NWU®

Fakulteit Ingenieurswese | Faculty of Engineering

Postgraduate
Nagraads

2020 Yearbook *Jaarboek*

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PLEASE MENTION YOUR UNIVERSITY NUMBER IN ALL CORRESPONDENCE.

The General Academic Rules of the University, to which all students have to subject themselves and which apply to all the qualifications offered by the University, appear in a separate publication and are available on the web page at: http://www.nwu.ac.za/yearbooks.

Please note: Although the information in this Calendar has been compiled with the utmost care and accuracy, the Council and the Senate of the University accept no responsibility whatsoever for errors that may occur. Before students finally decide on the selection of modules, they must consult the class timetable. If a clash occurs in the planned selection of a student, the relevant module combination is not permitted.

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NWU Office Bearers

Chancellor

Dr ATM Mokgokong

Vice-Chancellor

Prof ND Kgwadi

Vice-Principal

Prof L du Plessis

Deputy Vice-Chancellor: Assigned functions and Potchefstroom campus operations

Prof DM Balia

Deputy Vice-Chancellor: Planning and Vaal Triangle campus operations

Prof L du Plessis

Deputy Vice-Chancellor: Assigned functions and Mafikeng campus operations

Prof BMP Setlalentoa

Deputy Vice-Chancellor: Teaching and Learning

Prof R Balfour

Deputy Vice-Chancellor: Research and Innovation

Prof NR Phaswana-Mafuya

Executive Director: Student Life

Dr S Chalufu

Registrar

Prof MM Verhoef

NWU EXECUTIVE DEANS

Faculty of Economics and Management

Prof S Swanepoel

Faculty of Education

Prof L Conley

Faculty of Engineering

Prof L van Dyk

Faculty of Health Sciences

Prof AF Kotzé

Faculty of Humanities

Prof P Maseko

Faculty of Law

Prof SPLR de la Harpe

Faculty of Natural and Agricultural Sciences

Prof E Ebenso

Faculty of Theology

Vacant

FACULTY BOARD

Chairperson
Prof L van Dyk (Executive Dean)

Faculty Administrator
Vacant

Directors

School of Chemical and Minerals Engineering
Prof QP Campbell

School of Electrical, Electronic and Computer Engineering
Prof G van Schoor

School of Mechanical Engineering
Prof WLR den Heijer

School of Industrial Engineering
Prof SE Terblanche

Centre for Engineering Education
Prof M le Roux

Unit for Energy and Technology Systems
Prof FB Waanders

Business Development and Stakeholder Engagement
Prof M van Eldik

Academic staff

Professor
Prof JA de Kock

Associate Professors
Prof DE Serfontein
Vacant
Vacant

Senior Lecturers
Mr CJ Schabort
Dr HJ Marais
Vacant
Vacant

Lecturers
Mr PJ Tolmay
Mr PvZ Venter
Mr JD Human
Dr R Coetzee

Junior Lecturers
Mr JA Bezuidenhout
Me C du Plessis

NRF Rated Researcher
Prof R Gouws

Student Representative
Chairperson Ingenium

RESEARCH

Unit for Energy and Technology Systems
Prof FB Waanders

Centre of Excellence in Carbon Based Fuels
Prof FB Waanders

Centre for Research and Continued Engineering Development (CRCED)
Prof EH Mathews

Centre of Competence - Hydrogen Energy
Dr DG Bessarabov

Niche Area: Multilingual Speech Technologies (MuST)
Prof MH Davel

Centre for Advanced Manufacturing
Mr DB Vorster

RESEARCH CHAIRS

DTI Chair in Nuclear Engineering
Prof CG du Toit

SARChI Chair in Coal Research
Prof JR Bunt

DST/NRF Research Chair in Biofuels and Other Clean Alternative Fuels
Prof S Marx

Eskom Power Plant Engineering Institute (EPPEI) Specialisation Centre for Emission Control
Dr DJ Branken

RESEARCH GROUPS

Visit the website for more information on each subgroup: http://engineering.nwu.ac.za/

HIGHER DEGREES MANAGERS

M & PhD Manager and Ethics (ENG-REC)
Dr R Coetzee

Chair Higher Degrees Committee
Prof FB Waanders

HIGHER DEGREES PROGRAMME MANAGERS

Chemical and Minerals Engineering
Prof HWJP Neomagus

Electrical, Electronic and Computer Engineering
Dr M Ferreira

Industrial Engineering
Dr R Coetzee

Mechanical Engineering
Dr J Kruger

Nuclear Engineering
Prof DE Serfontein

Centre for Research and Continued Engineering Development (CRCED)
Dr JF van Rensburg

ENG.1 FACULTY RULES

ENG.1.1 AUTHORITY OF THE GENERAL ACADEMIC RULES

The faculty rules valid for the different qualifications, programmes and curricula of this faculty and contained in this faculty calendar are subject to the General Rules of the University, as determined from time to time by the Council of the University on recommendation by the Senate. The faculty rules should therefore be read in conjunction with these General Academic Rules.

The Manual for Masters and Doctoral students, with specific guidelines and procedures for masters and doctoral studies, as well as quality measures of research entities also apply.

ENG.1.2 FACULTY-SPECIFIC RULES

a) In accordance with General Academic rule 1.3.2., programme-specific requirements are specified in this yearbook, whilst faculty specific procedures are published in the relevant quality manual of the faculty.

b) In accordance with General Academic Rule 1.3.5., when amendments are made to the Faculty Rules, and approved by senate before the next version of the yearbook is published, steps must be taken to bring the amendments to the attention of all students in the faculty who are affected thereby. These steps may include electronic communication and changing information on the web page of the faculty.

ENG.1.2.1 Application, selection and admission to the university

a) In combination with General Academic Rule 1.5.1., no student will be considered for selection if the formal application process has not been followed.

b) In combination with General Academic Rule 1.5.2.1., the faculty also reserves the right to set selection criteria, in addition to the minimum admission requirements, and apply such criteria to admit or refuse admission to specific qualifications and programmes, taking into consideration the faculty's targets for the size (total number of students) and shape (fields of study and diversity profile) of the student population, and the capacity available to the faculty to offer the qualifications and programmes concerned.

c) Selection will take place during the approved time schedules of the NWU annual academic calendar.

d) Prospective students must consult the Faculty postgraduate website to guide them towards the process of identifying a study leader. The study leader will then sign a study leader acceptance form, which must accompany the application form. Students will not be allowed to register unless a study leader has been confirmed.

