NWU®

Faculty of Engineering

Postgraduate

Fakulteit Ingenieurswese

Nagraads

2023 Yearbook

Address all correspondence to:

The Registrar
North-West University Private Bag X1290 Potchefstroom
2520

Tel: (018) 299-1111/2222
Fax: (018) 299-4910
Internet: http://www.nwu.ac.za

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.

Contents

ENG.1 FACULTY RULES 1
ENG.1.1 AUTHORITY OF THE GENERAL ACADEMIC RULES 1
ENG.1.2 FACULTY-SPECIFIC RULES 1
ENG.1.2.1 Application, selection and admission to the university 1
ENG.1.2.2 Admission and advanced standing on grounds of recognition of prior learning 2
ENG.1.2.3 Annual registration 2
ENG.1.2.4 Research proposal and title registration 2
ENG.1.2.5 Submission to rules and resolutions 2
ENG.1.2.6 Active enrolment 3
ENG.1.2.7 Extension of period of study 3
ENG.1.2.8 Monitoring of academic performance 3
ENG.1.2.9 Termination of Studies 3
ENG.1.2.10 Student academic requests 3
ENG.1.2.11 Examination 4
ENG.1.2.12 Intellectual property in and publication of research products 4
ENG.1.2.13 Master's degrees 5
ENG.1.2.14 Doctoral degrees 7
ENG.1.3 WARNING AGAINST PLAGIARISM 8
ENG.1.3.1 Academic misconduct 8
ENG.1.4 CAPACITY STIPULATION 10
ENG.1.5 QUALIFICATIONS, PROGRAMMES AND CURRICULA 11
ENG.1.6 PROGRAMME OUTCOMES 15
ENG.1.7 PROGRAMME ASSESSMENT CRITERIA 16
ENG.2 THE POSTGRADUATE DIPLOMA 18
ENG.2.1 RULES FOR THE POSTGRADUATE DIPLOMA 18
ENG.2.1.1 Duration 18
ENG.2.1.2 Minimum Admission requirements for the qualification 18
ENG.2.1.3 Method of presentation 18
ENG.2.1.4 Recognition of prior learning and credit transfer 19
ENG.2.1.5 Monitoring of academic performance and progression requirements 19

ENG.2.1.6 Termination and extension of studies 19
ENG.2.2 POSTGRADUATE DIPLOMA IN NUCLEAR SCIENCE AND TECHNOLOGY 20
ENG.2.2.1 Curriculum: I503P 20
ENG.2.2.2 Curriculum outcomes 20
ENG.2.2.3 Compilation of curriculum 21
ENG.2.3 POSTGRADUATE DIPLOMA IN NUCLEAR SCIENCE AND TECHNOLOGY WITH NUCLEAR TECHNOLOGY MANAGEMENT 22
ENG.2.3.1 Curriculum: I501P 22
ENG.2.3.2 Curriculum outcomes 23
ENG.2.3.3 Compilation of curriculum 23
ENG.2.4 POSTGRADUATE DIPLOMA IN INDUSTRIAL ENGINEERING 24
ENG.2.4.1 Curriculum: I501P 24
ENG.2.4.2 Curriculum outcomes 25
ENG.2.4.3 Compilation of curriculum 25
ENG.3 THE DEGREE MASTER OF ENGINEERING 26
ENG.3.1 RULES FOR THE DEGREE MASTER OF ENGINEERING 26
ENG.3.1.1 Duration 26
ENG.3.1.2 Minimum admission requirements for the qualification 26
ENG.3.1.3 Composition of the programme 26
ENG.4 THE DEGREE MASTER OF SCIENCE IN ENGINEERING SCIENCES 27
ENG.4.1 RULES FOR THE MASTER OF SCIENCE IN ENGINEERING SCIENCES 27
ENG.4.1.1 Duration 27
ENG.4.1.2 Minimum admission requirements for the qualification 27
ENG.4.1.3 Composition of the programme 28
ENG.5 THE DEGREE OF DOCTOR OF PHILOSOPHY IN ENGINEERING 29
ENG.5.1 RULES FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN ENGINEERING 29
ENG.5.1.1 Duration 29
ENG.5.1.2 Minimum admission requirements for the qualification 29
ENG.5.1.3 Composition of programme 29
ENG.6 MODULE OUTCOMES 30

