

MECHANICAL ENGINEERING

The Department offers the following postgraduate degree programmes:

Research projects and courses are offered through which suitably qualified graduates may enter the PGDip in Power Plant Engineering, BSc Honours in Materials Science, MSc(Eng), MPhil(Eng), MEng and PhD.

These areas of specialisation include:

Computational Mechanics
 Mechanical and Mechatronic Engineering
 Energy and Development Studies
 Engineering Management
 Materials Engineering
 Mechanical Engineering
 Sustainable Energy Engineering

Research Entities

Blast Impact and Survivability Research Unit (BISRU)
 Centre for Materials Engineering (CME)
 Centre for Research in Computational and Applied Mechanics (CERECAM)
 Energy Research Centre (ERC)

The Department of Mechanical Engineering is situated in the Electrical & Mechanical Engineering, McMillan and Menzies Buildings on the Upper campus, fronting onto University Avenue. It can be accessed via University Avenue and Library Road.

Staff

Professor and Head of Department

GS Langdon, BEng PhD *Liverpool* MIMechE CEng

Deputy Heads of Department

Research: Professor PG Rousseau, PrEng BEng (Mech) MEng (Mech) PhD *Pretoria* OPM *HBS*
 Teaching: Professor BI Collier-Reed, PrEng MSc(Eng) PhD *Cape Town* FSAIMechE

Professors

T Bello-Ochende, PrEng BEng MEng *Ilorin* PhD *Duke* MASME
 RD Knutsen, BSc PhD *Cape Town* MSAIMM MSAIMechE
 H Winkler, MSc *Berkley* MA PhD *Cape Town*

Emeritus Professors

KF Bennett, BSc(Eng) *Cape Town* MSc CNA A PhD *Cape Town* FSAIMechE
 J Gryzagoridis, PrEng BSc(Eng) *Lamar* MSc(Eng) *Texas A&M* PhD *Cape Town* MSAIMechE
 M(SA)IRAC M(SA)INT M(SAAM) M(N.YORK) ACAD.SCIENCES
 GN Nurick, PrEng MSc(Eng) *Natal* PhD *Cape Town* FSAIMechE MASME FSAAE
 RB Tait, PrEng BSc(Hons) *Rhodes* MA *Oxon* BSc(Eng) PhD *Cape Town* MSAIMechE

Honorary Professor

L Jestin, Msc(Eng) PhD *Marseille* HDR *Provence*

Adjunct Professor

ADB Yates, BSc(Eng) MSc(Eng) PhD *Cape Town* MSAIMechE

200 DEPARTMENTS IN THE FACULTY AND COURSES OFFERED

SARChI South African Research Chair in Computational Mechanics

Professor BD Reddy, BSc(Eng) *Cape Town* PhD *Cantab*

SARChI South African Research Chair in Industrial CFD

Professor AG Malan, PrEng BEng(Mech) MEng(Mech) *Pretoria* PhD *Swansea*

Associate Professors

S Chung Kim Yuen, BSc(Eng) MSc(Eng) PhD *Cape Town*

WF Fuls, BSc(Eng) MSc(Eng) PhD(Eng) *NWU*

R Kuppusswamy, BEng(Hons) MTech PhD *Singapore* SMSME

HD Mouton, BSc(Eng) *Pretoria* BSc *Unisa* BEng(Hons) MEng *Pretoria* PhD Eng *NWU*

G Vicatos, PrEng BSc(MechElec)(Marine) *Newcastle* MSc(Aero) DIC *London* PhD *Cape Town*

CJ von Klemperer, BSc(Eng) MSc(Eng) PhD *Natal*

Senior Lecturers

TJ Cloete, BIng MIng *Stellenbosch*

C Findeis, NHD(Mech Eng) *Pretoria*

D Findeis, BSc(Eng) MSc(Eng) *Cape Town* MSAIMechE

SL George, BSc(Eng) MSc(Eng) PhD *Cape Town*

R Govender, BSc(Eng) MSc(Eng) PhD *Cape Town*

EB Ismail, BSc(Eng) MSc(Eng) *Cape Town*

BC Kloot, BSc(Eng) MSc(Eng) PhD *Cape Town* (Academic Development Lecturer)

MN Ngoepe, BSc(Eng) *Cape Town*, DPhil *Oxon*

HT Pearce, BSc(Eng) *Cape Town* MS PhD *Illinois*

S Parker, BSc(Eng) MSc(Eng) *Cape Town*

CB Shaw, BSc(Eng) MSc(Eng) HDE MPhil(EngMan) DPhil(EngMan) PhD *Cape Town*

CD Woolard, MSc *London* PhD *Cape Town*

Lecturers

LC Raw, BSc(Eng) MSc(Eng) *Cape Town*

Principal Technical Officers

P Smith

R Whittemore, BSc(Eng) *Cape Town*

Chief Technical Officer

D Jacobs

Senior Technical Officers

H Christians

G du Plessis

Technical Assistants

P Jacobs

W Slaverse

Departmental Manager

CMC Jonker, BCom(Hon) *UWC*

Administrative Officer (Undergraduate)

R Maree

Administrative Assistant (Postgraduate)

TBC

Administrative Officer (Finance)

B Glass

Senior Secretary

S van Sensie

Department Assistant

G Doolings

Postgraduate Programmes

- Bachelor of Science Honours in Materials Science
- Postgraduate Diploma in Power Plant Engineering
- Master of Engineering by 120 credits coursework and a 60 credit dissertation
- Master of Science in Engineering by 180 credit dissertation
- Master of Science in Engineering by 60 credits coursework and a 120 credit dissertation
- Master of Philosophy by coursework and dissertation
- Doctor of Philosophy

Honours Programmes

Bachelor of Science Honours in Materials Science [EH005MEC04]

Programme Convener:

CD Woolard, MSc *London* PhD *Cape Town*

The Department offers a BSc(Hons) in Materials Science to graduates with a three-year Bachelor of Science degree. The aim is to provide one year of intensive training in Materials Science and Technology. The broad-based instructional approach prepares graduates for careers in a wide range of industrial settings, from small manufacturing companies to large corporations producing bulk commodity products, and R&D laboratories. In addition the BSc(Hons) in Materials Science programme prepares students for registration for research degrees in Materials Engineering at the Master's and ultimately Doctoral levels.

The programme runs over one year, with students taking a structured programme of **144 credits** of coursework, including a project, as follows.

