lift and plunger lift. Sucker rod pumping design. Selection of pumping units. Design and selection of electrical submersible pumping installation. Design and selection of hydraulic pumping system.

### PE 551 Research Methods – Credits: 0

Definition, objectives, motivation and characteristics of research. Types of research. Definition and code of ethics and professionalism in science and engineering. Choosing a research topic. Formulating hypothesis. Functions of literature review. References and Bibliography. Research designs and approaches. Principles of experimental designs. Validity and Reliability of Data. Processing, analysis and interpretation of data. Report writing: Format for presentation of thesis at UMaT. Editing and revising, Assessment (Seminars, Thesis).

### PE 571 Applied Computational Methods – Credits: 3

Differential Equation, Linear Algebra, curve fitting and interpolation; geo-statistics and stochastic simulation: regression models, Laplace Transform, Fourier Transform, Finite Difference and Finite Element Methods, artificial intelligence techniques, uncertainty issues. Case studies and software applications in petroleum engineering.

### PE 573 Advanced Reservoir Engineering – Credits: 3

Oil and gas reservoir mechanics, analysis of reservoir rock-fluid systems, study of reservoir behaviour. Water Flood Management. PVT relationships. Theories of fluid flow through porous media. Computation of in-place gas, condensate and oil. Drainage equations and reservoir performance prediction. Screening reservoirs for the enhanced oil recovery processes. Case studies and software applications. Oil and Gas Reserves and Evaluation.

**PE 575 Advanced Drilling Engineering – Credits: 3**

Formation Pressure and Fracture Resistance. Drill String, Drill Bits: Well Control, Casing and Casing Design, Cementing technology; Drilling and Completion Fluids, Drilling Hydraulics, Well Control and Solid removal Equipment. Directional Drilling and Measurement While Drilling (MWD), Drilling problems.

**PE 577 Applied Petroleum Rock Mechanics – Credits: 3**

Theories and applications of rock mechanics to petroleum reservoirs and their physical behaviours, porous media and fracture flow models. Laboratory measurements of porosity and permeability. Deformation behaviours as a function of stress state, in-situ stress, measurement of wellbore stability, sand control and reservoir compaction and subsidence. Thermal and Hydraulic Properties of Intact Rock, Discontinuities, Viscosity and flow laws.

**PE 579 Advanced Natural Gas Engineering – Credits: 3**

Gas engineering principles and practices, development of gas fields, gas properties, phase behaviour, reserve calculation and flow in pipes, flash calculations, reservoir performance, production forecast and decline curves, gas conditioning, equipment sizing, pipeline design. Natural Gas and Liquid(s) Separations. Separator Design. Gas treatment. Hydrates. Marine CNG Transportation. LNGs. Direct and Indirect Conversion of Natural Gas. Storage.

**PE 581 Horizontal Well Technology – Credits: 3**

Introduction and Geologic Aspects of Horizontal Wells; Horizontal Well Considerations for Using Horizontal Wells: Applications and Limitations; Horizontal Well Drilling & Completion; Reservoir Engineering Concepts for Horizontal Wells, Fluid Flow In Horizontal Well, IPR for horizontal wells, Transient Flow Equations & Pressure regime, Well Testing of Horizontal Wells, Wellbore storage effects, Stimulation of Horizontal Wells, Economics of Horizontal Wells.

**PE 583 Advanced Petrophysics – Credits: 3**

Petroleum Reservoir Rocks. Rocks, Classification of sedimentary rocks. Distribution of Sedimentary rock types. Reservoirs, fractured reservoirs, reservoir column. Porosity and Fluid Saturation. Measurement of porosity. Pore Volume Compressibility. Permeability- Porosity Correlations. Capillary Tube Models. Non Darcy Flow. Heterogeneity. Measure of Central Tendency and Variance. Interfacial Phenomenon and Wettability. Thermodynamics of interfaces.

**PE 500 Thesis – Credits: (15 [MSc] or 24 [MPhil])**

An independent research work under the guidance of a Supervisor(s) on a topic in the student's area of specialisation. A thesis embodying the results of the research will be presented to the Department and defended orally. A panel will assess the thesis.

**PE 550 Postgraduate Seminar – Credits: 3**

Students will be required to make at least one presentation on the progress and research underway in their areas of specialisation. This will be assessed by a Departmental Panel. Postgraduate students are required to attend the seminar(s).

**PE 556 Field Trip and Report – Credits: 3**

Field trips are made to areas of interest and students are required to participate in at least one of them. They are required to submit a written report(s) and make oral presentation on it/them.

**PE 572 Advanced Production Engineering – Credits: 3**

Introduction, production schemes, drive mechanisms, well performance, integrated production systems, multiphase flow, stimulation techniques, artificial lift methods, facilities design. Horizontal and offshore applications. Separation and treatment, field management. Case studies and software applications. Data

Interpretation and Analysis. Surveillance and reservoir management, Productivity trends. Flow assurance. Sand Control.

**PE 574 Environmental Management in Petroleum Industry – Credits: 3**

Introduction to environmental management in the oil and gas industry; Impacts of drilling and production operations; environmental transport of petroleum product; waste treatment methods: treatment of water, treatment of solids, treatment of air emissions; Waste disposal; Environmental aspect in offshore operations; Planning for environmental protection; Remediation of contaminated sites: site assessment; Environmental impact assessment methodologies, practices and Regulations.

**PE 576 Petroleum Economics and Management – Credits: 3***

Global E&P Industry Structure. Petroleum Economics: Fundamentals, Resource, reserves and production forecasting; Petroleum Fiscal System: Fiscal systems and terms, fiscal systems models and application, fiscal system issues and concerns for stakeholders; Decision Under Risk and Uncertainty: Expected value concepts, decision tree analysis, simulation and sensitivity analysis; Computer spreadsheet analysis. Management of petroleum resources. Valuation of petroleum resources.

**PE 578 Offshore Drilling Technology – Credits: 3**

Types of Offshore Rigs, Types of Offshore, Rigs-Operational Details, Deep Offshore Rig Equipment, Wellhead housing, Subsea tie-back system, Mudline suspension system, Templates system, Subsea BOP Stack, Remote Operated Vehicle, Installation/workover control systems (IWOCS), Deep Offshore Drilling Issues, Offshore Rig Selection, Deep Water Drilling Peculiarities-Specific Calculations, Deep Offshore Drilling Challenges and the Future.

**PE 582 Advanced Reservoir Modelling & Simulation – Credits: 3**

Mathematical simulation models and boundary conditions. The development of unsteady state fluid flow equations for reservoir, application of finite difference methods, flow equations. Finite difference approximation. Grid systems and boundary conditions, solution methods. Mathematical reservoir simulator with special emphasis on practical applications. Fluid, production, flow rate data preparation. Simulation studies.

**PE 584 Improved Recovery Methods – Credits: 3**

Primary oil recovery phase, screening criteria, ways to improve recovery targets, life under secondary schemes, immiscible gas injection, gas flaring, water flooding, design considerations, technical challenges, current and future R&D directions; facilities modifications and personnel training; forecasting behaviour under various IOR methods and reservoir performance analysis. Importance of IOR in field development studies, IOR project monitoring.

**PE 586 Well Test Analysis – Credits: 3**

Introduction to well testing, Unsteady-state flow of reservoir fluids in porous media, theory and application of pressure build-up analysis, pressure drawdown analysis, log-log type curve analysis, flow regimes and log-log diagnostic plot, bounded reservoir behaviour, wellbore and near-wellbore phenomena. Well Test Interpretation Models, Partial penetration. Drill stem testing and water influx prediction, Case studies and software applications.

**PE 588 Multiphase Flow in Pipes – Credits: 3**

Principle of two-phase flow: The General Energy Equation, evaluation of Friction losses- the Friction Factor concept, single phase Flow. Flow regimes in gas-liquid flow, oil-water flow and liquid particle flows. Definitions of Variables used in Two-Phase Flow. Flow Patterns. Challenges of fluid and flow metering. Flow assurance. correlations for vertical, transition, horizontal and inclined flows.

### PE 592 Advanced Well Logging – Credits: 3

Introduction to formation evaluation; electrical, acoustic and radioactive properties of reservoir rocks; electromagnetic propagation tool; log normalisation, pressure measurements; complex lithology identification and effect of shale in log interpretation. Log types & application, Wireline Formation Testing, Data acquisition of porosity, lithology, Pulsed Neutron Sigma and resistivities, Geosteering basics. Conventional Interpretation Techniques.

### PE 594 Petroleum Refinery Operations – Credits: 3

Composition of Crude Oil, Oils and Products: Properties of Crude Oils, Crude Oil Classification, Crude Oil Refinery and its Major Products, Properties of Products, Crude Testing, Distillation of Crude Oil, Light Ends Processing; Naphtha Processing; Heavy Oil Processing, Treating Processes, Product Blending and Finished Products, Environmental Protection in Oil Refining; Process Integration and Optimisation in Petroleum Refineries.

## 16 DOCTOR OF PHILOSOPHY PROGRAMME IN PETROLEUM ENGINEERING

### 16.1 ENTRY REQUIREMENTS

**The entry requirements for PhD in Petroleum Engineering are:**

The entry requirements for PhD in Petroleum Engineering are:

i. A candidate shall hold a Master's degree or its equivalent in Petroleum Engineering Discipline, from a recognised institution and shall submit evidence of adequate training and ability to undertake the proposed programme.

ii. A candidate who does not hold a Master's degree but has a first class Bachelors' degree in Petroleum Engineering shall first register for a Master's degree by research. If he/she proves himself/herself to be of sufficient calibre by the end of the first year of the programme, he/she may be recommended to register for the PhD degree; this registration shall be deemed retrospective from the date of the original registration for the Master's degree.

iii. A candidate, who does not satisfy the requirements stated above but is otherwise adjudged suitable, may be admitted. For the purpose of assessing his/her suitability, such a candidate may be interviewed or required to take an entrance examination, or both as directed by the School of Postgraduate Studies on the recommendation of the Departmental Board.

iv. International applicants with proficiency in English language who satisfy the requirements of (i) or (ii) above are eligible for admission after careful consideration of certificate(s), transcripts and relevant documents.

### 16.2 PROGRAMME REQUIREMENT

- A student is required to do five (5) core modules. In addition, he/she may audit modules recommended by the Supervisor to facilitate the student's research work. The candidate is also required to present at least two seminars in the case of PhD.
- The successful defence of a thesis is required for the award of the PhD Degree in Petroleum Engineering. The thesis should be an embodiment of independent research conducted by a student under the guidance of a Supervisor on a significant problem in a chosen area of Petroleum Engineering.

### 16.3 PROGRAMME DURATION

PhD degree is typically by research, however, a candidate may take courses in consultation with his/her supervisor to gain firm grounding in the research area. A candidate shall pursue a full-time programme of study and research for at least two years, except that:

- A candidate fully engaged in advanced study and research for his/her degree, who, before registration, was engaged in research to the satisfaction of the Department concerned, may be exempted for not more than one academic year.

- In special circumstances, the Department may recommend that a candidate be allowed to spend not more than one academic year of his/her programme in advanced study research at another institution, provided that his/her work can be supervised in a manner satisfactory to the Department and the School of Postgraduate Studies.
- A Full-Time candidate who is engaged in research for the degree shall present himself/herself for examination not later than three years from the date of his/her registration.
- A Part-Time candidate shall present himself/herself for examination not later than four years from the date of registration. In special cases, an extension of these time limits may be granted on the recommendation of the Departmental Board.

## 16.4 AREAS OF RESEARCH

A candidate may be required to audit appropriate courses/modules and also submit a thesis under the supervision of an academic staff in any of the following areas of research:

- Drilling optimization
- Natural gas engineering
- Reservoir rock evaluation
- Well testing analysis
- Enhanced Oil recovery
- Petroleum Economics
- Oil and gas production optimization
- Drilling wastes management
- Reservoir simulation

## 16.5 EMPLOYMENT PROSPECTS OF GRADUATES

The sectors of the economy that could employ graduates of the programme:

- The Universities and other Educational and Research Institutions
- The Oil and Gas Industries
- Environmental Protection Agencies
- Financial Institutions
- Industries
- Other Government and Non-Governmental Organisations

## 16.6 AVAILABLE RESOURCES

a). Details of staff for the programme is presented in Table 16.1.

**Table 16.1 List of Academic Staff and Areas of Specilisation**

| Name of staff | Academic/Professional Qualification | Designation | Area of specialisation |
|---|---|---|---|
| Dr Saviour Mantey | PhD (UMaT), MPhil(Cambridge), BSc (KNUST) | Senior Lecturer HOD | GIS and Remote Sensing applications in environmental systems Analysis, Surveying and UAV Applications |
| Prof Dulu Appah | PhD (Uniport) | Professor | Production Engineering, Formation Evaluation |
| Prof Sunday Sunday Ikiensikimama | PhD (University of Lagos) | Associate Professor | Reservoir, Production and Gas Engineering, Oil & Gas Property Modeling, PVT Properties of Hydrocarbon Mixtures, Petroleum Economics & Risk Management, Process Development & Optimization. Computer Aided Design, Refining & Petrochemicals Software Solution Development. |

| | | | |
|---|---|---|---|
| Dr Eric Broni-Bediako | PhD, MPhil (UMaT), MSc (AUST), BSc (KNUST) | Senior Lecturer | Drilling Optimisation, Offshore Technology, Environmental Management, Health and Safety in Petroleum Industry, and Petroleum Economics |
| Dr Richard Amorin | PhD (UMaT), MSc (AUST) BSc (KNUST) | Senior Lecturer | Pseudo Oil Based Fluids, Natural Gas Engineering, Transportation of Oil and Gas, Health and Safety in the Oil and Gas Industry. |
| Dr Harrison Osei | PhD (UTP), MSc (AUST), BSc (KNUST) | Lecturer | Drilling and Completion, Reservoir Engineering, Enhanced Oil Recovery, Multiphase Flow and Separation, Fluid dynamics |
| Dr Ohenewaa Kakra Dankwa (Miss) | PhD (UNIPORT), MSc (AUST), BSc (UMaT) | Lecturer | Production Enhancements, Matrix Acidizing, Oilfield Scales, Drilling mud filter cakes removal, Environmental and Safety Management Environmental, Health and Safety |
| Dr Solomon Adjei Marfo | PhD (UNIPORT), MEng (Belgrade) BSc (KNUST) | Lecturer | Local Raw Materials Usage in the Petroleum Industry (Agro-waste performance evaluation), Directional Drilling Technology, Production Engineering, SHE, Oil & Gas Pipeline Transportation Design |
| **Eric Mensah Amarfio | MSc (AUST), BSc (KNUST) | Lecturer | Reservoir Engineering, Production Engineering, Nano-fluids, Drilling and well completion, Petroleum Economics |
| Daniel Ocran | MSc (AUST) BSc (UMaT) | Assistant Lecturer | Petroleum Economic, Reservoir optimization and Simulation, Production Engineering. |

***PhD in Progress*

# DEPARTMENT OF MECHANICAL ENGINEERING

## 17 MASTERS (MODULAR) PROGRAMME IN MECHANICAL ENGINEERING

### 17.1 TITLES OF PROGRAMMES

The title of the programme is MSc/MPhil Programme (Modular) in Mechanical Engineering.

### 17.2 PROGRAMME OBJECTIVES

The main objectives of the programme are to produce graduates with a wide range of knowledge of modern engineering enterprise and to develop skill in advanced mechanical engineering in the field of thermal power and fluid engineering.

### 17.3 ENTRY REQUIREMENTS

The entry requirements for the Master's degree in Mechanical Engineering are:

i) Applicants must have BSc First Class or Second Class (Upper Division) in Mechanical Engineering, Agricultural Engineering and Engineering from a Recognised University.

ii) All applicants who do not satisfy (i) above but have degree in Engineering and Science may be eligible only after passing an interview.

iii) Holders of UMaT Diploma in Mine Mechanical Engineering or Earth Sciences and related Engineering programmes who hold senior positions in a relevant industry and have at least 5 years professional experience with proven ability in their discipline are eligible for admission.

iv) Foreign applicants with proficiency in English language who satisfy the requirements of (i) or (ii) above are eligible for admission after careful consideration of relevant documents.

vi) Applicants who have satisfactorily completed a Postgraduate Diploma programme may be considered for admission on the recommendation of the Departmental Board concerned.

## 17.4 PROGRAMME REQUIREMENTS

The Department offers two Master's Degree programmes. These are:

- MSc in Mechanical Engineering (Thermal Power and Fluid Engineering).
- MPhil in Mechanical Engineering.

**a) Graduation Requirements**

i) MSc Mechanical Engineering Degree

- A minimum of 45 credit hours is required for the award of MSc. Degree. The programme is composed of a minimum of eight (8) modules (24 credit hours), Postgraduate Seminar (3 credit hours), Field Trip and Report (3 credit hours) and a Thesis (15 credits).

ii) MPhil Mechanical Engineering Degree

- A student is required to take three (3) core modules outlined in Section 14.5 and two others recommended by the supervisor to facilitate his/her research work. The candidate is also required to present at least one seminar.
- The successful defence of a thesis is required for the award of the MPhil Degree in the chosen area of specialization. The thesis should be an embodiment of independent research conducted by the student under the guidance of a Supervisor on a significant problem in a chosen area of Mechanical Engineering

**b) Programme Duration**

- Full-time – A maximum of four (4) semesters for coursework and thesis.
- Part-time – A maximum of six (6) semesters.

