

SHORT DESCRIPTION OF MEM/MPM COURSES

Asset Management

IAM 801 (16 credits)

"Asset Management" may be defined as a life cycle process for creating, establishing, maintaining, operating, rehabilitating and divesting an asset in an optimal or balanced manner to satisfy the constraints imposed by economy, ergonomics, technical integrity and business performance. Within this definition, physical assets include equipment, infrastructure, people and plant. The 'holistic' view implied here recognises the wider range of disciplines required for strategic decisions and tactical management of physical assets. Strategy and tactics depend on the asset, whereas people processes underpin the effective management of an asset.

The overall objective for the physical Asset Management module is to provide an integrated understanding of the complimentary disciplines applicable to the management of engineered assets. The module will emphasise the synergy between specialist and cross-disciplinary skills and their respective roles with respect to the management of physical assets. The overall outcome for the learner will be awareness of the collaboration required and application of cross-disciplinary skills in technical, engineering, finance logistics, human communication, and other functions to achieve effective management of physical assets.

Advanced Engineering Services Management IGB 802 (16 credits)

The course assumes that students have gained a sound foundation of contemporary service science theory in having completed the ESM course, which is based on traditional systems theory. The advanced course is far more directed at dealing with some of the more "real world" contemporary challenges associated with services delivery in a world that is largely unpredictable, subject to unexpected changes and unforeseen events that impact on service delivery. A typical case in point is the economic meltdown that has had a very dramatic impact on institutions and the services rendered. The concept of service resiliency management is briefly dealt with to provide students with an insight into institutional survival in dealing with such turbulent conditions. A Complex Adaptive Systems perspective therefore forms the foundation for this course. Increasingly, engineering and manufacturing institutions are adding services to the bundle of products provided to clients in order to gain a competitive advantage in the marketplace and improve their revenue stream. The systemic and human aspects involved in the process of moving from a manufacturing to a services dominant institution is explored in this advanced course. ICT support systems as they relate to services delivery is also analysed to engender an understanding as to their role in services management. It is often stated that marketing services is not unlike selling vapourware, it in fact differs quite substantially from traditional product marketing. As product manufacturing institutions move towards a services oriented management framework the marketing of services assumes increasing relevance and a brief grounding in theory and practice of services marketing is therefore addressed in the course.

Refer to paragraph 7.12 regarding pre-requisites

Completion of a Service Science based research project.

Students who also undertake a services-based research project are very definitely at an advantage if they have selected the IGB 801 and IGB 802 courses, as it will enable them to understand some of the contemporary management challenges involved, as well as providing them with an insight into possible areas of research that could be explored within this field of study. Typical research issues relate to the systems that need to be implemented, changed and managed in order to provide a range of services to complement the products offered by traditional engineering and manufacturing institutions. Other challenges involved relate to managing the culture changes involved, dealing with a very competitive services marketplace and positioning institutions to deal with the unforeseen and unexpected events that have a very definite impact on service delivery. Public sector challenges such as water, fire, electricity, and similar service delivery issues come to mind as very definite aspects requiring further research.

As an entity the domain of service science empowers students to deal with the management challenges associated with the largest and fastest growing sector of the South African economy.

For more information see the ESM Web Campus: <http://web.up.ac.za/ess>

Construction Management KBS 803 (16 credits)

The Project and Construction Management Professions Act (Act 48 of 2000) defines Construction Management and Construction Project Management as follows:

Construction Project Management is the management of projects within the built environment from conception to completion, including management of related professional services. The Construction Project Manager is the one point of responsibility in this regard.

Construction Management is the management of the *physical construction process* within the built environment and includes the co-ordination, administration, and management of resources. The Construction Manager is the one point of responsibility in this regard.

Although the name of the module only refers to construction management the focus of this module will however be much broader. This module provides an overview of the construction industry. Organisational and environmental challenges are addressed. Unique characteristics of the industry are highlighted. A lifecycle perspective of construction projects and assets is developed. An overview of the global construction economy is provided.

Refer also to paragraph 7.12 for clarity on “pre-requisite courses”.

Decision Analysis and Risk Management

IRI 801 (16 credits)

Risk can be defined as "the presence of adverse events or conditions that can threaten the survival of the system, or prevent the objectives of the system to be achieved". All systems, natural and human-made, are exposed to risk and this risk should be managed in a responsible way by any business enterprise. The risk exposure of modern organisations is increasing due to complex technical systems, resource structures, processes and interactions. The risk management process involves establishing the goals and objectives for the organisation or functional unit, identifying the risks, quantifying and prioritising the risks, developing responses to the high priority risks, and monitoring the operations. Business enterprises in the manufacturing and service industries have a number of functional areas and processes that are interlinked. Risk management is therefore applied in development of new products or services, operations, maintenance, projects, safety and security.

