



**HONOURS IN ENGINEERING AND TECHNOLOGY MANAGEMENT
(ETM)**

PROGRAMME GUIDE FOR 2021

**GRADUATE SCHOOL OF TECHNOLOGY MANAGEMENT
UNIVERSITY OF PRETORIA**

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FOREWORD

This document contains information about the Honours in Engineering and Technology Management (ETM) offered by the Graduate School of Technology Management (GSTM) of the University of Pretoria.

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This information brochure should be read in conjunction with the applicable General Regulations as well as year book of the Faculty of Engineering, Built Environment and Information Technology, which contains all the current regulations and syllabi. The requirements of the Yearbook will apply irrespective of the information contained in this brochure. Although every attempt has been made to ensure that this brochure is correct and up to date at time of publishing, the Graduate School of Technology Management reserves the right to make any changes without prior notice and without prejudice.

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1. INTRODUCTION

Welcome to the University of Pretoria and in particular to the Honours/Masters Programme in Technology Management. We are looking forward to meeting you all and working with you during the next year or two. This document contains important information concerning ETM. Please read it carefully and contact us if there is anything that you do not understand – it may just save you considerable time and effort later on.

The purpose of this programme guide is to provide information mainly to prospective students, but it is applicable to and should also be useful to current students. Please note that this programme guide has been prepared well before the commencement of the new academic year and that some information is subject to confirmation (e.g. programme schedules and fees).

2. DISCIPLINES OF ENGINEERING/TECHNOLOGY/PROJECT MANAGEMENT

The need for postgraduate education in engineering and technology management arises from two primary considerations, namely the classic approach to undergraduate education and the requirements of industry. The classic approach educates engineers in a specific engineering discipline such as electronic, mechanical, civil and industrial or computer engineering. The result is that the graduate engineer enters his/her practical career primarily as a specialist. Considering the vast scope and content of the various disciplines, as well as the maturity of the average undergraduate student, it is not feasible to devote attention to the "engineering process" or "management issues" at undergraduate level. Generally, within the first 3 to 6 years of the engineer's career s/he will become increasingly involved in the management of the process by which engineering systems, products and services are created, utilised, and maintained. This requires the management of projects and related resources such as technical and personnel, the management of funds and facilities, and the cost-effective integration of the contributions of more than one person and more than one discipline. This calls for skills and knowledge the engineer has not been trained for.

Historically, engineers in South Africa have been primarily involved in the operation and maintenance of engineering equipment and systems. With the exception of civil and mining engineering, a significant portion of design and development work was contracted in from abroad and operated locally to achieve some economic benefit. Over the last few decades, however, the need for local design and development has also arisen in the petro-chemical, defence, telecommunication and other technology-based business sectors. Local capabilities to establish a technology base have become increasingly important and are now vital to the growth of the economy and international competitiveness. An in-depth understanding of the total life-cycle as well as the application of resources in this context is required for a career in the management of engineering and technology.

Engineering, Project and Technology Management are globally evolving disciplines. The increasing complexity of engineering systems and activities, the scope and sophistication of resources as well as advances in technology have all been driving forces in the evolution of this new field.

Resources at the disposal of the engineering, project and technology manager are typically technology, people, money, facilities, equipment, and information. All of these resources are vitally important to the manager in achieving business objectives in practice. Of specific importance, however, is technology, a resource fulfilling a central role in the engineering environment. The life-cycle processes of engineering systems and products can be described as follows: design and development, production or construction, operation, support, maintenance and phase-out.

The availability of resources and knowledge of the life-cycle processes are not sufficient to create something useful - it is necessary to synthesise these two dimensions: resources must be applied in the context of the processes in order to create products or services. Synthesisers fulfil this role in the engineering space. Important integrating management functions like strategic management, project management and system engineering are addressed as well as conceptual tools like risk management, quality and decision analysis.

In order to gain insight into a system it must be viewed in the context of its environment. The (high-tech) enterprise, within which Engineering, Project and Technology Management are applied, is such a system where the environment has a significant impact on system performance. The environment can be classified as economic, legislative, technological, industrial, socio-political, and natural.

It is important to understand that whilst engineering, project and technology management supplements and enriches the technical training of the engineer or scientist, it does not replace it.