Core Courses

Code	Course	NQF Credits	HEQSF Level
MEC4091Z	Materials Science Honours Research Project.....	40	8
MEC4096Z	Manufacture & Properties of Composites	12	8
MEC4097Z	Manufacture & Properties of Ceramics.....	8	8
MEC4098Z	Properties & Manufacture of Metallic Materials.....	16	8
MEC4100Z	Manufacture & Properties of Polymers.....	12	8
MEC4114Z	Experimental Techniques in Materials Science.....	16	8
	Approved Electives	40	8
	Total credits	144	

202 DEPARTMENTS IN THE FACULTY AND COURSES OFFERED

Elective Courses

Select courses to the value of 40 credits from the following:

Code	Course	NQF Credits	HEQSF Level
CHE3069S	Mineral and Metallurgical Processing	16	7
MEC3060F	Materials under Stress	8	7
MEC3069S	Production Processes	8	7
MEC4088Z	Manufacturing with Materials	12	8
MEC4099Z	Phase Transformations in Materials	8	8
END5044F	Professional Communication Studies	16	9

Postgraduate Diplomas

Postgraduate Diploma in Power Plant Engineering [EG010MEC11]

Associate Professor:

WF Fuls, SSc(Eng) MSc(Eng) PhD(Eng) *NWU*

The department offers a Postgraduate Diploma in Power Plant Engineering. The aim is to provide growth and development opportunities for engineers, scientists and technologists employed by, or interested in, the power generation and distribution industry. The diploma allows students to further develop the high-level specialist skills required to deal with specific technical challenges faced by those working in, or entering, the power plant industry. The programme is specifically designed to run over two years to accommodate employed students, with students taking a structured programme of 120 credits of coursework, as follows:

Core Courses

Code	Course	NQF Credits	HEQSF Level
MEC4115Z	Overview of the Power Plant Industry	15	8
MEC4116Z	Power Plant Systems Analysis	15	8
MEC4118Z	Systems Engineering in the Power Industry	15	8
MEC4119Z	Mechanical Behaviour of Materials	15	8
MEC4120Z	Leadership in a Technical Environment	15	8
	Approved Electives	30	8/9
	Total credits	120	

Note: Certain courses run every other year. Contact the course convener for more information.

Elective Courses

Select courses to the value of 30 credits from the following:

Code	Course	NQF Credits	HEQSF Level
MEC4122Z	Turbine Plant Engineering	15	8
MEC4117Z	Power Plant Boilers: Thermofluid Processes & Controls	15	8
	Other approved electives*	30	8-9

*Other MEC or EEE courses at HEQSF level 8 or 9 may be taken as electives, subject to approval by the programme convener. It is also possible to take relevant courses at other universities as an occasional student, upon approval of the programme convener.

Master's Programmes

MSc in Engineering specialising in Mechanical Engineering [MEC01]

Research Master's by dissertation

[EM023MEC01]

EM023 Research Master's by dissertation

Core Course

Code	Course	NQF Credits	HEQSF Level
MEC5000W	Dissertation Mechanical Engineering	180	9
END5050X	Master's journal paper	0	9
	Total credits	180	

Research Master's by coursework and dissertation

[EM024MEC01]

Not offered in 2019

EM024 Research Master's by coursework and dissertation

Core Courses

Code	Course	NQF Credits	HEQSF Level
MEC5010Z	Dissertation Mechanical Engineering	120	9
	Elective courses approved by supervisor	60	9
MEC5097Z	Dissertation Preparation	0	9
END5050X	Master's journal paper	0	9
	Total credits	180	

MSc in Engineering specialising in Materials Engineering [MEC03]

The Centre for Materials Engineering prepares candidates for the Master of Science in Engineering in Materials Engineering and for the Doctor of Philosophy.

The Master of Science in Engineering specialising in Materials Engineering can be either by dissertation only [EM023] or by coursework (approved by your supervisor) and dissertation [EM024].

Research Master's by dissertation

[EM023MEC03]

EM023 Research Master's by dissertation

Core Course

Code	Course	NQF Credits	HEQSF Level
MEC5070W	Dissertation Materials Engineering	180	9
END5050X	Master's journal paper	0	9
	Total credits	180	

Research Master's by coursework and dissertation

[EM024MEC03]

Not offered in 2019

EM024 Research Master's by coursework and dissertation

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Core Courses

Code	Course	NQF Credits	HEQSF Level
MEC5071Z	Dissertation Materials Engineering	120	9
	Elective courses approved by supervisor.....	60	9
MEC5097Z	Dissertation Preparation	0	9
END5050X	Master's journal paper	0	9
	Total credits	180	

MSc in Engineering specializing in Sustainable Energy Engineering **[EM023MEC07]**

Professor and Convener:

H Winkler, MSc *Berkeley* MA PhD *Cape Town*

Compulsory Courses

Code	Course	NQF Credits	HEQSF Level
MEC5060W	Dissertation: Sustainable Energy Engineering.....	180	9
END5050X	Master's journal paper.....	0	9
	Total credits.....	180	

MSc in Engineering specialising in Sustainable Energy Engineering **[EM024MEC07]**

Not offered in 2019

Professor and Convener:

H Winkler, MSc *Berkeley* MA PhD *Cape Town*

The Energy Research Centre offers a structured Master's Programme in Sustainable Energy Systems Engineering, specifically aimed at science and engineering graduates with an interest in Energy Systems Analysis. Students are required to complete 60 credits of course work, specified below. Courses other than those on the list below may be taken subject to approval by the Director of the Energy Research Centre. To qualify for the degree in MSc(Eng), candidates are required to complete a supervised dissertation, equivalent to a further 120 credits, the topic of which requires the approval of the Director of the ERC.

Compulsory Courses

Code	Course	NQF Credits	HEQSF Level
MEC5061Z	Dissertation: Sustainable Energy	120	9
MEC5099Z	Fundamentals of Energy for Development.....	30	9
MEC5100Z	Energy Systems Analysis	30	9
MEC5097Z	Dissertation Preparation	0	9
END5050X	Master's journal paper	0	9
	Total credits.....	180	

Master of Philosophy specialising in Energy & Development Studies **[EM025MEC08]**

Professor and Convener:

H Winkler, MSc *Berkeley* MA PhD *Cape Town*

Compulsory Course

Code	Course	NQF Credits	HEQSF Level
MEC5093W	Dissertation Energy & Development Studies	180	9
END5050X	Master's journal paper	0	9
	Total credits	180	

Master of Philosophy specialising in Energy & Development Studies

[EM026MEC08]

Not offered in 2019

Professor and Convener:

H Winkler, MSc Berkeley MA PhD Cape Town

The Energy Research Centre offers a structured Master's Programme in Energy and Development Studies, specifically aimed at graduates from diverse academic backgrounds with an interest in Energy and Climate Policy. Students are required to complete 60 credits of course work, specified below. Courses other than those on the list below may be taken subject to the approval of the Director of the Energy Research Centre. To qualify for the MPhil degree candidates are required to complete a supervised dissertation, equivalent to a further 120 credits, the topic of which requires the approval of the Director of the ERC.

Compulsory Course

Code	Course	NQF Credits	HEQSF Level
MEC5092Z	Dissertation Energy & Development Studies.....	120	9
MEC5099Z	Fundamentals of Energy for Development.....	30	9
MEC5101Z	Energy and Climate Policy for Sustainable Development	30	9
MEC5097Z	Dissertation Preparation	0	9
END5050X	Master's journal paper.....	0	9
	Total credits.....	180	

Master of Philosophy specialising in Computational Mechanics

[EM026MEC01]

Professor and Convener:

Centre For Research in Computational and Applied Mechanics (CERECAM)

The Department offers the following courses in Computational Mechanics. This area of study is truly interdisciplinary and is available to all postgraduate students in the Faculty.

