

SCHOOL OF MECHANICAL, INDUSTRIAL AND AERONAUTICAL ENGINEERING
DETAILED COURSE DESCRIPTION FOR MASTERS PROGRAMMES

Course Code: MECN7000A	
Course Description: Operational Research Methods	
NQF Level: 9	NQF Credits: 20

The course will provide candidates with the competencies needed to analyse, model and optimise an organisation's processes. It aims to give candidates an understanding of how to select and apply mathematical modelling and data management techniques in different business contexts and to contribute to the optimisation of the performance of organisations. Various business process modelling and optimisation methods are presented. These include an: introduction to linear programming; transportation and network problems; integer programming; stochastic processes and related software. Problems are formulated to illustrate theory, practice and OR management.

Prerequisite: Suitable background in Mathematics and Statistics

Course Code: MECN7001A	
Course Description: Reliability Engineering	
NQF Level: 9	NQF Credits: 20

Basic concepts. Failure probability density functions. Component reliability. Reliability of systems. Methods for determining reliability of systems. Active and standby redundancy. Testing for reliability. Sampling techniques.

Prerequisite: Basic knowledge of Statistics.

Course Code: MECN7005A	
Course Description: Engineering Economics	
NQF Level: 9	NQF Credits: 20

Introduction: comparative economic systems; the market economy: demand, supply and equilibrium price; elasticity, measurement, economies of scale and learning curves

Theories of the firm: Neo-classical economics – price takers and seekers; objectives of organisations; New Institutional Economics

Functions in firms: economic theory for marketing and finance in engineering organisations. Directions for research in Production and Operations management.

Course Code: MECN7006A	
Course Description: Production and Operations Management	
NQF Level: 9	NQF Credits: 20

This course exposes the student to the broad scope of production and operations management, covering from high level strategic management philosophies down to day to day management tools. However the emphasis will be on tools that will help the student best manage at their level within the company. Emphasis will also be placed on the student's role in POMS in the workplace. The course structure will be made up by lectures and case studies (these will form an important part of the teaching process).

Prerequisite: Students are expected to have read a textbook in Production and/or Operations Management

Course Code: MECN7007A	
Course Description: Elements of Commercial and Industrial Law	
NQF Level: 9	NQF Credits: 20

Introduction to law; General principles of contract; Purchase and sale, Letting and hiring of work and services; Labour relations legislation; Agency and suretyships; Business entities; Principles of intellectual property rights (Copyright, Patents, Trademarks); Alternative dispute resolution; Liability and damages.

Course Code: MECN7008A	
Course Description: Financial Management	
NQF Level: 9	NQF Credits: 20

The course focuses on capital budgeting and financial decision making in the corporate environment. Studied are: methods of evaluating alternative investment proposals (e.g. payback, NPV and IRR), analysis of risk using decision trees and other methods, cash

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flows including inflation and tax effects, capital structure and working capital analysis.

Special topics are treated through case study analysis and syndicate research.

Prerequisite: MECN7011

Course Code: MECN7009A	
Course Description: Principles of Management	
NQF Level: 9	NQF Credits: 20

Management can be defined as "Achieving Results Through People". The course focuses on the functions of management. Planning, Organising, Leading, Controlling. Case study evaluations are used to delineate the function of management in each area. The tools and concepts of negotiation are also covered.

Course Code: MECN7010A	
Course Description: Human Resource Management	
NQF Level: 9	NQF Credits: 20

Human resources can best be managed as a partnership between line managers and human resource practitioners. This course endeavours to optimise this partnership by equipping prospective managers with the knowledge and skill to meaningfully contribute to HR Planning, Recruitment, Remuneration, Performance Management, Training and Industrial Relations. The course takes a strategic view of environmental variables that may necessitate change in HR management practices. Current issues that may have to be accommodated in the management strategy are discussed and analysed.

Course Code: MECN7011A	
Course Description: Accounting and Financial Statements	
NQF Level: 9	NQF Credits: 20

The nature and role of accounting in business. The elements of double-entry bookkeeping. The balance sheet, income statement and statement of changes in equity. Accounting for close corporations and companies. The cash flow statement. Analysis of financial statements for management and investment purposes.