## 17.5 PROGRAMME STRUCTURE

**a) Core/Compulsory Modules**

The MSc Course work comprises 6 core modules namely:

- Engineering Heat Transfer (MC 571)
- Fluid Mechanics (MC 573)
- Computational Fluid Dynamics (MC 575)
- Gas-Turbines and Fuel Cells (MC 576)
- Gas Dynamics (MC 572)
- Advanced Engineering Thermodynamics (MC 578)

In addition, a minimum of two (2) other modules must be selected by the candidate in consultation with his/her Supervisor(s). Applicants without adequate Mechanical Engineering background will be required to register for the module in Introduction to Mechanical Engineering. Research Methods (MC 551) is compulsory for all postgraduate students and none credit.

Numerical Methods and Computer Programming are compulsory non-scoring modules but a candidate may apply for exemption in either of them on satisfactory proof of proficiency in it/them.

Field trips will be organized and all students are required to participate in at least one of them. An essential requirement of the modules is that students devote the afternoons to tutorials, practicals or field trips.

**b) Content of Modules**

The modules to be run, credit hours and modules numbers are shown in Table 17.1

**Table 17.1 Programme Modules for the Master's Programme in Mechanical Engineering**

| Module No. | Name of Course | Credit Hour |
|---|---|---|
| First Year | | |
| MC 261 | Introduction to Mechanical Engineering | 0 |
| MC 379 | Numerical Methods | 0 |
| MC 389 | Computer Programming | 0 |
| First Semester | | |
| MC 551 | Research Methods | 0 |
| MC 571 | Engineering Heat Transfer | 3 |
| MC 573 | Fluid Mechanics | 3 |
| MC 575 | Computational Fluid Dynamics (CFD) | 3 |
| MC 577 | Combustion and Internal Combustion Engines * | 3 |
| Second Semester | | |
| MC 576 | Gas-Turbine and Fuel Cells | 3 |
| MC 572 | Gas Dynamics | 3 |
| MC 578 | Advanced Engineering Thermodynamics * | 3 |
| MC 574 | Renewable Energy Resources * | 3 |
| MC 582 | Engineering Economics * | 3 |
| MC 557 | Environmental Management * | 3 |
| Second Year | | |
| MC 515 | Postgraduate Seminar | 3 |
| MC 556 | Field Trip and Report | 3 |
| MC 500 | Thesis | 15 |

** Elective modules*

## Introduction to Mechanical Engineering (0)

Engineering Materials: Classification of Engineering Materials, Properties of Materials, Testing of Materials. Machine Tools: Lathe, Drilling, Milling, Shaping. Machine Design: Design process, material selection in design. Fluid Mechanics: Properties of fluid, Pascal's Law, Variation of pressure with depth and hydrostatic, energy and its form, Bernoulli's equation, Viscous and turbulent flow. Fluid Machineries: Fluid coupling, Pumps, Compressors, Hydraulic turbine, Hydraulic power plant, Pneumatic machines. Laws of Thermodynamics: Joule apparatus and mechanical equivalent, First Law of Thermodynamics, The Kelvin-Plancks second law of thermodynamics, Clausius statement for Second law of thermodynamics. Internal Combustion Engines: Types of internal combustion engines, working principles for four-stroke petrol and diesel engines, working principle for two stroke petrol and diesel engines, comparison of petrol and diesel engines, comparison of four-stroke and two-stroke engines, comparison of steam and internal combustion engine. Heat Transfer: Introduction to the three modes of heat transfer; Types of Heat Exchangers. Refrigeration and Air-Conditioning Industrial and Maintenance Engineering: Time and Work Study, Types of Maintenance Schedule.

## Numerical Methods (0)

Review of the various numerical techniques of solving linear and non-linear equations. The nature of iterative schemes. The Successive-Over Relaxation method (SOR) for both component and matrix forms. Finite differences. Interpolation. The Taylor's method, the Euler method, Modified Euler method. Runge-Kutta methods. The Shooting method, the finite difference method. Methods for Eleptic equations. Methods for Parabolic and Hyperbolic equations.

### Computer Applications: Programming in C/C++ (0)

Introduction to C Programming, Operators and Expressions. Fundamental Data Types and Storage Classes, Standard C/C++ pre-processor. Standard C/C++ library and Conditional Program Execution, Program Loops and Iteration, Modular Programming. Pointer to Objects, Arrays, Structures, Unions. Controlling Devices, Operating System Interaction, Mouse and graphic programming, Lists, Trees, String, Queues and stacks. Object Oriented paradigm and C++ at a glance, Classes and objects. Object initialization and cleanup, dynamic objects. Operator overloading, Inheritance, Virtual functions. Generic programming with templates, Streams computation with streams, Stream computation with files. Exception handling

### Name of Module: Research Methods (0)

Introduction to research. Epistemology and its implications for research methodology and design. Theoretical framework and Scientific research design. Qualitative data collection and Analysis. Principles of quantitative data analysis (Descriptive Statistics). Quantitative Methods. Sampling, questionnaire design and methods for pre-testing. Research proposal for competitive research grant. Format of research proposal. Reporting and communicating research results.

### Engineering Heat Transfer (3)

Introduction to the three modes of heat transfer. Physical laws governing these processes (the three modes of heat transfer). Differential equation of three-dimensional conduction. Complex and unsteady heat conduction. Laminar and turbulent heat convection. Natural and Forced convection. Heat Exchangers. Mass transfer. Boiling and condensation. Radiation and Solar energy.

### Fluid Mechanics (3)

Review of laws of fluid mechanics. Derivation of the governing differential equations. Introduction to potential flows. Exact solutions to the Navier-Stokes equations. Laminar boundary layers. Basic theory and description of turbulent flows and turbulent mixing processes. Physics of near-wall turbulent flows. Modeling of turbulent flows. Linear and non-linear eddy-viscosity schemes. Flow Management: active and passive measures to delay or avoid transition to turbulent flow or to reduce turbulent mixing.

### Computational Fluid Dynamics (CFD) (3)

CFD activity and Transport equation. Numerical verses analytical solutions. Discretisation techniques to transform governing equations into sets of linear equations. One-dimensional conduction equation, TSE and IOCV methods. Stability and convergence. Solution methods for linear systems (Gauss-Seidel, Tridiagonal Matrix Algorithm). Central and upwind differencing for convection terms, diffusion and pressure-velocity coupling. Two-dimensional boundary layers. Adaptive grid, transformation of coordinates and discretisation. Complex domains; curvilinear grids, unstructured grids.

### Combustion and Internal Combustion Engines (3)

Properties of gaseous mixtures: Gibbs-Dalton Law, evaluation of mixture energy, enthalpy and entropy. Properties of gaseous mixtures: gravimetric and molar analyses of mixtures, processes with mixtures. Combustion processes: simple chemistry, stoichiometry, mixtures of reactants.

Combustion processes: air/fuel ratios, energy release, and adiabatic flame temperature. Chemical equilibrium and dissociation: equilibrium constant, degree of dissociation. Chemical equilibrium and dissociation: effects on heat release and flame temperature. Chemical kinetics: rate constants, forward and backward (dissociation), law of mass action. Chemical kinetics: relation to equilibrium constant, forms of rate constant, example of NO, chemical time scales. Flames: premixed, partially premixed and diffusion. Flames: relation to engine output and performance, laminar and turbulent flame speed.

### Gas Turbines and Fuel Cells (3)

Gas Turbine as a prime energy converter. Gas turbine plant. Auxiliary devices and Suitable fuels for gas turbines. Review of the relevant thermofluid mechanics for the design and performance analysis. Fuel cell as the primary class of non-heat route energy conversion. Development of constituent materials. Multi-scale modelling. Stack design. Optimization and control. Fuel cell application, fuels and infrastructure.

### Gas Dynamics (3)

Thermodynamics concepts of compressible flow. Energy equation: static and stagnation temperatures. Elastic waves, the mach cone and the propagation of finite waves. Compressible flow around a body. One dimensional compressible flow in a duct. Subsonic flows. Supersonic flows. Isothermal flow in a pipe. Adiabatic flow in a pipe. Case Studies.

### Advanced Engineering Thermodynamics (3)

Classical thermodynamics of a general reactive system. Conservation of energy and principles of increase of entropy. Fundamental relation of thermodynamics. Availability and maximum work potential. Reversible work and irreversibility. Second-law efficiency; second law analysis of closed systems. Heat transfer with other systems or bodies. Second-law analysis of steady-flow systems. Second-law analysis of unsteady-flow systems. General unsteady-flow processes.

### Renewable Energy Resources (3)

Energy and the economy. Solar radiation production. Transmission and conversion. Photovoltaic. Solar panel and its accessories. Installation and maintenance of Solar panel. Biomass. Wind. Wave and tide. Hydropower conversion.

### Engineering Economics (3)

Nature of and Requirements for Engineering Projects. Time value of Money and Economic Equivalence. Estimation of Revenue and Costs. Choosing among Investment Alternatives. Financing Alternatives. Cash Flow Models and Analysis. Sensitivity and Risk Analysis. Equipment Replacement and Retirement. Feasibility Study. Case Studies.

### Environment Management (3)

Environmental Impact of Mechanical Engineering Activities (an Overview). Emissions/Pollutants from Internal Combustion Engines. Air Quality Modeling. Water Quality/ Pollution. Water Quality Modeling. Noise. Environmental Aspects of Ground Vibrations. Environmental Impact Assessment Methodologies. Environmental Impact Assessment Practices. Ghana's Environmental Policy.

### Postgraduate Seminar (3)

Students will be required to make a minimum of one presentation on the progress and research underway in their areas of specialization. The seminar will be assessed by a Departmental Panel. Postgraduate students are required to attend.

### Field Trip and Report (3)

Field trips will be organized and all students will be required to participate in at least one of them. Candidates are required to submit a written report and make oral presentation(s) on it/them.

### Thesis (15/24)

The thesis must be an embodiment of independent research work under the guidance of Supervisor(s) on a topic in the student's area of specialization. A thesis embodying the results of the research will be presented to the Department for assessment. A panel of examiners will assess the thesis.

## 17.6 AREAS OF RESEARCH

A candidate may submit a thesis under the Supervision of an academic staff in any of the following areas and related topic:

- Thermal power engineering.
- Fluid engineering.
- Renewable energy systems
- Application of Computational Fluid Dynamics to the solution of complex flow phenomena including heat and mass transfer in single and multi-phase.

## 17.7 EMPLOYMENT OPPORTUNITIES

There are employment opportunities in the following areas:

- Oil and gas industry.
- Thermal and hydro power generation industries.
- Water and thermal engineering industries.
- Manufacturing industries using systems involving transport of heat and mass e.g. cocoa processing factories and the breweries.
- Universities, Polytechnics and other Educational and Research Institutions.

**Table 17.2 List of Academic Staff and Areas of Specialisation**

| Name | Academic/Professional Qualification | Designation | Areas of Specialisation |
|---|---|---|---|
| Seth P. Agbomadzi | MSc Eng., Univ. of Newcastle Upon Tyne, UK, BSc (Hons) Eng., UST, Ghana. | Senior Lecturer | Thermofluid Engineering, Hydraulic Structures and Design |
| Prof D. Mireku-Gyimah | DSc (KNUST), PhD, DIC (London), MSc (Moscow Min. Inst.), CEng, MIMM, MSME, MNYAS, FGhIE | Professor | Mine Design and Planning, Operation Research, Mine Economic and Financial Evaluation, Mineral Resource Estimation, Mine Feasibility Study and Environmental Impact Assessment. |
| Prof. N. Amegbey | Dr Ing (TU Berlin), MSc (Romania), FMVS, MGDMB, MSME | Professor | Mine Ventilation, Environmental and Safety Engineering/Human Factors, Mining Regulations, Mine Machinery |
| Assoc Prof V. A. Temeng | PhD (Michigan Tech), MSc (Zambia), PgD, BSc (KNUST) | Associate Profesor | Operation Research, Materials Handling, Mine Economic Evaluation, Mine Planning |
| Assoc Prof A. Simons | PhD, St. Petersburg State Mining Institute, Russia, MSc Eng., Mogilev Machine Building Institute, Mogilev, Belarus | Associate Profesor | Internal Combustion Engines, Heat Transfer, Mining Transport Machinery |
| Stephen K. Adzimah | MSc Eng., Volgograd Polytechnic Institute, Russia. | Lecturer | Production Engineering |
| Emmanuel Seckley | MSc Eng., KNUST, Ghana, BSc Eng., UST, Ghana | Lecturer | Solid Body Mechanics and Strength of Materials |

## 17.8 AVAILABLE FACILITIES

There are up-to-date facilities in the University, the mining industry and allied industries and other research institutions in the country to allow for a comprehensive and detailed work in the programmes. The facilities include:

- A refrigeration and air-conditioning teaching laboratory with work stations.
- A power hydraulics teaching laboratory with work stations.
- A power pneumatic teaching laboratory with work stations.

# DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

## 18 MASTER'S (MODULAR) PROGRAMME IN ELECTRICAL AND ELECTRONIC ENGINEERING

### 18.1 TITLE OF PROGRAMME

The title of the programme is Masters (Modular) Programme in Electrical and Electronic Engineering.

### 18.2 PROGRAMME OBJECTIVES

Electrical and electronic engineering is essential for maintaining and developing a modern society. From the production of electricity through the multiplicity of electrical and electronic apparatuses to communications and robotics, electrical and electronic engineering is fundamental to many of the technical systems that are used every day at work and at home. Electrical and electronic engineering is also changing rapidly.

The Masters programme is designed for Electrical/Electronic Engineering graduates who are practicing engineers, designers or industry planners who seek a further understanding of areas of electrical and electronic engineering such as power systems, mechatronics and industrial automation and communications engineering. The programme is intended to equip the student so as to adapt to the challenging demands of the modern electrical and electronic engineering industries. The main objectives of the programme are to:

- Give candidates professional training in the theoretical and practical aspects of electrical and electronic engineering so as to turn out competent postgraduates to meet the current demands of analysis, synthesis and design of systems of the electrical and electronic engineering industries.
- To provide an academic environment for study and research for the engineer wishing to follow a MSc/PhD programme, in order to contribute in solving the problems of electrical and electronic engineering by the use of appropriate technologies.
- To enrich the capacity of the student to continuously adapt to the constant changes of the state of the art in electrical and electronic engineering

### 18.3 ENTRY REQUIREMENTS

a) The entry requirements for the Master's Degrees in Electrical and Electronic Engineering are:

i. Applicants must have B.Sc. First Class or Second Class (Upper Division) or its equivalent in Electrical and/or Electronic Engineering or in related Engineering disciplines from a recognised University.

ii. All other applicants who do not satisfy (i) above but have degrees in engineering & Science may be eligible only after passing an interview.

iii. Holders of UMaT Diploma in Mine Electrical Engineering who hold senior positions in a relevant industry and have at least 5 years professional experience with proven ability in their discipline are eligible for admission.

iv. Foreign applicants with proficiency in English language who satisfy the requirements of (i) or (ii) above are eligible for admission after careful consideration of relevant documents.

v. Applicants who have satisfactorily completed a Postgraduate Diploma programme may be considered for admission on the recommendation of the Departmental Board concerned.

### 18.4 PROGRAMME REQUIREMENTS

The Department offers two Master's Degree Programmes. These are:

i. MSc Electrical and Electronic Engineering Degree Programme

ii. MPhil Electrical and Electronic Engineering Degree Programme

a) Graduation Requirements

**i. MSc Electrical and Electronic Engineering Degree**

- A minimum of 45 credit hours is required for the award of MSc. Degree. This is made up of a minimum of eight (8) modules (at least 24 credit hours) in five (5) core modules and at least three (3) other modules which must be selected by the candidate in consultation with his/her supervisor, a Graduate Seminar (3 credit hours), Field Trip and Report (3 credit hours) and a Thesis (15 credit hours).

**ii. MPhil Electrical and Electronic Engineering Degree**

- A student is required to take four (4) core modules outlined in Section 15.5a. In addition, the student should take modules recommended by the Supervisor to facilitate the student's research work. The candidate is also required to present at least one seminar.
- The successful defence of a thesis is required for the award of the MPhil degree. The thesis should be an embodiment of independent research conducted by the student under the guidance of a Supervisor on a significant problem in a chosen area of Electrical and Electronic Engineering.

**b) Programme Duration**

- Full-time: A maximum of four (4) semesters for coursework and thesis.
- Part-time: A maximum of six (6) semesters of coursework and thesis.

## 18.5 PROGRAMME STRUCTURE

a) Core and Compulsory Modules

The MSc course work comprises 4 core modules namely:

- Power System Operation, Protection and Planning (EL 575)
- Economic and Financial Evaluation (EL 554)
- Intelligent Systems in Manufacturing (EL 573)
- Advanced Signal Processing (EL 572)

Research Methods (EL 551) is compulsory but does not earn any credit for all postgraduate students

- Introduction to Computer Applications and Computer Applications: C++ and MATLAB/SIMULINK for engineers are compulsory but a candidate may apply for exemption. A minimum of three elective modules must be completed by each student.
- Field trips will be organised and all students will be required to participate in at least one of them. An essential requirement of the modules is that students devote the afternoons to tutorials, practicals or field trips.