NWU Office Bearers

Chancellor

Dr ATM Mokgokong

Vice-Chancellor

Dr B Tyobeka

Vice-Principal

Prof LA du Plessis

Deputy Vice-Chancellor: Assigned functions and Potchefstroom campus operations

Prof DM Balia

Deputy Vice-Chancellor: Planning and Vaal Triangle campus operations

Prof LA du Plessis

Deputy Vice-Chancellor: Assigned functions and Mafikeng campus operations

Prof S Swanepoel (Acting)

Deputy Vice-Chancellor: Teaching and Learning

Prof R Balfour

Deputy Vice-Chancellor: Research and Innovation

Prof J Mphahlele

Executive Director: Student Life

Dr S Chalufu

Registrar

Prof MM Verhoef

NWU EXECUTIVE DEANS

Faculty of Economics and Management

Prof B Surujlal

Faculty of Education

Prof LN Conley

Faculty of Engineering

Prof L van Dyk

Faculty of Health Sciences

Prof AF Kotzé

Faculty of Humanities

Prof D Moyo

Faculty of Law

Dr N Morei

Faculty of Natural and Agricultural Sciences

Prof DM Modise

Faculty of Theology

Dr H Goede

FACULTY BOARD
Chairperson
Prof L van Dyk (Executive Dean)

Faculty Administrator
Mrs B Mackenzie

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 M van Eldik

School of Industrial Engineering
Prof R Siriram

Centre for Engineering Education
Prof M le Roux

Unit for Energy and Technology Systems
Prof R Coetzee

Research Director
Prof HWJP Neomagus

Business Development and Stakeholder Engagement
Vacant

Academic staff
Professor
Prof A Jonker

Associate Professors
Prof V Naicker
Vacant

Senior Lecturers
Mr CJ Schabort
Dr A Eloka-Eboka
Dr MH du Toit
Prof LJ Grobler

Lecturers
Mr M Roopa
Dr F Moyo
Prof K Ntwampe
Dr P van Vuuren

Junior Lecturers
Mrs C du Plessis
Vacant

Student Representative
Chairperson Ingenium

RESEARCH

Unit for Energy and Technology Systems
Prof R Coetzee

Centre of Excellence in Carbon Based Fuels
Prof HWJP Neomagus

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

Centre of Competence - Hydrogen Energy
Prof DG Bessarabov

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

Centre for Advanced Manufacturing
Mr DB Vorster

RESEARCH CHAIRS

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 Emissions Control
Prof BB Hattingh

RESEARCH GROUPS

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

HIGHER DEGREES PROGRAMME LEADERS

Chair Engineering Research Ethics Committee (ENG-REC)
Prof HWJP Neomagus

Chair Higher Degrees Committee
Prof R Coetzee

HIGHER DEGREES PROGRAMME MANAGERS

Chemical and Minerals Engineering
Dr FH Conradie

Electrical, Electronic and Computer Engineering
Dr M Ferreira

Industrial Engineering
Prof R Coetzee

Mechanical Engineering
Dr JH 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 accordance with General Academic Rule 1.5.1.3. Programme-specific additional admission requirements are provided for in the faculty rules and no application for admission may be accepted unless the applicant complies with both the general admission requirements and faculty-specific requirements where applicable. Refer to the specific programmes in this calendar for further information.

c) 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.

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

e) Prospective students must consult the faculty postgraduate website to guide them towards the process of identifying a study leader. If a suitable (subject-matter expert) study leader is available, he/she 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 4.9.1. & 5.9.1. a student must, within six months after the final date of registration determined in the annual university calendar, present a research proposal and proposed title for approval and registration to a Scientific Committee.

b) 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 Higher Degrees Committee.

c) In accordance with General Academic Rule 4.9.5. & 5.9.5, the faculty may direct the registrar to cancel a student's registration, if the required research proposal is not submitted for approval in time.

d) 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 by means of a motivation letter to the Higher Degrees Committee 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.

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.

ENG.1.2.7 Extension of period of study

a) In accordance with General Academic Rule 4.14 & 5.13, students may apply for extension of their study period. Applications are presented to the higher degrees committee for consideration:

b) If an application for extension is approved, the student needs to present their progress at a Scientific Committee Meeting 6 months after the extension was approved. A warning letter will also be issued to the student due to unsatisfactory academic performance.

c) In accordance with General Academic Rule 1.18.1.6, the executive dean concerned may direct the registrar to terminate a student's registration if such student fails, after having been granted an extension of time, to complete the study.

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.

Simultaneously each student must submit a confidential report about progress made and supervision received to the Higher Degrees Committee.