ENG.1.2.2 Admission and advanced standing on grounds of recognition of prior learning

a) In accordance with General Academic Rule 1.6.2., the process of equivalence-setting between such learning and formal modules must be documented following the Faculty Standard for RPL Portfolio Template for the correct processes and procedures to be followed.

b) In accordance with General Academic Rule 1.6.2., the outcome of the RPL evaluation will be recorded using a standardised evaluation report and the official student record.

c) Recognition of prior learning (RPL) applications will be endorsed at the faculty board.

ENG.1.2.3 Annual registration

a) In accordance with General Academic Rule 1.10.1.3., the faculty also reserves the right to refuse or cancel the registration of a student where an applicant provides false, incorrect or incomplete information or documentation material during registration as a student, or where any other condition provided for in these rules is not satisfied.

b) In accordance with General Academic Rule 1.10.1.4, the requirements for active participation by students in specific programmes will be set out in the applicable study guides and postgraduate yearbook and students may not register for modules in which they are unable to or intend not to actively participate.

c) With reference to General Academic Rule 4.7.2 & 5.7.2, an existing postgraduate student who fails to re-register for any academic year, must apply for re-admission and continuation. Such student will be responsible for paying outstanding tuition fees of preceding year(s) as well.

ENG.1.2.4 Research proposal and title registration

a) In accordance with General Academic Rule 4.9.4. & 5.9.4., every research proposal is subject to ethical clearance as provided for in the applicable quality manual of the faculty and relevant policies, and confirmation of ethics approval must be submitted to the relevant faculty committee.

b) In accordance with General Academic Rule 4.9.5. & 5.9.5, if a student fails to present a research proposal as referred to above for approval in time, the study may, after due notification, be terminated by the faculty.

c) If a student failed to register a title as referred above, and there is valid reasons for not registering a title, the student may apply to the faculty board to re-register in the following academic year without a registered title on condition that the title must be registered within six months from the second registration.

d) The Faculty Board ratifies the approved title registrations.

ENG.1.2.5 Submission to rules and resolutions

In accordance with General Academic Rule 1.10.2., by signing and submitting either on paper or electronically the prescribed application and registration forms, the applicant or registered student agrees to be bound by the applicable rules, policies and resolutions of the university and the faculty until the registration of the student is terminated.

ENG.1.2.6 Active enrolment

a) Students of the faculty registered for research degrees must be actively involved in the study guidance process as agreed with the supervisor/promoter as well as research activities of the applicable entity or project.

b) The registration of a student who fails to participate satisfactorily in the activities referred to in Academic rule 1.10.3.1 is subject to review in accordance with the progression requirements provided for in Academic rule 1.16, or as specified in programme specific requirements in the postgraduate yearbook.

ENG.1.2.7 Extension of period of study

a) In accordance with General Academic Rule 4.14 & 5.13, the provisions for an extension of a study period is available in the faculty quality manual

b) In combination with General Academic Rules 4.14.2 & 5.13.2, an application for extension of the study period must also be endorsed by the relevant faculty committee.

ENG.1.2.8 Monitoring of academic performance

Each semester, each supervisor must submit a report on the progress made by each student on the research component of the programme concerned. This must be submitted to and considered by the Higher Degrees committee to be considered at the first committee meeting of April as well as the first committee meeting of September. The Higher Degrees committee will – based on these reports – recommend to the executive dean to issue an official warning. Simultaneously each student must submit a confidential report about progress made and supervision received to the executive dean, research director and school director concerned. Based on the above recommendation by the Higher Degrees committee and the confidential student report, the executive dean, in consultation with the research director and school director will decide on appropriate action, which may include the issuing of a written warning or an appropriate intervention in consultation with the supervisor.

ENG.1.2.9 Termination of Studies

In accordance with General Academic Rule 1.18.4, a student whose studies have been terminated may apply for admission to another study programme but must in the course of the application mention the termination.

ENG.1.2.10 Student academic requests

No academic request will be approved without submission and processing of a formal student request form, which will be processed according to the guidelines outlined in the applicable faculty quality manual. No verbal approval will be given for any student request. All decisions will be confirmed and noted in the minutes of the relevant faculty committee meeting and recorded on the student's academic record.

ENG.1.2.11 Examination

ENG.1.2.11.1 Submission of the research product for examination

a. The student must give notification (on the prescribed form) of his/her intention to submit for examination during the period set out for it in the annual University calendar.

b) A student who is not registered may not give notice to submit.

ENG.1.2.11.2 Recommendation to the examination of the research product in a master's or doctoral degree

a) In accordance with General Academic Rule 4.11.5.1., an examiner may recommend that a research product –

- be accepted unconditionally; (Faculty rules make provision that smaller typographical errors for instance typo errors, spelling errors, grammatical errors, etc. can be included in this option.)
- be accepted on condition that specified revisions be made to the satisfaction of the supervisor; (If the research is considered scientifically in order and acceptable, faculty rules make provision that revision of errors of a greater extent, for instance refining of arguments and/or logical restructuring or improving of layout and technical finishing may be included in this option.)
- be accepted on condition that specified revisions of a substantive nature be made to the satisfaction of the examiners or the academic director concerned; (Faculty rules allow for feedback to be submitted to an examiner by means of a detailed rebuttal which focuses on the specific recommendations and/or required changes called for.)
- not be accepted in its current format, in which case it is referred back to the candidate for revision, elaboration or amendment and resubmission for re-examination; (Faculty rules require that a final mark below 50% must be awarded for a dissertation/mini-dissertation, should this option be opted for. This option further entails that the research is scientifically not adequate or in order and should be expanded and/or revisited. Feedback may be submitted to the examiner during re-examination by means of a detailed rebuttal letter which focuses on the specific recommendations and/or required changes called for. The mini-dissertation/dissertation/thesis will be submitted to the examiner for re-examination unless it is decided otherwise by the Faculty Board or its delegates in which case the examiner will receive notification from the executive dean.) or

- not be accepted at all, in which case the candidate fails. (This option entails specifically that the research has failed in its totality, that it cannot be reworked or resubmitted and that the student must start all over.)

ENG.1.2.12 Intellectual property in and publication of research products

a) In accordance with General Academic Rules 4.12.1. & 5.12.1., the university (and faculty) is the owner of all intellectual property that may be created in the course of a master's degree study, which includes, but is not limited to intellectual property referred to in the Intellectual Property Rights from Publicly Financed Research and Development Act 51 of 2008 and the regulations promulgated thereunder.

b) In accordance with General Academic Rules 4.12.2. & 5.12.2., the university (and faculty) is entitled to physically or electronically multiply and distribute or make available any research product submitted in its final form by a master's degree candidate.

ENG.1.2.13 Master's degrees

ENG.1.2.13.1 Requirements for a master's degree

In accordance with General Academic Rule 4.3.4, where coursework modules are required in a master's degree programme, those modules must be completed before the research component may be submitted for examination.