**b) Content of Modules**

The modules to be run, credit hours and module numbers are as follows:

| Module No. | Name of Course | Credit Hours |
|---|---|---|
| | **Semester 1** | |
| EL 351 | Introduction to Computer Applications* | 0 |
| EL 263 | Computer Applications: C++ and MATLAB/SIMULINK for En-gineers* | 0 |
| EL 551 | Research Methods | 0 |
| EL 553 | Operations Research | 3 |
| EL 575 | Power System Operation, Protection and Planning** | 3 |
| EL 573 | Intelligent Systems in Manufacturing** | 3 |
| EL 555 | Statistical Models | 3 |
| EL 579 | Computer Control Systems | 3 |
| EL 515 | Postgraduate Seminar | 3 |
| EL 581 | Advanced Robotics | 3 |
| EL 583 | Factory Automation | 3 |
| EL 577 | Microwave Engineering and Optical Communication Systems | 3 |

| Semester 2 | | |
|---|---|---|
| EL 500 | Thesis | 15 |
| EL 554 | Economic and Financial Evaluation** | 3 |
| EL 572 | Advanced Signal Processing** | 3 |
| EL 574 | Microprocessor Systems | 3 |
| EL 576 | Power System Stability, Modelling and Control | 3 |
| EL 582 | Power Electronics and Industrial Drives Systems | 3 |
| EL 584 | Mechatronic System Modelling and Design | 3 |
| EL 556 | Field Trip and Report | 3 |
| EL 586 | Mobile Communications and Wireless Technology | 3 |
| EL 578 | Broadcasting Technologies | 3 |
| EL 588 | Environmental and Safety Engineering | 3 |
| EL 571 | Modelling and Simulation | 3 |

**Preparatory Module ** Core module*

### EL 351 Introduction to Computer Applications

Credits: 0

Introduction to the PC, Basic hardware components of the PC, Operating systems software DOS, Operating systems hardware (DOS shell, Windows, File Managers and Utilities), Word processing, Data processing, Database, Graphics, Software installation and interfacing, Summary.

### EL 263 Computer Applications: C++ and MATLAB/Simulink

Credits: 0

Introduction to C++ programming for engineers, C++ language basics (Variables, Statements, Data types), Control flow (if/else statements, for and while loops), Object-oriented concepts (classes, objects, creating classes), Arrays, exceptions, more about OOP, input/output, inheritance, abstract classes, polymorphism, Introduction to GUI programming, Introduction to applets, Threads, vector class, string buffer class, Working with files, Analysis of generation and network aspects of marginal cost based on electricity markets.

### EL 551 Research Methods

Credits: 0

Introduction to research, Epistemology and its implications for research methodology and design, Theoretical framework and scientific research design, Qualitative data collection and analysis, Principles of quantitative data analysis (descriptive statistics), Quantitative methods, Sampling, questionnaire design and methods for pre-testing, Research proposal for competitive research grant, Format of research proposal, Reporting and communicating research results.

### EL 575 Power System Operation, Protection and Planning

Credits: 3

Insulation engineering, Protection systems and control, Diagnosis of causes and modes of power system failure, Performance prediction and design of earthing systems, Measurement and safety evaluation of earthing systems, Introduction to system planning and optimisation, Generation and transmission system planning, System expansion planning and optimisation, Dynamic system security and control optimisation using FACTS devices, Forecasting and scheduling.

### EL 554 Economic and Financial Evaluation

Credits: 3

Nature of and requirements for engineering projects. Time value of money and economic equivalence, Estimation of revenue and costs, Investment allowances, taxation and royalties, Financing alternatives, Cash flow models and analysis, Investment decision methods and criteria, Sensitivity and risk analysis, Feasibility study, Case studies.

### EL 573 Intelligent Systems in Manufacturing

Credits: 3

Overview of AI techniques in manufacturing: Overview and survey of AI techniques that has recently been applied to solving/simulating activities in manufacturing engineering, Knowledge-based systems, Expert systems, Fuzzy logic, Artificial neural networks, Adaptive neural controllers and emulators, Commercially available systems: Neuralworks explorer and neural works professional, Case-based learning/ reasoning, Genetic algorithms, Applications of intelligent systems.

### EL 572 Advanced Signal Processing

Credits: 3

Scalar random variables and stochastic processes, Linear systems models, Principles of estimation theory, Signal modelling and parametric spectral estimation, Discrete-time signals and systems, Autocorrelation and cross-correlation, MA and AR processes, prediction, DTFT, DFS, DFT, FFT, filter specifications, Filter structures and design, C/D and D/C conversions, Multi-rate practical digital signal processing and applications.

### EL 515 Postgraduate Seminar

Credits: 3

Students will be required to make a minimum of one presentation on the progress and research underway in their areas of specialisation. The seminar will be assessed by a Departmental Panel. Postgraduate students are required to attend.

### EL 556 Field Trip and Report

Credits: 3

Field trips will be organised and all students will be required to participate in at least one of them. Candidates are required to submit a written report and make oral presentation(s) on it/them. Also, reports on laboratory works shall be defended by the candidate.

### EL 500 Thesis

Credits: 15/24

The thesis must be an embodiment of independent research work under the guidance of Supervisor(s) on a topic in the student's area of specialisation. A thesis embodying the results of the research will be presented to the Department for assessment and defended orally. A panel of examiners will assess the thesis.

### EL 553 Operations Research

Credits: 3

Nature of operations research, Linear, the simplex algorithm for integer and goal programming, Transportation and assignment problems, Decision analysis, Markov analysis, Simulation, Queuing models, Inventory control models, Production scheduling methods – CPM, Dynamic programming.

### EL 555 Statistical Models

Credits: 3

Basic statistical procedures I, Basic statistical procedures II, Regression and linear models I, Regression and linear models II, Application to multiple regression I, Application to multiple regression II, Application to multiple regression III, Statistical inference and statistical modelling I, Statistical inference and statistical modelling II, Use of transformation, correlation and its relationship with regression.

### EL 574 Microprocessor Systems

Credits: 3

Review of basic microprocessor system design fundamentals, Programming techniques, Hardware of microcontrollers, Digital signal processors, Memory system, Design and use of memory management unit, Virtual memory systems, Multiprocessors case studies, Hands-on laboratory sessions.

### EL 579 Computer Control Systems

Credits: 3

Mathematical background, Process modelling and identification, Simulation tools, Discrete systems, stability analysis, Digital control system design and implementation, Sensors, Control algorithm implementation, Programme packages for identification, Case study, Hands-on session and laboratory exercises/mini project.

### EL 576 Power System Stability, Modelling and Control

Credits: 3

Power quality: concept, voltage fluctuations and variations, Transient over voltages, Harmonic distortions, Power system stability, Swing equations and its solutions, Application of equal-area criterion to switching transients, Instability due to symmetrical line-ground fault, Improvement in the transient stability, Power system modelling and control, Power system control.

### EL 582 Power Electronics and Industrial Drive Systems

Credits: 3

Introduction to electric drives and its components, Fundamentals of power semiconductor controlled electric drives, DC motor drives, Speed control of electric drives, Switched reluctance drives, AC motor drives, Dynamic model of AC and DC machines, Vector control of industrial drives systems, Inverter-fed AC drives, Application case studies.

### EL 584 Mechatronic System Modelling and Design

Credits: 3

Physical modelling of mechanical, electrical systems, Thermal, fluid and mixed systems, Bond graphs and response analysis, Overview of a mechatronic design process and specification, development/planning, Conceptual, embodiment, detail designs and integration, Application procedure for patents, Quality function deployment, failure model and effect analysis, Pugh charts, Axiomatic design, Case studies.

### EL 581 Advanced Robotics

Credits: 3

Position and orientation transformations and robot kinematics of position, Inverse kinematics problem, Rigid body motion, robot kinematics of velocity, and robot statics, Robot trajectory planning and kinematic robot control, Robot dynamics, Properties of the robot dynamic model, Robot position control, Implementation and robustness issues, Robot compliance and force control, Lab: industrial robot demonstrations.

### EL 583 Factory Automation

Credits: 3

Sensors, actuators and switching elements, Programmable logic devices and arrays, Pneumatic valves, Logic operation, Design of sequential control systems, Programmable controllers, Distributed control systems, Supervisory control and data acquisition (SCADA) for factory automation, Modelling and simulation for factory automation, Case studies of factory automation.

### EL 586 Mobile Communications and Wireless Technology

Credits: 3

Inverse fourth power, Shadowing and rayleigh fading losses, narrow band system performance, Wide band system principles, Multiple access techniques for wireless communications, GSM system, UMTS system, Wireless technologies and data network, Satellite communication, Placement of a satellite in a geostationary orbit, Modulation and multiplexing techniques for satellite links.

### EL 577 Microwave Engineering and Optical Communication Systems

Credits: 3

Microwave power dividers, directional couplers and hybrids, Filter theory, Ferrite properties, wave propagation in ferrite, Noise in microwave systems, Active microwave circuits, Characterisation of microwave communication systems, Budgets for terrestrial microwave systems, Optical communication systems, Optical detectors and optical sources, Advanced optical systems.

### EL 578 Broadcasting Technologies

Credits: 3

Conventional FM broadcasting, Digital audio broadcasting (DAB) techniques, Analog TV transmission, Digital terrestrial TV broadcasting (DTTB) techniques, Single frequency networking (SFN), Digital satellite TV broadcasting (DVB-S and ISDB), Digital cable TV transmission, New developments in television broadcasting, Case studies.

### EL 588 Environmental and Safety Engineering

Credits: 3

Environmental impact of industrial activity (an overview), Air quality/pollution, Air quality modelling, Water quality/pollution, Water quality modelling, Noise, Ergonomics and industrial safety technology, Accident prevention, Laws on safety, Environmental impact assessment methodologies and practices.

### EL 571 Modelling and Simulation

Credits: 3

Overview of Models, Simulation and Techniques of Modelling and Simulation, Modelling and Simulation Software and Packages, The MATLAB User Interface and Simulink, Methods to Solve Formal Problems, Mathematical Modelling and Numerical Methods, Experimental Modelling and Polynomial Methods, Simulation Modelling and Analysis, Regression and Business Case Modelling, Modelling and Simulation of Power, Electromechanical and Complex Systems, Case Studies.

## 19 DOCTOR OF PHILOSOPHY PROGRAMME IN ELECTRICAL AND ELECTRONIC ENGINEERING

### 19.1 ENTRY REQUIREMENTS

- A candidate shall hold a Master's degree in electrical and electronic engineering or its equivalent in a related discipline from a recognised institution and shall submit evidence of adequate training and ability to undertake the proposed programme

- A candidate who does not hold a Master's degree shall first register for an MPhil. If he/she proves himself/herself to be academically capable by the end of the first year of the programme, he/she may be recommended to register for the PhD degree; this registration shall be deemed retrospective from the date of the original registration for the Master's degree
- A candidate, who does not satisfy the requirements stated above but is otherwise adjudged suitable, may be admitted.

For the purpose of assessing his/her suitability, such a candidate may be interviewed or required to take an entrance examination, or both as directed by the School of Postgraduate studies on the recommendation of the Departmental Board.

### 19.2 PROGRAMME DURATION

A candidate shall pursue a full-time programme of study and research for at least two years, except that:

- A candidate fully engaged in advanced study and research for his/her degree, who, before registration, was engaged in research to the satisfaction of the Department concerned, may be exempted for not more than one academic year.
- In special circumstances, the Department may recommend that a candidate be allowed to spend not more than one academic year of his/her programme in advanced study research at another institution, provided that his/her work can be supervised in a manner satisfactory to the Department and the School of Postgraduate Studies.
- A Full-Time candidate who is engaged in research for the PhD Degree shall present himself/herself for examination not later than three (3) years from the date of commencement of the academic year in which the student was enrolled.
- A Part-Time candidate shall present himself/herself for examination not later than four (4) years from the date of commencement of the academic year in which the student was enrolled.

In special cases, an extension up to one (1) year of these time limits may be granted on the recommendation of the Department.

### 19.3 AREAS OF RESEARCH

A candidate may be required to audit appropriate courses/modules and also submit a thesis under the supervision of an academic staff in any of the following areas of research:

- Power systems protection and control
- Control and design of power electronic circuits for alternative energy systems
- Power system operation, planning, management, optimization and economics.
- Power Quality Studies.
- Distribution System Analysis and Automation
- High-Power Power Electronics.
- Flexible AC Transmission Systems (FACTS)
- Robotics and Control
- Electric Drives.
- Microelectromechanical Systems (MEMS).
- Computer Mechatronics and Artificial Intelligence Systems.
- Industrial Automation Systems.
- Power Systems Analysis and Automation.
- Intelligent Control Systems.
- Stochastic modelling, analysis, optimisation and control problems arising in communication networks and distributed systems.

- Analytical and experimental research in traffic modelling, traffic engineering, and quality of service techniques in communication networks.
- Telecommunications Network control and management.
- Optimal Resource Allocation in Wireless Access Networks.
- Distributed Algorithms for Wireless Ad hoc Networks.

## 19.4 EMPLOYMENT OPPORTUNITIES

There are employment opportunities in the following areas:

- Power generation, transmission and distribution industries e.g. VRA, GridCo, ECG
- Manufacturing industries e.g. Kabelmetal, VALCO, Unilever, Aluworks.
- Automated pharmaceutical and allied industries.
- Mining companies.
- Oil and gas industries.
- Universities and other Educational and Research institutions.
- The Ghana Armed Forces.
- United Nations Industrial Development Organisation (UNIDO).
- Project management consulting firms.
- Process and Plant Automation consulting firms.
- Ghana Broadcasting Corporation, TV3, Metro TV, TV Africa, etc.
- Telecommunications industries, e.g. Vodafone, TIGO, MTN, Kasapa, etc.

## 19.5 AVAILABLE RESOURCES

**a) Academic Staff**

See the list of academic staff.

**b) Facilities and other Resources**

See list of existing facilities.

**Table 19.1 List of Academic Staff and Areas of Specialisation**

| Name | Academic/Professional Qualification | Designation | Areas of Specialisation |
|---|---|---|---|
| Dr Solomon Nunoo | MPhil (UMaT),<br>BSc (KNUST) | Senior Lecturer<br>HOD | Telecommunications, Signal Processing, Computer-Aided Design |
| Prof D. Mireku-Gyimah | DSc (KNUST), PhD, DIC (London), MSc (Moscow Min. Inst.), CEng, MIMM, MSME, MNYAS, FghIE | Professor | Operations Research, Economic and Financial Evaluation. |
| Prof N. Amegbey | Dr. Ing (TU Berlin), | Professor | Environmental and Safety Engineering/Human Factor, Mining Regulations, Mine Environment, Mine Ventilation Environmental Impact Assessment, Safety in Mines, Mining Regulations, Mine machinery. |
| Prof Sulemana Al-Hassan | PhD (Wales), BSc, PgD (KNUST), MIMM | Assoc Professor | Statistical Models. |
| Prof V. A. Temeng | PhD (Michigan Tech) MSc (Zambia), PgD, BSc (KNUST) | Assoc Professor | Operations Research. |
| Prof C. K. Amuzuvi | PhD (Nottingham)<br>MSc (Kharkov), GMGhIE | Assoc Professor | Communications and Control Systems |
| Dr J. C. Attachie | MSc (Kharkov), MGhIE | Lecturer | Power Systems and Networks, High Voltage Engineering |

| | | | |
|---|---|---|---|
| Mr E. Normanyo | MSc (Kharkov), MGhIE | Senior Lecturer | Automated Electric Drives, Industrial Automation, Instrumentation and Control, Mechatronics |
| Mr John Annan | MPhil (UMaT),<br>BSc (KNUST) | Lecturer | Communications and Control Systems, Computer-Aided Design |
| Mr S. Ofori | MSc (London),<br>BSc (KNUST) | Lecturer | Signal Processing, Broadband Networks |
| Mr P. Blewushie* | MPhil (UMaT)<br>BSc (KNUST) | Lecturer | Power Systems Operation, Protection and Control. |

** On study leave*

# DEPARTMENT OF MATHEMATICAL SCIENCES

## 20 MASTER'S (MODULAR) PROGRAMME IN MATHEMATICS

### 20.1 TITLE OF PROGRAMME

The title of the programme is Master's Programme (Modular) in Mathematics.

### 20.2 PROGRAMME OBJECTIVES

The main objectives of the programme are:

- To provide postgraduate level education to support the growing financial institutions and allied industries.
- To train professional Mathematicians capable of solving scientific and technological problems using computational knowledge.
- To train professional Statisticians to meet current statistical demands in various industries.
- To train postgraduates who will be capable of supporting teaching and research at higher levels.