Course Code: MECN7013A	
Course Description: Principles of Air Conditioning	
NQF Level: 9	NQF Credits: 20

This course is designed to equip the candidate with a fundamental scientific understanding of the most important issues concerning the design of air conditioning systems for buildings. The course consists of the following components: Psychrometry and psychrometric processes; physiological principles of thermal interchanges between man and his/her environment, comfort and health; cooling and heat load calculations in buildings; fan and duct systems; basic air conditioning systems focusing on fundamentals, application and performance.

Prerequisite: Suitable background in Thermodynamics

Course Code: MECN7014A	
Course Description: Principles of Refrigeration	
NQF Level: 9	NQF Credits: 20

This course is designed to equip the candidate with a fundamental scientific understanding of refrigeration processes and equipment, as used in industrial, air conditioning and mining applications. The course covers the following: Compression refrigeration cycles. multi-pressure systems; refrigeration system components; refrigerants; absorption and other refrigeration processes; heat pumps.

Prerequisite: Suitable background in Thermodynamics.

Course Code: MECN7016A	
Course Description: Quality Management	
NQF Level: 9	NQF Credits: 20

Concepts and perspectives on quality. How to analyse and improve a work process. Quality of design, conformance, maintenance and service. Various tools for improvement. Process

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capability and process control methods. Using cost data as a basis for improvement. The measurement of customer response and the achievement of customer-focus. Quality management systems: ISO 9000, Total Quality Management, Benchmarking, The Baldrige System. Philosophies of quality management: e.g. Deming, Juran, Shingo and the process of Quality Function Deployment. Case studies and site visits.

Prerequisite: Proof of introductory course in Statistics

Course Code: MECN7017A	
Course Description: Value Engineering and Analysis	
NQF Level: 9	NQF Credits: 20

History and application. Value systems – group dynamics. Planning of workshops. Information validation and objective setting. Definition and priority of functional requirements. Innovative and lateral thinking techniques. Function – cost relationship. Evaluation and decision analysis. Project reporting and implementation. Financial justification. Workshop application study.

Course Code: MECN7019A	
Course Description: Internal Combustion Engine Analysis	
NQF Level: 9	NQF Credits: 20

Engine types and their operation. Engine designs and their operating parameters. Thermochemistry of fuel-air mixtures. Properties of working fluids. Ideal models of engine cycles.

Prerequisite: Suitable background in Thermodynamics

Course Code: MECN7020A	
Course Description: Manufacturing Strategy	
NQF Level: 9	NQF Credits: 20

The goal of the course is to establish the basic concepts of strategy within the context of business and how to transition from the business strategy into a manufacturing (operations) strategy. The candidate will be provided with frameworks and tools to be able to align the manufacturing strategy with the business strategy and continually keep the manufacturing strategy aligned with operations and changing markets. This course focuses on both the manufacturing and services industries.

By the end of the course the student will have developed a practical understanding of the following concepts and techniques: understanding the key business strategic concepts and schools of strategy; the ability to link business strategies to the required operations by means of manufacturing strategy; appreciate the role of manufacturing strategy in relation with competitiveness with a local and global market; understanding the components of manufacturing strategy and the interdependencies between the components as to be able to develop an manufacturing strategy; integrate services into the manufacturing strategy (servitisation); developing of manufacturing (operations) strategy for services. While all the required strategy concepts will be covered in the unit, a basic knowledge of finance is assumed.

Course Code: MECN7023A	
Course Description: Management of Technology	
NQF Level: 9	NQF Credits: 20

Managing innovation and technological change. Strategic and tactical issues covering the process; technology transfer; research and development infrastructure; co-operation in research and development; technology and economic analysis; technology and human issues; commercialisation including intellectual property rights.

Course Code: MECN7024A	
Course Description: Maintenance of Engineering	
NQF Level: 9	NQF Credits: 20

Maintenance objectives; RAM – Reliability, Availability and Maintainability; Maintenance organisation; Maintenance staffing and training; Maintenance planning and schedule; The work order system; Maintenance control – performance measures for internal control and benchmarking for comparisons with other companies and other industries; Maintenance inventory; Maintenance audits; Specific techniques: critical path analysis for the project

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management of outages, RCM for maintenance optimisation, condition monitoring; Computerised maintenance management systems (CMMSS); Maintenance contracts and penalty and reward systems; Total productive maintenance (TPM).

Course Code: MECN7025A	
Course Description: Investigational Project	
NQF Level: 9	NQF Credits: 40

Comment [CL1]: Note that this course is only for students who are still competing the old MEng.