The Higher Degrees committee will – based on these reports – recommend to the executive dean appropriate actions (where applicable).

Based on the above recommendation by the Higher Degrees Committee t, 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 relating to the examination of the research product

a) In accordance with General Academic Rule 4.11.5.1 and Rule 5.11.5.1., an examiner may recommend that a research product –

1. be accepted unconditionally;

   Smaller typographical errors for instance typo errors, spelling errors, grammatical errors, etc. can be included in this option.

2. 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, 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.

3. be accepted on condition that specified revisions of a substantive nature be made to the satisfaction of the academic director concerned;

   Feedback should be submitted to the examiner concerned by means of a detailed amendment report which focuses on the specific recommendations and/or required changes called for.

4. be accepted on condition that specified revisions of a substantive nature be made to the satisfaction of the examiners concerned;

   Feedback should be submitted to the examiner concerned by means of a detailed amendment report which focuses on the specific recommendations and/or required changes called for.

5. 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;

   No mark is awarded. 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 amendment report 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.

6. 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 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.1.2.13.3 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) For each student, at least one supervisor/promotor will be appointed that is of the status of being eligible to be appointed as a member of the Faculty Board. However, applications for exceptions, may be presented to the higher degrees committee, who will make a recommendation to the Faculty Board for final consideration.
c) With reference to General Academic Rule 4.8.5., the faculty board may in exceptional circumstances approve the appointment of a co-supervisor 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 scientific committee and recommended for approval by the Faculty Board.
d) When a student submits his/her notice of submission, the final list of supervisors/promotors may be amended, based on their contributions made during the study.

ENG.1.2.13.4 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) In accordance with General Academic Rule 1.13.8, the executive dean must, in consultation with the academic director concerned, ensure that the risk of conflict of interest is limited to the minimum when supervisors, promoters, examiners, and moderators are appointed, Refer to the Faculty Quality Manual for detail on possible

scenarios of conflict of interest

c) Additional faculty requirements:

- 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.1.2.14.2 Faculty-specific completion requirements

In accordance with General Academic Rule 5.3.2, a doctoral candidate is required to

a) In addition to the title registration presentation at a Scientific committee meeting, a PhD student needs to present the progress of their work at a Scientific Committee Meeting or an accredited conferences where aspects of their work are presented to an audience of established researchers and peers; and

b) Have at least one full-length research paper on aspects of the thesis accepted for publication in a DHET accredited journal. The list of DHET accredited journals is available at:

https://collections.nwu.ac.za/dbtw-wpd/textbases/accredited-journals/accred.html

ENG.1.2.14.3 Supervision

a) 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.

b) For each student, at least one supervisor/promotor will be appointed that is of the status of being eligible to be appointed as a member of the Faculty Board. However, applications for exceptions, may be presented to the higher degrees committee, who will make a recommendation to the Faculty Board for final consideration.

c) When a student submits his/her notice of submission, the final list of supervisors/promotors may be amended, based on their contributions made during the study.

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) In accordance with General Academic Rule 1.13.8, the executive dean must, in consultation with the academic director concerned, ensure that the risk of conflict of interest is limited to the minimum when supervisors, promoters, examiners, and moderators are appointed,

Refer to the Faculty Quality Manual for detail on possible scenarios of conflict of interest

c) Additional faculty requirements are as follows:

- 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 a strong publication record in the field within which the research has been completed;
- Recurrent usage of the same examiners must 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

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

[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.

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	**7DC D01**	Distance	PC	8
Postgraduate Diploma in Nuclear Science and Technology with Nuclear Technology Management	**7DC D02**	Distance	PC	8
Postgraduate Diploma in Industrial Engineering	**7DB D01**	Distance	PC	8

MASTER'S DEGREES (Structured) – Phased out 2020 – No longer available					
Qualification	**Specialisation**	**Qualification Code**	**Mode of delivery**	**Campus**	**NQF level**
Master of Engineering in Nuclear Engineering **(MEng)**		**7DA P01**	Contact	PC	9
Master of Sciences in Engineering Sciences **(MSc)**	Nuclear Engineering	**203 200**	Contact	PC	9