Compulsory Courses

Code	Course	NQF Credits	HEQSF Level
MEC5010Z	Dissertation.....	120	9
MEC5097Z	Dissertation Preparation	0	9
END5050X	Master's journal paper.....	0	9

Elective courses

Select courses to the value of 60 credits:

Code	Course	NQF Credits	HEQSF Level
MEC5063Z	An Introduction to Finite Elements	12	9
MEC5064Z	Finite Element Analysis	12	9
MEC5065Z	Programming for Scientists & Engineers	12	9
MEC5066Z	Continuum Mechanics.....	12	9

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Code	Course	NQF Credits	HEQSF Level
MEC5067Z	Non-linear Material Behaviour	12	9
MEC5068Z	Topics in Computational & Applied Mechanics	12	9

Research Masters in Engineering Management [MEC02]

The Department offers a Master of Science specialising in Engineering Management and a Master of Philosophy specialising in Engineering Management as research only master's programmes. The nature of the research project could either be of a strongly interdisciplinary nature, in which case the candidate will register for a Master of Philosophy specialising in Engineering Management. Alternatively, if the research project is strongly focussed on the scientific method or an appropriate engineering method, then the candidate will register for a Master of Science specialising in Engineering Management.

Master of Science in Engineering specialising in Engineering Management [EM023MEC02]

Doctor and Convener:

CB Shaw, BSc HDE MPhil(EngMan) PhD Cape Town

Compulsory Courses

Code	Course	NQF Credits	HEQSF Level
MEC5047W	Dissertation: Engineering Management	180	9
END5050X	Master's journal paper	0	9
	Total credits	180	

Master of Philosophy specialising in Engineering Management [EM025MEC02]

Doctor and Convener:

CB Shaw, BSc HDE MPhil(EngMan) PhD Cape Town

Compulsory Courses

Code	Course	NQF Credits	HEQSF Level
MEC5047W	Dissertation: Engineering Management	180	9
END5050X	Master's journal paper	0	9
	Total credits	180	

Master of Philosophy specialising in Engineering Education [EM026MEC09]

Programme Convener:

CB Shaw, BSc HDE MPhil(EngMan) PhD *Cape Town*

The Faculty of Engineering and the Built environment offers a structured MPhil programme in Engineering Education. Students are required to complete a minimum of 60 credits of coursework, 45 credits of which are core to the programme. The additional credits will include an elective course approved by the supervisor. To qualify for the MPhil degree specialising in Engineering Education candidates are required to complete a supervised dissertation equivalent to a further 120 credits. The dissertation should incorporate any or all of the following: design of an engineering education research project involving advanced concepts and theoretical principles located in the engineering education research field; a research project of a theoretical or practical nature; a critical review of a

specified topic based upon a comprehensive search of the literature or available data, a rigorous analysis of empirical data, and the development of a coherent discussion of the analysis, or any other study acceptable to the Faculty. Students will register for the dissertation in the home department of their supervisor.

Core Course

Code	Course	NQF Credits	HEQSF Level
MEC5102Z	Knowledge and Practices in Engineering Education	15	9
EEE5148Z	Theoretical Foundations in Engineering Education Research	15	9
MEC5097Z	Dissertation Preparation	0	9
CIV5147Z	Methodologies in Engineering Education Research	15	9
Elective	Subject to approval by supervisor	15	9
MEC5103W	Dissertation Engineering Education	120	9
	Total Credits	180	

Doctoral Programmes

Doctor of Philosophy

[ED001]

ED001 Doctor of Philosophy is a Research Degree

Core Course

Code	Course	NQF Credits	HEQSF Level
MEC6000W	Thesis (Mechanical Engineering)	360	10
MEC6002W	Thesis (Engineering Management)	360	10
MEC6003W	Thesis (Sustainable Energy Engineering)	360	10
MEC6004W	Thesis (Materials Engineering)	360	10
MEC6005W	Thesis (Energy & Development Studies)	360	10
MEC6006W	Thesis (Engineering Education)	360	10

Course descriptions are set out in the section Courses Offered. The course code abbreviation for Mechanical Engineering is MEC.

Course Outlines

MEC4088Z MANUFACTURING WITH MATERIALS

12 NQF credits at HEQSF level 8

Convener: Dr SL George

Course entry requirements: MEC2042F or co-registration of BSc(Hons) MatSc

Course outline:

This course aims to develop an advanced understanding of manufacturing materials. Topics include: modelling deformation during processing, manufacturing process selection, net shape casting processes, forming processes, joining processes and machinability of materials, surface engineering., injection moulding, blow moulding and extrusion of polymeric materials, manufacturing and business strategy, case studies in product manufacture.

Lecture times: 3 lectures per week

DP requirements: None

Assessment: Projects, class test, 3 hour examination

MEC4091Z MATERIALS SCIENCE HONOURS RESEARCH PROJECT

This course starts in semester 1 and finishes in semester 2

40 NQF credits at HEQSF level 8

Convener: Dr SL George

Course entry requirements: Completion of BSc degree.

Course outline:

Students are required to attend a series of lectures and practicals on experimental techniques. Each student will be given an individual laboratory project on a problem relating to materials. A period of twelve weeks is allocated for the project and on completion a treatise must be submitted for examination.

DP requirements: None

Assessment: Project report.

MEC4096Z MANUFACTURE & PROPERTIES OF COMPOSITES

12 NQF credits at HEQSF level 8

Convener: Dr C Woolard

Course entry requirements: MEC2042F or BSc (Hons) MatSc candidate

Course outline:

This course aims to develop an advanced understanding of the manufacture and properties of composites. Topics include: history of composites; carbon, glass and aramid fibres; functions of the reinforcement and matrix, polymer-, metal- and ceramic-matrix composites; manufacture of composites; thermal properties, elastic properties of fibre composites; fracture and toughness, the fibre/matrix interface; geometric aspects; laminate theory and the strength of laminates; testing of composites and environmental effects; selection, and modification and design of composites.

DP requirements: None

Assessment: Class tests, examination 3 hours.

MEC4097Z MANUFACTURE AND PROPERTIES OF CERAMICS

8 NQF credits at HEQSF level 8

Convener: Professor RD Knutsen

Course entry requirements: MEC2042F or BSc (Hons) MatSc candidate

Course outline:

This course aims to develop an advanced understanding of the manufacture and properties of ceramics. Topics include: history of ceramics; traditional ceramics; glasses and glass ceramics; advanced ceramics; chemical bonding in ceramics; physical, mechanical and chemical properties of ceramics, nucleation and growth phenomena; production and properties of engineering ceramics, refractories; fracture and reliability of ceramics; powder technologies; and selection and design of ceramic components.

DP requirements: 35% minimum for class record.

Assessment: Class tests, examination 3 hours (40% min for examination).

MEC4098Z PROPERTIES AND MANUFACTURE OF METALLIC MATERIALS

16 NQF credits at HEQSF level 8

Convener: Professor RD Knutsen

Course entry requirements: MEC2042F or BSc(Hons) MatSc candidate

Course outline:

This course aims to develop an advanced understanding of the properties and manufacture of metallic materials. The course covers four main topics, namely, the solidification process; the metallurgy of ferrous, non-ferrous and light metal alloys; the relationship between manufacturing processes, mechanical properties and microstructures of metallic materials; and an introduction to metallic corrosion. The course also includes a week-long intensive module on wrought aluminium processing.