There can be little doubt that technology is increasingly becoming an important base for competition between companies and also a key factor in international competitiveness. The ability to manage technology and technological innovation in a structured way is the key to a winning advantage.

The honours programme is aimed at engineers and scientists who have recently completed a bachelor's degree. The objective is to produce engineers and scientists who not only have technological capabilities, but also the ability to manage technology – specialists who know not only how to develop and deploy technology but also why. The degree builds on and adds value to the young engineer's and scientist's undergraduate education by exposing him or her to the management of technology and the management of technological innovation. Thereby skills are acquired that are not normally addressed at undergraduate level, but are nonetheless increasingly being sought after in industry. The honours programme consists of a set of prescribed modules. Each module is offered by way of two and a half consecutive days of full-time attendance. The modules are all telematically supported.

The option for a master's degree after the honours is completed, based either on a research dissertation or on the completion of four theoretical modules and thesis, is offered. This degree is aimed at graduate business managers and recent graduates with management and leadership potential to prepare them for leadership roles in business through professional postgraduate education.

3. HISTORY AND ORIGIN OF PROGRAMMES

A Chair for Engineering Management was established at the University of Pretoria in 1987. The Chair developed a Masters Programme in Engineering Management (MEM) and the first group of 45 students was admitted in 1989. Since then, between 40 and 50 practising engineers from across the industry spectrum register for the Programme every year. Building on the success of the start-up years, a formal separate department, the Department of Engineering and Technology Management was established in 1994 in the then Faculty of Engineering, the one and only of its kind in South Africa. Today the Department of Engineering and Technology Management offers a variety of engineering, technology and project management related programmes. Knowledgeable and experienced individuals from industry are also involved on a part-time basis, often as "extraordinary professors".

A Masters Programme in Project Management (MPM) was established in 1999 and initially 45 students were admitted. This programme is based on the same format of presentation as the MEM, but the emphasis is on Project Management in technology-based enterprises. However, project management principles can be applied in any type of organisation. Most work in modern

organisations is executed by multi-disciplinary teams led by project managers, hence the popularity of this programme.

Since the year 2000 the Graduate School of Management, in close co-operation with the Department, managed the MEM and MPM programmes. However the academic home of the programmes remained the Department of Engineering and Technology Management.

Management of Technology (MOT) honours and master's (dissertation) programmes were also launched in 1995. In 2004, a Master's in Technology Management (MTM) was introduced which consists of theoretical modules and a research project. This degree is aimed at graduates with a MOT degree to further prepare them for leadership roles in business through professional postgraduate education.

With the establishment of the Graduate School of Technology Management (GSTM) as the fourth School in the Faculty of Engineering, Build Environment and IT (EBIT) in 2007, the management of the MEM and MPM programmes were transferred back to the GSTM. In addition to these programmes (MOT/MTM/MEM/MPM), the GSTM also offers a master's degree in Technology Management by full dissertation as well as PhD's in the field of Project Management, Engineering Management and Technology Management. Significant growth of these types of programme is expected in South Africa and abroad during the coming years. International standards and recognition become more important as UP becomes part of global research and education. Additional focus, resources and research were required. Additional capabilities are envisaged. The integration of research, teaching, programme design and delivery as well as industry contact, proved to be successful.

In 2018 the ETM programme was launched as well as the Masters in Technology Management (MTM) was restructured and a Master's in Technology and innovation Management (MTIM) with twelve modules and a Mini-dissertation was introduced. In this Masters programme, you will be introduced to the basics and innovation management, technology management, human resource development and strategic management, all of which support the long term goals of building levels of innovation and productivity within an organisation.

4. PROGRAMME MANAGEMENT MODEL AND PERSONNEL

The ETM programme is managed as distinct programmes by the Programme Director and supporting staff in the GSTM. The Programme Director for the programme is Dr Siebert Benade and the Programme Administrator is Thuli Mvakali. The academic/intellectual content and quality resides within the GSTM. **Mr Corro van Waveren** is the academic advisor for the **ETM**, programme. The Chairman of the GSTM is Prof Elma van der Lingen. Due to the multi-disciplinary nature of the Programmes, lecturers from other faculties in the University and from industry also present modules, depending on where the required expertise is available. These modules remain the responsibility of the source department. This responsibility includes all operational aspects, such as module design, delivery and assessment, etc. In essence, the "deliverable" to the programme is the list of final marks for the class.