ENG.1.2.13.2 Supervision

a) In accordance with General Academic Rule 4.8.2., a student admitted to a master's degree programme works under the supervision of a supervisor appointed, subject to the approval of the faculty board, by the academic director concerned.

b) With reference to General Academic Rule 4.8.5., if a co-supervisor is appointed on the grounds of relevant technical expertise despite such a person not being in possession of a master's degree, such applications will be motivated by the applicable research director, applicable research committee and recommended for approval by the executive dean.

ENG.1.2.13.3 Appointment of examiners for the research component of a master's degree

a) In accordance with General Academic Rule 4.11.1.1, the executive dean will appoint, with the approval of the relevant faculty higher degrees committee concerned, at least two examiners, of which at least one must be an external examiner, for the examination of the research product of every master's degree study.

b) Additional faculty requirements:

- Two (2) uninvolved persons as examiners, at least one (1) of which must be an external examiner;
- Conflict of interest must be considered;
- Examiners who functioned as co-workers in the same project or article will not be appointed as examiners;
- External examiners (if more than one is appointed) may not be affiliated to the same institution/department;
- Examiners must have as minimum requirement a master's degree or equivalent qualification.
- Recurrent usage of the same examiners should be avoided;
- Persons who served as postgraduate students of a supervisor during the past 36 months will not be appointed as examiner for students of the same supervisor;
- Extraordinary staff members are appointed as internal examiners;
- Academics who were affiliated to the NWU and have since moved to another institution, may after a period of 36 months be appointed as external examiners.

ENG.1.2.14 Doctoral degrees

ENG.1.2.14.1 Requirement for completion of a doctoral degree

In accordance with General Academic Rule 5.3.2., a doctoral candidate is required to have at least one full-length research paper on aspects of the thesis accepted for review in an accredited journal before results are finalised.

ENG.1.2.14.2 Requirements for the research component of a doctoral degree

In accordance with General Academic Rule 5.4.2., it may be required by the specific research entity in terms of quality specifications that full or partial compliance with the research component of a doctoral degree may take the form of one or more publishable or published research articles in a specified field, taking into account the requirements of General Academic Rules 5.10 and 5.12 and specifying the minimum number of research articles required in lieu of a thesis or the research component of a doctoral degree.

ENG.1.2.14.3 Supervision

In accordance with General Academic Rule 5.8.2., a candidate admitted to a doctoral degree programme works under the supervision of a promoter and co-promoter where applicable, appointed, subject to the approval of the faculty board, by the academic director concerned.

ENG.1.2.14.4 Appointment of examiners for the research component of a doctoral degree

a) In accordance with General Academic Rule 5.11.1.1, the executive dean will appoint, with the approval of the relevant faculty higher degrees committee concerned, at least three examiners, of which at least two must be external examiners, for the examination of the research product of every doctoral degree study.

b) Additional faculty requirements are as follows:

- One (1) uninvolved examiner, affiliated with the university will be appointed as internal examiner and two (2) external examiners, of which one must preferably be situated abroad or must be internationally accredited;
- Conflict of interest must be considered;
- Examiners who functioned as co-workers in the same project or article will not be appointed as examiners;
- External examiners who are appointed may not be affiliated with the same institution/department;
- Examiners will have as minimum requirement a doctoral degree or equivalent qualification, and at least one examiner must have delivered students at the same qualification level before successfully;
- At least one examiner should have publications in the field within which the research has been completed;
- Recurrent usage of the same examiners will be avoided;
- Persons who served as postgraduate students of a supervisor during the past 36 months will not be appointed as examiner for students of the same promoter;
- Extraordinary staff members are appointed as internal examiners;
- Academics who were affiliated to the NWU and have since moved to another institution, may after a period of 36 months be appointed as external examiners.

ENG.1.2.14.5 Examination and moderation

With reference to General Academic Rule 5.11.2.3., only the examination materials, and not any additional summative assessment components, will be submitted for external moderation.

ENG.1.3 WARNING AGAINST PLAGIARISM

Assignments are individual tasks and not group activities (unless explicitly indicated as group activities). For further details see:

http://www.nwu.ac.za/content/policy_rules

ENG.1.3.1 Academic misconduct

Academic misconduct includes plagiarism and academic dishonesty (copying from others during examinations). Dishonest academic conduct is a serious transgression, regardless of whether it takes place orally, by conduct or in writing, during examinations or in the context of other forms of evaluation such as assignments, theses, reports and publications. It is the policy of the University that no form of academic dishonesty will be tolerated and should any such action be reported or observed and the transgressor be found guilty, s/he will be punished in terms of the University's disciplinary policies, rules and procedures. Hence there are two overarching types of academic misconduct, namely:

ENG.1.3.1.1 Plagiarism[1] and academic dishonesty

[1] *The author acknowledges with gratitude the work of the UK Centre for legal education, Pauline Ridley, University of Brighton, and the University of Pretoria's Plagiarism Prevention Policy on the topic of academic plagiarism.*

Plagiarism is the word attributed to a specific type of academic dishonesty – the repeating of somebody else's words, or even the offering of somebody else's train of thought as if it were one's own. Traditionally plagiarism is defined as the taking of the words, images, ideas, etc. of an author and presenting them as if they were one's own. This may manifest itself in a variety of ways and is not limited to students' writings of published articles or books. The cutting and pasting of web pages in itself is regarded in higher education as plagiarism if the web pages are not properly acknowledged and quoted. Whatever the source of the material or the intended outcome, plagiarism is cheating and is therefore unacceptable.

What then if one copies large portions of work **AND** uses quotation marks with accurate references, and one also links one's own opinion to them? Can one regard it as one's "own" work? On the level of higher education, it is expected of you to develop your **own** voice and opinions and to build on other people's work, rather than to hide behind it. It would therefore be regarded as bad academic practice but not as plagiarism.

Make sure that you fully understand plagiarism and that you are familiar with the policies and regulations that relate to plagiarism. Plagiarism is a serious academic transgression, but you are on the right track if you are clear, careful and honest. Do not let a fear of plagiarism prevent you from fully utilising the rich resources that are available. Turnitin.com and Research Resources provide a checklist for preventing plagiarism.

Learn how to write in the style of your discipline. Your writing must be **YOUR** writing.

Learn to think critically and independently. Readers are interested in **your** understanding of an idea. Writing is a valuable exercise that tests your ability to explain a subject. It is an important part of learning.

Always give the necessary acknowledgement for every reference you use in your writing. Any ethically responsible writer **always** acknowledges the contributions of others and the source of his/her ideas.