The course consists of a project in which a problem or topic in the general fields of Mechanical, Industrial or Aeronautical Engineering is investigated and recommendations are made on the solution to the problem or topic. A comprehensive report covering the investigative process and describing the solution is to be submitted. The candidate is required to demonstrate competencies in investigation, evaluation, technical reporting and presentation by poster and oral presentation.

Course Code: MECN7026A	
Course Description: Finite Element Methods	
NQF Level: 9	NQF Credits: 20

The course focuses on introducing the concept for developing 1D and 2D linear finite elements including the formulation for developing the strain and stiffness matrices. It also further aims at giving detailed analysis for solving the differential equations using Gauss Integration. Finally few practical examples will be solved using the commercial FEA packages.
Prerequisite: Suitable background in Mechanics and Mathematics

Course Code: MECN7027A	
Course Description: Discrete Event Simulation	
NQF Level: 9	NQF Credits: 20

The course is designed to introduce basic probability theory and then apply to probabilistic analysis and modelling of stochastic systems. Topics include: Probability distributions, Chi Squared testing, Markov chains, Monte Carlo simulation, Elementary queuing theory, Discrete event simulation modelling.

Course Code: MECN7028A	
Course Description: Lean Manufacturing	
NQF Level: 9	NQF Credits: 20

This course introduces the principles of lean operations in manufacturing and service industries. Five lean principles, waste elimination; lean production systems; value stream mapping; managing extended supply chains; the lean enterprise; tools and terminology for fast, flexible flow. Lean and Six Sigma. Introduction to Lean in service, introduction to Lean new product introduction.

Course Code: MECN7029A	
Course Description: Mathematical Topics for Engineering Management	
NQF Level: 9	NQF Credits: 20

Revision of linear algebra: Linear spaces, bases and dimension, matrices, eigenvalues and eigenvectors.

A selection from the following applications:

Leontief input-output analysis: The representation by linear equations of the Leontief model for an economy and the workability of this model. Von Neuman balanced growth model: Relative stability of the balanced growth path, the minimax theorem on zero-sum two-person games, Von Neuman growth model.

Production processes in activity analysis: Linear programming problems, the differential calculus approach to linear programming. Graph theory: Elementary concepts as required for a selection from the following topics.

Eulerian graphs: Applications to transportation problems.

Hamilton graphs: Related to transportation problems.

Connection problems: An introduction to trees, trees and probability, the theorem of Bayes as applied to connection problems.

Diagraphs: A traffic system problem.

Planar graphs: An introduction to planar graphs using the three house and three utilities problem.

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Course Code: MECN7032A	
Course Description: Management Accounting	
NQF Level: 9	NQF Credits: 20

Cost classification; the allocation of direct and indirect cost (traditional versus ABC); absorption versus variable costing; decision-making including risk and uncertainty, modelling and relevant costing; planning and control including budgeting, standard costing and performance evaluation; design of costing systems.

Course Code: MECN7033A	
Course Description: Automotive Engineering	
NQF Level: 9	NQF Credits: 20

The course is made up of topics related to the automotive industry with an emphasis on engines. Topics may include: lean manufacturing in automotive manufacture, mechatronic systems, engine testing and control, instrumentation and data acquisition, overall engine performance, suspension design.

Prerequisite: Suitable background in Thermodynamics

Corequisite: MECN7028 Lean Manufacturing

Course Code: MECN7034A	
Course Description: Bulk Solids Storage and Handling	
NQF Level: 9	NQF Credits: 20

This course provides the candidate with a comprehensive introduction to the subject of bulk materials handling and storage. It demonstrates the importance of flow property measurements and the application of this information to the design of storage bins and feeding and handling equipment. The following topics are studied in the course: Characterisation of bulk solids; basic properties of particulates; property variation of bulk solids; basic concepts in mass, funnel and expanded flow bin design; application of flow properties to the determination of bin wall loads and feeder loads; interfacing of feeders with storage vessels; determination of draw-down characteristics and live capacity of gravity-reclaim stockpiles; design of screw feeders and an introduction to mechanical conveying.

Course Code: MECN7035A	
Course Description: Belt Conveying of Bulk Solids	
NQF Level: 9	NQF Credits: 20

This course provides the candidate with a comprehensive overview of the subject of belt conveying. The course presents the fundamental concepts related to the static and dynamic design of belt conveyor systems. It demonstrates the importance of belt and bulk solid interactions and presents an overview of transfer chute design and maintenance strategies. The subject matter of this course will include: An overview of open and closed belt conveying systems; static design principles; design of horizontal and vertical curves; conveyor belt manufacturing considerations; dynamic analysis; high speed belt conveyor design considerations; bulk solid and conveyor belt interactions; transfer chute design; belt conveyor maintenance strategies.