Engineering Logistics

IIX 801 (16 Credits)

The objective is to introduce the student to the fundamental concepts of the engineering of logistics (i.e. logistic system design). This is done from the perspective of the developer of the system. A broad view of logistics is taken by introducing a model for integrated logistic support to be able to view the engineering of logistics within the right perspective.

This course has been designed to (1) provide the student with a framework, fundamental knowledge and basic skills related to logistics engineering; (2) prepare the student to fulfil his/her logistics engineering roles and responsibilities as a team member of a system development project. This is done by introducing the concept of integrated logistic support with all its associated technical and management disciplines; investigating the goal, objectives and processes of logistics engineering; how to establish an operations and support concept; how the logistic support analysis process can aid in design influencing and the establishment of detailed logistic requirements; how to manage the logistics development process; and finally an introduction to the technologies associated with specifying, designing and producing the logistic support elements.

Engineering Services Management

IGB 801 (16 credits)

Services is the fastest growing sector of the global and South African economy and currently more jobs are created in this sector than in any other sector of the economy. Services are so interwoven in our day-to-day lives that they are generally taken for granted with little thought as the design, implementation and management of these services, as these are more often than not thought of as the back-stage elements that are of little consequence to us as clients. The front-stage client facing activities are generally the elements we come into contact with and our experiences, particularly if they are rather unfavourable, are what we react to. This course is directed at providing you with an understanding of both the front- and back-stage activities that define the

service experiences that touch our lives and that of the communities we live within on a daily basis. It is hoped that the knowledge and insights that you gain from this course will empower you to make a difference in not only your work environment, but on a wider basis as well, by improving the services encounters you are involved in with a broader client community, thereby given true meaning to the Ubuntu concept of: "I am because you are". Notably, engineers are increasingly drawn into services related aspects of management, particularly within public sector institutions where service delivery is deemed to be quite challenging. This course provides students with the essential foundation for managing engineering related services.

Financial Management 830 (FBS 830) (16 credits)

The course objective is to provide the student with a thorough understanding and knowledge about the role and functioning of financial management in order to achieve the objective of the firm. The course is student centred. Consequently students should continuously strive towards a high level of self-activity. Study-units should be studied by students beforehand. During class discussions the emphasis will fall on problems and obscurities, which may arise from the study material. The syllabus of the course comprises the following: Understanding corporate annual financial reports. Financial statement analysis. The time value of money. Risk and rates of return. Valuation. Capital investment decisions. The required rate of return and long-term financing. Capital structure decisions. Long-term financing instruments. Short-term financing instruments. Current asset management.

Information Management ILB 884 (16 credits)

"Information systems are at the heart of virtually every business interaction, process, and decision, especially when one considers the vast penetration of the Web in the last few years. Managers do not have the luxury of abdicating participation in information system decisions. Managers who choose to do so risk limiting their future business options. In essence, managers who let someone else make decisions about their information systems are letting someone else make decisions about the very foundation of their business. This is a course about managing and using information, presented for current and future managers as a way of introducing the broader implications of the impact of Information systems. Attention will be given to IT in very broad terms, including traditional data processing and management information systems, as well as enterprise resource planning systems, electronic commerce data resource warehousing and data mining, managerial support systems, groupware, artificial intelligence applications, and so forth."

Introduction to Project Management IPM 801 (16 credits)

This module forms the basis for many (if not all) of the MPM modules that follow. As the name of the module indicates, it is designed to give the MPM student an introduction of some basic concepts. One aspect of great importance in project management is to manage projects in a way that would ensure that the project would be finished on time (either completed by a predetermined due date or, alternatively,

completed as soon as possible). In addition to reviewing the basic concepts of project management, *project time management* is therefore covered in depth in this module.

Legal Aspects of Project Management **ILC 803 (16 credits)**

The objective of this course is to present the basic principles of the law with which the project manager has to deal with during the planning and execution of a project. An introduction is presented on the sources of law, the structure of the South African legal system, legal representatives and the right of persons. The general law of contract is done in great detail with special reference to clauses used in contracts, as well as to different types of contracts. Practical examples are given to enable the student to understand how the law is applied in practice. Special attention is then given to the law of purchase and sale and to construction/engineering law (letting and hiring of work). Other relevant aspects discussed in less detail are representation (agency), credit agreement law (lease agreements), as well as the relevant aspects of labour law and alternative dispute resolution.