Any verbatim text of another author that is used must be placed in quotation marks and quoted accurately.

When you paraphrase and/or summarise the work of others, reflect the exact meaning of the other author's ideas or facts in your own words and sentence structure.

Responsible authors have an ethical responsibility towards readers and the authors from whom they borrow to respect the ideas and words of others and to acknowledge those from whom they borrow – and where possible to use their own words when they paraphrase.

It is **NOT** an excuse that you had not **MEANT** to commit plagiarism or had not **KNOWN** that you were doing it.

ENG.1.3.1.1.1 Punishment for transgressions, which is not limited to the two instances discussed in the previous section, may include one or a combination of the following:

- Expulsion from the University, with or without notice to all or specific other higher education institutions and appropriate occupational or professional bodies;
- Suspension from the University for a period of time, subject to conditions which are justifiable on educational grounds and acceptable within the institutional culture of the University;
- Permanent expulsion from a residence, or refusal of access to all or some of the buildings, land or services of the University or admission only subject to specific conditions;
- Suspension from attending classes for a specific period, either totally or only in respect of specific course units;
- Refusal of admission to any examination or test occasion, which includes forfeiture of any marks already obtained and the cancellation of any subject or course unit;
- Imposition of a fine, which may not exceed an amount equal to the fees payable by the student for the particular year;
- Refusal of readmission to the University for a specific period or permanently, with or without notice to all or specific higher education institutions;
- Disallowing of specific privileges as a student, with or without conditions that are justifiable on educational grounds and acceptable within the institutional culture of the University;
- Imposition of any other penalty, combination of penalties or suspended penalty that, from the educational point of view and in accordance with the institutional culture of the University, is reasonable and fair in the circumstances; or

- A severe admonition and caution.

ENG.1.4 CAPACITY STIPULATION

Please take cognizance of the fact that, owing to specific capacity constraints, the University reserves the right to select candidates for admission to certain fields of study. This means that prospective students who comply with the minimum requirements may not necessarily be admitted to the relevant courses.

ENG.1.5 QUALIFICATIONS, PROGRAMMES AND CURRICULA

POSTGRADUATE DIPLOMA				
Qualification	**Qualification Code**	**Mode of delivery**	**Campus**	**NQF level**
Postgraduate Diploma in Nuclear Science and Technology	**7AB D01**	Contact	PC	8

MASTER'S DEGREES (Structured)					
Qualification	**Specialisation**	**Qualification Code**	**Mode of delivery**	**Campus**	**NQF level**
Master of Engineering in Nuclear Engineering ***(MEng)***		**7DA P01** **** 702 104**	Contact	PC	9
Master of Sciences in Engineering Sciences **(MSc) ***	Nuclear Engineering	**203 200**	Contact	PC	9

* No new admissions from 2020

** Old qualification code – refer to older calendars for more information

MASTER'S DEGREES (Research)					
Qualification	**Specialisation**	**Qualification Code**	**Mode of delivery**	**Campus**	**NQF level**
Master of Engineering in Chemical Engineering		**7CE N01** ** 702 110	Contact	PC	9
Master of Engineering in Computer and Electronic Engineering		**7CD N01** ** 702 109	Contact	PC	9
Master of Engineering in Electrical and Electronic Engineering		**7CC N01** ** 702 108	Contact	PC	9
Master of Engineering in Industrial Engineering		**7CP N01**	Contact	PC	9
Master of Engineering in Mechanical Engineering		**7CB N01** ** 702 107	Contact	PC	9
Master of Engineering	Development and Management Engineering	**7CF N01** ** 702 111	Contact	PC	9
Master of Science in Engineering Sciences with **(MSc) Engineering Sciences**	Chemical Engineering	**7CM N02** ** 203 152	Contact	PC	9
	Computer and Electronic Engineering	**7CM N04** ** 203 154	Contact	PC	9
	Electrical and Electronic Engineering	**7CM N03** ** 203 153	Contact	PC	9
	Mechanical Engineering	**7CM N01** ** 203 151	Contact	PC	9
	Nuclear Engineering	**7CM N05** ** 203 200	Contact	PC	9

** Old qualification code – refer to older calendars for more information

DOCTORAL DEGREES					
Qualification	**Specialisation**	**Qualification Code**	**Mode of delivery**	**Campus**	**NQF level**
Doctor of Philosophy in Engineering	Chemical Engineering	**7CA R01** ** 703 104	Contact	PC	10
	Computer Engineering	**7CA R03** ** 703 113	Contact	PC	10
	Computer and Electronic Engineering	**7CA R02** ** 703 109	Contact	PC	10
	Electrical Engineering	**7CA R06** ** 703 105	Contact	PC	10
	Electronic Engineering	**7CA R07** ** 703 106	Contact	PC	10
	Electrical and Electronic Engineering	**7CA R05** ** 703 108	Contact	PC	10
	Industrial Engineering	**7CA R11** ** 703 110	Contact	PC	10
	Development and Management Engineering	**7CA R04** ** 703 111	Contact	PC	10
	Mechanical Engineering	**7CA R09** ** 703 107	Contact	PC	10
	Nuclear Engineering	**7CA R10** ** 703 112	Contact	PC	10

** Old qualification code – refer to older calendars for more information

ENG.1.6 PROGRAMME OUTCOMES

DOCTOR OF PHILOSOPHY (*PhD*)	**The programme outcomes have been achieved if the student has made an original contribution to knowledge in the chosen field as evidenced by a thesis with proper structure, style, and language that includes:** • Identification and formulation of an original engineering research problem; • Critical engagement with existing knowledge to compile a comprehensive and relevant exposition thereof, which also reveals the originality of the envisaged contribution; • Development and execution of appropriate and advanced research procedures to solve research problem and verify solution; • Assessment, validation and conclusion of research results and solutions; and • Communication and defence of the research problem, research process, research results and the originality of the contribution.
MASTER OF ENGINEERING (*MEng*)	**The programme outcomes have been achieved if the student demonstrates competence in applying research methodology as evidenced by a dissertation with proper structure, style, and language that includes:** • Identification and formulation of an engineering research problem; • Critical engagement with existing knowledge to compile a relevant literature survey; • Development and execution of appropriate research procedures to solve research problem and verify solution; • Assessment, validation and conclusion of research results and solutions; and • Communication of the research problem, research process and research results.
MASTER OF SCIENCE IN ENGINEERING SCIENCES (*MSc*)	**The programme outcomes have been achieved if the student demonstrates competence in applying research methodology as evidenced by a dissertation with proper structure, style, and language that includes:** • Identification and formulation of a research problem within the context of engineering science; • Critical engagement with existing knowledge to compile a relevant literature survey; • Development and execution of appropriate research procedures to solve research problem and verify solution; • Assessment, validation and conclusion of research results and solutions; and • Communication of the research problem, research process and research results.