### 20.3 ENTRY REQUIREMENTS

The entry requirements for the Master's degree in Mathematics are:

i. Applicants must have BSc First Class or Second Class (Upper Division) in Mathematics, Statistics, Economics, Engineering and physical sciences from a recognized University.

ii. All applicants who do not satisfy (i) above but have degrees in Mathematics, Statistics with Economics, any Engineering field or other related Physical Sciences and are adjudged suitable by the departmental board concerned may be interviewed where applicable.

iii. International applicants with proficiency in English language who satisfy the requirements of (i) or (ii) above are eligible for admission after careful consideration of relevant documents.

iv. A student who has satisfactorily completed a postgraduate diploma programme may be considered for admission on the recommendation of departmental board concerned.

### 20.4 PROGRAMME REQUIREMENTS

The Department offers two Master's degree programmes. These are:

i. MSc Mathematics (Elective Option) Degree Programme

ii. MPhil Mathematics Degree Programme

**a) Graduation Requirements**

i. MSc Degree in Mathematics

- A minimum of 45 credit hours is required for the award of an MSc degree. This is made up of a minimum of eight (8) modules (at least 24 credit hours), Postgraduate Seminar (3 credit hours) Field trip & Report (3 credit hours) and Thesis (15 credit hours).

ii. MPhil in Financial Mathematics, Statistics and Computational Mathematics

- A minimum of 42 credit hours is required for the award of an MPhil degree. This is made up of a minimum of five (5) modules (at least 15 credit hours), Postgraduate Seminar (3 credit hours) and Thesis (24 credit hours).
- A student is required to take five (5) core modules outlined in Section 18.5 of Guidelines for Postgraduate Studies. In addition, the student may take modules recommended by the supervisor to facilitate his/her research work. The student is also required to present at least one seminar.
- The successful defence of a thesis is required for the award of the MPhil degree. The thesis should be an embodiment of independent research conducted by a student under the guidance of a Supervisor on a significant problem in a chosen area of Financial Mathematics, Statistics and Computational Mathematics.

**b) Programme Duration**

- Full-time - A maximum of four (4) semesters for course work and thesis work
- Part-time - A maximum of six (6) semesters for course work and thesis work.

**c) Registration**

- Full-time students will be required to register a minimum of three (3) modules per semester.
- Students should register modules they intend to participate in by the third week of every semester. Students may, however, pay module participation fee at the time the module is being offered.
- To be of good standing a part-time student must do, at least, three modules per annum.

## 20.5 PROGRAMME STRUCTURE

1. Each module runs for a maximum of two weeks (10 working days) duration; examinations in each module shall be taken within a week after completion of the module.
2. There shall be a minimum of forty (40) contact hours in each module (4 hrs. /day).
3. A prospective applicant may participate in a module within two years prior to applying for postgraduate programme; the results of such a module shall upon request by the applicant be credited to him/her upon admission.

**a) Core and Compulsory Modules**

The MSc and MPhil coursework comprises five (5) core/compulsory modules namely:

- Time series and Forecasting (MA 589)
- Numerical Methods for Linear and Nonlinear Equations (MA 502)
- Operations Research (MA 577)
- Computer Programming (MA 571)
- Advanced Probability and Statistics (MA 506)

MSc Students shall specialise in any of the following elective areas.

- Financial Mathematics
- Computational Mathematics
- Statistics

In addition to the core modules, a minimum of 3 (three) other elective modules must be selected by the candidate in consultation with his/her Supervisor(s) with regard to any of the elective areas above.

**b) Content of Modules**

The modules to be run, credit hours and module numbers are as follows:

**Table 1 Programme Modules for the Master`s Programme**

| No. | Course No. | Course Name | Credit Hours |
|---|---|---|---|
| 1 | MA 275 | Numerical Methods | 0 |
| 2 | MA 551 | Research methods | 0 |
| 3 | MA502 | Numerical Methods for Linear and Nonlinear Equations | 3 |
| 4 | MA 589 | Time series and Forecasting | 3 |
| 5 | MA 504 | Advanced Probability and Statistics | 3 |
| 6 | MA 577 | Operations Research | 3 |
| 7 | MA 571 | Computer Programming | 3 |
| 8 | MA 515 | Seminar | 3 |
| 9 | MA 556 | Field Trip and Report | 3 |
| 10 | MA 500 | Thesis | 15 |
| **Elective Courses** | | | |
| **Financial Mathematics** | | | |
| 11 | MA 572 | Computational Finance | 3 |
| 12 | MA 512 | Optimization Models in Economics and Finance | 3 |
| 13 | MA 513 | Investment Analysis and Portfolio Theory | 3 |
| 14 | MA 514 | Economics | 3 |
| 15 | MA 522 | Risk Analysis and Management | 3 |
| **Computational Mathematics** | | | |
| 16 | MA 521 | Application of Numerical Analysis to ODEs | 3 |
| 17 | MA 522 | Advanced Numerical Methods | 3 |
| 18 | MA 523 | Application of Numerical Analysis to PDEs | 3 |
| 19 | MA 524 | Computational Methods in Optimisation | 3 |
| 20 | MA 526 | Computational Methods for Optimal Control Problems | 3 |
| **Statistics** | | | |
| 21 | MA 591 | Multivariate Analyses | 3 |
| 22 | MA 578 | Stochastic Processes with Applications | 3 |
| 23 | MA 593 | Design and Analysis of Experiments | 3 |
| 24 | MA 534 | Statistical Models | 3 |
| 25 | MA 582 | Sample Surveys | 3 |

- *Research Methods is a compulsory module for all registered students. Every student is expected to pass this as a prerequisite to continue with the course.*
- *Students from related fields other than mathematics must take Numerical Methods.*

## MA 275 Numerical Methods

Credits: 0

Sources and types of error; round-off errors, truncation error, Basic error analysis. Evaluation of functions. Numerical solution of non-linear algebraic equation; one-point methods, simple iteration, secant and Newton-Raphson methods. Acceleration and relaxation. Bracketing methods; Bisection and false-position methods. Numerical solution of sets of linear algebraic equations: elimination back substitution. Matrix inversion. Instabilities and pivoting. Gaussian elimination. Iterative methods for linear systems: Gauss-Jacobi, Gauss-Siedel and successive over relaxation (SOR). Convergence and error analysis. Order of an iterative process. Use of computer essential. Conjugate Gradient. Methods for first-order differential equations: Taylor's method, Euler methods, Runge-Kutta methods, multi-step methods. Methods for higher-order differential equations: Taylor's, Euler and Runge-Kutta methods.

### MA 551 Research Methods

Credits: 0

Introduction to research: Research project formulation/management, the research process, literature review and organization. Epistemology and its implications for research methodology and design. Theoretical framework (variable definition and generation of hypothesis). Scientific research design (differences between qualitative and quantitative methodology, measurement issues: reliability and validity). Qualitative data collection (e.g. in-depth interviews, focus groups, observations). Analysis of qualitative data. Principles of quantitative data analysis (descriptive statistics). Quantitative methods (hypothesis testing, inferential statistics). Sampling, questionnaire design and methods for pre-testing. Research proposal for competitive research grant. Research presentation (formatting dissertation). Case studies.

### MA502 Numerical Methods for Linear and Non Linear Equations

Credits: 3

Solutions of algebraic equations; Direct methods for linear equations, orthogonal factorization, sparse matrix techniques. Markowitz criterion, Nested dissection, applications. Solutions of non – linear equations; one point iterative methods, Newton's and Brain methods, convergence of these methods; Multi – step iteration formulae, secant methods, gradient methods, Bracketing methods, convergence and stability of these methods; special methods, applications.

### MA 589 Time Series and Forecasting

Credits: 3

Introduction: Examples of Time Series, Objectives of Time Series Analysis, Some Simple Time Series Models, Models with Trend and Seasonality, a general Approach to Time Series Modeling, Stationary Models and the Autocorrelation Function ,Estimation and Elimination of Trend and Seasonal Components. Stationary Processes: Basic Properties, Linear Processes, Introduction to ARMA Processes, Properties of the Sample Mean and Autocorrelation Function, Forecasting Stationary Time Series, The Durbin–Levinson Algorithm , The Innovations Algorithm, Prediction of a Stationary Process in Terms of Infinitely Many Past Values. ARMA Models : ARMA(p, q) Processes, The ACF and PACF of an ARMA(p, q) Process, Calculation of the ACVF, The Autocorrelation Function, The Partial Autocorrelation Function, Forecasting ARMA Processes. Spectral Analysis: Spectral Densities, The Periodogram, Time-Invariant Linear Filters, The Spectral Density of an ARMA Process. Modeling and Forecasting with ARMA Processes: Preliminary Estimation, Yule–Walker Estimation,. Burg's Algorithm, The Innovations Algorithm, The Hannan–Rissanen Algorithm, Maximum Likelihood Estimation, Diagnostic Checking. Nonstationary and Seasonal Time Series Models: ARIMA Models for Non stationary Time Series, Identification Techniques, Unit Roots in Time Series Models, Unit Roots in Autoregressions, Unit Roots in Moving Averages, Forecasting ARIMA Models, The Forecast Function, Seasonal ARIMA Models, Forecasting SARIMA Processes, Regression with ARMA Errors, OLS and GLS Estimation, ML Estimation 213. Forecasting Techniques: The ARAR Algorithm, Memory Shortening, Fitting a Subset Auto regression, Forecasting, Application of the ARAR Algorithm, The Holt–Winters Algorithm, Holt–Winters and ARIMA Forecasting, the Holt–Winters Seasonal Algorithm, Choosing a Forecasting Algorithm.

### MA 577 Operations Research

Credjits: 3

Introduction to Deterministic methods for Optimization, with focus on mathematical programming (linear, nonlinear, integer) and network methods. Introduction to probabilistic methods for modelling and analysing the performance of complex systems. Topics include Markov chains, queuing, forecasting, discrete event simulation and inventory modelling.

### MA 571 Computer Programming

Credits: 3

Input and output procedures. Elementary mathematical functions . User defined functions. Relational and logical operators. Conditional statements . Looping and the switch structure. Solution of Linear and non linear algebraic equations. Application to differential equations. Symbolic processing with MATLAB.

### MA 515 Postgraduate Seminar

Credits: 3

Students will be required to make a minimum of one presentation on the progress and research underway in their areas of specialization. The seminar will be assessed by a Departmental Panel. Postgraduate students are required to attend.

### MA 556 Field Trip and Report

Credits: 3

Field trips will be organised and all MSc students will be required to participate in at least one of them. MPhil Students may participate. Students are required to submit a written report after the field trip.

### MA 500 Thesis

Credit: 15/24

The thesis must be an embodiment of independent research work under the guidance of Supervisor(s) on a topic of the student's area of specialization. A thesis embodying the results of the research will be presented to the Department for assessment. A panel of examiners will assess the thesis.

### Elective Option 1: Financial Mathematics Modules

### MA 572 Computational Finance

Credits: 3

Option pricing computations. Options on stocks, call option, the long short positions on options. The factors affecting option prices and the concept of the put-call parity. The binomial option pricing model (BOPM). The trading strategies involving options. The Black-Scholes option model. The spot interest rate. The expectations hypothesis of the term structure. The reinvestment risk and the market risk. Value-at-risk.

### MA 512 Optimization Models in Economics and Finance

Credit: 3

Overview of Optimization concepts: Modelling-analysis-design loop in financial and economic practice. Linear, non-linear, integer programming applications in finance and economics. Discrete optimization models in finance: Modelling possibilities through binary and integer variables; Relaxation methods; branch-and-bound methods; Quadratic and convex programming, Applications in portfolio management. Using linear and nonlinear programming software. Seminar.

### MA 513 Investment Analysis and Portfolio Theory

Credits: 3

Money markets instruments; debts capital markets; term structure models. Bond valuation, duration and convexity; bond ratings; tools of bond portfolio management; Equity markets and instruments; common stock valuation; Mathematics of portfolio selection. Mean-variance and index models. Models of market equilibrium. Models of market equilibrium; market efficiency. Performance measurement and attribution. Active and passive portfolio management. Uses of assets derivative in portfolio management, global investments.

### MA 514 Economics

Credits: 3

Concepts of macroeconomics. Money, Inflation, Income, and Unemployment. Banking and financial markets. Exchange rate determination. Emerging markets. Basics of microeconomics. Demand, Supply, and Market Equilibrium. Perfect competition. Imperfect competition. Cooperative and non-cooperative solutions in game theory with financial applications.

### MA 522 Risk Analysis and Management

Credits: 3

Principles of risk theory. Credibility premiums and experience rating. Operations research techniques in insurance and reinsurance decision making. Financial innovation. Sources of risk and risk profile. Measuring market risk, credit risk, operational and legal risks. Securitization, hedging and arbitrage fundamentals. Design and financing of life insurance products and retirement plans. Stochastic investment models for life insurance and pension funds. Willkie's model.

### Elective Option 2: Computational Mathematics Modules

### MA 521 Application of Numerical Analysis to Ordinary Differential Equations (ODEs)

Credits: 3

Initial and Boundary value problems in ODEs, Numerical approximation of solutions. Higher order one step methods, Taylor series. Runge-Kutta (R-K) methods. Convergence and stability of these methods. Multistep methods. Topics in approximation. Chebyshev polynomial approximation. Least – squares approximation. Approximation by series.

### MA 522 Advanced Numerical Methods

Credits: 3

Weighted Residual methods. Allocation methods. Orthogonal allocation. Ritz Galerking methods. Nagume's Lemma, applications. Introduction to finite elements. Applications. Finite difference Method.

### MA 523 Applications of Numerical Analysis to Partial Differential Equations (PDEs)

Credits: 3

Partial differential equations. Classification, Parabolic equations. Solution techniques by explicit methods. Fourier stability methods. Matrix methods. Stability and convergence analysis. Solution techniques by finite difference methods. Hyperbolic equation, Solution techniques by methods of characteristics. Explicit methods. Hybrid methods.

### MA 524 Computational Methods in Optimisation

Credits: 3

Optimization Problems. Examples of Optimization problems. The Optimization in one dimension. Iterative methods of Optimization. Least squares procedures for solving equations, Contraction mapping theorem. Newton's methods. Steepest Descent Methods, Conjugate direction Methods in R, Conjugate Gradient Method Algorithms, Projection Methods.

### MA 526 Computational Methods for Optimal Control Problems

Credits: 3

Unconstrained continuous. Optimal Control Problems. Fletcher – Reeves Algorithm. Seminar. Polak–Ribiere algorithm and its application to equality. Constrained control problems. Unconstrained Discrete Optimal control problems and methods of solution

### Elective Option 3: Statistics Modules

#### MA 591 Multivariate Analyses

Credits: 3

Theory of Matrices and their properties. Multivariate Normal Distribution. Multiple and partial correlation. Regression theory. Estimation of parameters. Hotelling's T2 Mahalanobis D2Wishart distribution. Tests concerning mean vectors and variance. Confidence bounds. Multi-variance distributions

#### MA 578 Stochastic Processes with Applications

Credits: 3

Classification of stochastic processes. Random walk models, discrete queueing chain. Inventory model, branching processes. Poison, Birth and Death Processes, waiting time models. Guassian processes. Martingales. Mean covariance and sample functions. Integration and differentiation of SPs. Estimation problems. Tutorials.

#### MA 593 Design and Analyses of Experiments

Credits: 3

General Linear Models. Generalized inverse of a Matrix, Factorial Experiments: Symmetric and Asymmetric. Balanced and Partially Balanced Incomplete Block Designs. Resolvable, Group Divisible Connected, Lattice Designs. Row – Column Designs; Latin Square, Lattice, Cross Over Design. Response Surface Methodology. Construction of Designs.

#### MA 534 Statistical Models

Credits: 3

Point estimations, Unbiasedness, Mean-squared error, Confidence interval, Tests of hypotheses, Power calculations. Derivation of one and two-sample procedures. Simple linear regression, Regression diagnoses. Prediction: linear models, Analysis of variance (ANOVA). Multiple linear regressions. Factorial experiments, Analysis of covariance models including parallel and separate regressions. Model building.

#### MA 582 Sample Surveys

Credits: 3

Use of auxiliary information; Multivariate ratio. Regression estimators and their extension to double sampling procedure. Difference estimators and their extension to double sampling procedure. Quenouille's technique of bias reduction. Sampling on successive occasions. Exampling of Errors. Non–Exampling Errors. Some specialised sampling techniques. Tutorial.

## 21 DOCTOR OF PHILOSOPHY PROGRAMMES

### 21.1 TITLE OF PROGRAMME

The Department offers the following Doctor of Philosophy programmes:

- PhD in Mathematics
- PhD in Statistics

### 21.2 ENTRY REQUIREMENTS

- A candidate shall hold a master's degree in Mathematics or Statistics or its equivalent from a recognized institution and shall submit evidence of adequate training and ability to undertake the proposed programme.
- A candidate who does not hold a Master's degree shall first register for a Master's degree by research. If he/she proves himself/herself to be of sufficient calibre by the end of the first year of the programme, he/she may be recommended to register for the PhD degree; this registration shall be deemed retrospective from the date of the original registration for the Master's degree.
- A candidate, who does not satisfy the requirements stated above but is otherwise adjudged suitable, may be admitted.

For the purpose of assessing his/her suitability, such a candidate may be interviewed or required to take an entrance examination, or both as directed by the School of Postgraduate Studies on the recommendation of the Departmental Board.