Course Code: MECN7051A	
Course Description: Business to Business Marketing	
NQF Level: 9	NQF Credits: 20

Introduction to the principles of marketing; the marketing variables; market segmentation, differentiation and positioning. Business to business product offering. Buyer-seller relationships. Business to Business exchanges. The role of relationship marketing in business marketing arena. Share of mind and share of wallet. The business marketing communication mix. The role of internet and email marketing in communicating value in Business Marketing. Value driven pricing determination. Personal selling and sales management. The development of a marketing plan for a business product. Case studies and oral presentation.

Course Code: MECN7053A	
Course Description: Systems Engineering Management	
NQF Level: 9	NQF Credits: 20

This course introduces risk management, configuration management, technical performance management, concurrent engineering management and speciality

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management. For all of these, the purpose and what needs to be done and how it can be approached are presented.

Prerequisite: At least 3 years of relevant working experience in industry
MECN7058 Systems Engineering: Hard Systems Methodologies

Course Code: MECN7054A	
Course Description: Systems Engineering: Soft Systems Methodologies	
NQF Level: 9	NQF Credits: 20

Introduction to systems theory and the systems framework. Methodologies for problem solving and systems analysis. Applications areas. Selected topics on systems management. Case studies.

Course Code: MECN7055A	
Course Description: Requirements Analysis in Systems Engineering	
NQF Level: 9	NQF Credits: 20

Starting with the purpose of RA, the requirements process and requirements types need to be presented. An area which needs some attention is elicitation techniques, using scenarios for example, and sources of requirements. Considerable effort is spent on techniques for RA, including the purpose and applicability of each technique. These are essential to defining the problem before any specifications are written. Students will need to develop the discipline of separating the problem from the solution. The characteristics of good requirements (requirements quality) should be addressed in conjunction with writing specifications. Managing RA ranges from planning a RA effort to creating traceability to stakeholders and operational concepts. A healthy dose of emphasis on iteration is required. Product scoping may be very useful in the context of RA to create a common vision, draw a boundary as to what is or is not a requirement and a tool for gauging the size of the effort.

Prerequisite: At least 3 years of relevant working experience in industry
MECN7058 Systems Engineering: Hard Systems Methodologies

Course Code: MECN7056A	
Course Description: Systems Engineering: Architecture	
NQF Level: 9	NQF Credits: 20

Architecture is not a mature field with a widely accepted underlying theory, thus, a number of approaches to architecture are presented. This depends on whether these are software, or hardware and the specific type of hardware systems e.g. largely signal processing, like radar. Key to architecture is creativity, dealt with in concept generation. Alternatives need to be generated both at the system level and at function level. Concept generation is supported by behaviour analysis (part of which is functional analysis). The course covers both the development of structural (physical) and behavioural aspects of architecting. Concepts relating to the development of alternatives, the evaluation of these and the selection of candidate architectures; the issue of traceability from requirements, functions and allocation to system elements; the concept of technical budgeting, supported by modelling and simulation and technology as the basis of any solution and the concept of technology maturity are presented.

Prerequisite: At least 3 years of relevant working experience in industry; MECN7058; MECN 7055

Course Code: MECN7057A	
Course Description: Enterprise Engineering	
NQF Level: 9	NQF Credits: 20

The course explores how enterprises structure themselves and how technology is used as an enabler to ensure the enterprise achieves competitive advantages. Topics cover computer integrated management encompassing the technological hierarchy from non assembled products (field devices), simple assembled products (robotics), closed systems (management, administration) and open systems (ERP management, world wide web); different technological hierarchies are linked from a technological and enterprise wide level; how technologies converge and how this convergence of technology may lead to better enterprise collaboration.

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Course Code: MECN7058A	
Course Description: Systems Engineering: Hard Systems Methodologies	
NQF Level: 9	NQF Credits: 20

The course introduces the basic concepts and motivation for applying Systems Engineering principles. Basic concepts are be introduced, for example, "What is a system?", "What is a system lifecycle?" and "What is systems thinking?". Hard Systems principles are covered, for example: Capture and understand the problem before committing to the solution. Modelling notations for SE are introduced that support understanding, reasoning and communication about the system. An implicit architecture framework underlying the modelling notation is presented.