ENG.1.7 PROGRAMME ASSESSMENT CRITERIA

DOCTOR OF PHILOSOPHY (*PhD*)	Question existing knowledge boundaries and practices in the field related to research problem. Formulate complex, unfamiliar problems in the field of Engineering. Deal with complexity, lacunae and contradictions in the knowledge base of the field of Engineering to identify and formulate an original research problem.
	Demonstrate in-depth and critical knowledge and high levels of theoretical understanding in a complex and specialised area within the field of Engineering and/or across specialised or applied areas and expand or redefine existing knowledge in the field of Engineering. Show mastery of the literature and state of research in area related to the research problem.
	Use intellectual independence and advanced research skills through the ability to apply sophisticated knowledge and research methodologies towards solving the research problem and to verify the solution.
	Execute autonomous independent judgements about information and concepts at highly abstract levels and make evaluations of research results on the basis of independently generated criteria and confirm that the proposed solution solves the research problem.
	Compile an appropriately structured and coherent written thesis to communicate and defend the research problem, research process, research results and originality of the contribution and to demonstrate accomplishments of all other outcomes. This may be presented in traditional monograph format, or as a thesis based on a series of journal articles authored by the candidate. Disseminate some research results by means of academic journals and/or conferences.
MASTER OF ENGINEERING (*MEng*)	Identify knowledge boundaries and practices in the field related to research problem. Within this context, formulate a research problem in the field of Engineering.
	Demonstrate knowledge and theoretical understanding in a specialised area within the field of Engineering. Synthesise existing knowledge in the field of Engineering. Show mastery of the literature and state of research area related to the research problem.
	Use appropriate research skills to apply appropriate knowledge and research methodologies towards solving the research problem and to verify solution.
	Execute judgements and make evaluations to confirm that the proposed solution solves the research problem. Apply theoretical insights and research findings beyond the context of research process.
	Compile an appropriately structured and coherent written dissertation to communicate the research problem, research process and research results and to demonstrate accomplishment of all the other outcomes.

MASTER OF SCIENCE IN ENGINEERING SCIENCES (*MSc*)	Identify knowledge boundaries and practices in the field related to research problem. Within this context, formulate a research problem in the field of Engineering science.
	Demonstrate knowledge and theoretical understanding in a specialised area within the field of Engineering and/or across specialised or applied areas and expand or redefine existing knowledge in the field of Engineering. Show mastery of the literature and state of research in area related to the research problem.
	Use appropriate research skills to apply appropriate knowledge and research methodologies towards solving the research problem and to verify solution.
	Execute judgements and make evaluations to confirm that the proposed solution solves the research problem. Apply theoretical insights and research findings beyond the context of research process.
	Compile an appropriately structured and coherent written dissertation to communicate the research problem, research process and research results and to demonstrate accomplishment of all the other outcomes.

ENG.2 THE POSTGRADUATE DIPLOMA

ENG.2.1 RULES FOR THE POSTGRADUATE DIPLOMA

ENG.2.1.1 Duration (minimum and maximum duration)

The minimum term of study is **one (1) year** and the maximum term of study is **two (2) years**.

ENG.2.1.2 Admission requirements for the qualification

- Three-year BSc degree (with Mathematics or Physics, at least at second year level); or
- BTech (Engineering).

ENG.2.1.3 Method of presentation

The modules are presented by means of a distance-contact method. The e-learning platform e-Fundi, with an interactive site for each module, enables students to participate in well-structured self-study learning activities prior to attending the contact lecture session.

Six to eight weeks, of which one week is a contact session, are scheduled for each module. Students may not register for more than two modules being presented simultaneously, except if it is for the Nuclear Engineering Project.

All lectures of a specific module are presented in one week. The other weeks are used for self-study, assignments and assessment. During this period students have access to a facilitator who will provide support as required.

ENG.2.2 POSTGRADUATE DIPLOMA IN NUCLEAR SCIENCE AND TECHNOLOGY

ENG.2.2.1 Curriculum: I501P / I502P

Qualification code: 7AB D01

Delivery mode: Contact-Distance

This programme provides learners with:

- a wider and deeper knowledge of nuclear science;
- advanced training in the field of nuclear science and technology;
- problem-solving abilities;
- integration of knowledge across fields; and
- the ability to execute a project in the field of nuclear science and technology.

ENG.2.2.1.1 List of modules

Module code	Descriptive name	Prerequisites	Credits
NUCI 511	Nuclear Engineering I	-	16
NUCI 521	Introduction to Thermal-Fluid Sciences	-	16
* NUCI 571	*Mathematics for Nuclear Engineers*	-	16
* NUCI 572	*Nuclear Reactor Technology*	-	16
NUCI 573	Nuclear Reactor Safety	-	16
NUCI 574	Nuclear Engineering Project	-	16
* NUCI 575	*Nuclear Physics*	-	16
NUCI 576	Radiation and the Environment	-	16
NUCI 577	Reactor Analysis	-	16
NUCI 578	Nuclear Engineering II	-	16
NUCI 579	Nuclear Project Management	-	16

* *No longer available from 2020*

** The Unit reserves the right not to offer certain modules during a certain year.

ENG.2.2.2 Curriculum outcomes

The Postgraduate Diploma in Nuclear Science and Technology pursues knowledge and innovation in the field of nuclear power generation and develops and empowers graduates to think laterally and critically in this field.

ENG.2.2.3 Compilation of curriculum

The curriculum comprises 4 core modules, 3 fundamental modules and a project report. Together, all of these 16-credit modules, as well as the 16-credit module report accumulate to the diploma's total of 128 credits.

One credit represents 10 notional study hours, which suggests that a student should expect to spend at least 1280 study hours on the programme.

Components	Composition	Credits
Project Report	Core (Compulsory)	16
7 x Modules	Core (Compulsory)	16 each
Total credits for the curriculum		**128**

ENG.3 THE DEGREE MASTER OF ENGINEERING

ENG.3.1 RULES FOR THE DEGREE MASTER OF ENGINEERING

ENG.3.1.1 Duration

Refer to A-Rule 1.14.