### 21.3 PROGRAMME DURATION

Subsequent to duration, the candidate shall pursue a full-time programme of study and research for at least two years, except that:

- A candidate fully engaged in advanced study and research for his/her degree, who, before registration, was engaged in research to the satisfaction of the Department concerned, may be exempted for not more than one academic year.
- In special circumstances, the Department may recommend that a candidate be allowed to spend not more than one academic year of his/her programme in advanced study research at another institution, provided that his/her work can be supervised in a manner satisfactory to the Department and the School of Postgraduate Studies.
- A Full-Time candidate who is engaged in research for the degree shall present himself/herself for examination not later than three years from the date of his/her registration.
- A Part-Time candidate shall present himself/herself for examination not later than four years from the date of registration.
- In special cases, an extension of these time limits may be granted on the recommendation of the Department.

### 21.4 AREAS OF RESEARCH

A candidate may be required to audit appropriate courses/modules and also submit a thesis under the Supervision of an academic staff in any of the following areas of research:

- Financial Mathematics.
- Computational Mathematics.
- Statistics.

Other related topics will be accepted but must be approved by the Department.

### 21.5 EMPLOYMENT OPPORTUNITIES

There are employment opportunities in the following areas:

- Banking;
- Mining and allied industries;
- Education;
- Bureau of Statistics;
- Research Institutes;
- Non-Governmental Organizations.

### 21.6 AVAILABLE RESOURCES

**a) Academic Staff**

See the list of Academic Staff.

**Table 21.1: List of Academic Staff and Areas of Specialisation**

| Name | Academic/Professional Qualification | Designation | Areas of Specialisation |
|---|---|---|---|
| Dr Issaka Yakubu | PhD (UMaT), MPhil (UMaT), BSc (KNUST), Certificate (UT) | Senior Lecturer | GIS and Applications, Global Navigation Satellite Systems (GPS, GLONASS) and Applications, Engineering and Cadastral Surveying; Multi-Criteria Spatial Analysis; Disaster Risk Management and Environmental Assessment for Spatial Planning. |
| Prof D. Mireku-Gyimah | DSc (KNUST), PhD, DIC (London), MSc (Moscow Min. Inst.), CEng, MIMM, MSME, MNYAS, FGhIE | Professor | Mine Design and Planning, Operations Research, Mine Economic and Financial Evaluation, Mineral Resource Estimation, Mine Feasibility Study and Environmental Impact Assessment. |
| *Prof. Bentil, Daniel. E | PhD. (University of Oxford), England | Professor | Applied Maths, Mathematical Biology |
| Assoc Prof Sulemana Al-Hassan | PhD (Wales), BSc,PgD (KNUST), MIMM | Assoc Professor | Geostatistics, Statistical Models, Mineral Economics |
| Assoc Prof V. A. Temeng | PhD (Michigan Tech), MSc (Zambia), PgD, BSc (KNUST) | Assoc Professor | Operations Research, Materials Handling, Mine Economic Evaluation, Mine Planning. |
| Dr. Nyarko Peter Kwesi | MSc (KNUST), Kumasi, BSc (UCC), Cape Coast | Lecturer | Differential Equations, Numerical Methods, Optimisation techniques, Computer Applications to Numerical Methods. |
| Dr Ms.Christian C. Nyarko | PhD (UMaT), MPhil (University of Ghana) Accra, BSc Maths Education | Senior Lecturer | Bio Statistics, Descriptive Statistics and Probability, Numerical Methods, Differential Equations |
| Dr Brew Lewis | PhD (UMaT), MPhil(KNUST), Kumasi, B.Ed. (UCC), Cape Coast | Senior Lecturer | Pure Mathematics |
| Dr Eric Wiah | PhD, (UMaT), MSc (KNUST), Kumasi, BSc (KNUST), Kumasi | Lecturer | Differential Equations, Optimal control, Optimisation, Computer Applications to Numerical Methods |
| Dr Paul Boye | PhD (UMaT), MSc, BSc (KNUST), Kumasi | Lecturer | Pure and Applied Mathematics |
| Dr Henry Otoo | PhD (UMaT), MPhil, BSc (KNUST) | Lecturer | Numerical Methods, Optimization, Computer Programming, Linear Algebra, Mathematical Analysis |
| Dr Joseph Acquah | PhD (UMaT), MPhil (UCC), Cape Coast, BSc (UCC), Cape Coast | Lecturer | Pure Mathematics, Differential Equations, Numerical Methods, Optimisation techniques, Numerical Methods. |
| Mr Danso - Addo Ernest | MPhil (UCC), Tarkwa, BSc (UCC), Cape Coast | Lecturer | Differential Equations, Numerical Methods, Optimisation techniques, Numerical Methods. |
| Mr B. N. Ibrahim | MSc (Malardalens, Sweden), BSc (KNUST, Ghana) | Lecturer | Calculus, Statistics, Solid Geometry, Computational Financial, and Modeling of Financial asserts. |
| Miss Veronica Monica Crankson | MSc (Aust), BSC (UMaT) | Lecturer | Convex Analysis and Optimization |
| Mr Benjamin Odoi | MPhil, BSc (UMaT) | Assistant Lecturer | Statistics |

**Adjunct Staff*

# DEPARTMENT OF MANAGEMENT STUDIES

## 22 MASTER'S (MODULAR) PROGRAMME IN ENGINEERING MANAGEMENT

### 22.1 TITLE OF PROGRAMME

The title of the programme is Master's Programme (Modular) in Engineering Management.

### 22.2 PROGRAMME OBJECTIVES

The main objectives of the programme are:

- Train competent graduates who have technological, entrepreneurial and managerial skills; and
- Develop the human resource to manage science and technology based industries through technical competence and leadership abilities.

### 22.3 ENTRY REQUIREMENTS

The entry requirements for the Master's degree in Engineering Management are:

i. A BSc First Class or Second Class (Upper or Lower Division) or its equivalent in Business, Social and Physical Sciences, Technology and Engineering related programmes.

ii. All applicants who do not satisfy (i) above but are otherwise adjudged suitable by the Departmental Board, may be eligible only after an interview.

iii. Applicants with UMaT Diploma in the Earth Sciences, who have at least five (5) years professional experience with proven ability in their discipline.

iv. Applicants who have satisfactorily completed a Postgraduate Diploma programme may be considered for admission on the recommendation of the Departmental Board concerned.

v. International applicants with proficiency in English language who satisfy the requirements of (a) or (b) above and after careful consideration of transcripts and relevant references, such as NAB's interpretation of equivalent qualifications.

All candidates shall pass an interview before admission.

### 22.4 PROGRAMME REQUIREMENTS

**a) Graduation Requirements**

- A minimum of 48 credit hours is required for the award of an MSc degree. This is made up of a minimum of eleven (11) modules (at least 33 credit hours), Postgraduate Seminar (3 credit hours) and Thesis (12 credit hours).

**b) Programme Duration**

- Full-time - A maximum of four (4) semesters (2 years) for course work and thesis work.
- Part-time - A maximum of six (6) semesters (3 years) for course work and thesis work.

**c) Registration**

- Full-time students will be required to register a minimum of two (2) modules per month and six (6) modules per semester.
- Students should register modules they intend to participate in by the third week of every semester. Students may, however, pay module participation fee at the time the module is being offered.
- To be of good standing a part-time student must do, at least, two modules per annum.

### 22.5 PROGRAMME STRUCTURE

1. Each module runs for a maximum of five (5) weekends (Saturday and Sunday); examinations in each module shall be taken within the last weekend of the module.
2. There shall be a minimum of forty (40) contact hours in each module (8 hrs. /weekend).

3. A prospective applicant may participate in a module within two years prior to applying for postgraduate programme; the results of such a module shall upon request by the applicant be credited to him/her upon admission.

**a) Core and Compulsory Modules**

The MSc Engineering Management course is structured into compulsory and elective modules. Students are required to take at least one of the elective modules and all the compulsory models.

**Compulsory Modules**

EM 500 Thesis
EM 571 Management and Organisational Behaviour
EM 573 Business Economics
EM 575 Accounting for Managers
EM 577 Management Science
EM 579 Quantitative Management of Systems and Processes
EM 581 Project and Operations Management
EM 583 Procurement and Contracts
EM 585 Analysis and Management of Supply Chains
EM 587 Economic and Financial Analysis
EM 589 Strategic Management
EM 591 Business Statistics
EM 551 Research Methods
EM 550 Seminar

## Elective Modules

EM 572 Corporate Finance
EM 574 Energy and Environmental Policy Analysis
EM 576 Sustainable Development and Corporate Social Responsibility
EM 578 Management of Underground and Surface Operations
EM 582 Engineering Facilities Management

**b) Content of Modules**

The course is structured into compulsory and elective modules. Students are required to take at least two of the elective modules and all the compulsory models. The module to be run, credit hours and module numbers are as follows:

**First Semester (Compulsory Modules)**

| Course No. | Course Name | Credits |
|---|---|---|
| EM 500 | Thesis** | 12 |
| EM 571 | Management and Organisational Behaviour* | 3 |
| EM 573 | Business Economics* | 3 |
| EM 575 | Accounting for Managers* | 3 |
| EM 577 | Management Science* | 3 |
| EM 579 | Quantitative Management of Systems and Processes* | 3 |
| EM 581 | Project and Operations Management* | 3 |
| EM 533 | Procurement and Contracts* | 3 |
| EM 585 | Analysis and Management of Supply Chain* | 3 |

| | | |
|---|---|---|
| EM 587 | Economic and Financial Analysis* | 3 |
| EM 589 | Strategic Management* | 3 |
| EM 591 | Business Statistics** | 3 |
| EM 551 | Research Methods** | 0 |
| EM 550 | Seminar** | 3 |

*** Required courses*

** Core courses*

**Second Semester (Elective Modules)**

| Course No. | Course Name | Credits |
|---|---|---|
| EM 572 | Corporate Finance | 3 |
| EM 574 | Energy and Environmental Policy Analysis | 3 |
| EM 576 | Sustainable Development and Corporate Social Responsibility | 3 |
| EM 578 | Management of Underground and Surface Operations | 3 |
| EM 582 | Engineering Facilities Management | 3 |

## Course Description

## Compulsory Modules

### EM 571 Management and Organisational Behaviour

The course provides students with concepts of organizational behavior and politics, leadership and management. Individual and group behaviour in organizations: Development of self-awareness and interpersonal skills, self assessment of leadership and management ability through a 360 degree evaluation. Learning to lead, Systems thinking, team decision making, communication across cultures, shared visions, change and change management; motivation, performance and rewards, job satisfaction Conflict and conflict resolution: frameworks, tools, and skills to effectively manage conflict in the workplace Communication.

### EM 573 Business Economics

The objective of this course is to provide students with an overview of the main principles, theories and techniques of Economics and their relevance to the management of enterprises in market economies.Tools of economic analysis, Demand and supply, Production and Cost; Theory of production, cost and profit analysis, Market structures and the firm, Pricing policy and objectives, Public and private goods, Dealing with externalities, Cost-benefit analysis, identifying and measuring costs and benefits, time-value of money, transfer and shadow prices, The firm and the macroeconomic environment, Measuring Gross Domestic Product (GDP), Economic policy instruments for managing the economy, The business cycle, Fiscal policy and the government budget, Monetary Policy, the Central Bank, government regulation, Economic growth strategies, employment and inflation.

### EM 575 Accounting for Managers

At the end of the course students should be able to explain fundamental accounting concepts, the elements of financial statements and basic accounting vocabulary; use the accounting equation in basic financial analysis; prepare basic financial statements and basic entries for business transactions. Branches of accounting, Qualities of accounting Information, User of accounting information Financial accounting, Accounting principles, Concepts and conventions, Book keeping, Trial balance, Final accounts, Depreciation methods, Financial statement analysis (objectives and techniques), Preparation and analysis of cashflow, Investment appraisal, Budgeting, Short-term decisions, Activity-based costing, cost-volume-profit analysis, cost estimating, and the costs of outsourcing, Standard costing, variance analysis, responsibility accounting, and performance evaluation, cost behaviour, cost systems, and the limitations concerning the use of average costs.

### EM 577 Management Science

This course is aimed at introducing students to the basic operations research concepts and techniques and encourages students to employ operations research techniques to solve problems of industry to arrive at objective decisions. Mathematical models involving optimisation, simulation and forecasting; Production scheduling methods, distribution, inventory control, Linear, integer and goal programming. Transportation and assignment problems. Decision analysis. Markov analysis. Simulation. Queuing models. Network scheduling.

### EM 579 Quantitative Management of Systems and Processes

The course equips students on how to use quantitative techniques to evaluate systems and processes. Quantifying process capability; Six Sigma, Total quality management, Lean, and the probability and statistical fundamentals for these strategies. Data types and their relationship to distribution types. Systems engineering, reliability and failure: Statistical approaches to systems thinking and system design engineering. Methods for measuring, analysing, predicting and improving product reliability. Systems engineering process models and strategies. Systematic innovation, improving functionality within existing products, development of new generation products, or reducing cost.

### EM 581 Project and Operations Management

The course is designed to train students on how to manage projects and operations towards total quality management. Quantitative project management, production planning and scheduling, materials management, lean manufacturing. Analysis and construction of project plans for the development of complex engineering processes and products. The design, planning, control, and improvement of manufacturing and service operations, capacity and facilities planning and operations strategy. Best practices in outsourcing and offshoring, Cite administration.

### EM 583 Procurement and Contracts

At the end of this course students should be able to review the end to end procurement management process, know about the role of a procurement department in a company and a project, and understand contract administration. Introduction to procurement procedures, Contract administration, Cost-Price Analysis, Negotiation of contracts and modifications, Agreements of contracts, philosophy of contract systems, contract promotion, types of contracts, contract risks and responsibilities, contract document and their application, general conditions of contract, insurance, claims, bill of quantities and methods, Public procurement management, Principles of supply chain management, Stores administration and control of stocks, Buying in competitive environments, Philosophy and Contract systems in engineering.

### EM 585 Analysis and Management of Supply Chains

For this course students will understand optimization and apply it to production, purchasing and supplies, transportation and warehousing. Analytical approaches to optimisation in production and supply chain systems. Product and process design, Production and inventory control, planning and control, location analysis, supply chain strategies, Purchasing and negotiations. Performance measurement, Pull vs. push ordering systems, vendor selection, contract management, outsourcing decisions and inventory management, Global supply management Case studies materials, Supply chain coordination, supply chain integration, the bullwhip effect along the supply chain, taxonomy of supply chain.

### EM 587 Economic and Financial Analysis

The course give students the firm foundation on how to use financial statements to evaluate firm performance and obtain cash flow for the firm and equity holders; calculate the cost of debt, cost of equity and cost of capital; evaluate alternative financing options and the economic/industry environment, and use discounted cash flow and other valuation techniques to value projects Economic feasibility of projects, systems and products. Project budgets, estimation, return on investment, supply and demand, and earned value management. Time value of money and economic equivalence, estimation of revenue and costs. Investment allowance, Taxation and royalties.

Financial alternatives. Cash flow models and analysis, investment decision methods and criteria, decisions under uncertainty, sensitivity and risk analysis. Case studies.

### EM 589 Strategic Management

The course provides students with strategic management skills including analytical tools, creativity and how to drive innovation in a global system. Overview of both micro and macroeconomics. Business strategy for an organisation. Concepts of strategic management of technology companies in a global context. Leveraging analytical tools, critical thinking and creativity in developing and applying economic and business models that consider the interactions among competition, patterns of technological and market change, and internal firm capabilities. Drivers of innovation, successful commercialisation of new technologies and businesses: New product portfolio management, technology road mapping, incremental, radical and disruptive innovation. Globalisation, leading the global environment in large multinational organisations.

### EM 591 Business Statistics

At the end of this course the students should be able understand the significance of statistics, probability, precision and accuracy in interpreting the results of measurements; the role of numbers as a logical, predictable system for expressing and relating quantities in analyzing and solving problems; demonstrate several approaches to problem solving and implement those strategies. Data collection and presentation; Arranging data to convey meanings; measures of central tendency; association of attributes; probability; computer applications in descriptive statistical analysis; hypothesis testing; Bayesian decision making; Correlation; Analysis of variance; Nonparametric methods; Simple and multiple regression models; time series and business forecasting.

### EM 551 Research Methods

This course will equip students with skills in conducting scientific research with regards to data collection, analysis, interpretation and report writing. Definition and concepts of research. Research process. Research design. Literature review. Sampling. Reliability and validity of data. Qualitative and quantitative research methods. Research reporting. Research ethical theory and applications. Standards of ethical conduct in research. Common ethical principles in research. Fraud in research. Whistle blowing. Conflict of interest. Research with human subject. Case studies.

### EM 550 Seminar

Each student will be required to make at least one seminar presentation on the progress of his/her thesis work. The presentation will be assessed by a Departmental Panel. All Postgraduate students are required to attend the seminar(s).

### EM 500 Thesis

For this module students will learn how to gather, analyse, present data and use the concepts to solve problems in novel ways. Each student will be required to undertake an independent research work under the guidance of a supervisor(s) on a topic in the student's area of specialisation. A bound thesis embodying the results of the research will be presented to the Department after an oral defense. A panel will assess this.