Prerequisite: At least 3 years of relevant working experience in industry

Course Code: MECN7059A	
Course Description: Supply Chain Management	
NQF Level: 9	NQF Credits: 20

The course aims to give an in-depth coverage of Supply Chain management and Logistics in the context of contemporary operations, taking into account the major competitive drivers of efficiency and responsiveness and the solutions enabled by new technologies. The module addresses the scope, impact and importance of SC and Logistics management and the major decisions that need to be made in today's world of global supply and global markets.

Course Code: MECN7060A	
Course Description: Operations Management for Mining Systems	
NQF Level: 9	NQF Credits: 20

This course will explore operations management in the mining context from a systems perspective, considering the context and challenges of this unique environment. The purpose is to provide candidates with an overview of key terminology, an introduction to basic techniques and examples and cases of how these can be applied in the mining context. The course aims to develop the critical thinking and application skills of candidates. The syllabus includes: current state analysis; value chain mapping; process analysis; constraint identification; root cause analysis; metrics and measures; problem solving methodologies, principles of systems engineering; organisational behaviour and soft systems issues.

Course Code: MECN7061A	
Course Description: Extended Finite Element Methods and Meshfree Methods	
NQF Level: 9	NQF Credits: 20

The course aims to develop an extended finite element (XFEM) analysis for understanding the computational fracture mechanics that involves initiation and propagation of cracks. The course also focuses on introducing the meshfree methods, concept of weighting functions and meshfree approximations. Further it addresses the coupling procedure for meshfree methods with FEM. Lastly, the concept of enrichment linked with the development of XFEM, Level sets and implementation will be addressed.

Course Code: MECN7062A	
Course Description: Systems Engineering: An Overview	
NQF Level: 9	NQF Credits: 20

The course aims to provide the student with a global understanding of Systems Engineering history, concepts and role in everyday business practice. The course examines the concepts of Soft and Hard Systems Methodologies, and, through a case studies, how a Systems Approach can be used to integrate a number of interrelated disciplines such as:

- Project management.
- Lean concepts.
- Information technology and
- Innovation.

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Course Code: MECN7063A	
Course Description: Systems Engineering: Modelling and Simulation: Principles and Approaches	
NQF Level: 9	NQF Credits: 20

The course introduces the basic concepts and motivation for the use of M&S as part of Systems Engineering. Basic concepts are to be introduced, for example, "What is a framework", "What is a model, and what is meant by simulation?" The important question of model boundaries will be addressed. Cascading through modelling approaches to develop system and sub-system concepts will be introduced and the idea of analysis-synthesis loops will be covered. The module will build on the notations introduced in the introduction to Systems Engineering that support understanding, reasoning and communication about the system

Course Code: MECN7064A	
Course Description: Systems Engineering: Integration, Verification and Validation	
NQF Level: 9	NQF Credits: 20

The course introduces the concepts of integration, verification and validation. The importance of interface design and management in integration is addressed. Design verification, design margin verification (qualification), reliability verification, software quality verification and system certification is all included under the verification concepts. Validation addresses techniques in ensuring that the users are satisfied and that the system is fit for purpose.

Course Code: MECN7065A	
Course Description: Service Engineering	
NQF Level: 9	NQF Credits: 20

The course aims to give an in-depth coverage of Service engineering in the context of contemporary operations, taking into account the major competitive drivers of efficiency and responsiveness and the solutions enabled by new technologies. The module addresses the scope, impact and importance of service engineering and the major decisions that need to be made in today's world of a globally connected service based economy. In this context, the field of service engineering enables us to innovate, design, and manage simple and complex service operations and processes of the intelligent service-based economy.

Course Code: MECN7033A	
Course Description: Research Methods in Engineering	
NQF Level: 9	NQF Credits: 15

Comment [CL2]: New course code likely

The course aims to prepare the student for the final submission of his/her research proposal. The course will cover research problem formulation, compiling, organising and critically reviewing literature, dividing problems into sub problems, identifying required data, variables and controls and data analysis. The course will also familiarise the student with research methods and identification of types of data (qualitative or quantitative), different methods of data collection, and approaches to analysing both qualitative and quantitative data.