ENG.3.1.2 Minimum admission requirements for the qualification

a) The student holds an applicable four (4) year bachelor's degree (ECSA-accredited) in engineering or an equivalent qualification.

b) Nuclear Engineering:

- Students holding either a **BEng (Chemical)** or **BEng (Mechanical)** degree can be required to register for the bridging module Mathematics for Nuclear Engineers (**NUCI 671**).
- Students holding a **BEng (Electrical/Electronic)** can be required to register for both the bridging modules Mathematics for Nuclear Engineers (**NUCI 671**) and Introduction to Thermal-Fluid Sciences (**NUCI 621**).
- The Research Director, in consultation with the Higher Degree Programme Manager, may determine that there will be no separate examinations for these bridging modules. In such an instance the purpose of the bridging modules will be viewed purely as supplying background knowledge and skills for the modules that follow them. Therefore, the only form of testing as to whether the outcomes of the bridging modules have been achieved will be the examinations of the modules that follow on it. In such a case the bridging modules might be taught in a flexible manner where specific blocks of content may be taught just prior to those modules that need this knowledge most, or it can even be integrated with the presentation of such modules.

** The credits for the two bridging modules do not count towards the 180 credits for the master's degree.*

*** The required bridging modules for specific students may be determined by discretion of the study leader, in consultation with the Research Director.*

ENG.3.1.3 Composition of the programme

The master's degree programme allows for two options, namely a Research Masters and a Structured Masters. All structured master's degrees have been phased out, except for the one in Nuclear Engineering. These options allow different combinations of coursework and/or research, as shown below in the following table. The research is based on an engineering problem leading to a synthesised solution based on engineering methods and designs.

Research		**Structured (Nuclear)**	
Description	**Credits**	**Description**	**Credits**
Dissertation	180	Dissertation	100
		5 x Modules	16 each
Total	**180**	**Total**	**180**

Composition of Structured (Nuclear)			
Module code	**Descriptive name**	**Co-requisites**	**Cr**
NUCI 872	Dissertation	-	100
NUCI 811	Nuclear Engineering I	-	16
NUCI 883	Nuclear Engineering II	NUCI 811	16
NUCI 887	Reactor Analysis	NUCI 811	16
NUCI 888	Reactor Safety	NUCI 811	16
NUCI 879	Nuclear Project Management	-	16
Total credits for the curriculum			**180**

ENG.3.1.4 Faculty-specific requirements

The title of the dissertation, the research proposal and the appointment of external examiners must be reviewed by the Higher Degrees Committee. Additional information regarding rules and procedures are contained in the Faculty-specific rules, General Academic Rules 4.9, 4.10 and 4.11, and also in the Manual for Masters and Doctoral Study Sections 2.5 and 3.

In addition to attaining the abovementioned outcomes, students are also required to:

- Participate in at least one formal colloquia and/or technical conference where aspects of their work are presented to an audience of peers; and
- Have at least one full-length research paper on aspects of the thesis submitted for review in an accredited journal OR have two papers accepted in accredited peer reviewed conference proceedings on aspects of the thesis before results are finalised (Rules 4.10.4, 4.10.5).

ENG.3.1.5 List of modules

To graduate with a MEng in Engineering, the student must accumulate a total number of 180 credits. Each credit represents 10 hours of notional study. The student registers for structured course modules relevant to a specific curriculum that enables him/her to obtain the relevant qualification. The approved structured course modules for the master's degree curricula in the Faculty of Engineering, are listed below.

UNIT FOR ENERGY AND TECHNOLOGY SYSTEMS			
Programme	**Module code**	**Descriptive name**	**Credits**
Chemical	CEMI 871	Dissertation	180
Computer, Electrical & Electronic	EERI 871	Dissertation	180
Industrial	INGB 871	Dissertation	180
Mechanical	MEGI 871	Dissertation	180
Development and Management	IIOB 871	Dissertation	180
Nuclear (Research)	NUCE 871	Dissertation	180
Nuclear (Structured)	NUCI 621	Introduction to Thermal-Fluid Sciences	16
	NUCI 671	Mathematics for Nuclear Engineers	16
	Core modules as seen above in ENG.3.1.3		

ENG.3.1.6 Course modules from other curricula

A student may register for any postgraduate structured course module offered by any other Faculty, but only after consultation with the appropriate Programme Manager and the student's study leader, provided that:

- more than 50% of the structured course modules are within the relevant curriculum;
- the complimentary structured course modules available, are relevant to the proposed research project, with prior approval from the study leader, on an NQF level 9, with the appropriate credits; and
- the supervisor provided written approval for the student to register for other postgraduate structured course modules.

ENG.4 THE DEGREE MASTER OF SCIENCE IN ENGINEERING SCIENCES

ENG.4.1 RULES FOR THE MASTER OF SCIENCE IN ENGINEERING SCIENCES

ENG.4.1.1 Duration

Refer to A-Rule 1.14.

ENG.4.1.2 Minimum admission requirements for the qualification

a) BSc (Hons) degree; or

b) Applicable four (4) year bachelor's degree (*ECSA-accredited*) in engineering or the student has been allowed to that status; or

c) Another recognised qualification that allows the student to attain equivalent status and which has been approved by the Higher Degrees Committee; or

d) Nuclear Engineering:

- Any qualification on at least NQF level 8, such as the current Postgraduate Diploma in Nuclear Science and Technology, provided that it supplies the student with proper theoretical knowledge on the following topics: Nuclear Science, Nuclear Engineering and Nuclear Technology Management.

ENG.4.1.3 Composition of the programme

The research is based on an engineering problem leading to a synthesised solution based on engineering methods and designs.

Research	
Description	**Credits**
Dissertation	180
Total	**180**

ENG.4.1.4 Faculty-specific requirements

The title of the dissertation, the research proposal and the appointment of external examiners must be reviewed by the Higher Degrees Committee. Additional information regarding rules and procedures are contained in the Faculty-specific rules, General Academic Rules 4.9, 4.10 and 4.11, and also in the Manual for Masters and Doctoral Study Sections 2.5 and 3.

In addition to attaining the abovementioned outcomes, students are also required to:

- Participate in at least one formal colloquia and/or technical conference where aspects of their work are presented to an audience of peers; and

- Have at least one full-length research paper on aspects of the thesis submitted for review in an accredited journal OR have two papers accepted in accredited peer reviewed conference proceedings on aspects of the thesis before results are finalised (Rules 4.10.4, 4.10.5). (Not applicable for Chemical or Mechanical Engineering.)

ENG.4.1.5 List of modules

To graduate with an MSc in Engineering, the student must accumulate a total number of 180 credits. Each credit represents 10 hours of notional study. The student registers for structured course modules relevant to a specific curriculum that enables him/her to obtain the relevant qualification. The approved structured course modules for the master's degree curricula in the Faculty of Engineering, are listed below.