### Elective Modules

### EM 572 Corporate Finance

This course aims to provide the students with the fundamental concepts, principles and approaches of corporate finance, enable the students to apply relevant principles and approaches in solving problems of corporate finance and help the students improve their overall capacities Business structures, Sources of finance, financial theory applied to capital structure, investment decisions, corporate valuation and corporate financial policies. Preparation of final accounts in the format of International Accounting Standards 1 (IAS 1), Overview of budget, Preparation of cash budget.

### EM 574 Energy and Environmental Policy Analysis

For this course, students will learn about policy making as it applies to energy generation and distribution and environmental/public health. Environmental policymaking and policy analysis. The limits of science in policymaking, and the impact of environmental policies on society. A comparison of national and international policymaking. Water Resources, supply, regulation and sanitation. Scientific and public policy dilemmas related to the provision of safe drinking water and protection of global human health. A study of the efficient use of energy in buildings, factories and transport systems; Energy audit. Public policy processes and institutions that give rise to the shape, direction and outcomes in the energy sector. Conventional and alternative sources; energy conservation and options for future energy supplies.

### EM 576 Sustainable Development and Corporate Social Responsibility

This course aims at providing students with knowledge on the relations between industries and their surrounding communities The concept of sustainable development and globalisation. The evolution of Corporate Social Responsibility (CSR): Drivers and definitions. Theories to analyse and explain Corporate Social Responsibility. Guide to Corporate Social Responsibility in Ghana. Compensation, relocation/resettlement and alternative livelihood issues. Case studies.

### EM 578 Management of Underground and Surface Operations

For this course students will learn about management of underground and surface mining operations. Definition(s) of Management of Underground and Surface Operations, Analysis of Key Mine Operations Management Terms and Practice, Key Mine Operations Management Functions, Problem Definition(s) in Mine Operations Management, Problem Identification Skills, Decision Making Skills, Mine Operations Communication Skills, Mine Operations Training Skills, Budgeting and Controls, Legal Requirements, Management Traits for Mine Operations Positions

### EM 582 Engineering Facilities Management

For this course students will learn about developing a modern maintenance programme for industrial plants and management of engineering facilities. Maintainability, reliability centred maintenance; Maintenance scheduling optimization of equipment, budgeting; Total productive maintenance strategies to achieve high plant availability, optimization of product quality; Shutdown and turnaround within maintenance of complex systems; Safety and environmental issues

## 22.6 AREAS OF RESEARCH

A candidate may be required to audit appropriate courses/modules and also submit a thesis under the Supervision of an academic staff in any of the following areas of research:

- Corporate Finance.
- Sustainable Development and Corporate Social Responsibility.
- Engineering Facilities Management.
- Management of Surface and Underground Operations.
- Energy and Environmental Policy and Analysis

Other related topics will be accepted but must be approved by the Department.

## 22.7 EMPLOYMENT OPPORTUNITIES

There are employment opportunities in the following areas:

- Engineering based and Allied Industry;
- Research Institutes;
- All Manufacturing and Processing Industry.

## 22.8 AVAILABLE RESOURCES

### a) Academic Staff

See the list of Academic Staff.

**Table 22.1: List of Academic Staff and Areas of Specialisation**

| Name | Academic/Professional Qualification | Designation | Areas of Specialisation |
|---|---|---|---|
| Dr A. Ewusi | PhD & MSc (Bransdenburg Tech Unv., Germany), BSc (KNUST) | Senior Lecturer | Groundwater Resource Assessment & Management, Groundwater Monitoring, Groundwater Modelling, Geophysics |
| Assoc Prof S. A. Ndur | PhD (New Mexico Tech), MSc (Moscow), MSME, MMMPSG, MSEGH | Associate Professor | Mine Waste Characterization, Mine Waste Management, Aqueous Processes and Studies, Water Quality, Environmental Monitoring and Management |
| Assoc Prof A. Simons | PhD, St. Petersburg State Mining Institute, Russia, MSc Eng., Mogilev Machine Building Institute, Mogilev, Belarus | Associate Professor | Internal Combustion Engines, Heat Transfer, Mining Transport Machinery |
| Dr F. Boateng | PhD (Walden University, Minneapolis, MN, USA), MPhil (KNUST), MBA (Leicester, UK), BSc (Central) | Lecturer | Corporate Governance, Corporate Social Responsibility, Mine Financial Administration, Mine, Asset Retirement Obligation, Enterprise Risk Management |
| Dr A. Tetteh | PhD & MSc (Donghua University, Shanghai, China), BSc (KNUST) | Lecturer | Supply Chain Management, Operations/ Service Management, Decision Science |
| Dr Kofi Kamasa | PhD (KNUST), MPhil (KNUST), Bed Social Sciences (Economics Major), UCC | Lecturer | International Trade and Finance, Monetary Economics, Public Sector Economics, Economic Growth and Applied Economics |
| Dr Juliana Abagsonema Abane | PhD (NIDA, Thailand), MPhil, BA (Ghana) | Lecturer | Development Administration, Development, Modern and Strategic Human Resource Management, Public Policy and Administration, Organisational Theory and Analysis |
| Dr E. Boadi | PhD (University of Electronic Science, and Technology, China), MBA, (UPSA), BSc (GIMPA) | Part-Time Lecturer | Financial Regulations, Banking Accounting and Finance |

# 23 MASTER'S (MODULAR) PROGRAMME IN BUSINESS AND TECHNOLOGY MANAGEMENT

## 23.1 TITLE OF PROGRAMME

The title of the programme is Master of Business and Technology Management – Finance and Investment, Supply Chain Management and Management Information Systems options.

## 23.2 PROGRAMME OBJECTIVES

The main objectives of the programme are:

- Train and equip business leaders/managers with decision-making skills through synergy of business and technology strategies to address business and technology challenges; and
- Develop business professionals who have the knowledge, skill and personal qualification to lead and support the effective and competitive use of engineering and information technologies.

## 23.3 ENTRY REQUIREMENTS

The entry requirements for the Master's degree in Engineering Management are:

i. A BSc First Class or Second Class (Upper or Lower Division) or its equivalent in Business, Social and Physical Sciences, Technology and Engineering related programmes.

ii. All applicants who do not satisfy (i) above but are otherwise adjudged suitable by the Departmental Board, may be eligible only after an interview.

iii. Applicants with UMaT Diploma in the Earth Sciences, who have at least five (5) years professional experience with proven ability in their discipline.

iv. Applicants who have satisfactorily completed a Postgraduate Diploma programme may be considered for admission on the recommendation of the Departmental Board concerned.

v. International applicants with proficiency in English language who satisfy the requirements of (a) or (b) above and after careful consideration of transcripts and relevant references, such as NAB's interpretation of equivalent qualifications.

All candidates shall pass an interview before admission.

## 23.4 PROGRAMME REQUIREMENTS

Master of Business and Technology Management Programme

The programme has three (3) options. These are:

Master of Business and Technology Management (Finance and Investments);

Master of Business and Technology Management (Supply Chain Management);

Master of Business and Technology Management (Management Information Systems); and

Master of Business and Technology Management (Strategi Human Resource Management)

### d) Graduation Requirements

**Master of Business and Technology Management – Finance and Investment**

- A minimum of 48 credit hours is required for the award of an MSc degree. This is made up of a minimum of twelve (12) modules (at least 36 credit hours), Postgraduate Seminar (3 credit hours) and Thesis (9 credit hours).

**Master of Business and Technology Management – Supply Chain Management**

- A minimum of 48 credit hours is required for the award of an MSc degree. This is made up of a minimum of twelve (12) modules (at least 36 credit hours), Postgraduate Seminar (3 credit hours) and Thesis (9 credit hours).

**Master of Business and Technology Management – Management Information Systems**

- A minimum of 48 credit hours is required for the award of an MSc degree. This is made up of a minimum of twelve (12) modules (at least 36 credit hours), Postgraduate Seminar (3 credit hours) and Thesis (9 credit hours).

### e) Programme Duration

- Full-time - A maximum of four (4) semesters (2 years) for course work and thesis work
- Part-time - A maximum of six (6) semesters (3 years) for course work and thesis work.

### f) Registration

- Full-time students will be required to register a minimum of two (2) modules per month and six (6) modules per semester.
- Students should register modules they intend to participate in by the third week of every semester. Students may, however, pay module participation fee at the time the module is being offered.
- To be of good standing a part-time student must do, at least, two modules per annum.

## 23.5 PROGRAMME STRUCTURE

4. Each module runs for a maximum of five (5) weekends (Saturday and Sunday); examinations in each module shall be taken within the last weekend of the module.
5. There shall be a minimum of forty (40) contact hours in each module (8 hrs. /weekend).
6. A prospective applicant may participate in a module within two years prior to applying for postgraduate programme; the results of such a module shall upon request by the applicant be credited to him/her upon admission.

**a) Core and Compulsory Modules**

The Master of Business and Technology Management (Finance and Investment) option course is structured into compulsory and elective modules. Students are required to take all of the compulsory modules and five of the elective modules.

**Compulsory Modules**

MB 500 Thesis

MB 571 Human Resource Management

MB 573 Managerial Economics

MB 575 Accounting for Managers

MB 577 Quantitative Methods

MB 579 Database Management Systems

MB 581 Operations and Project Management

MB 583 Data Mining and Data Warehousing

MB 585 Marketing Management

MB 587 Management Information Systems

MB 589 Strategic Management

MB 591 Business Data Communication and Networking

MB 551 Research Methods

MB 550 Seminar

**Elective Modules**

MBF 572 International Finance

MBF 574 Monetary Economics

MBF 576 Corporate Finance and Accounting

MBF 578 Investment Analysis and Portfolio Management

MBF 582 Quantitative Finance and Financial Markets

MBF 584 Financial Risks Management

MBF 586 Derivatives and Investment Management

**a) Core and Compulsory Modules**

The Master of Business and Technology Management (Supply Chain Management) option course is structured into compulsory and elective modules. Students are required to take all of the compulsory modules and five of the elective modules.

**Compulsory Modules**

MB 500 Thesis

MB 571 Human Resource Management

MB 573 Managerial Economics

MB 575 Accounting for Managers

MB 577 Quantitative Methods
MB 579 Database Management Systems
MB 581 Operations and Project Management
MB 583 Data Mining and Data Warehousing
MB 585 Marketing Management
MB 587 Management Information Systems
MB 589 Strategic Management
MB 591 Business Data Communication and Networking
MB 551 Research Methods
MB 550 Seminar

**Elective Modules**

MBS 572 Logistics and International Trade
MBS 574 Supply Chain Management
MBS 576 Contract and Procurement Management
MBS 578 Enterprise Resource Management
MBS 582 E-Commerce and Logistics Automation
MBS 584 Total Quality Management
MBS 586 Manufacturing Strategy
MBS 588 Health and Safety Management

**a) Core and Compulsory Modules**

The Master of Business and Technology Management (Management Information Systems) option course is structured into compulsory and elective modules. Students are required to take all of the compulsory modules and five of the elective modules.

**Compulsory Modules**

MB 500 Thesis
MB 571 Human Resource Management
MB 573 Managerial Economics
MB 575 Accounting for Managers
MB 577 Quantitative Methods
MB 579 Database Management Systems
MB 581 Operations and Project Management
MB 583 Data Mining and Data Warehousing
MB 585 Marketing Management
MB 587 Management Information Systems
MB 589 Strategic Management
MB 591 Business Data Communication and Networking
MB 551 Research Methods
MB 550 Seminar

**Elective Modules**

MBM 572 Java Programming
MBM 574 Cloud Computing
MBM 576 Cybercrime Prevention and Protection

MBM 578 Enterprise Resource Management

MBM 582 Advanced Database Management

MBM 584 Knowledge Management and Information Systems

MBM 586 Information Security Systems, Control and Audit

**b) Content of Modules**

The course is structured into compulsory and elective modules. Students are required to take at least two of the elective modules and all the compulsory models. The module to be run, credit hours and module numbers are as follows:

**First Semester (Compulsory Modules)**

| Course No. | Course Name | Credits |
|---|---|---|
| MB 500 | Thesis | 9 |
| MB 571 | Human Resource Management | 3 |
| MB 573 | Managerial Economics | 3 |
| MB 575 | Accounting for Managers | 3 |
| MB 577 | Quantitative Methods | 3 |
| MB 579 | Database Management Systems | 3 |
| MB 581 | Operations and Project Management | 3 |
| MB 583 | Data Mining and Data Warehousing | 3 |
| MB 585 | Marketing Management | 3 |
| MB 587 | Management Information System | 3 |
| MB 589 | Strategic Management | 3 |
| MB 591 | Business Data Communication and Networking | 3 |
| MB 551 | Research Methods | 0 |
| MB 550 | Seminar | 3 |

Second Semester (Elective Modules)

| **Supply Chain Management** | | |
|---|---|---|
| **Course No.** | **Course Name** | **Credits** |
| MBS 572* | Logistics and International Trade | 3 |
| MBS 574* | Supply Chain Management | 3 |
| MBS 576* | Contract and Procurement Management | 3 |
| MBS 578 | Enterprise Resource Management | 3 |
| MBS 582* | E-Commerce and Logistics Automation | 3 |
| MBS 584* | Total Quality Management | 3 |
| MBS 586 | Manufacturing Strategy | 3 |
| MBS 588 | Health and Safety Management | 3 |

** Required courses*

| **Finance and Investments** | | |
|---|---|---|
| **Course No.** | **Course Name** | **Credits** |
| MBF 572* | International Finance | 3 |
| MBF 574* | Monetary Economics | 3 |
| MBF 576* | Corporate Finance and Accounting | 3 |
| MBF 578* | Investment Analysis and Portfolio Management | 3 |

| | | |
|---|---|---|
| MBF 582 | Quantitative Finance and Financial Markets | 3 |
| MBF 584* | Financial Risk Management | 3 |
| MBF 586 | Derivatives and Investment Management | 3 |

** Required courses*

| Management Information Systems | | |
|---|---|---|
| **Course No.** | **Course Name** | **Credits** |
| MBM 572* | Java Programming | 3 |
| MBM 574 | Cloud Computing | 3 |
| MBM 576* | Cybercrime Prevention and Protection | 3 |
| MBM 578 | Enterprise Resource Planning | 3 |
| MBM 582* | Advanced Database Management | 3 |
| MBM 584* | Knowledge Management and Information Systems | 3 |
| MBM 586* | Information Security Systems, Control and Audit | 3 |

** Required courses*

| Strategic Human Resource Management | | |
|---|---|---|
| **Course No.** | **Course Name** | **Credits** |
| MBH 572 | Strategy and Human Resource Management | 3 |
| MBH 574 | Workplace Health and Safety Management | 3 |
| MBH 576 | Human Resource Planning and Job Analysis | 3 |
| MBH 578 | Total Rewards and Performance Management | 3 |
| MBH 582 | Industrial Relations and Conflict Management | 3 |
| MBH 584 | Cross Cultural and International Human Resource Management | 3 |
| MBH 586 | Human Capital and Workforce Capital Development | 3 |

## Course Description

### Compulsory Modules

### MB 500 Thesis

Each student will be required to undertake an independent research work under the guidance of a supervisor(s) on a topic in the student's area of specialisation. A bound thesis embodying the results of the research will be presented to the Department after an oral defense. A panel will assess this.

### MB 571 Human Resource Management

Current challenges in workforce management, Strategic workforce management, Equal employment opportunity, Job analysis, job descriptions, and alternative work arrangements, Staffing, Performance management and appraisal, Talent management, Developing compensation systems, Competitive employee benefits, Employee rights, disciplinary practices and termination, Creating high-performance work systems, Employee Relations, Global human resource management.

### MB 573 Managerial Economics

Tools of economic analysis, Demand and supply, Production and Cost; Theory of production, cost and profit analysis, Market structures and the firm, Pricing policy and objectives, Public and private goods, Dealing with externalities, Cost-benefit analysis, identifying and measuring costs and benefits, time-value of money, externalities, transfer and shadow prices, The firm and the macroeconomic environment, Measuring Gross

Domestic Product (GDP), Economic policy instruments for managing the economy, The business cycle, Fiscal policy and the government budget, Monetary Policy, the Central Bank, government regulation, Economic growth strategies, employment and inflation.

### MB 575 Accounting for Managers

Branches of accounting, Qualities of accounting Information, User of accounting information Financial accounting, Accounting principles, Concepts and conventions, Book keeping, Trial balance, Final accounts, Depreciation methods, Financial statement analysis (objectives and techniques), Preparation and analysis of cashflow, Investment appraisal, Budgeting, Short-term decisions, Activity-based costing, cost-volume-profit analysis, cost estimating, and the costs of outsourcing, Standard costing, variance analysis, responsibility accounting, and performance evaluation, cost behaviour, cost systems, and the limitations concerning the use of average costs.

### MB 577 Quantitative Methods

Equations and inequalities, simultaneous equations, linear functions and linear inequalities, introduction to matrix algebra, applied differential calculus, measures of averages, measures of variability or dispersion, probability theory and applications, correlation theory, regression, forecasting and time series analysis, index numbers, arithmetic and geometric progression, interest rate and depreciation, present value and investment analysis, linear programming.