5. ADMISSION PROCESS

5.1. Admission and Selection

Admission is competitive and a selection committee carefully selects candidates with the highest potential. A fair and unprejudiced selection process is strived for. All applications for admission to the Programmes are subject to a selection based on academic achievement. For this purpose applicants must also submit a full academic record (subjects, marks, time frame for completion). Selection may include a personal interview.

5.2. Qualifications Awarded

Two degrees are offered, i.e. BEng(Hons) (Engineering and Technology Management), and BSc(Hons) (Engineering and Technology Management).

5.3. Admission Criteria

Honours Degree

The admission requirement for the BEng(Hons) is a recognized bachelor's degree in Engineering and for the BSc(Hons) a recognized and appropriate bachelor's degree in the Natural Sciences or an appropriate BTech degree. Applicants should submit a full academic record (subjects, marks, time frame for completion) on application. Special attention will be given to mathematics education and appropriate English language proficiency. The minimum requirement is first year mathematics at university or an equivalent level. Only applicants with a minimum average of 65% (calculated on the grades of all the final year modules (failed/passed) for the pre-requisite degree) will be considered for registration for the BSc (Hons) Technology Management degree. A TOEFL or IELTS test will be required of candidates who have not studied the pre-requisite degree through the medium of English.

5.4. Application and Closing Date

Closing date for applications:

Honours: 30 November

Application procedures:

Any person who wishes to register at the University for the first time , OR after an interruption of studies	Please complete the online University's Application form
Current UP studies	Please apply online through the UP portal Enquiries: laurrine.mqjiba@up.ac.za

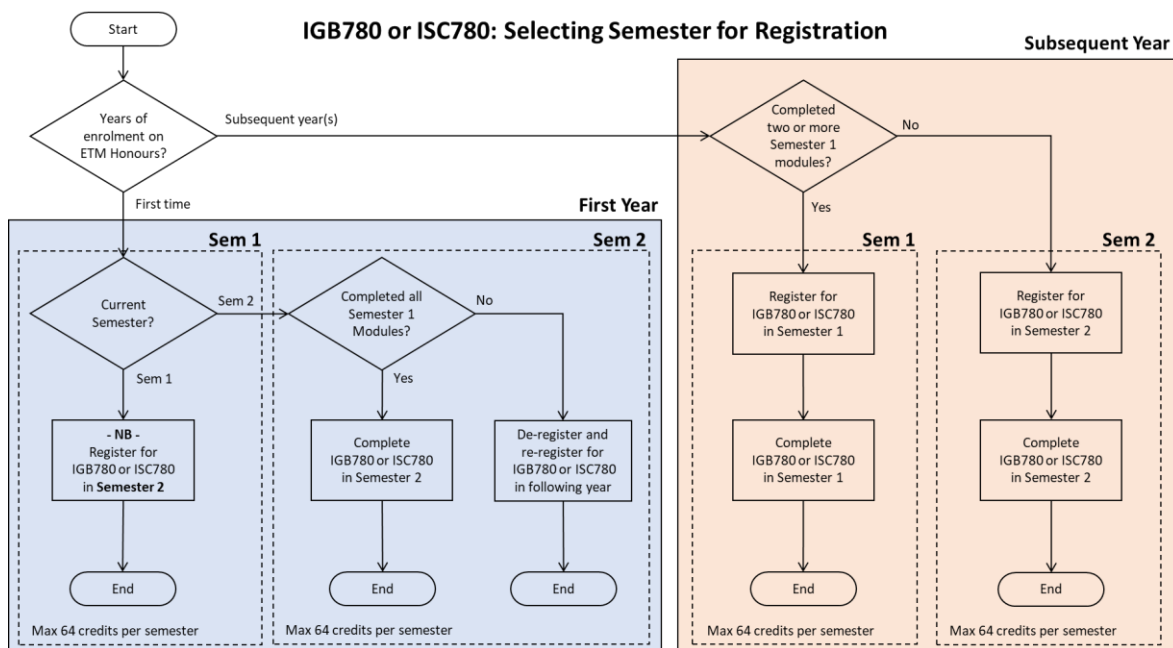
Registration

Students will register online on the UP portal. Website: www.up.ac.za and click on My Tuks login.