UNIT FOR ENERGY AND TECHNOLOGY SYSTEMS			
Programme	**Module code**	**Descriptive name**	**Credits**
Chemical	CEMI 871	Dissertation	180
Computer, Electrical & Electronic	EERI 871	Dissertation	180
Industrial	INGB 871	Dissertation	180
Mechanical	MEGI 871	Dissertation	180
Development and Management	IIOB 871	Dissertation	180
Nuclear (Research)	NUCE 871	Dissertation	180

ENG.5 THE DEGREE OF DOCTOR OF PHILOSOPHY IN ENGINEERING

ENG.5.1 RULES FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN ENGINEERING

ENG.5.1.1 Duration

Refer to A-Rule 1.14.

ENG.5.1.2 Admission requirements for the qualification

- MEng; or
- Applicable MSc in Engineering/Natural Sciences; or
- Another recognised qualification that allows the student to attain equivalent status which is approved by the Faculty Board.

To gain admission to the PhD in Engineering, a student must hold a master's degree in the field of study in which the student intends to enrol. Alternatively, applicants must have the status of such a master's degree granted on request by the Senate, by attaining a level of competence which, in the opinion of Senate, on the recommendation of the Faculty, is adequate for the purposes of admission as a candidate for the degree. An applicant, for registration, must provide evidence of his/her attainments and education and complete such preliminary work as Senate may require, and must satisfy Senate as to the suitability of his/her subject.

ENG.5.1.3 Faculty-specific requirements

The title of the thesis, the research proposal and the appointment of external examiners must be reviewed by the Higher Degrees Committee.

In addition to attaining the abovementioned outcomes, students are also required to:

- Take part in at least two formal colloquia and/or technical conferences where aspects of their work are presented to an audience of established researchers and peers; and

- Have at least one full-length research paper on aspects of the thesis submitted for review in an accredited journal **OR** have two papers accepted in accredited peer reviewed conference proceedings on aspects of the thesis before results are finalised.

ENG.5.1.4 Doctoral Programmes

DOCTORAL				
Qualification	**Qualification and Qualification Code**	**Curriculum Code**	**Method of delivery**	**NQF level**
Doctor of Philosophy in Engineering (***PhD***)	Chemical Engineering	**7CA R01**	Contact	10
	Computer Engineering	**7CA R03**	Contact	10
	Computer and Electronic Engineering	**7CA R02**	Contact	10
	Development and Management Engineering	**7CA R04**	Contact	10
	Electrical Engineering	**7CA R06**	Contact	10
	Electronic Engineering	**7CA R07**	Contact	10
	Electrical and Electronic Engineering	**7CA R05**	Contact	10
	Industrial Engineering	**7CA R11**	Contact	10
	Mechanical Engineering	**7CA R09**	Contact	10
	Nuclear Engineering	**7CA R10**	Contact	10

ENG.6 MODULE OUTCOMES

NUCI 511	**NQF level: 8**

Title: Nuclear Engineering I

Module outcomes:

Students are provided with a broad overview of nuclear power systems to provide them with the basic knowledge they need to function in the nuclear reactor industry. The student should be able to demonstrate an understanding of and the ability to apply and evaluate key terms, concepts, facts, principles, rule and theories of the nuclear field. The student should also have detailed knowledge of the specialization area and how that knowledge relates to other fields. The student's problem-solving skills should include the ability to identify, analyse, evaluate, critically reflect on and address complex problems. Therefore, the following topics in nuclear engineering are covered:

- The history of nuclear engineering;
- Basics of atomic and nuclear physics for engineers;
- Interaction of neutrons and nuclear radiation with matter;
- Basic types of nuclear power plants;
- Neutron diffusion and moderation;
- Nuclear reactor theory;
- Time dependent behaviour; and
- Effects and heat generation in nuclear cores.

NUCI 521	**NQF level: 8**

Title: Introduction to Thermal-Fluid Sciences

Module outcomes:

- *Thermodynamics*: Properties of pure substances, work and heat, First Law of Thermodynamics, Second Law of Thermodynamics, power cycles;
- *Fluid mechanics*: Fluid statics, flow analysis, conservation laws for control volumes, differential forms of basic laws, dimensional analysis, incompressible viscous flow through pipes, one-dimensional compressible flow;
- *Turbo machinery*: Basic laws, compressors, turbines; and
- *Heat transfer*: Conduction, convection and radiation heat transfer, heat exchangers.

NUCI 571	**NQF level: 8**

Title: Mathematics for Nuclear Engineers

Module outcomes:

On the completion of this module the student should be able to solve mathematical problems related to nuclear engineering. With this knowledge he/she should be able to:

- use different methods to solve partial and differential equations analytically;
- study special functions and their application in solving differential equations;
- use this basic knowledge to solve more complex problems; and
- use the methods learnt here in other nuclear engineering modules.

NUCI 572	NQF level: 8

Title: Nuclear Reactor Technology

Module outcomes:

The purpose of this module is to introduce students from a non-engineering discipline (BSc or BTech) to nuclear power reactor technology. The module gives a broad overview of the different types of nuclear power reactors, LWR (PWR and BWR), HWR and GCR (AGR and HTR). The module also covers the main technological elements of each type of reactor (fuel elements and core, main components, etc.). Aspects of reactor operation, reactor control and stability are covered, including elementary concepts of reactor fuel and core design, core loading, spent fuel and radioactive waste management.

NUCI 573	NQF level: 8

Title: Nuclear Reactor Safety

Module outcomes:

The main purpose of this module is to impart to the student sound knowledge, training and skills in nuclear reactor safety. The main objective is to familiarise the student with the essential principles of nuclear power plant safety, reactor siting, reactor licensing and radiation doses from nuclear power plants, reactor accidents and accident risk analysis, as well as environmental radiation protection requirements. The main areas of nuclear reactor safety cover multiple reactor design to prevent the escape of radioactivity into the environment. This involves the safe design of the fuel, cladding material, the closed coolant system, the reactor vessel and the containment. Reactor control and reactor emergency shutdown systems are presented in the module. The three levels of safety, including suitable site location and essential evacuation procedures in case of an accident, are all an integral part of the module.

NUCI 574	NQF level: 8

Title: Nuclear Engineering Project

Module outcomes:

Learners are required to demonstrate their ability to execute a project in the field of nuclear engineering independently by publishing a concise scientific report on it.

NUCI 575	NQF level: 8

Title: Nuclear Physics

Module outcomes:

Learners are introduced to the principles of radioactivity and the interaction of different types of radiation with matter.

The content of the module includes:

- Properties of the nucleus;
- Basic features of radioactivity and the radioactive decay process;
- The radiations emitted by radioactive substances and their interaction with matter;
- Comparison of atomic decays; and
- Nuclear reactions.