Course Code: MECN7067A	
Course Description: Financial Modelling for Nuclear Energy Projects	
NQF Level: 9	NQF Credits: 20

- Identifying risks relating to financing power generation projects and the management of such risks
- Preparing budgets for power generation projects
- Building a business case for alternate power generation projects with particular focus on Nuclear projects
- Matching resource requirements to budgets for project life cycles

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Course Code: MECN7068A	
Course Description: Leadership of Nuclear Strategy	
NQF Level: 9	NQF Credits: 20

Concepts of strategic leadership in the development of organisations

- Project performance and their link to strategic goals
- Understanding stakeholders and managing their expectations and concerns including the use of power dynamics in the organisation
- Managing human resources to achieve strategic objectives
- Leading and managing a culture of innovation and self-development including creating a learning organisation
- Lead change initiatives, including those of mergers and acquisitions and management of joint ventures
- Creating and implementing a safety culture
- Strategic management of corporate social responsibility

Course Code: MECN7069A	
Course Description: Regulation and Security of Nuclear Energy Projects	
NQF Level: 9	NQF Credits: 20

- Enhancement of skills for managing safety and licensing and associated regulatory processes in accordance with up-to-date international standards and best practice
- Provision of up-to-date insight into topical nuclear and radiation safety and licensing issues
- Provide skills to manage interfaces between regulatory authorities, technical support organizations operator organizations, vendors and other stakeholders in the regulatory and licensing process over the lifetime of facilities and activities
- Basic elements of nuclear security: Prevention, Transport security, Detection, Response, Information security
- Planning nuclear security of nuclear/radiological facility: Creating a visible security policy, Conduct, competence, Behaviour and trustworthiness of staff, Clear roles and responsibilities, Physical protection systems, Design basis threat, Physical protection principles, design and evaluation, Response measures and communication, Nuclear material accounting and radioactive material inventory control, Contingency plans and drills.
- Providing delegates with the essential knowledge of current legislation pertaining to the Nuclear environment

Course Code: MECN7070A	
Course Description: Strategic Management of the Nuclear Energy Project Lifestyle	
NQF Level: 9	NQF Credits: 20

- Conceptualization of the project
- Planning , including funding proposal
- Securing funding
- Project inception
- Testing
- Commissioning
- Operating and maintenance of the project
- Decommissioning and/or refurbishment of a project
- Rehabilitation including planning, funding, operation and closeout
- Strategic roles relating to the management of the lifecycle
- Project sponsors
- Steering committees and the like

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Course Code: MECN7071A	
Course Description: Pipeline Conveying of Bulk Materials	
NQF Level: 9	NQF Credits: 20

This course introduces the candidate to the scientific fundamentals of conveying particulate solids through pipelines using carrier fluids. Practical applications are described through worked examples. The course consists of two parts, slurry conveying and pneumatic conveying, the contents of which are as follows:

Slurry conveying:

Review of pipeline hydraulics and issues relevant to slurry flow; introduction to slurry systems; settling slurries; non-Newtonian slurry flow behaviour; mixed regime slurries; slurry pipeline hydraulics; applications and examples.

Pneumatic conveying:

Systems and components; gas-solid flows; system design; system operation.

Course Code: MECN7094A	
Course Description: The Air Transportation System	
NQF Level: 9	NQF Credits: 20

The course presents a review of air transportation as part of a global, multimodal transportation system, evolution of the technological, social, environmental, and political aspects of this system since its inception at the beginning of the previous century. The long-term and short-term effects of economic deregulation, energy shortages, governmental restraints, national and international issues, and international terrorism are examined. Passenger and cargo transportation, as well as military and private aircraft modes, are studied in relation to ever-changing transportation requirements.

Course Code: MECN7095A	
Course Description: Human Factors in the Aviation/Aerospace Industry	
NQF Level: 9	NQF Credits: 20

This course presents an overview of the importance of the human role in all aspects of the aviation and aerospace industries. Emphasis is on issues, problems, and solutions of unsafe acts, attitudes, errors, and deliberate actions attributed to human behaviour and the roles supervisors and management personnel play in these actions. Students examine the human limitations in the light of human engineering, human reliability, stress, medical standards, drug abuse, and human physiology. Discussions include human behaviour as it relates to the aviator's adaptation to the flight environment, as well as the entire aviation/aerospace industry's role in meeting the aviator's unique needs.