Important information on the registration for the Research Project:

Only students who are enrolled for the ETM Honours programme and who **have successfully completed all the first semester** modules are allowed to take the Research Project module in the second semester. The reason is that the modules form the building blocks for the Research Project.

A special arrangement is applicable to some students that are completing their ETM Honours programme over a two-year period. In such cases a student may register for the Research Project in the first semester of the following (second) year as indicated in the flow chart below.



Students may only register for the Research Project in the first semester under the following conditions (See the selections chart above):

1. Student has failed the research module in the second semester of the first year as their first attempt.
2. Student that did not register for the Research Project in the second semester of the first year and have completed all other modules.
3. The total credits for the first semester of the second year should not exceed 64 credits per semester taking into consideration the student's ability to deal with the work load (e.g. Research Project of 32 credits and a maximum of two additional and outstanding modules of 16 credits each).

As a general rule, four modules should have been successfully completed prior to the Research Project, while the remaining two modules may be completed together with the Research Project.

5.5. Registration and Student Card

After registration you will be able to print a proof of registration on the UP Portal. You need to present your proof of registration at the Client Service Centre (CSC) on campus (at some convenient time) to have your student card issued. You could do that during your first study block. You will need your student card to enter the campus and access the library. It is essentially your campus ID and you should have it with you at all times when on campus.

6. FINANCIAL INFORMATION

6.1. Programme Fees

The fees for 2020 are indicated hereunder. An increase of approximately 10% is expected for 2021.

International students can visit the website www.up.ac.za and click at the top on 'International Students' for more information. Distance examinations are arranged for students who apply. Examination fees are reviewed annually.

DISTANCE EXAMINATION FEE:

The fee for student wishing to write their exams outside of Pretoria during 2020 is indicated hereunder. The 2021 fee will be available in 2021.

- R 600 per examination (inside RSA and SADC countries); and
- R 1 300 per examination (international countries)

The course fee for the Honours in Engineering and Technology Management degree in 2020 was R 40 760. An increase of approximately 10% is expected for 2021.

The total fee is distributed over a maximum of two years and charged on the basis of modules taken in a year. Full-time students are expected to pay the total fee in the first year. Prescribed books are not included in the fee.

6.2. Bursaries and loans

A limited number of bursaries are awarded annually to deserving candidates. The criteria include a means test, the student's potential and past academic performance. Continuation of financial support is subject to satisfactory performance. Information can be obtained at "Bursaries and Loans" at the Client Service Centre (CSC), (012 420 3111) not from the ETM programme management team.

6.3. Finances

Please contact student accounts for any queries with regard to your account.

Contact detail:

Mr Frans Mothogoane
E-mail: frans.mothogoane@up.ac.za
Tel Nr: +27 12 420 5115

Mr Ayanda Simelane
E-mail: ayanda.simelane@up.ac.za
Tel Nr: +27 12 420 6393

7. LEARNING PROCESS AND SYSTEM

7.1. GSTM Student Resources

The GSTM Student Resources website (www.up.ac.za/gstm/student) contains all the programme documents, e.g. Timetable, assignment cover pages, guidelines for written assignments, etc. Make sure you visit the website.

7.2. English Proficiency

The medium of instruction and communication of the programme is English. It is therefore essential that applicants are able to write, read and express themselves in English. Candidates may submit assignments and the project report in Afrikaans, if they so wish.

7.3. Learning Model

The programmes aim to enhance group activity, personal development and a higher level of intellectual interaction. It is recognised that effective learning depends largely on group activity and the intellectual level and maturity of the participants. It is therefore required from participants to actively take part in class and group interaction.

Participants are typically professionals, entrepreneurs and (project/technical) managers in the age group of 23-30 years. Honours students are mostly starting with their careers. Hence, available time for class attendance is limited. Student/lecturer contact is however considered to be crucial. In view of the above, candidates are expected to free themselves completely from other duties during class contact sessions. Candidates may be expected to work in the evenings and over weekends during study blocks.