NUCI 576	NQF level: 8

Title: Radiation and the Environment

Module outcomes:

Learners should develop a sound understanding of the characteristics of ionizing radiation and radionuclides, interactions of radiation with matter, biological effects, protection of persons and the environments against harmful effects of radiation and detection and measurement of radiation. The module provides the student with baseline knowledge of the use of radiation and radionuclides in various branches of science, technology and medicine, with special emphasis on the monitoring of environmental pollution on nuclear techniques.

The content includes:

- Characteristics of ionizing radiation;
- Properties of radionuclides and other sources of radiation;
- Basic processes involved in interactions of radiation with matter;
- Main radiation quantities and units;
- Physical, chemical and biological effects of radiation;
- Protection of people and the environment against harmful effects of radiation;
- Radiation detection, measurement and spectrometry;
- Monitoring of environmental radioactivity;
- Applications of radiation and radionuclides in science, industry and medicine; and
- The use of nuclear techniques in assessing various pollutants in the environment.

NUCI 577	NQF level: 8

Title: Reactor Analysis

Module outcomes:

After completion of this module, the student should demonstrate:

- Integrated knowledge of nuclear reactor neutronics analysis, which includes the following topics:
    - Physics of neutron-nuclear interactions and fission chain reaction;
    - Neutron transport model and diffusion theory;
    - Neutron energy distribution, including slowing down, resonance absorption and group energy method;
    - Nuclear reactor dynamics; and
    - Fuel burn-up.
- Critical understanding of these underlying physical principles and the ability to apply computational methods to reactor design and analysis, such as using simplified neutron diffusion and slowing down theories to calculate neutron flux distributions in space and energy for simple homogenous geometrics and heterogeneous lattices.

NUCI 578	NQF level: 8

Title: Nuclear Engineering II

Module outcomes:

After completion of this module, the student should demonstrate:

- Applied knowledge and integrated understanding regarding the design and operation of nuclear power plants;
- The ability to solve basic thermal-hydraulic problems related to nuclear reactor engineering;
- The ability to communicate with the engineering community regarding these issues; and
- Integrated knowledge regarding thermal-hydraulic analysis of nuclear reactors, nuclear fuel and reactor operations in order to enable him/her to work in the nuclear industry.

NUCI 579	NQF level: 8

Title: Nuclear Project Management

Module outcomes:

After completion of this module, the student should demonstrate:

- Integrated knowledge and coherent understanding of the theory, concepts, processes, tools and techniques of project management regarding the following topics:
  - System Engineering Process;
  - Scheduling project execution;
  - Nuclear safety;
  - Cost estimation and cost-value analysis;
  - Planning project execution;
  - Project functional management; and
- The ability to apply this knowledge to a typical nuclear industry project.

NUCI 621	NQF level: 8

Title: Introduction to Thermal-Fluid Sciences

Module outcomes:

On the completion of this module the student should be able to:

- Demonstrate a thorough understanding of thermodynamics, fluid mechanics, heat transfer and turbo machines by analysing and solving simple and complex industry related problems;
- Demonstrate an understanding of how the different constituent parts of an integrated system interact and influence each other by describing the interaction and calculating the effect of changing certain variables; and
- Evaluate the performance of simple and complex systems and propose actions to improve their performance.

NUCI 671	NQF level: 8

Title: Mathematics for Nuclear Engineers

Module outcomes:

On completion of this module the student should be able to solve mathematical problems related to nuclear engineering. With this knowledge they should be able to:

- Use different methods to solve partial and differential equations analytically;
- Solve partial and differential equations numerically;
- Study special functions and their application in solving differential equations;
- Use this basic knowledge to solve more complex problems; and
- Use the methods learnt here in other nuclear engineering modules.

NUCI 811	NQF level: 9

Title: Nuclear Engineering I

Module outcomes:

The module provides students with a broad overview of nuclear engineering to provide them with the basic knowledge they need to function in the nuclear reactor industry. The student should be able to demonstrate specialist knowledge to enable engagement with criticism of current nuclear research and nuclear practices. The student's problem-solving skill should be developed to demonstrate the ability to use a wide range of specialist skills in identifying, conceptualizing, designing and implementing methods to address complex practical and theoretical nuclear problems. The student should also demonstrate an understanding of the consequences of any nuclear solution.

Therefore, the following topics in nuclear engineering are covered:

- The history of nuclear engineering;
- Basics of anatomic and nuclear physics for engineers;
- Interaction of neutrons and nuclear radiation with matter;
- Basic types of nuclear power plants, neutron diffusion and moderation;
- Nuclear reactor theory;
- Time dependent behaviour and effects;
- Heat generation in nuclear cores;
- Radiation protection;
- Radiation shielding; and
- Reactor safety and licencing.

NUCI 879	NQF level: 9

Title: Nuclear Project Management

Module outcomes:

After successful completion of the Nuclear Project Management (NPM) module the student should demonstrate mastery of basic knowledge and skills pertaining to the theory, concepts, processes, tools and techniques of project management. He/she will have applied it to a typical nuclear industry project.

NUCI 883	NQF level: 9

Title: Nuclear Engineering II

Module outcomes:

On completion of this module, the student will have obtained the basic knowledge and understanding of how nuclear power plants are designed and operated.
With the knowledge the student has obtained from the module, he/she should be able to solve basic thermal-hydraulic problems related to nuclear reactor engineering and communicate with the engineering community about these problems.
The student's knowledge in the thermal-hydraulic analysis of nuclear reactors, as well as knowledge of nuclear fuel and reactor operations, will enable him/her to work in the nuclear industry.

NUCI 887	NQF level: 9

Title: Reactor Analysis

Module outcomes:

Upon successful completion of the module, the student should have acquired basic knowledge of nuclear reactor analysis, which includes the following topics:

- Physics of neutron-nuclear interactions and fission chain reaction;
- Neutron transport model and diffusion theory;
- Neutron energy distribution, including slowing down, resonance absorption and group energy method;
- Nuclear reactor dynamics; and
- Fuel burn-up.

This level of knowledge would enable the student to understand physical principles and apply computational methods for reactor design and analysis such as the calculation of neutron flux distribution in space and energy for simple homogenous geometrics and heterogeneous lattices.

NUCI 888	NQF level: 9

Title: Reactor Safety

Module outcomes:

On completion of this module the student should have developed a basic knowledge of the field of reactor safety. With this knowledge he/she should be able to:

- Understand accident situations and the student should have learned the necessary methods to evaluate them;
- Communicate with the engineering community about these problems;
- Carry out estimations for important accidents in nuclear plants;
- Use the basic knowledge to go deeper and to use complex programmes for safety analysis; and
- Use the knowledge to work in the nuclear industry or in safety organizations for supervision of nuclear power plants.

The methods used in nuclear safety analysis are helpful in other fields of technology.