Lecture times: This course is presented in the first semester

DP requirements: None

Assessment: Projects, class tests, examination 3 hours.

MEC4099Z PHASE TRANSFORMATIONS IN MATERIALS

8 NQF credits at HEQSF level 8

Convener: Professor RD Knutsen

Course entry requirements: MEC3060F

Course outline:

This course aims to give an understanding of the thermodynamics and kinetics of phase transitions. The course covers the following topics: the application of thermodynamics in kinematics in materials science and engineering; thermodynamic states of variables; the first law of thermodynamics (energy conservation law); phase transitions (liquid/solid and solid state matter); single component and binary systems; equilibrium phase diagrams; and diffusion in liquid and solid state matter.

Lecture times: This course is presented in the first quarter of the year

DP requirements: Completion of all practicals & assignments

Assessment: Class record (30%); 2 hour examination (70%).

MEC4100Z MANUFACTURE & PROPERTIES OF POLYMERS

12 NQF credits at HEQSF level 8

Convener: Dr C Woolard

Course entry requirements: MEC2042F or BSc(Hons) MatSc candidate

Course outline:

This course aims to develop an advanced understanding of the manufacture and properties of polymers. Topics include: polymer nomenclature; morphology; bonding; molecular weight, polymerization, crystallisation; polymer types; rheology; manufacturing methods; applications; polymer identification; polymer modification, additives; analytical techniques; biodegradability; and selection and design.

DP requirements: None

Assessment: Practical, class tests, examination 3 hours.

MEC4111Z NUCLEAR MANUFACTURING AND CONSTRUCTION ENG MANAGEMENT

12 NQF credits at HEQSF level 8

Convener: Dr C Shaw

Course outline:

This course covers: Application of appropriate tools, techniques and theories for management problem solving; an overview of how construction projects are initiated and driven forward; roles and responsibilities of the various human resources involved in construction projects; knowledge of forms of regulations, contract and of law relevant to construction projects; health and safety; costing and financial implications in construction projects; processes and conversion of activities into processes in a nuclear power plant; value chain for identifying improvements; understanding of the origins of “wastes” in an organisation.

Assessment: Group assignment and presentation (10%); Individual assignments (20%); Written examination (70%)

MEC4114Z EXPERIMENTAL TECHNIQUES IN MATERIALS SCIENCE

This course starts in semester 1 and finishes in semester 2

16 NQF credits at HEQSF level 8

Convener: Dr CD Woolard

Course entry requirements: Registration for BSc(Hons) in MatSc

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Course outline:

This course aims to provide detailed insight into the experimental techniques for manipulating and investigating the properties and the microstructure of engineering materials. Techniques include: heat treatment (furnace construction, temperature control, furnace environment); mechanical testing (hardness, tensile/compression/bending, impact, work-hardening, fatigue and creep); corrosion resistance (exposure and potentiostatic/dynamic tests); thermal analysis including thermo-dilatometry, thermo-gravimetry and differential scanning calorimetry; quantitative microstructure characterization (X-ray diffraction, light microscopy, electron microscopy including SEM, TEM, EDS and EBSD).

DP requirements: None

Assessment: Coursework 50%, Examination 50%

MEC4115Z OVERVIEW OF THE POWER PLANT INDUSTRY

15 NQF credits at HEQSF level 8

Convener: Professor L Jestin and Mr P Gosai

Course outline:

The aim of this course is to establish a balanced understanding of the global energy domain, by enhancing the contextual understanding of content in other courses. Topics include: world energy outlook; integrated energy planning; types of power generation plants; environmental impact and sustainability; renewable energy resources; nuclear power generation; energy efficiency and demand side management; energy industry and economics; power generation mix and the IRP (integrated resource plan); and the economics of power generation.

DP requirements: Submission of all the assignments on time as stipulated in the programme plan.

Attendance and participation in the contact week on campus.

Assessment: Coursework 40%, exam 60%

MEC4116Z POWER PLANT SYSTEMS ANALYSIS

15 NQF credits at HEQSF level 8

Convener: Professor P Rousseau

Course outline:

The aim of this course is to lay the theoretical foundations of thermofluid process modelling applied to power plants, based on the fundamentals of thermodynamics, fluid mechanics and heat transfer. Topics include: Introduction to thermofluid systems analysis. Overview of fundamental concepts. Conservation laws for fluid control volumes. Component characteristics: Pipe and duct flows, Pumps, fans and turbomachinery and Furnaces, boilers and heat exchangers. Also covered are simple analyses of important thermofluid processes, integrated systems analysis and modelling (steady state) as well as integrated systems analysis and modelling (dynamic).

DP requirements: Submission of all the assignments on time as stipulated in the programme plan.

Attendance and participation in the contact week on campus.

Assessment: Assessment of the assignments: the average mark obtained for the assignments will contribute 30% to the final course mark. Assessment of the final examination: the mark obtained for the final examination will contribute 70% to the final course mark.

MEC4117Z POWER PLANT BOILERS: THERMOFLUID PROCESSES AND CONTROLS

15 NQF credits at HEQSF level 8

Convener: Professor P Rousseau

Course entry requirements: None

Course outline:

The aim of this course is to lay the theoretical foundation for modelling and analysing the performance of boilers in a typical coal-fired power plant. The focus is on combustion, thermodynamics, heat transfer and fluid mechanics in the boiler, and how these processes are controlled. Also included are boiler types and configurations, fuels and combustion, furnace heat

transfer, two-phase flow heat transfer and hydraulics, superheater and reheater heat transfer, draft system hydraulics and air pre-heaters, furnace controls, fouling and slagging, erosion and corrosion, and the commissioning and acceptance testing of boilers.

DP requirements: Submission of all the assignments on time as stipulated in the programme plan. Attendance and participation in the contact week on campus.

Assessment: Assessment of the assignments: the average mark obtained for the assignments will contribute 30% to the final course mark. Assessment of the final examination: the mark obtained for the final examination will contribute 70% to the final course mark.

MEC4118Z SYSTEMS ENGINEERING IN THE POWER INDUSTRY

15 NQF credits at HEQSF level 8

Convener: Associate Professor W Fuls

Course entry requirements: None

Course outline:

This course aims to enable students to structure and plan a high level system design and to generate system and sub-system development specifications as well as comprehend and apply the various technical management processes involved in Systems Engineering.

DP requirements: None

Assessment: Coursework 70%, exam 30%

MEC4119Z MECHANICAL BEHAVIOUR OF MATERIALS

15 NQF credits at HEQSF level 8

Convener: Professor R Knutsen

Course entry requirements: None

Course outline:

This course aims to provide an understanding of the relationship between structure of materials and responses to applied stress. This understanding is in turn used for problem solutions such as materials selection for design (with particular emphasis on meeting the requirements for power plant) and failure analysis case studies. Topics include: crystallography and bonding, elastic and plastic deformation, deformation and annealing mechanisms, strengthening mechanisms, steel metallurgy and heat treatment, welding metallurgy, time-dependent microstructure/property evolution (high temperature/high stress exposure), corrosion and oxidation, wear mechanisms (abrasion, erosion, slurry erosion), stress concentration and fracture mechanisms, crack propagation, factors affecting fracture toughness, fatigue, creep, LEFM approach, methods to improve toughness, fracture toughness testing, fracture surface feature identification, failure analysis investigation, as well as failure case studies.