Each module is offered by way of two and a half consecutive days of full-time attendance. A web-based distance support system (clickUP) is used to create a virtual classroom. For this reason, all students are required to have access to the Internet through a suitable browser and be able to take part in discussions using the Internet. Lecturers facilitate distance learning (group and individual activities) throughout each academic cycle. It is expected from participants to come to contact sessions fully prepared: Pre-assignments are required for most modules. Student/lecturer interaction is consequently on a higher intellectual level where concepts and the application of theory are discussed. Assignments are done during and after the class contact sessions. Group interaction as an integral part of learning and personal development is emphasised. Lecturers furthermore facilitate the learning process to enhance group activity. A balance between theory and practice, individual and group activity, class contact and distance education is hence strived for.

Although a single lecturer is appointed to accept responsibility for a given module, a selection of guest lecturers can also be employed.

7.4. Study groups and teamwork

Some lecturers make use of group work and the lecturer may require that the assignment be completed prior to commencement of the study blocks. Access to the Internet is an essential requirement, geographic location should not be a problem – you will not be grouped on a geographical or company basis. You are not permitted to make any changes to the group allocations without discussing it with the responsible lecturer. The programme administrator should be informed about any changes in study groups. Bear in mind that a great deal of the course value is derived from the interaction you have with fellow students from other companies. Groups will be formed to be as diverse as possible. This interaction is often challenging; try to learn from one another!

If a group member does not make an acceptable contribution the group leader should seriously discuss the matter with the specific member to get him/her on track again. If this unacceptable/no inputs to group work continues, the group can allocate a percentage to the specific member when handing in the group assignment. 0% contribution means the mark of the specific member will be 0% of the final mark for the group assignment; meaning 0%. The same goes for e.g. 50% or 75%. The goal however remains to encourage open and honest discussion within the group and to include and motivate all group members to successfully participate in group assignments. The Programme Director will intervene if deemed absolutely necessary, to try to resolve study-group issues.

7.5. Class Attendance

Class attendance during study blocks is compulsory and important. If you, for some unforeseen reason, will be absent from a lecture for a few hours, you must obtain the lecturer's permission beforehand. This will not necessarily be granted. If you cannot attend a study block, please inform the Programme Administrator to deregister you for the particular module. The onus is on you to re-register for the module the next year. Please do not request permission from the Programme Director to be excused from a study block!

7.6. Typical class contact day, evenings and weekends

A typical class contact day starts at 08h00 to 17h00. On Wednesdays at lunchtime a module is typically concluded. The next module will commence at 13h00 after lunch. You can be expected to be available at short notice to attend guest lectures and/or do group work or self study during the evenings or weekends of the study blocks; hence keep this time open for academic or teambuilding activities.

7.7. Tea and Lunch Breaks

The lecturer will give breaks, typically at 10:00, 13:00 and 15:00. Students may buy tea/coffee/lunch at the various restaurants on campus.

7.8. Distance Support (clickUP)

Distance support for the programmes is provided via the internet. Each module has a separate “web page” and provides module content, proposed study schedule, assignments, communication tools and download facilities. The study guide for each module can also be downloaded and printed. You will receive a manual on the use of clickUP (e-learning system) as part of your registration documents. As soon as you are registered, you will have access to Student online services (clickUP) at www.up.ac.za (click on current students/portal log-in on the right-hand side). If you do not have a password, log on with your student number (e.g s14552536) and your ID number. If you experience any technical or password problems, please phone (012) 420 3837 or email studenthelp@it.up.ac.za (please state your student number in the e-mail). You need to access clickUP **before** the first classes, as you need to prepare **before** the first classes.

7.9. Self study and Preparation

Graduate study differs from undergraduate study in a number of ways. One important difference is the amount and level of self study required. It is important that you realise this and plan for a substantial amount of work at home in order to master the module material. The web-based support has been specifically introduced to assist you in this regard – make use of it. Make sure you check your mail (in clickUP) and the discussion space regularly (at least once a week) and respond when required. Take part in group and class discussions. The contact time is not sufficient to internalise and digest everything. Rather, this time will be used to highlight important areas, obtain feedback from the class, have group discussions and presentations, and also have lectures on specific areas. You are encouraged to read wider than the material provided and make use of the library.

Create your own project plan for each semester with important events, deliverables and dates. Organise yourself accordingly. Please make sure that you are aware of any preparation required for a module before the study block, so that you come to class fully prepared.

8. ASSESSMENT PROCESS

8.1. Assessment Policy and Marks

Students are assessed in a number of ways. Preparation and participation in class is important. Class presentations and group tasks during study blocks will be evaluated. Individual and group tasks during the semesters also contribute towards a semester mark. The semester mark and the final examination will typically have equal weight to constitute the final mark.