Life-Cycle Management of Safety, Health and Environment **ILE 802 (16 credits)**

Typical business practices have broad influences on internal and external sustainability, i.e. on economic, environmental and social performances. Furthermore, all of these practices may be viewed from a life cycle perspective with definite phase-in and phase-out activities and specific stages in between. The challenge for any modern business is to incorporate the impacts of the different life cycle stages and activities of operations and products or services into the larger decision-making framework, i.e. the concept of Life-Cycle Management. Internal sustainability is typically focused on the workforce and impacts are therefore measured in terms of conventional Health and Safety practices. External sustainability incorporates the impacts of business activities outside the physical boundaries of the company, or on society in general. Environmental (and Social) Management practices deal with these aspects.

Maintenance Management **IIB 801 (16 credits)**

The objective of this module is to obtain the required theoretical knowledge of maintenance management and apply the principles and methodology in practice, with an emphasis on the tools, techniques, procedures and processes to manage the maintenance function within any business enterprise. The module comprises the following themes:

Introduction to Maintenance Management, Maintenance Planning, Organisation of Maintenance Resources, Leading in the Maintenance Environment, Control of the Maintenance Function, Reliability, Maintainability and Availability, Maintenance Approaches and Strategies

Marketing Management

IIM 801 (16 credits)

This course is based on the principles of business to business marketing ([B2B](#)) as well as services marketing. The primary objective of this module is to provide students from a technology or engineering background with a thorough foundation of B2B principles and how it can be applied in practice. The areas of market segmentation, macro and micro market environment, developing a value proposition, and understanding buyer behaviour will be explained. Services marketing will include: service development and design, pricing aspects, how services are delivered, how to manage employees and customers in service delivery, managing demand and supply, marketing communication aspects, building customer relationships and loyalty, and how to recover service failures.

New Ventures and Entrepreneurship

IOE 801 (16 credits)

This subject aims to provide a wider understanding of the concepts and importance of entrepreneurship and the requirements and processes in commercialising technology-based ventures.

The themes include methodology in screening opportunities and understanding the commercialization process; compiling Technology Entrepreneurship Strategies, Product Development Process & Business Model development; understanding and protecting Intellectual Property, funding options for Entrepreneurial Ventures and understanding the scope and content of a Business Plan.

People Management

PEM 883 (16 credits)

The aim of this module is to equip engineering managers to understand the human challenges within the engineering environment and manage these with the aim of optimal performance. The course draws on insights from organisational behaviour and human resource management to prepare engineering managers on three levels. Firstly, managing people through effective recruitment, selection and placement as well as managing diversity, motivation, performance, training, careers and labour relations. Secondly, managing relationships between people by considering team development and group dynamics. Thirdly, equipping engineering managers to deal with organisational processes by considering conflict management and negotiations, stress management, leadership, organisational communication, change management and organisational culture.

Production and Operations Management

IPP 801 (16 credits)

This course presents an integrated perspective on the central role of production and operations (manufacturing and services) within industrial enterprises and covers the spectrum of systems, products and services. Firstly, the course deals with the role of the production and operations function in the enterprise and its interaction with the other functions in the organisation, emphasising aspects like customer requirements, competitiveness and measurements. An overview of the different types of

production/operations processes is also provided. Secondly, the basic elements within the POM environment are covered in detail and include the aspects of quality in production/operations, master planning consisting of demand management, production and capacity planning and the master production schedule, purchasing, scheduling and inventory reduction. TOC with its foundation as a continuous improvement management approach is central to the course. The aim is to supply the student with background knowledge to understand the principles of production and operations management.

Project Financial and Cost Management **IPF 802 (16 credits)**

The first part (*financial management*) of the course focuses on: Understanding corporate annual financial reports. Financial statement analysis. The time value of money. Risk and rates of return. Valuation. Capital investment decisions. The required rate of return and long-term financing. Capital structure decisions. Long-term financing instruments. Short-term financing instruments. Current asset management.

The second part of the course addresses only some aspects *project cost management*. The management of project costs is of critical importance. This aspect of management can materially influence the ultimate success or failure of a project. In this course, students are introduced to the concepts, ideas and methods used in cost determination and management. Upon studying this course, the student should understand what accountants do, to the extent that he/she should be familiar with the alternative methods available and the limitations of the various methods. This will allow the student to interact meaningfully with the accounting members of a team without necessarily accepting the accountant's answer as sacrosanct. The course covers topics such as: Cost determination, Activity-based costing, Relevant costing and Project pricing considerations.