DP requirements: Submission of all coursework assignments

Assessment: Coursework 40%, exam 60%.

MEC4120Z LEADERSHIP IN A TECHNICAL ENVIRONMENT

15 NQF credits at HEQSF level 8

Convener: Dr C Shaw

Course entry requirements: None

Course outline:

This course aims to develop the abilities required to influence a group of people towards a goal and to maximise their performance. The focus is on cultivating a personal leadership philosophy and managing technical professionals and technical projects in a diverse environment. Topics include: organisational theory and culture, strategic thinking, resource and supply chain management, ethics and the roles of managers, and maintenance management and the ability to lead change are also included.

DP requirements: None

Assessment: Coursework 40%, exam 60%.

MEC4122Z TURBINE PLANT ENGINEERING

15 NQF credits at HEQSF level 8

Convener: Dr Wim Fuls

Course entry requirements: None

Course outline:

This course aims to provide theoretical and practical foundations for modelling and analysing performance of power plant equipment associated with the steam turbine, including condensers and feed heaters. In addition, this course aims to develop methodologies for the commissioning, acceptance testing and condition monitoring of such equipment.

Topics include: Regenerative Rankine cycle overview, Steam turbines (types, function, thermodynamics, operation, control, condition monitoring), Condensers, Feedwater heaters (open and closed, shell and header types), Auxiliary equipment (ejectors, gland seals, oil system, water purification), and Valves.

DP requirements: 40% minimum for assignments

Assessment: Assignments 40% Exam 60%

**MEC5000W MASTER OF SCIENCE IN MECHANICAL ENGINEERING
DISSERTATION**

180 NQF credits at HEQSF level 9

Course outline:

The dissertation should incorporate any or all of the following: design of all or part of an engineering project to a specification involving advanced concepts and theoretical principles; a research project of a theoretical or practical nature; a critical review of a specified topic based upon a comprehensive search of the literature or available data; development of an item of equipment or a technique involving novel features or advanced design; or any other study acceptable to the Faculty.

DP requirements: None

Assessment: Written work counts 100%.

**MEC5010Z MASTER OF SCIENCE IN MECHANICAL ENGINEERING PART
DISSERTATION**

120 NQF credits at HEQSF level 9

Course entry requirements: MEC5097Z DP

Course outline:

The dissertation should incorporate any or all of the following: design of all or part of an engineering project to a specification involving advanced concepts and theoretical principles; a research project of a theoretical or practical nature; a critical review of a specified topic based upon a comprehensive search of the literature or available data; development of an item of equipment or a technique involving novel features or advanced design; or any other study acceptable to the Faculty.

DP requirements: None

Assessment: Written work counts 100%.

MEC5024S STRUCTURAL IMPACT

12 NQF credits at HEQSF level 9

Convener: Professor G Langdon

Course outline:

This course aims to develop an advanced understanding of the importance of structural impact. Topics include: Static plastic behaviour of beams; plates and shells; dynamic plastic behaviour of beams, plates and shells; influence of transverse shear and rotary inertia; influence of finite displacements; strain rate sensitive behaviour of materials; dynamic progressive buckling; dynamic loading effects; plastic buckling; and scaling laws and experimental techniques.

DP requirements: None

Assessment: Project(s)

MEC5025Z MASTERS DISSERTATION IN ENGINEERING MANAGEMENT

120 NQF credits at HEQSF level 9

Convener: Dr C Shaw

Course entry requirements: Completion of 60 credits of approved postgraduate coursework.

Course outline:

The dissertation should incorporate any or all of the following: design of all or part of an engineering project to a specification involving advanced concepts and theoretical principles a research project of a theoretical or practical nature; a critical review of a specified topic based upon a comprehensive search of the literature or available data; development of an item of equipment or a technique involving novel features or advanced design; or any other study acceptable to the Faculty.

DP requirements: None

Assessment: Written work counts 100%.

MEC5035Z PROJECT MANAGEMENT

Not offered in 2019

20 NQF credits at HEQSF level 9

Convener: Dr C Shaw

Course outline:

This course aims to develop an advanced understanding of project management. Topics include: The need for and objectives of project management. Organising for project management. Project manager qualities and competency. Planning and implementing a human resource management, team motivation, planning, feasibility studies. Managing project time, cost and quality. Estimating budgeting cost control. Procurement and expediting. Contractual arrangements and legal aspects. Communications, controlling meetings, handling contractors. Project commissioning. Risk analysis and hazard assessment. Conflict management. Time value of money and use of discounted cash flows for project appraisal and decision making. The perspective is managerial, with emphasis on the use of the techniques to aid project decision making. Information systems, and projects in developing countries.

DP requirements: None

Assessment: Project report(s), assignments, examination.

MEC5036Z MANAGING FOR PERFORMANCE IMPROVEMENT

Not offered in 2019

20 NQF credits at HEQSF level 9

Course outline:

This course aims to develop an advanced understanding of managing for performance improvement. Topics include: Productivity: definition and importance. Productivity models, measurement and quality. People and productivity. The nature of quality, costs of quality and Kaizen, and 14000; organising and managing for quality, quality engineering, quality assurance and control; ISO9000 series, techniques of quality control, vendor rating; process capability, precontrol and advanced techniques; total quality management, quality friction development. Just-in-Time; human factors in quality, the zero defects approach; computer use in quality systems. Job design, BPR and work improvement. Value analysis and simultaneous/concurrent engineering. Theory of constraints. Total productive maintenance. Continuous productivity; and improvement programmes.

MEC5037Z OPERATIONS MANAGEMENT PROJECT

Not offered in 2019

20 NQF credits at HEQSF level 9

Convener: Dr C Shaw

Course outline:

On the recommendation of the supervisor and the programme convener, a student may be permitted to enter into a programme of individual study on a specialised topic. A statement of objectives must be agreed upon, and the course of study will be guided by the supervisor. The programme will

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involve the student in about 180 hours of work, and a written report must be submitted. The written report will be examined, and a further oral examination may be held.

DP requirements: None

Assessment: Project(s).

MEC5046Z SYSTEMS ENGINEERING PRACTICE

Not offered in 2019

40 NQF credits at HEQSF level 9

Convener: Dr C Shaw

Course outline:

This course aims to develop an advanced understanding of systems thinking and systems practice. Topics include: management and organisational concepts; qualitative mapping and modelling; and a system's approach to problem solving.

Lecture times: Block release (two contact modules).

DP requirements: None

Assessment: Position papers 50%, portfolio of projects and reflective papers 50%.