Course Code: MECN7096A	
Course Description: Advanced Aerodynamics	
NQF Level: 9	NQF Credits: 20

In this course, students will examine current flight applications and problems. Specifically, this includes: transonic, supersonic, and hypersonic aerodynamics; principles of aircraft stability and control; and operational strength considerations. Emphasis is placed on the applications of the rapidly changing technological innovations in aerodynamics and the solutions to the problems created by these advances.

Course Code: MECN7097A	
Course Description: Earth Observation and Remote Sensing	
NQF Level: 9	NQF Credits: 20

This course reviews U.S. and International solar system exploration programs and relates them to the current and proposed Earth-research projects. Examination of these research programs will be structured towards defining problems related to environmental changes and resource exploration. Formatted research data from Earth-resource satellites and EOS sources will be used for demonstrating specific research techniques, exploration methods, and economic and social elements of exploration.

Course Code: MECN7098A	
Course Description: Aviation/Aerospace Simulation Systems	
NQF Level: 9	NQF Credits: 20

The course focus is on a comprehensive examination of simulation in modern aviation/aerospace that includes history, state-of-the-art, and current research and development. Discussions focus on the extent and impact of simulator application throughout the industry and the effects on training costs and safety. Topics range from basic design principles to flight crew training for initial qualification, continuation and currency purposes. The course emphasizes implementation of training that

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is transferable from simulated to real world environments. Systems simulators to the simulation models used in management, flight operations, scheduling, or air traffic control, are examined in detail.

Course Code: MECN7099A	
Course Description: Applications in Crew Resource Management	
NQF Level: 9	NQF Credits: 20

In this course, students examine the common concepts of crew resource management (CRM) as developed by major air carriers and explore the theoretical basis of such training. Topics such as supervision of crewmembers, counselling, manner and style, accountability, and role management will be studied. Each student has the opportunity to become knowledgeable in a specific area of CRM by assisting in the development of a CRM research document as part of the course. Additionally, each student uses simulators and computer-based instruction to supplement academic instruction.

Course Code: MECN7100A	
Course Description: Unmanned Aerospace Systems	
NQF Level: 9	NQF Credits: 20

This course offers a conceptual approach to overall system design of unmanned aircraft and spacecraft systems, including remotely operated and autonomous unmanned aerial systems (UAS) and unmanned space systems. The course will include the concepts of communication systems, payload systems, control stations and related systems, vehicle specific systems, and support systems. The requirements for system architecture development and conceptual level assessment of major system elements will be examined as they relate to use in industry. The major system elements will be evaluated from a systems engineering perspective to include consideration for cost and weight estimation, basic aircraft performance, safety and reliability, lifecycle topics, vehicle subsystems, and system integration.

Course Code: MECN7102A	
Course Description: Advanced Rotorcraft Operations	
NQF Level: 9	NQF Credits: 20

The course introduces the complexities of rotary wing flight systems and the advancements made to overcome them. The unique problems facing an organization involved in rotorcraft operations are studied from the initial inception of a program to the government rules and regulations, environmental and noise considerations, special landing and take-off facilities, flight and maintenance ratings, and techniques of control. Special consideration is given to the unique problems and issues facing such rotorcraft operations as police, medical evacuation, forestry service, off-shore, and corporate aviation.

Course Code: MECN7101A	
Course Description: Applications in Space: Commerce Defence and Exploration	
NQF Level: 9	NQF Credits: 20

The scientific, military, and commercial interests in international and domestic space programs are examined throughout the history of space flight. The needs of commercial space endeavours and methods of expanding space technology into manufacturing are contrasted to the importance of scientific exploration, and the requirements of military space operations. The justification, development, and costs of scientific exploration programs, defence-related projects, and commercial endeavours are used to study the evolution of space missions and the development of future programs.

Course Code: MECN7103A	
Course Description: Aircraft and Space Craft Development	
NQF Level: 9	NQF Credits: 20

This course is an overview of aircraft and spacecraft development. Included are vehicle mission, the requirements directed by economics, the military and defence considerations, and the research and developmental processes needed to meet the vehicle requirements. Aviation and aerospace manufacturing organizations and techniques are addressed to include planning, scheduling, production, procurement, supply and distribution systems. The course studies aviation and aerospace maintenance systems, from the built-in test equipment to the latest product support activities.