Project Human Resource Management **IHR 801 (16 credits)**

This subject addresses the critical success factors in projects pertaining to people and human resource systems and processes applied in a project environment. This course is divided into four study units:

- ☐ **Overview of Organisational Behaviour, and Human Resource Management :** related macro-trends impacting on the project environment.
- ☐ **Managing People in Projects:** Understanding who the key stakeholders are and how to manage and lead them to positively contribute towards project performance, e.g. understanding individual performance, managing people diversities and building effective project work relationships. Human Resource systems and processes applied to projects, e.g. staff acquisition, motivation and job satisfaction, performance management, labour relations and sustainable people development.
- ☐ **Project team work:** Team development and group dynamics.
- ☐ **Organisational processes impacting on project success:** organisational design/matrix structure, leadership in projects, conflict management and negotiations with stakeholders, power and politics in the project environment, managing a project as a change process and stress management.

Project Management IPK 803 (16 credits)

The nature of projects and project management. The project life cycle and project phases. Organisational aspects of project management. Project teams and roles. Responsibility matrixes. Processes and methodologies for planning and control: Initiating the project, Scope planning, Scope definition and the WBS, Scope verification and work authorisation. Scheduling: Stochastic PERT, CPM time-cost tradeoffs and critical chain. Resource planning and scheduling of multiple projects and scheduling of multiple projects. Cost estimating, project budgeting and project cash flow. The control process. Performance analysis: earned value and performance indices. Project closure: evaluation, reporting and termination. Project management information systems. Project closure and continuing improvement. Reasons for project successes and failures.

Project Management Practice IMP 801 (16 credits)

This module aims to address the final knowledge area, namely Integration. The objectives of the module are to:

- Identify, develop and motivate a Project Business Case,
- Develop an integrated Project Plan that will be used as reference for project implementation.

Learners will need to utilise all the knowledge and skill obtained during the MPM modules, source additional information and apply to a practical project.

Project Procurement Management IPJ 801 (16 credits)

On all projects a significant amount of work is contracted to other organisations, and the rest is contracted internally. Procurement, the study of everything to do with contracting, is thus a vital part of project management. This course will cover the processes involved with procurement, specifically Procurement Planning, Solicitation Planning, Solicitation, Source Selection, Contract Management and Contract Close-out. It includes issues such as the various contracting models; the methods of entering into a contract; the types of contract; incentive contracts; contractual risk transfer, risk management and risk enforcement; and source selection techniques based on the analytic hierarchy process. A special focus will be on build-own-operate-transfer contracts in the form of public-private partnerships, as an example of a sophisticated procurement process.

Project Quality Management IQM 801 (16 credits)

The objective of this course is to create awareness of quality as an integrating tool, rather than a subset of project management, and to develop participant's skills to improve their overall ability in delivering better quality projects. Topics to be covered include project quality management in context, quality during project planning,

project quality management during design and development, tools and techniques, quality systems (ISO 9001, 10006) and case studies.

Project Risk Management IRM 801 (16 credits)

The objective of this module is to obtain the required theoretical knowledge of project risk management and to apply the methodology in practice, with an emphasis on the tools, techniques, procedures and processes to manage risks within any project. The module comprises the following themes:

Introduction to Project Risk Management, Risk management standards and approaches, Probability and distributions, Risk management planning, Identification of risks, Risk analysis and evaluation, Risk resolution and treatment, Risk monitoring and control, Tools and techniques for risk management, Overall project risk, Cost and schedule risk simulation

Project System Engineering ISE 802 (16 Credits)

The course is similar to System Engineering and Management ISE 801, because the objective is also to provide *context* for MPM and to better understand the technology-based enterprise. The objective is to *conceptualise* a tech-based enterprise in terms of processes and interaction amongst processes. These are essential to you as a developing engineering manager and project manager to be successful in your studies and application in the work environment. The *system life cycle*, phases and related processes are focussed upon. High-level process modelling and design are also touched on. The *information management challenge* and processes in the enterprise are analysed and related to business processes. Certain aspects of logistics, configuration management and organisational design are studied. The focus is on Project management activities within the SE process. The important and integrating role of the Project Manager to make SE successful is addressed.

Quality Management IKK 801 (16 credits)

The objective of this course is to create the ability to initiate and manage the implementation of Total Quality Management (TQM) in an organization. Concepts and definitions of quality. Framework for TQM. Design as a key process in ensuring customer satisfaction. The process approach to planning for quality. The role and relevance of quality management systems such as ISO 9000. Use of excellence models such as the South African Excellence Model for self-assessment and benchmarking. Measurement of quality. Tools and techniques for quality improvement. Quality as a process at senior level in an organization. The roles of teams in implementing TQM. Importance of communications and training in implementing TQM.