MEC5047W MASTERS DISSERTATION IN ENGINEERING MANAGEMENT

180 NQF credits at HEQSF level 9

Course outline:

The dissertation should incorporate any or all of the following: design of all or part of an engineering project to a specification involving advanced concepts and theoretical principles; a research project of a theoretical or practical nature; a critical review of a specified topic based upon a comprehensive search of the literature or available data; development of an item of equipment or a technique involving novel features or advanced design; or any other study acceptable to the Faculty.

DP requirements: None

Assessment: Written work counts 100%.

MEC5048S NON-DESTRUCTIVE TESTING & EVALUATION

12 NQF credits at HEQSF level 9; 24 lectures, 5 tutorials / assignments.

Convener: Mr D Findeis

Course entry requirements: BSc(Eng) degree

Course outline:

This course aims to develop an advanced understanding of non-destructive testing and evaluation. Topics include: Methods and guidance to non-destructive techniques. Selected topics in: Principles of Ultrasonic inspection and methods and their applicability. Electronic Speckle Pattern Interferometry as applied to flaw detection. Shearography as a novel optical non-contacting defect detection method. Eddy current versatility for the measurement of thickness of coatings, the detection of seams, cracks, voids and inclusions. Testing for flaws in composite materials by mechanical impedance and Infrared Thermography.

DP requirements: None

Assessment: Project, November examination 3 hours

MEC5049S ADVANCED REFRIGERATION

12 NQF credits at HEQSF level 9

Convener: Associate Professor G Vicatos

Course outline:

This course aims to develop an understanding of advanced refrigeration. Topics include: Aspects of compression refrigeration. Effects that degrade vapour compression refrigeration; multiple compression; multiple evaporators; flash chambers; and cascade systems. Aspects of absorption refrigeration. Theory of mixtures; absorption continuous cycle; mathematical and graphical analysis of the cycle; intermittent systems; lithium-bromide water system; water-ammonia-hydrogen system; and aspects of combined compression/absorption cycle: comparison of performance.

DP requirements: None

Assessment: Examination 3 hours.

MEC5051Z MECHANICAL ENGINEERING PROJECT

20 NQF credits at HEQSF level 9

Course entry requirements: Completion of appropriate postgraduate courses.

Course outline:

On the recommendation of the supervisor and with the agreement of the Head of Department, a student registered for a Master's degree may be permitted to enter into a programme of individual study on a specialised topic. A statement of objectives and/or a syllabus must be agreed upon, and the course of study will be guided by a member of the department, usually the supervisor. The programme will involve the student in about 180 hours of work. This can include assignments and projects of an appropriate nature. The course will be assessed by examination or project or both and an oral examination may be held thereafter, if required.

DP requirements: None

Assessment: Examination and/or project.

MEC5054Z INTRODUCTION TO BUSINESS ADMINISTRATION

Not offered in 2019

40 NQF credits at HEQSF level 9

Convener: Dr C Shaw

Course entry requirements: Registration for postgraduate qualification.

Course outline:

This course aims to provide an advanced introduction to business administration. Topics include: Introduction to business and the business environment; marketing management; finance management; human resources management; operations management; general management; quantitative methods in management economics, accounting, business and society.

Lecture times: Block release (two contact modules).

DP requirements: None

Assessment: Position papers 50%, portfolio of projects and reflective papers 50%.

MEC5060W MASTERS DISSERTATION SUSTAINABLE ENERGY ENGINEERING

180 NQF credits at HEQSF level 9

Course outline:

In exceptional cases and on the recommendation of the supervisor, and with the approval of the Head of Department, a student registered for the Master's degree may be permitted to enter a programme of individual study on a specialised topic, WITHOUT registering for additional course work. A research proposal must be agreed upon, and the supervisor will guide the project. The programme will involve the student in 1 440 hours of work, and a written report must be submitted, which will be examined by internal and external examiners.

DP requirements: None

MEC5061Z MASTERS DISSERTATION SUSTAINABLE ENERGY ENGINEERING

Not offered in 2019

120 NQF credits at HEQSF level 9

Course entry requirements: MEC5097Z DP.

Course outline:

The purpose of the dissertation, which complements the course work that is a requirement of the degree, is to afford the student the opportunity to demonstrate his/her ability to conduct independent research. Although the student will work under the direction of a supervisor, the quality and content of the work must be a reflection of the ability of the candidate. The subject chosen for the

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dissertation will be by mutual agreement between supervisor and student and should incorporate elements of the course work while also being relevant to the general field of sustainable energy. Where practical, the area of research chosen should be appropriate to the student's country of origin. A dissertation towards a MSc (Eng) degree may incorporate any or all of the following: design of all or part of an engineering or built environment project to a specification involving advanced concepts and theoretical principles; a research project of a theoretical and/or practical nature on an advanced topic belonging to the Engineering sciences; critical review of a specified topic based on a comprehensive search of the literature or available data pertinent to an advanced topic belonging to the Engineering Sciences development of an item of equipment or a technique involving novel features or advanced design; and any other study acceptable to the Faculty of Engineering & the Built Environment.

DP requirements: None

MEC5063Z AN INTRODUCTION TO FINITE ELEMENTS

12 NQF credits at HEQSF level 9; 36 lectures, 12 tutorials / lab sessions.

Convener: Professor BD Reddy

Course outline:

The finite element method (FEM) is a mathematical and numerical technique for finding solutions to boundary value problems for differential equations. FEM techniques are central to multiple engineering disciplines (eg Aeronautics, Biomechanics, Civil and many others) as they are particularly useful for solving differential equations over complex geometries. Topics covered in the course include: weak formulations of boundary value problems; the finite element method for one- and two-dimensional problems; coding the finite element method using Matlab; applications problems concerning heat conduction and electricity.

DP requirements: An average of 50% in all class tests. Submission of all assignments and projects.

Assessment: June examination

MEC5064Z FINITE ELEMENT ANALYSIS

12 NQF credits at HEQSF level 9; 36 lectures, 12 tutorials / lab sessions.

Convener: Professor BD Reddy

Course entry requirements: MEC5063Z.

Course outline:

This course is an extension of MEC5063Z into advanced topics. The course aims to provide students with an advanced understanding of finite element techniques and enable them to perform finite element analysis on a wider range of problems. Topics covered in the course include: incompressibility and mixed-methods; time-dependant problems; non-linear problems.

DP requirements: An average of 50% in all class tests. Submission of all projects and assignments.

Assessment: November examination.

MEC5065Z PROGRAMMING FOR SCIENTISTS AND ENGINEERS

12 NQF credits at HEQSF level 9; 36 lectures, 12 tutorials / lab sessions .

Convener: Professor BD Reddy

Course outline:

This course aims to prepare students for the development, implementation and management of engineering software for research and/or professional purposes. Such software is characterised by reliable, efficient and user-friendly programmes. Topics include: fundamentals of C++; program design and implementation; project management strategies; and algorithms and data structures. C++ will be used to demonstrate features and usage of modern object-oriented programming languages. A substantial project component is included.

DP requirements: A course mark (combined tests and projects) of at least 50%.

Assessment: June examination

MEC5066Z CONTINUUM MECHANICS

12 NQF credits at HEQSF level 9; 36 lectures, 12 tutorials / lab sessions.

Convener: Professor BD Reddy

Course outline:

This course aims to present a general introduction to continuum mechanics. Topics include: tensors; kinematics of continuous media; balance of mass, linear and angular momentum, and energy; stress; constitutive theory; linear elasticity; ideal fluids and Newtonian fluids.