### MB 579 Database Management Systems

Data models, database languages, transaction-storage management, database administrator, users, overall system structure, entity relationship model, mapping constraints, relational model-structure, relational algebra, extended operations, modifications on a database views, SQL- basic structure, set operations, aggregate functions, nested sub queries, derived relations, views; integrity constraints, object oriented data model-languages, object relational database, database system architectures- centralized systems, client server systems, distributed systems; parallel databases-introduction, inter query, intra query, intra operations; interoperation parallelism- distributed database data storage, network transparency-query processing, transaction model-commit protocols, coordinator selection, concurrency control, deadlock handling, multi database systems.

### MB 581 Project and Operations Management

Quantitative project management, production planning and scheduling, materials management, and lean manufacturing. Analysis and construction of project plans for the development of complex engineering processes and products. The design, planning, control, and improvement of manufacturing and service operations. Materials management, production planning and scheduling, lean manufacturing, capacity and facilities planning and operations strategy. Best practices in outsourcing and offshoring.

### MB 583 Data Mining and Data Warehousing

Introduction to data mining, functionalities, classification of data mining systems, major issues in data mining, data warehousing and OLAP technology for data mining, what is data warehouse, a multi -dimensional model, data warehouse architecture, data warehouse implementation, future development of data cube technology, data pre-processing-data cleaning, data integration and transformation, data reduction, discretization and concept hierarchy generation, data mining primitives, what defines a data mining tasks, mining association rules; classification and prediction

### MB 585 Marketing Management

Understanding marketing management, conducting marketing research, Analysing consumer and business markets, identifying market segments and targets, Creating brand equity. Brand positioning and competitive dynamics, setting product strategies, Designing and managing services, developing pricing strategies and programmes, Managing integrated marketing channels, Direct and interactive marketing, Global marketing

strategy, service marketing, Marketing process, Marketing environment, Personal communication channel, International marketing management

### MB 587 Management Information Systems

Information system concepts as applied to business operations and management; Systems thinking and Development, Business Information Systems, Managing the change process; Data Warehousing and Decision Support Systems; Business Intelligence Systems, Customer relationship management, and Competitive Advantage; Networks Acquiring and Managing the Information Resource; Security and information systems, Information ethics and privacy, Internet and social media, E-business.

### MB 589 Strategic Management

Overview of both micro and macroeconomics. Business strategy for an organisation. Concepts of strategic management of technology companies in a global context. Leveraging analytical tools, critical thinking and creativity in developing and applying economic and business models that consider the interactions among competition, patterns of technological and market change, and internal firm capabilities. Drivers of innovation, successful commercialisation of new technologies and businesses: New product portfolio management, technology road mapping, incremental, radical and disruptive innovation. Globalisation, leading the global environment in large multinational organisations, Corporate governance, Corporate Social Responsibility, International Strategies, Strategic Entrepreneurship

### MB 591 Business Data Communication and Networking

Overview of modern data communication requirements, basic distributed data concepts, History of internet, basics of OSI and TCP/IP computer networks models, basic data communication concepts, design issues, error detection and correction, channel allocation problems, multiple access protocols, IEEE standard 802 for LANs and WLANs, bridges, switches and high-speed LANs, internetworking, network layer in the internet, transport service and elements of transport protocols, TCP and UDP Internet transport protocols, basic network security and management concepts.

### MB 551 Research Methods

Definition and concepts of research. Research process. Research design. Literature review. Sampling. Reliability and validity of data. Qualitative and quantitative research methods. Research reporting. Research ethical theory and applications. Standards of ethical conduct in research. Common ethical principles in research. Fraud in research. Whistle blowing. Conflict of interest. Research with human subject. Case studies.

### MR 550 Seminar

Each student will be required to make at least one seminar presentation on the progress of his/her thesis work. The presentation will be assessed by a Departmental Panel. All Postgraduate students are required to attend the seminar(s).

## ELECTIVE MODULES

### MBS 572 Logistics and International Trade

International trade and globalisation, Logistics management and strategy, Purchasing and materials management, Warehousing: principles and practices in a global economy, Maritime and transport law, Shipping transportation and forwarding, Understanding logistics documentation, International distribution logistics, Insurance issues surrounding international trade, Logistics monitoring and control, Analysis of product import/export potential, International finance tools.

### MBS 574 Supply Chain Management

Analytical approaches to optimisation in production and supply chain systems. Product and process design, Production and inventory control, planning and control, location analysis, supply chain strategies, including game-theoretic approaches, Purchasing and negotiations. Performance measurement, Information technology and decision support. Materials management and its impacts the product management cycle; Pull vs. push ordering systems, vendor selection, contract management, outsourcing decisions and inventory management, Transportation and warehousing, Global supply management, Strategic management. Supply chain design and integration, supply chain risk management, green supply chain management. Case study materials.

### MBS 576 Contract and Procurement Management

Introduction to procurement procedures, Contract administration, Cost-Price Analysis, Negotiation of contracts and modifications, Public procurement management, Principles of supply chain management, Stores administration and control of stocks, Buying in competitive environments, Introduction to management information systems, Procurement planning, procurement methods, sustainability issues on procurement.

### MBS 578 Enterprise Resource Management

Introduction and Overview and review of Enterprise Level and ERP Concepts, Business and IT Integration Trends, Life Cycle concepts: 1) development life cycle rationale. 2) traditional ERP life cycles 3) accelerated ERP life cycles, Enterprise process modeling concepts, Enterprise process modeling tools and techniques, ERP Implementation Challenges and Success Factors, Business Process Reengineering (BPR and ERP), ERP Fits and Misfits Analysis, ERP Requirements Management, ERP Project Team Selection, Development and Project Communications, Change Management & Control, ERP Configuration and Control, Data migration and Data Cleansing, Quality Assurance, ERP Risk Management, ERP Method Engineering.

### MBS 582 E-Commerce and Logistics Automation

Overview of electronic commerce, E-Marketplaces (Auctions, Portals etc.), E-Tailing products and services, Online marketing and online consumer behaviour, Business-to-Business E-Commerce, E-Commerce security, Payment solutions and order fulfilment, E-Commerce strategy and global Issues, Legal, ethical and tax Issues, Launching an E-Commerce business, E-Commerce business Analysis. Logistics automation, components of logistics automation, benefits of logistics automation, automation software, material handling equipment, supply chain software, production planning and control, facilities planning and design, transport and distribution planning, vehicle routing and scheduling, sustainability and green logistics, decision support system in production and logistics

### MBS 584 Total Quality Management

Understanding Quality : Definition of quality, quality and competitiveness, understanding and building quality chains, managing processes, quality in all functions, quality gurus & TQM: Design for quality: Innovation: design and improvement, Quality function deployment (QFD) – house of quality, Design control and management, specifications and standards, Failure mode effect and criticality analysis (FMECA), quality in the service sector; Total Quality Management: The meaning and principles of Total Quality Management (TQM), TQM as an element of the corporate business management process. TQM models: Malcom Baldrige Excellence model, European Foundation for Quality Management (EFQM) Excellence model; Implementation of TQM: Benchmarking, Communications for quality, Training for quality, Implementation of TQM and management of change. Quality Circles.

### MBS 586 Manufacturing Strategies

Manufacturing in Corporate Strategy; Manufacturing Strategy Concepts; Production System Design: Production System Design, Just-in-time (JIT) System (Push Vs Pull); Lean Manufacturing: Lean & Flexible Manufacturing Operations, Standardization: Standardized Layout, Standardized Processes, Standardized Equipment; Capacity & Facility Strategies; Manufacturing Process Technology Strategy: Manufacturing Process Technology Strategy;

Positioning Strategies &Learning Curve; Sourcing Strategy; Evolving Operating Systems & New Manufacturing Technologies; International Approaches to Manufacturing Management; World Class Manufacturing; Continuous Improvement Capability, Overall Equipment Effectiveness, Waste Reduction Capability, Inventory Reduction Capability.

### MBS 588 Health and Safety Management

Introduction to health and Safety: Hazard, Risk, Safe, Accident, An Introduction to Health and Safety Law: Risk Assessment: General Working Environment: That the following are all features of a healthy and safe workplace: Stairways, Lighting, Temperature, Ventilation, Housekeeping –Safe storage, Falling objects, Toilets and Washing Facilities, Smoking etc., The importance of safety signs and their usage,; Slips, Trips And Falls: The significance of injuries received through slips, trips and falls,; Hazardous Substances: Occupational Health: Machinery and Equipment: Manual Handling: Electricity At Work: Personal Protective Equipment: The different types of PPE and the hazards against which they provide protection,; Fire: Accidents and Emergencies.

### MBF 572 International Finance

Globalisation and the multi-national firm, balance of payments, the foreign exchange markets, international capital markets, currency derivative markets, risk management and hedging strategies, foreign direct investment, financing in the short term and long term, managing net working capital, international trade finance, investment decisions in the global marketplace.

### MBF 574 Monetary Economics

Money demand and money supply, inflation and optimal quantity of money, monetary policy transmission mechanism, the term structure of interest rates, strategy of monetary policy and optimal monetary policy, time inconsistency problem in monetary policy, monetary policy targets and rules, and non-conventional monetary policies as well as Central bank independence.

### MBF 576 Corporate Finance and Accounting

Business structures, Sources of finance, financial theory applied to capital structure, investment decisions, corporate valuation and corporate financial policies. Preparation of final accounts in the format of International Accounting Standards 1 (IAS 1), Overview of budget, Preparation of cash budget, cost of capital and capital structure, capital budgeting, risk and return in security market, dividend policy, international accounting environment, corporate financial reporting, accounting for leases, statement of cash flows

### MBF 578 Investment Analysis and Portfolio Management

Investment process, portfolio applications, asset allocation decision in global setting; organization and functioning of financial markets; equity and bond valuation; asset valuation models; equity and bond portfolio management; options, forwards and futures contracts; evaluation of portfolio performance; and review of alternative economies and emerging markets.

### MBF 582 Quantitative Finance and Financial Markets

Concept of finance; corporate finance; structures of the financial system; capitalization; trading on equity; leverages; nature and significance of capital budgeting; methods of evaluating capital expenditure proposals; financial statements of corporate organizations.

### MBF 584 Financial Risk Management

Identifying types of risks; transactions and economic exposure; quantifying risk and hedging techniques; price variation; short-term borrowing; assets liability management; risk, return and price behavior of securities in competitive markets; financial futures and other financial and real investments; how corporations manage their myriad business risk exposures and which of these exposures derivative securities are designed to address.

### MBF 586 Derivatives and Investment Management

Capital market – traditional and emerging; introduction to derivatives and commodities; Portfolio theory with applications to the markets, fixed income portfolio management. Future trading; share lending scheme, buy back of shares; risk analysis and investment strategies; mergers and acquisitions, nature and role of money market; instruments in money market; securitisation of debts; merchant banking services and functions; investment types and valuation methods; the bond market; the options market; business financing decisions; making a bid.

### MBM 572 JAVA Programming

Programming, Java Evolution, Java History, Java Features: Overview of Java Language, Constants, Variables and Data Types, Operators and Expressions, Decision making, Branching and looping, Classes, Objects and Methods, Arrays, String and Collections, Interfaces, Packages, Managing Errors and Exceptions, Multithreading, Applet Programming, Java AWT, Event Handling, Java I/O Handling, Java Database Connectivity, Java Beans and Swing: Bean concepts -Events in bean box - Bean customization -Persistence -Application-deployment using swing -Advanced swing techniques -JAR file handling, Java Enterprise Applications: Java Servlets, Java Server Pages, JDBC -Session beans -Entity beans, Deploying n-tier application, Introduction to Android, Introduction to struts Framework. Java database connectivity, Unit testing and debugging, Multithreading and Concurrency, Generics and Collections in depth, Graphical user interfaces using Swing.

### MBM 574 Cloud Computing

Introduction to cloud computing, Cloud computing concepts and models, Cloud-enabling technologies, Open Stack, Data centers, Virtualization, Overview of cloud security, Cloud infrastructure, Cloud management, Cloud architectures, Data storage, Big data, Data security, Map Reduce, Secure Computation, Cloud OS, Cloud Architectures including Federated Clouds, Scalability, Performance, QoS, Data centers for Cloud Computing, Principles of Virtualization platforms, Security and Privacy issues in the Cloud, VMWare ESX Memory Management, Capacity Planning and Disaster Recovery in Cloud Computing.

### MBM 576 Cybercrime Prevention and Protection

Introduction & History of Computer Crime, Computer Laws, Techniques, Collecting & Documenting Evidence, the internet, what is Cybercrime, Collecting Evidence from Hardware and the Operating System, Litigation & Deposition of Trials, Civil Matters and Online Protection, Harassment, Stalking & Hacker Techniques, The victim How Cybercriminals Communicate, the research process, Theories.

### MBM 578 Enterprise Resource Planning

Introduction to ERP, integrated management information, seamless integration, supply chain management, integrated data model, benefits of ERP, business engineering and ERP-Definition of business engineering, principles of business engineering, business engineering with information technology, business model for ERP-Building the business model, ERP implementation overview, role of consultants, vendors and users, customization, ERP post implementation options, ERP implementation Technology-guidelines for ERP implementation, ERP and competitive advantage, commercial ERP Package description, multi client server solution, open technology, user interface, application integration, architecture; basic architectural concepts, the system control interfaces, services-presentation interface, database interface, case studies.

### MBM 582 Advanced Database Management

Theoretical concepts, Relational model conformity and Integrity, Advanced SQL programming, Query optimization, Concurrency control and Transaction management, Database performance tuning, Distributed relational systems and Data Replication, Security considerations, Object oriented, deductive, spatial, temporal and constraint database management systems, New database applications and architecture, Data Warehousing; Multimedia; Mobility; Multi databases; NoSQL, Native XML databases (NXD), Internet, SQL standards, SQL 1999, SQL:2003, Object Data Management Group (ODMG) version 3.0 standard, Standards for interoperability and integration e.g. Web Services, SOAP, XML related specifications, e.g. XQuery, XPath.

### MBM 584 Knowledge Management and Information Systems

Knowledge society, from data to information to knowledge, drivers of knowledge management, intellectual capital, knowledge management and learning organization-case studies, strategic alignment, creating awareness, articulation, evaluation and strategic alignment, infrastructural development and deployment-leadership, measurement and refinement, role of CKO, analysing business environment, knowledge audit and analysis, designing KM team, creating KM system blue print, implementation, capture, store and sharing, technology components: intranet and groupware solutions-tools for collaborative intelligence package choices, implementation security, definition of computer based user machine system, integrated system, utilization models, operating elements, structured programmable decisions, MIS structure based on management activity and organizational functions, system support, system development and management.

### MBM 586 Information Security Systems, Control and Audit

Introduction to information security, security threats, planning and administration, ethical hacking of computer network, system and application, information security assessment process, cracking the shadow and administrator, wireless security and review, security policy and awareness, physical threats to information system, access control systems and methodology, access control techniques, access control administration, attacks and monitoring, methods of attacks, auditing and monitoring penetration testing techniques.

## 23.6 AREAS OF RESEARCH

A candidate may be required to audit appropriate courses/modules and also submit a thesis under the Supervision of an academic staff in any of the following areas of research:

- Corporate Finance.
- Supply Chain and Inventory Control Management
- Cloud Computing.
- Enterprise Risk Management.
- Engineering and Procurement Contract Management

Other related topics will be accepted but must be approved by the Department.

## 23.7 EMPLOYMENT OPPORTUNITIES

There are employment opportunities in the following areas:

- Technology based and Allied Industry;
- Research Institutes;
- All Manufacturing and Processing and Dispatch Industries;
- Financial Institutions;
- Telecommunication Industry;
- Freight Forwarding Companies; and
- Mining Industries.

## 23.8 AVAILABLE RESOURCES

a) Academic Staff

See the list of Academic Staff.

**Table 23.1: List of Academic Staff and Areas of Specialisation**

| Name | Academic/Professional Qualification | Designation | Areas of Specialisation |
|---|---|---|---|
| Dr A. Ewusi | PhD & MSc (Bransdenburg Tech Unv.), BSc (KNUST) | Senior Lecturer | Groundwater Resource Assessment & Management, Groundwater Monitoring, Groundwater Modelling, Geophysics |
| Dr F. Boateng | PhD (Walden), MPhil (KNUST), MBA (Leicester, UK), BSc (Central) | Lecturer | Corporate Governance, Corporate Social Responsibility, Mine Financial Administration, Mine, Asset Retirement Obligation, Enterprise Risk Management |
| Dr A. Tetteh | PhD, MSc (Donghua University), BSc (KNUST) | Lecturer | Supply Chain Management, Operations/Service Management, Decision Science |
| Dr Kofi Kamasa | PhD (KNUST), MPhil (KNUST), B.Ed (Cape Coast) | Lecturer | International Trade and Finance, Monetary Economics, Public Sector Economics, Economic Growth and Applied Economics |
| Dr Juliana Abagsonema Abane | PhD (NIDA, Thailand), MPhil, BA (Ghana) | Lecturer | Development Administration, Development, Modern and Strategic Human Resource Management, Public Policy and Administration, Organisational Theory and Analysis |
| Dr E. Boadi | PhD (University of Electronic Science, and Technology, China),/ MBA, (UPSA), BSc (GIMPA) | Part-Time Lecturer | Financial Regulations, Banking Accounting and Finance |
| Dr Hamidu Fatao | PhD (UniSA), BSc (UMaT) | Lecturer | Data Mining and Data Warehousing, GPS/ Cellular Data Mining, WSN |
| W. A. Agangiba | MSc, BSc (Tver State Technical University) | Lecturer | Management Information Systems |
| Prof B. K. Alese | PhD (FUTA) | Professor | Cybercrime Prevention and Protection, Information Security, Digital Signal Processing, Quantum Computing |
| Dr V. M. Nofong | PhD (UniSA), BSc (UMaT) | Lecturer | Java Programming, Data Mining, Pettern Mining, Trend Prediction, Classification |
| T. Kwantwi | MSc (Tver State Technical University) | Lecturer | Advance Database Management |

# APPENDICES

# APPENDIX 1

## A1 Date for Graduation

There shall be two dates for conferment of degrees for Postgraduate Students, the first in February and the second in June.