The final pass mark for all modules is 50%. You require a sub-minimum of 40% for your semester mark in order to qualify to write the exam. The sub-minimum for the examination is also 40%. There may also be sub-minima for different sections of a module.

The final examination will typically take the form of a 3-hour written examination. There is no programme policy as to exactly how each module will be assessed. In all cases, there will be tests, assignments (Individual and group) plus a final examination. This depends on the nature of the module. Often there will also be a component of class contribution. However, the grading policy for each module is clearly defined in the study guide on clickUP. Please read it carefully.

In addition to the final marks for each module being posted on the University's web page each individual lecturer will publish interim semester marks on clickUP. No marks will be given telephonically. Individual lecturers can give further details as to the availability of marks for their particular module.

8.2. Examination days

All final examinations will typically take place on Fridays from 09h00 to 12h00. No notebook or laptop computer is allowed during exams. Exams may be open or close book (consult your study guide).

8.3. What if you fail a Module?

No supplementary examinations are given at post-graduate level. This means that if you fail a module you will have to complete the entire module the following year. You may repeat a module only once. If you fail a module twice you will be excluded. If you fail a module it is your responsibility to register for it again the following year. If you register for a module but then decide not to do it, you should make sure that you request that the Programme Administrator (by e-mail) de-register you for the module before the block week. If not, you will automatically earn a fail mark and forfeit one of your chances to pass it. Also note that there is a time limit for the completion of the Programme. You will need special permission from the Dean of the EBIT Faculty and a valid reason to complete your degree over a period longer than two years.

8.4. In case of Sickness or Accident

In the unfortunate situation of sickness or an accident you should inform the Programme Administrator that you cannot write the examination. You can contact the Dean's Office (Mr Kenneth Nkanyana – Kenneth.nkanyana@up.ac.za academic administration) to apply for a sick exam. This may or may not be approved.

8.5. Arrangements concerning Assignments

On most modules you will be required to submit one or more assignments. In most cases lecturers will require you to submit assignments via the **clickUP assignment tool**. Read your study guide to determine the mode of assignment submission. If you are not certain, confirm with the lecturer. You should always keep electronic backups of assignments at least until the semester is concluded and all marks have been finalised.

If an extension is granted you must submit the late assignment directly to the lecturer. You will probably be penalised and marks subtracted to be fair towards other students who submit on time.

Under no circumstances may you submit an assignment by fax.

Note that where assignments are part of the final examination they will not be returned to you. You are however welcome to inspect your assignment by prior arrangement with the lecturer after it has been graded.

8.6. Distance Examinations

Students who do not reside within a **200-km** radius from Pretoria may apply to write distance examinations. The policy and procedure as well as application form for distance examination will be handed out early during each study block period and should be completed and returned to the Programme Administrator before the end of the first block week. Distance examinations will not be arranged without an application handed in on time.

PREREQUISITES:

- Students do not automatically qualify for distance examination.
- We will attempt as far as possible to arrange your examination at your requested venue but alternative venues might be arranged. You will be notified.
- Students within a 200 km radius of Pretoria do **not** qualify for distant examination. Students may however apply to write in Witbank.

Examination fees are reviewed annually, and could thus be higher in 2019. Forms to apply for distance examination will be handed out in the various classes.

8.7. Code of Honour

Although we encourage group work to facilitate the exploration and understanding of module material, in the final instance you also have to earn an individual mark for each module. This means that the work you submit on an individual basis must in fact be your own. To simply “copy and paste” from Websites or other material is not acceptable. Refer also to the UP website w.r.t plagiarism. Turn-it-in (a web-based plagiarism detection service) might be used to detect possible plagiarism.

9. ETM PROGRAMME ARCHITECTURE

The programme consists of 7 modules that may be completed in one year of study or two years' study. The programme starts in January each year. All modules will be presented every year (offering of electives is subject to sufficient demand). Module work totalling 128 credits is required for the honours' degree. The curriculum consists of a four core modules (16 credits each), two electives (169 credits each) and a research report (32 credits).