DP requirements: An average of 40% in all class tests.

Assessment: June examination.

MEC5067Z NONLINEAR MATERIAL BEHAVIOUR

12 NQF credits at HEQSF level 9; 36 lectures, 12 tutorials.

Convener: Associate Professor S Skatulla

Course entry requirements: MEC5066Z

Course outline:

This course aims to develop an advanced understanding of nonlinear material behaviour. Topics in nonlinear mechanics; nonlinear elasticity; behaviour of elastic-plastic solids and non-Newtonian fluids are included.

DP requirements: An average of 40% in all class tests.

Assessment: November examination

MEC5068Z TOPICS IN COMPUTATIONAL & APPLIED MECHANICS

12 NQF credits at HEQSF level 9

Convener: Professor BD Reddy

Course entry requirements: MEC5063Z, MEC5066Z.

Course outline:

The aim of this course is to introduce advanced computational aspects of the finite element method using the modern, open-source finite element library deal.II. The topics covered include: non-linear problems, time-dependent problems, parallelisation and adaptivity. The course is project based.

DP requirements: None

Assessment: Project.

MEC5069Z COMPUTATIONAL FLUID DYNAMICS (CFD)

12 NQF credits at HEQSF level 9

Convener: Professor AG Malan

Course entry requirements: MEC4045F

Course outline:

This course provides a postgraduate level foundation to computational fluid dynamics (CFD). It entails mastering the fundamentals of a number of aspects of modern CFD. These include edge-based discretization, incompressible and compressible flow modelling, advanced solvers, turbulence modelling and selected aspects of free-surface flow modelling. To consolidate understanding, programming assignments make out an important part of the course. You will be writing your own solver and CFD codes, which will include both incompressible and compressible flow. Due to the modern nature of the course, recent journal publications will also be used for course material.

DP requirements: None

Assessment: Assignments and Examination.

MEC5070W DISSERTATION MATERIALS ENGINEERING

180 NQF credits at HEQSF level 9

Course outline:

The dissertation should incorporate any or all of the following: design of all or part of an engineering project to a specification involving advanced concepts and theoretical principles; a research project of a theoretical or practical nature; a critical review of a specified topic based upon

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a comprehensive search of the literature or available data; development of an item of equipment or a technique involving novel features or advanced design; or any other study acceptable to the Faculty.

DP requirements: None

Assessment: Written work counts 100%.

MEC5071Z MASTERS DISSERTATION MATERIALS ENGINEERING

120 NQF credits at HEQSF level 9

Course entry requirements: MEC5097Z DP

Course outline:

The dissertation should incorporate any or all of the following: design of all or part of an engineering project to a specification involving advanced concepts and theoretical principles; a research project of a theoretical or practical nature; a critical review of a specified topic based upon a comprehensive search of the literature or available data; development of an item of equipment or a technique involving novel features or advanced design; or any other study acceptable to the Faculty.

DP requirements: None

Assessment: Written work counts 100%

MEC5080Z MANAGING NEW VENTURE PROJECTS

20 NQF credits at HEQSF level 9

Convener: Dr C Shaw

Course entry requirements: Registration for a postgraduate qualification

Course outline:

The aim of this course is to assist students prepare a business plan for launching a high potential new business. Students will work in teams and be given the opportunity to pool skills and experience and apply these to a practical hands-on project, focused on developing a comprehensive plan for a new business.

Lecture times: 1 week of full time lectures with additional lectures as per schedule.

Assessment: Project, presentations and Learning Log .

MEC5089Z ENERGY PROJECT

Not offered in 2019

20 NQF credits at HEQSF level 9

Convener: Professor H Winkler

Course outline:

On the recommendation of the supervisor, and with the approval of the Director of the Energy Research Centre, a student registered for a Master's degree may be permitted to enter a programme of individual study on a specialised topic. A research proposal must be agreed upon, and the project will be guided by the supervisor. The programme will involve the student in 200 hours of work, and a written report must be submitted which will be examined by an internal and external examiner.

DP requirements: None

Assessment: Project(s) 100%.

MEC5092Z MASTERS DISSERTATION ENERGY & DEVELOPMENT STUDIES

Not offered in 2019

120 NQF credits at HEQSF level 9

Course entry requirements: MEC5097Z

Course outline:

The purpose of the dissertation, which complements the course work that is a requirement of the degree, is to afford the student the opportunity to demonstrate his/her ability to conduct independent research. Although the student will work under the direction of a supervisor, the quality and content of the work must be a reflection of the ability of the candidate. The subject chosen for the dissertation will be by mutual agreement between supervisor and student and should incorporate elements of the course work while also being relevant to the general field of sustainable energy or

energy and development. A dissertation towards a MPhil degree may incorporate any or all of the following: design of all or part of an engineering or built environment project to a specification involving advanced concepts and theoretical principles; a theoretical and/or practical research project of an inter-disciplinary nature; critical review of a specified topic based on a comprehensive search of the literature or available data of an inter-disciplinary nature; and any other study acceptable to the Faculty of Engineering & the Built Environment.

DP requirements: None

Assessment: Written work counts 100%

MEC5093W DISSERTATION ENERGY AND DEVELOPMENT STUDIES

180 NQF credits at HEQSF level 9

Course outline:

In exceptional cases and on the recommendation of the supervisor, and with the approval of the Head of Department, a student registered for the Master's degree may be permitted to enter a programme of individual study on a specialised topic, WITHOUT registering for additional course work. A research proposal must be agreed upon, and the supervisor will guide the project. The programme will involve the student in 1 440 hours of work, and a written report must be submitted, which will be examined by internal and external examiners. A dissertation towards a MPhil degree may incorporate any or all of the following: design of all or part of an engineering or built environment project to a specification involving advanced concepts and theoretical principles; a theoretical and/or practical research project of an inter-disciplinary nature; critical review of a specified topic based on a comprehensive search of the literature or available data of an inter-disciplinary nature; and any other study acceptable to the Faculty of Engineering & the Built Environment.

DP requirements: None

Assessment: Written work counts 100%.

MEC5095Z MINOR DISSERTATION ENGINEERING MANAGEMENT

60 NQF credits at HEQSF level 9

Convener: Dr C Shaw

Course entry requirements: Completion of appropriate postgraduate courses.

Course outline:

In agreement with a suitable supervisor, a research topic will be selected, a research proposal agreed, research will be undertaken and a research report prepared. This will represent at least 600 hours of work.

DP requirements: None

Assessment: The written report will be examined, and a further oral examination may be held.

MEC5097Z DISSERTATION PREPARATION

0 NQF credits at HEQSF level 9

Course outline:

The aim of this course is to allow a student to undertake preparatory work for the master's dissertation. Work required includes literature searches and reviews; identification of the research problem, objectives and hypothesis; consideration of research methodology; planning for the active research phase; and ensuring that research infrastructure (e.g. apparatus etc.) is or will be in place. The student should maintain regular contact with his/her supervisor in order to show evidence of suitable progress towards these aims. The supervisor must indicate satisfactory fulfilment of the course aims prior to the student proceeding to the dissertation.