Research Methodology

INI 800 (16 Credits)

The objective with this module is to provide students with sufficient knowledge and skills to undertake independent research for a Masters dissertation. The module is designed primarily for students from the Department of Engineering and Technology Management, but all post-graduate students will benefit from the Course. Additional reading is provided for students from other disciplines.

Research Project

MEng: IGB 898 (64 credits) done during second year.

MSc: ISC 898 (64 credits) done during second year.

A research project on a topic of the student's choice from any of the courses offered by the Graduate School of Technology Management is done. The work takes place under the supervision of a study leader (project adviser). In addition to the satisfactory completion of the report itself, the student also has to prepare an article and present a paper based on the project at a final year symposium held during November each year. Evaluation is based on report content, article, as well as the presentation. A follow-up symposium is also held during May in the next year.

Reliability Engineering - IBI 801 (16 credits)

Maintenance plan development through Reliability Centred Maintenance (RCM) and Total Productive Maintenance (TPM) is reviewed. Concepts of failure modes, failure consequences, functional and potential failures is lectured to enhance the students understanding of the various maintenance strategies such as run to failure, scheduled discard, scheduled refurbishment, redesign, condition monitoring and scheduled inspection. Conceptual differences between terms such as preventative maintenance, predictive maintenance and proactive maintenance is defined. The module deals with the implementation of the maintenance plan. Basic concepts of statistical failure analysis and renewal theory such as mean time between failures, failure rate, reliability functions, cumulative failure distributions and conditional probability of failure are reviewed. The fitting of the continuous statistical failure distributions (Exponential, Normal, Weibull, Log Normal) is lecture in order to facilitate the calculation of the optimum component replacement interval. The fundamental practical issues with regards to statistical failure analysis are presented as well as data trend analysis in the form of the Laplace trend test. Repairable systems theory is lectured to provide the student with the knowledge to model systems, which are repaired to an as good as old condition. The module deals furthermore with reliability modelling of systems and decisions, active and passive redundancy, maintenance strategy modelling, the supporting role of the maintenance management information system, performance measurement and benchmarking.

Strategic Management

ISM 801 (16 credits)

The objective with this module is to stimulate strategic thinking and the development of strategic decision making skills amongst students in the field of strategic

management in an engineering environment. In this module the following topics are addressed:

Concepts and Practice of Strategy: An historical background serves as introduction. Classical concepts and misconceptions in strategic and operational management work are given.

The Process of Strategic Management: The work content and structure of strategic management are discussed. A schematic model of the process is developed.

Formulation of Strategy: This section gives a statement of the work to be done in formulation of strategy. The following aspects are covered: The company mission. External environment. Environmental forecasting. The company SWOT analysis. Formulating objectives and grand strategies. Strategic analysis and choice.

Implementation of Strategy: In the concluding part of the course attention is given to implementation through business functions, structure, leadership and culture, rewards, control mechanisms for measuring, evaluating and corrective actions.

Strategic Project Management ISM 804 (16 Credits)

The conducting of projects is the means for achieving strategic objectives as well as the way that many organisations realise value. Only the right projects should consume the limited money and human resources available to maximize Organizational Effectiveness and Efficiency.

This course deals with the holistic system that enables organisations to successfully navigate from strategy definition to delivery of the value expected from the strategy. It includes the processes, the management systems necessary to achieve system effectiveness as well as a number of tools that can be used at the various steps in the processes.

Systems Architecture ILS 801 (16 credits)

System Architecture is a key process in the system engineering process. The course will focus on architecture descriptions and the processes needed to populate them. Explore modern principles of system architecture in accordance with generally-accepted international standards and best practices.

System Engineering and Management ISE 801 (16 Credits)

This course provides *context for the MEM Programme*, i.e. how the other courses will interact to form an integrated whole. The system engineering process and management activities are addressed within the *context of the technology-based enterprise*. The objective is to *conceptualise* a tech-based enterprise in terms of processes and interaction amongst processes. These are essential to you as a developing engineering manager and project manager to be successful in your studies and application in the work environment. The *system life cycle*, phases and related processes are focussed upon. High-level process modelling and design are also touched on. The *information management challenge* and processes in the enterprise are analysed and related to business processes. Certain aspects of logistics, configuration management and organisational design are studied.

Technology Management
ITB 801 (16 credits)

This subject aims to provide the student with insight into the concept of technology and the utilization thereof in the business environment to achieve the strategic goals of the enterprise. The course in technology management provides theory and application skills, mainly at the operational level. Themes addressed are: Technological evolution, Technology and competitiveness, Linking technology to business strategy. Theory of technology, Technology forecasting, Introduction to intellectual property, Technology audits and acquisition strategies, Introduction to the national context.