## A2 Format for Thesis Synopsis

**THESIS SYNOPSIS**

| | |
|---|---|
| **NAME** | IBRAHIM YUSSIF |
| **DEPARTMENT** | GEOMATIC ENGINEERING |
| **FACULTY** | MRT |
| **TITLE OF PROGRAMME** | MSc (GEOMATIC ENGINEERING) |
| **DURATION** | PART-TIME (3-Yrs)/FULL-TIME (4-Yrs) |
| **ESTIMATED DATE OF SUBMISSION OF THESIS** | JUNE, 2014 |

### A. THESIS TITLE

The topic for the research should be selected carefully. It should be specific and worded to show the nature of work involved as far as possible.

### B. STATEMENT OF THE PROBLEM

Logically, the first step in any research is to provide a clear statement of the problem. This step is indispensable in the writing process in that it governs the organisation and flow of the thesis. The statement of problem should provide a synopsis of the purpose of the study, briefly define and delimit the specific area of the research, identify the unit of analysis in the study, and foreshadow the hypotheses to be tested or the questions to be raised. In stating the problem, it is also necessary to specify why it is important and what new insights may be found. A problem may be stated in terms of a verbal statement, i.e., "The purpose of this research is to examine..." or "This study aims at ascertaining …." Problem could also be stated in the form of a question like: what has changed? Where and when did the change occur? What is the effect of the land-use/cover changes on carbon sequestration? How can ecosystem failures be averted?

### C. OBJECTIVE(S) OF RESEARCH

Broad objectives as visualised to be achieved should be clearly outlined and these should be itemised. These objectives will indicate the major aspects of the study to be undertaken.

### D. EXPECTED OUTCOME(S)

This must state the results to be anticipated at the end of the research. You must carefully craft it out of your objectives.

### E. METHODS TO BE USED

A plan of work describing the various aspects of the study in a logical sequence along with the actual methods to be employed, are the most important aspects of any research plan. Sufficient details to demonstrate that you have a fairly good idea about the nature of work likely to be involved should be provided.

### F. FACILITIES TO BE USED FOR RESEARCH

In order to complete the proposed research some specialised facilities may be required. For example in case of experimental sciences different equipments may be involved. Therefore it is important to identify the place where the research work will be undertaken and whether the resources and facilities required for doing the research are available.

**G. SIGNATURES**

…….... ……..…….....……..

Ibrahim Yussif Dr Bernard Kumi-Boateng

(STUDENT) (SUPERVISOR)

Recommended by Head of Department

Name:……..

Signature:……..

Date:……....

**A3 Format for PhD/MPhil Research Proposal**

**[Cover Page]**

**PhD/MPhil Research Proposal**

**for**

**the Degree of Doctor of Philosophy/Master of Philosophy**

**in**

**(State Programme)**

**at**

**the University of Mines and Technology, Tarkwa**

**Prepared by**

**Candidate's Name**

**[Tarkwa, Year]**

**Thesis Title**

**( The research proposal title should demarcate the main focus/or theme of the proposed study)**

**A proposal submitted in fulfilment of the requirements for the Degree of PhD/MPhil in (State Programme)**

**Candidate's Name**

## Proposed Supervisor

---

## Proposed Co-supervisor(s) (if applicable)

---

## Name of the Department

## Date of Submission

### A. BACKGROUND

The background highlights empirical foundations of research and gives an overview of the subject area. The purpose of this background section is to give the reader the relevant facts about the topic and/or research site so that they understand the material or case in the proposal and how it links to the questions posed. This should take the form of an abstract of the general subject or study area and identify the discipline(s) within which it falls. From this analysis the problem you wish to research will emerge and constitutes the reason or condition which necessitates the research. You should also indicate here the way in which your background gives you competencies in the chosen area.

### B. RESEARCH PROBLEM

From the overview of the subject area follows the research problem, i.e. you have to identify the possible cause(s) of the problem. This section states the problem that you are exploring.

### C. RESEARCH QUESTION

The research question is specific, concise, and clear. The research question can be expanded upon by stating sub-questions.

Note: The difference between the research problem and research question is that the problem is broader, while the research question represents the "one question that you will answer at the end of your dissertation".

### D. RESEARCH OBJECTIVES

Next, you have to describe the research objectives as it relates to solving the uncertainty or burning question you are interested in. It should explicitly state the contribution you want to make with the intended study. You will in a later section elaborate on the scientific contribution made.

### E. METHODS AND PROCEDURES TO BE USED

The methods or procedures section is undeniably the heart of your research proposal. This section normally includes four main areas: the type of study being conducted, data collection procedures, the sample selection and data analysis.

### F. PROPOSED CONTRIBUTION TO SCIENCE/KNOWLEDGE

A convincing statement is required as to why your topic merits scientific research, i.e. how it will contribute to and enrich the academic knowledge and understanding of theory and professional practice. This contribution results from the systematic investigation of your research activities, which are conducted to discover new information, as well as to expand and verify existing knowledge. This contribution does not simply imply the gathering of new data and a description thereof, i.e. the What? questions. There are many things we do not know and that we could

find out. This is data-gathering. The contribution to be made by doctoral research goes beyond this and requires the So what? questions, i.e. explanations, relationships, generalisations and theories.

## G. LITERATURE REVIEW

The literature review helps relate the proposed study to the larger ongoing discourse in the literature about a phenomenon, filling in gaps in the literature and extending earlier studies. The literature review is neither a chronological summary of related works nor a mere catalogue of previous studies published in the field. Literature review is a well-organized critical appreciation of related and relevant literature conceptually integrated within the logic of the proposed investigation. You are to show whether other researchers have studied the same or similar problems before, from what perspectives have these studies been conducted, and whether these researches have been theoretically or empirically adequate. In fact this is where you demonstrate that you are au fait (Having a good or detailed knowledge of) with the debates and issues raised in related literature. References to key texts and recently published articles should be made to convince that you appreciate their integrative relevance to your research area. A PhD is original research and you should be able to demonstrate that your proposed area has not been studied before. As such, you need to identify how your own research might make a useful contribution to the particular scientific-related area.

## H. PROPOSED CHAPTER OUTLINE

Research proposals also contain tentative chapter outline. It indicates the number of chapters the thesis or dissertation is expected to be composed of. You are to give the tentative chapter headings with brief annotations of expected chapter content.

## I. REFERENCES

A full list of references to key texts and articles must be included.

---

*BASIC TECHNICAL REQUIREMENTS: As a rule of thumb, the proposal should not exceed 5,000 words (about 15-20 typed, one and half-spaced pages). Nevertheless, the proposal must be of adequate length to describe, in fair detail, the nature of the proposed project as outlined above. For other basic technical requirements (reference format, layout for tables and figures etc) students are advised to consult The UMaT format for the Presentation of Thesis and Project Reports (May 2011).*

**[Last Page]**

## J. RESEARCH PROTOCOL

You need to include a preliminary time and work schedule outlining the main phases in your research project. This is referred to as the research protocol. Identify the major tasks involved in your proposed study and place and identify the length of time to complete the tasks and the order in which they will be done in line with the table provided. You are free to modify.

| | First Academic Year (20_____/20_____) | | |
|---|---|---|---|
| Research activities | Semester I | Semester II | Remarks |
| Proposal Write-up | | | |
| Data collection | | | |
| Data Analysis | | | |
| Proposal Defence | | | |
| Seminar Presentation 1 | | | |
| Seminar Presentation 2 | | | |
| Catch-up | | | |
| Writing: | | | |
| Chapter One | | | |

| | | | |
|---|---|---|---|
| Chapter Two | | | |
| Chapter Three | | | |
| Chapter Four | | | |
| Consultation with Supervisor(s) | | | |
| | Second Academic Year (20_____/20_____) | | |
| Research activities | Semester I | Semester II | Remarks |
| Proposal Write-up | | | |
| Data collection | | | |
| Data Analysis | | | |
| Proposal Defence | | | |
| Seminar Presentation 1 | | | |
| Seminar Presentation 2 | | | |
| Catch-up | | | |
| Writing: | | | |
| Chapter One | | | |
| Chapter Two | | | |
| Chapter Three | | | |
| Chapter Four | | | |
| Consultation with Supervisor(s) | | | |
| | Third Academic Year (20_____/20_____) | | |
| Research activities | Semester I | Semester II | Remarks |
| Proposal Write-up | | | |
| Data collection | | | |
| Data Analysis | | | |
| Proposal Defence | | | |
| Seminar Presentation 1 | | | |
| Seminar Presentation 2 | | | |
| Catch-up | | | |
| Writing: | | | |
| Chapter One | | | |
| Chapter Two | | | |
| Chapter Three | | | |
| Chapter Four | | | |
| Consultation with Supervisor(s) | | | |

## A4 Dates for Submission of Thesis Synopsis

(a) MPhil/PhD Programmes (by research): Submission of research proposal shall be made not later than the end of the SECOND SEMESTER of the First Year of the programme.

(b) Master's Programmes (Part Taught and Part Research): Submission of Synopsis shall be not later than the end of the SECOND SEMESTER of the First Year of the programme.

(c) Postgraduate Diploma Programme (with Project): Synopsis shall be submitted not later than the end of the FIRST Semester of the programme.

## A5 Procedure for Complaint and Redress at Postgraduate Level

(a) Grounds for Complaint

A student has grounds for complaint based on any of the following:

(i) Inadequacy of supervisory arrangement including the non-availability of the Supervisor at crucial times during the course of study and lack of constructive criticism of the work.

Lack of satisfactory progress for reasons outside the control of the student including lack of facilities to adequately tackle work required.

Lack of effective working relationship between a student and his/her Supervisor(s) including serious difference between the student and Supervisor in the approach to the solution of a problem.

(iv) Any other reasonable ground acceptable to the Board of Postgraduate Studies.

(b) Procedure for Complaint

A student who has grounds for complaint must:

(i) Address his/her complaint in writing to his/her Head of Department, (in the first instance)

(ii) The complaint must contain:

- An explicit statement of the grounds of the complaint.
- The stage at which he/she had reached in his/her research at the time of complaint.
- The expected date of completion of his/her research programme.

(c) Handling of Complaints

If a Department fails in the handling of the complaint of a student, he/she shall appeal to the Board by addressing his/her complaint in writing to the Dean, School of Postgraduate Studies.

It shall be obligatory for the Dean of Postgraduate Studies to ask for the Head of Department's comments, which would be submitted through the Dean of his/her Faculty.

The Board shall then consider the complaint and take the appropriate decision on it.

# APPENDIX 2

# PROGRESS REPORT

# SECTION A: STUDENT'S SELF ASSESSMENT

## (a) BACKGROUND

1. Full Names: ...……..…
   (Surname first and in capitals)
2. Student ID No.: ……..……..
3. Department: ……...
4. Faculty: ……..
5. Programme: ……...…….
6. Status: (a) Full Time ( ) Part-Time ( )
7. (a) Date of Registration: ……...

(b) Expected Date of Completion: ……...

(c) Date of Deferment of Studies (where applicable): ……..

8. Number of Semesters Completed So Far:
   (a) Masters: …… Semesters
   (b) PhD: ……... Semesters
9. Title of Thesis: ……..……
…….....

**(b) EVALUATION**

10. State status of Study (Tick appropriate boxes in both columns).

(% Completed)

(i) Course Work* ( )
(ii) Synopsis Defence ( )
(iii) Seminar ( )
(iv) Literature Review ( )
(v) Field Work ( )
(vi) Laboratory Experiments ( )
(vii) Data Analysis ( )
(viii) Thesis ( )
(ix) Others. Please Specify: ……
…

* List Modules Completed:

……
....……

11. Evaluation of my progress

In the past 12 months, I have made (thick appropriate box)

(a) Satisfactory progress ( )
(b) Unsatisfactory progress ( )

If 11 (a) is your answer, then go to Q 14

12. What are the probable reasons for your perceived unsatisfactory progress so far? (Tick as many boxes as are appropriate)

(a) ( ) I have to combine my programme with full-time employment
(b) ( ) Interaction with my Supervisor is less than satisfactory
(c) ( ) Library and other resources required for my work are not available
(d) ( ) I need more funds
(e) Others. Please specify: ……
……
….....

13. How do you think the School of Postgraduate Studies can assist you in alleviating the problems ticked in 12

……
……

14. Student's Signature: ……..

Date:……..

## PROGRESS REPORT

## SECTION B: SUPERVISOR'S EVALUATION

*(To be completed by Student's Supervisor)*

1. Student's Name: .....
2. I have been supervising him/her since: .....
3. Evaluation of candidate's research abilities (Tick appropriate boxes).

| | | Excellent | V. Good | Good | Fair | Poor |
|---|---|---|---|---|---|---|
| (i) | Experimental skills | | | | | |
| (ii) | Creative abilities | | | | | |
| (iii) | Independence | | | | | |
| (iv) | Responsiveness to criticism/advice | | | | | |
| (v) | Persistence/Determination | | | | | |
| (vi) | Approach to problem solving | | | | | |

4. Proportion of work done (Tick appropriate boxes).

| | | % Completed |
|---|---|---|
| (i) | Experimental/Field Work | |
| (ii) | Literature Review | |
| (iii) | Analysis of Data | |
| (iv) | Thesis | |

5. Which of the following best summarises the student's performance in the past 12 months?

(a) Satisfactory progress ( )

(b) Unsatisfactory progress ( )

If you ticked Q5(a) go to Q8

6. If your evaluation of the student's performance suggests that his/her progress has been unsatisfactory, can you please suggest possible reasons?

| | % Completed |
|---|---|
| **(a) The student is not devoting sufficient time to the programme** | ( ) |
| **(b) The necessary resources for the student's work are not available** | ( ) |
| **(c) The research needs important inputs from:** | |
| (i) Other departments/units within the University | ( ) |
| (ii) Outside the University | ( ) |
| **(d) The orientation of the student's work has changed beyond my interest and/or competence** | ( ) |
| **(e) The student's financial resources appear inadequate to cope with the research** | ( ) |

(f) Others. Please specify: ……

……

7. Please suggest how best the student can be assisted in the above ticked problem(s).

……

8. If the student's current work rate continues, how long might it take to complete the research programme?

(a) Months……

(b) I don't know ☐

9. Supervisor's Name:……..

Signature: …….....

Date:…….....

## SECTION C: DEPARTMENTAL BOARD'S ACTION

*(To be completed by the Head of Department)*

Having carefully examined the Student's and Supervisor's evaluation of progress in the past year, bearing in mind the University of Mines and Technology's regulations for Postgraduate Studies, the Departmental Board recommends as follows (Tick one of the three alternatives):

(a) ( ) The student continues with the programme

(b) ( ) The student be withdrawn from the programme

(c) ( ) The student be put on probation

(d) ( ) The student continues with the programme, provided:

(Tick as many boxes as are appropriate).

(i) ( ) The student spends more time on the research and with the Supervisor(s)

(ii) ( ) The student finds sponsorship or additional funds

(iii) ( ) The student changes research topic

(iv) ( ) A new/additional Supervisor is found

(v) ( ) Student finds additional resources for the research

(vi) ( ) Others. Please specify: ……

…….....

Head of Department's Name: ……..

Signature:……

Date: ……

Note: Please forward the report directly to the Dean's Office of the Faculty.

## SECTION D: FACULTY BOARD'S ACTION

Having carefully examined the Student's, Supervisor's evaluation of progress in the past year and the Departmental Board's recommendation, bearing in mind the University of Mines and Technology's regulations for Postgraduate Studies, the Board recommends as follows (Tick one of the three alternatives):

(a) ( ) The student continues with the programme

(b) ( ) The student be withdrawn from the programme

(c) ( ) The student be put on probation

(d) ( ) The student continues with the programme, provided:

(Tick as many boxes as are appropriate).

(i) ( ) The student spends more time on the research and with the Supervisor(s)

(ii) ( ) The student finds sponsorship or additional funds

(iii) ( ) The student changes research topic

(iv) ( ) A new/additional Supervisor is found

(v) ( ) Student finds additional resources for the research

(vi) ( ) Others. Please specify ……

……..……

Name of Dean: ……...…….....

Signature:……

Date: ……...

# State of the Art Research Facilities at UMaT