DP requirements: None

MEC5099Z FUNDAMENTALS OF ENERGY SYSTEMS AND POLICY FOR DEVELOPMENT

Not offered in 2019

30 NQF credits at HEQSF level 9

Course outline:

The course aims to equip students with foundational understanding of basic and advanced energy concepts that can be applied in further coursework in both the MSc and MPhil energy streams, dissertation writing, and future studies or work in the field. The course is inter-disciplinary and accessible to students from a wide range of backgrounds, including engineering, science, humanities, social science, law and commerce. The course is set around overarching themes, including Energy for Development, Energy Transitions and Energy Justice, with particular application to the South African context. Through the lens of these themes, the course will explore and examine key concepts, including techno-economic, energy specific and policy concepts, thus addressing both 'qualitative' and 'quantitative' dimensions of energy analysis. Teaching of concepts and skills will be arranged around broader subject matter, such as transformations in energy markets and technologies, macroeconomics, and global climate change.

DP requirements: Attendance at lectures and seminars and submission of all assignments.

Assessment: 60% coursework (30% long paper, 30% class assignments and participation), 40% examination (20% theory and 20% quantitative).

MEC5100Z ENERGY SYSTEMS ANALYSIS

Not offered in 2019

30 NQF credits at HEQSF level 9

Course outline:

This course aims to deliver a practical introduction to techno-economic energy systems modelling and analyses in order to firstly, analyse existing energy systems to gauge deficiencies, vulnerabilities and inefficiencies: economic and technical; and secondly, inform plans of a future energy system that meets multiple objectives, including least-cost, socio-economic development and environmental sustainability.

Students will define and structure problems in order to assess model application and scope; understand the concept of scenarios and their formulation; analyse conventional and emerging energy technologies in order to quantify their relative performance against multiple criteria; construct energy system models (in context of economy, environment and social issues); comprehend their limitations and the uncertainty in model parameterisation; and translate model results into policy recommendations.

Students will be exposed to different types of energy systems models, learn how to setup and parameterise different types of models of energy demand and supply given available data, learn how to use the models to evaluate different courses of action/decisions in different uncertainty-driven scenarios.

DP requirements: Participation in practicals and completion of in-class exercises.

Assessment: Class assignments examining course content 20%-30%; examination covering key subject concepts 15%-20%; long assignment (practical modelling exercises with written report and oral presentation) 50%-60%

MEC5101Z ENERGY AND CLIMATE POLICY FOR SUSTAINABLE DEVELOPMENT

Not offered in 2019

30 NQF credits at HEQSF level 9

Course outline:

This course aims to train students to understand the importance and options in decision making in energy and climate policy and its impacts on environment and socio-economic development. The course develops an understanding of the conflicts around decision-making and provision of public goods in the energy sectors in developing countries, acknowledging the constraints of poverty and

inequality and a changing climate. Students will gain skills in methodologies from social science and humanities, and combine these with learning from the Energy Fundamentals course to be able to integrate knowledge across different disciplines to address multiple challenges. The course aims to apply methods and concepts from the following disciplines to analysis of energy and climate change: economics, geography, anthropology, sociology, law and political science.

MEC5102Z KNOWLEDGE AND PRACTICES IN ENGINEERING EDUCATION

15 NQF credits at HEQSF level 9

Course outline:

This course aims to provide Master's students with an introduction to conceptual frameworks in teaching and learning appropriate to engineering education. The aim is to provide conceptual tools to enable a critical approach to engineering knowledge and to enable reflection on higher education practice. Students should be able to: apply theoretical frameworks to engineering education practice; reflect critically on their own practices with reference to theoretical frameworks; identify and describe the principles behind curriculum design decisions; and understand the different forms of knowledge effective engineering educators draw on.

MEC6000W THESIS MECHANICAL ENGINEERING

360 NQF credits at HEQSF level 10

Course outline:

A PhD thesis is required to be an original, coherent and consistent body of work which reflects the candidate's own efforts. The thesis may not be more than 80 000 words. A candidate will undertake research, and such advanced coursework as may be required, under the guidance of a supervisor or supervisors appointed by Senate.

DP requirements: None

Assessment: Written work counts 100%.

MEC6002W THESIS ENGINEERING MANAGEMENT

360 NQF credits at HEQSF level 10

Course outline:

A PhD thesis is required to be an original, coherent and consistent body of work which reflects the candidate's own efforts. The thesis may not be more than 80 000 words. A candidate will undertake research, and such advanced coursework as may be required, under the guidance of a supervisor or supervisors appointed by Senate.

DP requirements: None

Assessment: Written work counts 100%.

MEC6003W THESIS SUSTAINABLE ENERGY ENGINEERING

360 NQF credits at HEQSF level 10

Course outline:

A PhD thesis is required to be an original, coherent and consistent body of work which reflects the candidate's own efforts. The thesis may not be more than 80 000 words. A candidate will undertake research, and such advanced coursework as may be required, under the guidance of a supervisor or supervisors appointed by Senate.

DP requirements: None

Assessment: Written work counts 100%.

MEC6004W THESIS MATERIALS ENGINEERING

360 NQF credits at HEQSF level 10

Course outline:

A PhD thesis is required to be an original, coherent and consistent body of work which reflects the candidate's own efforts. The thesis may not be more than 80 000 words. A candidate will undertake

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research, and such advanced coursework as may be required, under the guidance of a supervisor or supervisors appointed by Senate.

DP requirements: None

Assessment: Written work counts 100%.

MEC6005W THESIS ENERGY AND DEVELOPMENT STUDIES

360 NQF credits at HEQSF level 10

Course outline:

A PhD thesis is required to be an original, coherent and consistent body of work which reflects the candidate's own efforts. The thesis may not be more than 80 000 words. A candidate will undertake research, and such advanced coursework as may be required, under the guidance of a supervisor or supervisors appointed by Senate.

DP requirements: None

Assessment: Written work counts 100%.

MEC6006W THESIS ENGINEERING EDUCATION

360 NQF credits at HEQSF level 10

Course outline:

A PhD thesis is required to be an original, coherent and consistent body of work which reflects the candidate's own efforts. The thesis may not be more than 80 000 words. A candidate will undertake research, and such advanced coursework as may be required, under the guidance of a supervisor or supervisors appointed by Senate.

DP requirements: None

Assessment: Written work counts 100%.

END5050X MASTERS JOURNAL PAPER REQUIREMENT

0 NQF credits at HEQSF level 9

Course outline:

The aim of submitting a research paper for the masters' degree is to develop an understanding of what is required for the publication of research findings. To this end a candidate shall submit a summary of the key aspects of the dissertation, presented in the form of a paper which is, potentially, of publishable standard, approved by a Panel of Assessors. This is a requirement for candidates submitting either a 180 or 120 credit dissertation for the following degrees: MSc in Construction Economics and Management, MSc(Eng), MSc(ProjMan), MPhil, MSc in Property Studies. Refer to the appropriate degree rules.

DP requirements: None