Core modules

Technology & Innovation Management
Engineering Techno Economics
Project Management
Systems Thinking & Engineering
Research Report

Electives

Technological Entrepreneurship
Maintenance and Asset Management
Operations Management

Only full time students registering for all modules may register for the Research Report in the 1st year. If a student, however, fails one module during the 1st semester, s/he must cancel the Research Project for the 1st year and register for it in the 2nd year of study.

NB: It is each student's own responsibility to ensure that s/he completes the necessary prescribed modules. Students who complete more than one elective and thus obtain the total number of credits BUT not all the prescribed modules will not be allowed to graduate even if the total number of credits has been obtained.

10. PROGRAMME SCHEDULES

The schedules are available on the website (www.up.ac.za/gstm/student) and will also be sent to all students together with the registration documents.

Carefully diarise study blocks, assignments and examinations etc. well in advance. If you have any uncertainty regarding schedules, do not hesitate to contact the Programme Office or specific lecturer.

The programme schedule is carefully designed for the one or two planned years of study. Every effort has been made to ensure a correct, meaningful and executable schedule. However, if students fail and consequently need to repeat modules, the onus is on the student to make sure that there are no clashes the next year in terms of his specific requirement regarding study block attendance and examinations. Special exams are not arranged to cater for clashes as explained above.

The bottom line is: Do not register for a module that in any way clashes with another one.

11. DESCRIPTION OF MODULES

Engineering Techno Economics IKN 780 (16 credits)

A research term paper will be prepared. Engineering Economy assists the engineer in making a wide range of decisions. These decisions involve the fundamental elements of monetary cash flow, time, value of money, project life and the interest rate. Engineering Economy calculates the net present worth, future worth, annual equivalent worth and the internal rate of return of the cash flows of the alternatives under consideration. By applying these values in different ways, the most economical alternative can be identified. Calculation of these values for a cash flow takes into account the effective interest rate, inflation and the income tax payable.

Technology and innovation management (INV 780) (16 credits)

A research term paper will be prepared. In an increasingly competitive and fast changing business world the management of technological innovation is a key function of organisations that want to prosper. It is therefore important that engineers, scientists and managers understand the fundamental principles of technology and innovation. This module addresses aspects such as the activities and tools of technology management and the processes and dynamics of innovation as important contributors to the creation of new knowledge, products and processes.

Maintenance and Asset Management IMC 780 (16 credits)

Every man-made component, spare part, equipment, system or infrastructure has an inherent reliability that is determined by design, construction, installation, manufacture or how it is built. This inherent reliability is influenced by both organisational and physical conditions under which, for example, an item of equipment operates. The operational reliability significantly determines the availability of the equipment. A primary objective of maintenance intervention is to eliminate the operating environment hazards which reduce the operational reliability of equipment and consequently, the availability of equipment for use. In the event of malfunction or failure, the goal of maintenance is to restore the operational reliability and availability of an item of equipment. Irrespective of whether a maintenance activity is intervening or restorative, it needs to be properly planned, scheduled and executed towards achieving the highest levels of operational reliability and availability, whilst concurrently minimising the expenditure of time and resources. Organisational systems of work (which encompass business processes, culture, and information technology) greatly influence the planning, scheduling and execution of maintenance activities. Furthermore, knowledge of technologies embedded, as well as how various items of equipment malfunction or fail in operation, determines how well the

maintenance activities are planned, scheduled and executed. The content of the module not only covers strategies, technical principles, practical processes and systems but also includes standards (e.g., CEN13306) and legislative guidelines that influence the management of maintenance in all industrial sectors. The content will also include an introduction to the ISO 5500x asset management standards.

Operations Management IVV 781 (16 credits)

A research term paper will be prepared. Operations management develops the ability of students to think about the transformation processes in organisations in a global way. The emphasis is on learning how to improve operating systems significantly through maximising throughput and minimising costs. The understanding of operating systems is developed from a flow- as well as an effect-cause-effect perspective.

Project Management IPK 780 (16 credits)

A research term paper will be prepared. This module addresses basic project management concepts, principles and techniques. The module is aligned with both the U.S. Project Management Institute's Project Management Body of Knowledge (PMBok) as well as PRINCE2 methodology developed in the UK. Scheduling of projects is a core element of project management and IPK780 covers project scheduling in somewhat more detail and at a more advanced level than the other topics.