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Course Code: MECN7104A	
Course Description: Aerospace Accident Investigation and Analysis	
NQF Level: 9	NQF Credits: 20

This course covers all aspects of the aircraft accident investigation process starting with preparation for investigation through report writing. Particular emphasis is placed on the study of human factors connected with flight and support crew activities in aviation operations. The course provides students with knowledge of the process of investigating accidents and incidents in an aviation organization. A critical analysis of selected aircraft accidents and an evaluation of casual factors are covered.

Course Code: MECN7105A	
Course Description: Airport Safety and Certification	
NQF Level: 9	NQF Credits: 20

This course provides a review and analysis of all local and international regulations applicable to the safe conduct of airport operations. The requirements for airport certification are covered, as well as airport environmental protection and occupational safety compliance. Day-to-day safe operations are emphasized.

Course Code: MECN7107A	
Course Description: Human Factors in Unmanned Aerospace Systems	
NQF Level: 9	NQF Credits: 20

This course is designed to present an overview of the importance of major human factors issues associated with unmanned systems, including remotely operated and autonomous unmanned systems (US) and unmanned space systems operations across a variety of platforms employed in both commercial and military operations. Emphasis will be placed on the differences and commonalities between occupied and unoccupied systems, with a focus on the human factor issues encountered by individual unmanned operators (pilots and sensor operators) as well as UAS teams. Students will become familiar with human factor issues surrounding unmanned launch, recovery, long duration operations, fatigue, human performance, Ground Control Station (GCS) design, use of automation, Situation Awareness (SA), Crew Resource Management (CRM), integration into the National Airspace System (NAS), attitudes and perspectives of both government agencies and public entities, use of technology to compensate for no-pilot-on-board, and regulatory issues and solutions. Discussions of human capabilities and limitations as it relates to safe and effective operation of unmanned aircraft and space systems in a variety of commercial and military operations will be included.

Course Code: MECN7106A	
Course Description: Management of Research and Development for the Aerospace Industry	
NQF Level: 9	NQF Credits: 20

The types and sources of aviation/aerospace research and development are analysed, with a focus on the structure and interrelationship of the industry, educational institutions, and other organizations. Sources and methods of funding, specification determination, the relationship of research and development to procurement and production, and the regulatory factors affecting progress from the initial development to production of the aircraft and components are examined. Concepts of motivation and management as applied to research scientists and engineers will be studied as well as procedures for promoting optimum creativity concurrently with efficient operations.

Course Code: MECN7108A	
Course Description: Lean Management of Healthcare Systems	
NQF Level: 9	NQF Credits: 20

This course will explore operations management in healthcare from a systems perspective, considering the context and challenges of this unique environment. The purpose is to provide candidates with an overview of key terminology, an introduction to basic techniques and examples and cases of how these can be applied in a healthcare context. The course aims to develop the critical thinking and application skills of candidates. The syllabus includes: Lean philosophy; current state analysis; value stream mapping and process analysis; constraint identification; root cause analysis; metrics and measures; problem solving methodologies and principles of systems engineering and thinking; scheduling and planning for efficient practice; organisational behaviour and soft systems issues.

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Course Code: MECN7109A	
Course Description: The Mechanics of Heavy Vehicles	
NQF Level: 9	NQF Credits: 20

The course will provide students with the competencies needed for truck design, operation and manufacture. It aims to give students an understanding of the swept path, stability, and rollover behaviour of articulated vehicles. The course will focus on how the tyres, suspensions, brakes and steering systems affect the overall performance of the vehicle in terms of vehicle dynamics. The syllabus will cover:

Performance-based standards to assess vehicle safety; low-speed swept path; frontal swing; tail swing; rearward amplification; high-speed transient offtracking; dynamic load transfer ratio; yaw-damping coefficient; trackability on a straight path; static rollover threshold; startability; gradeability A and B; and acceleration capability.

Course Code: MECN7110A	
Course Description: Vehicle Dynamics and Automotive Engineering	
NQF Level: 9	NQF Credits: 20

The course will provide students with the basic tools and analysis methods to assess the vehicle dynamics of a vehicle. The course will cover the topics of tyre models, traction and braking, quarter-car analysis, pitch-plane analysis, and roll-plane analysis. The course will cover: how to use handling diagrams to determine the oversteer or understeer characteristics of a vehicle; the effect of load distribution, engine characteristics, gearing and braking torque on acceleration; analysis of body acceleration, working space and dynamic tyre force using a quarter-car model; wheelbase filtering; the ride versus vehicle stability trade-off.