The aim of the module is to develop the learner's ability to identify and solve problems in a way that display critical thinking and the application of quantitative methods. The module focuses on project initiation, planning, monitoring and control. Specifically the development of a project plan, different scheduling techniques, earned value, decision making and basic risk management. A deliverable of the module is a project plan (including project scope, WBS, schedule, risk management plan and cash flow) for a project in the learner's work environment.

Systems Thinking and Engineering ISE 780 (16 credits)

The modern world is made up of "systems". This is evident from everyday discussions amongst even the general public. Statements such as "The system failed us", or "The national energy system is under pressure" abound. Unfortunately most people have little or no understanding what a system is, or how to deal with it. Digging deeper into the concept of "system" leads one to realise that engineers and scientists without any working knowledge of "systems thinking" cannot succeed when attempting to solve complex problems. The module will equip students with the ability to solve problems from a "whole", "big picture" or holistic perspective. Students will develop a range of critical skills allowing them to successfully function in a complex world made up of many interrelated systems. The module will also provide students with an overview of systems engineering resulting from systems thinking, including the requisite tools and processes. This module will challenge much about a students' work environment, but it also will be unlike any other module a student has ever completed, mostly presented independent of any traditional engineering discipline.

A company's ability to remain competitive in modern times hinges increasingly on its ability to perform systems engineering. The technology and complexity of a company's products appears to steadily increase and with it, the risks that need to be managed. This module provides specialised knowledge to apply systems engineering by understanding the tools, processes and management fundamentals.

Technological Entrepreneurship IEE 780 (16 credits)

A research term paper will be prepared. Technical solutions can overcome various problems confronting the world, but new business leaders need to emerge by identifying these potential opportunities that can lead to sustainable enterprises with more employment opportunities. The module highlights the role of technology innovation and strategy in entrepreneurship, the development of business models and plan, the lean start-up principle, legal aspects and venture

leadership. Entrepreneurship is an intellectual discipline in its own right with its own systematic methods and techniques that can be learned and mastered through professional practice and hard work. This module will equip you with the fundamentals of technological entrepreneurship that can be applied in new ventures or your existing career.

Research Project IGB/ISC 780 (32 credits)

The research project is the capstone of the ETM programme. It comprises an independent research study into an area of technology management, applying the principles learned during the programme. Although this is a research project of limited breadth and scope, it nonetheless has to comply with the requirements of scientific research on post-graduate level. The total volume of work that is to be invested in this module by an average student must be 320 hours. Normal requirements for assessment that include the use of an external examiner apply to this module.

12. GENERAL INFORMATION

Location of Offices

The programme offices are in the GSTM, situated on the western side of campus (Engineering Building 2, second floor).

Lecture Rooms

All lectures take place at the Conference Centre and the Post Graduate Centre (eastern side of campus). Lecture rooms are indicated on the timetable

Parking and Property

Honours students will not be able to park on campus but parking is available close to the class attendance venues. (Inter-active map). If possible, Masters students will receive a parking disk. The parking discs will allow you to park on specially demarcated parking area on campus for the duration of the study block; if parking on the campus is available during that time. Please take note that parking is at your own risk. Likewise, any property that you bring with you and leave in class is also at your own risk. Unfortunately there have been some thefts in the past and you are therefore advised not to leave any valuables (especially mobile phones and notebook computers) unattended.

Cell Phones and Messages

All cell phones must be switched off in class and no calls may be taken. Except in extreme emergencies (medical, accident, death,...), no messages will be taken at our offices. If such an event occurs, we will do our best to contact you. Unfortunately, the telephones and fax machine at our offices cannot be made available for your personal or official use. In general, it is important to free yourself from your office and your place of employment during the study block periods. Please request your colleagues and superiors to respect this. You will need all the time to focus on your studies.

12.1. Personal information

Please keep the Programme Administrator informed of any changes of personal information, specifically e-mail addresses and telephone numbers. This is essential for communication and registration purposes.

12.2. University and Faculty Regulations

In addition to information contained in this document there are also University and Faculty Regulations of which you should also be aware. It is important that you familiarize yourself with these [regulations](#). Copies are available from Faculty Administration.

12.3. Alumni Affairs

The GSTM considers our Alumni to be key role-players regarding continuous education, programme development as well as potential partners in business endeavours and research. We have a dedicated person coordinating alumni affairs. More detail will be provided during the module of the programmes.