MASTER'S DEGREES (Research)					
Qualification	**Specialisation**	**Qualification Code**	**Mode of delivery**	**Campus**	**NQF level**
Master of Engineering in Chemical Engineering		**7CE N01**	Contact	PC	9
Master of Engineering in Computer and Electronic Engineering		**7CD N01**	Contact	PC	9
Master of Engineering in Electrical and Electronic Engineering		**7CC N01**	Contact	PC	9
Master of Engineering in Electrical and Electronic Engineering	Electromechanical Engineering	**7CC N02**	Contact	PC	9
Master of Engineering in Industrial Engineering		**7CP N01**	Contact	PC	9
Master of Engineering in Mechanical Engineering		**7CB N01**	Contact	PC	9
Master of Engineering in Mechanical Engineering	Electromechanical Engineering	**7CB N03**	Contact	PC	9

Master of Science in Engineering Sciences with **(MSc) Engineering Sciences**	Chemical Engineering	**7CM N02**	Contact	PC	9
	Computer and Electronic Engineering	**7CM N04**	Contact	PC	9
	Electrical and Electronic Engineering	**7CM N03**	Contact	PC	9
	Mechanical Engineering	**7CM N01**	Contact	PC	9
	Nuclear Engineering	**7CM N05**	Contact	PC	9
	Nuclear Engineering and Nuclear Technology Management	**7CM N06**	Contact	PC	9

DOCTORAL DEGREES					
Qualification	**Specialisation**	**Qualification Code**	**Mode of delivery**	**Campus**	**NQF level**
Doctor of Philosophy in Engineering	Chemical Engineering	**7CA R01**	Contact	PC	10
	Computer Engineering	**7CA R03**	Contact	PC	10
	Computer and Electronic Engineering	**7CA R02**	Contact	PC	10
	Electrical Engineering	**7CA R06**	Contact	PC	10
	Electronic Engineering	**7CA R07**	Contact	PC	10
	Electrical and Electronic Engineering	**7CA R05**	Contact	PC	10
	Industrial Engineering	**7CA R11**	Contact	PC	10
	Development and Management Engineering	**7CA R04**	Contact	PC	10
	Mechanical Engineering	**7CA R09**	Contact	PC	10
	Nuclear Engineering	**7CA R10**	Contact	PC	10

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

Nuclear Science and Technology / Nuclear Science and Technology with Nuclear Technology Management:
The minimum term of study is one (1) year.

Industrial Engineering:
The minimum term of study is two (2) years.

For the maximum duration refer to General Academic Rule 1.14.

ENG.2.1.2 Minimum Admission requirements for the qualification

Nuclear Science and Technology / Nuclear Science and Technology with Nuclear Technology Management:

- A qualification such as a three-year BSc degree (an appropriate qualification that exit at NQF level 7, with Mathematics or Physics at least at second year level); or
- A qualification such as a BTech (Engineering) (an appropriate qualification that exit at NQF level 7).

Explanatory notes for the above Nuclear Engineering admission requirements are available at the following link:

http://engineering.nwu.ac.za/nuclear-engineering/postgraduate-diploma-nuclear-engineering

Industrial Engineering:

- Qualifications such as such as a BSc, or a BTech, or equivalent qualification that exit at NQF level 7, or
- a qualification such as the BEng or BIng, BSc (Eng), or equivalent qualification that exit at NQF level 8, or
- an appropriate NQF level 7 qualification within disciplines related to engineering with sufficient mathematical and physical science foundation (50% in relevant final year modules at NQF level 7), as approved by the postgraduate admissions committee.

ENG.2.1.3 Method of presentation

Modules in the Postgraduate Diplomas will be presented using distance mode. A learning management system will provide a platform for the modules. Each module will consist of a combination of an interactive site, that will enable students to participate in well-structured self-study learning activities, and live and other interactive sessions.

The various programmes make use of a combination of formative and summative assessment approaches that are designed to provide feedback, evaluate student progress and assess the attainment of the various programmes' outcomes.

NOTE: The sub-minimum for all modules in the various Postgraduate Diplomas is 50%.

ENG.2.1.4 Recognition of prior learning and credit transfer

Please refer to General Academic Rules 1.6, 1.7 and 3.2.

ENG.2.1.5 Monitoring of academic performance and progression requirements

Please refer to General Academic Rules 1.15 and 1.16.

ENG.2.1.6 Termination and extension of studies

Please refer to General Academic Rules 1.17 and 1.18.

ENG.2.2 POSTGRADUATE DIPLOMA IN NUCLEAR SCIENCE AND TECHNOLOGY ENG.2.2.1 Curriculum: I501P

Qualification code: 7DC D01
Delivery mode: Distance

This programme supplies students all the theoretical knowledge required by the NWU's research Masters of Science in Engineering Sciences with Nuclear Engineering.

The field of Nuclear Engineering comprises the technical aspects, such as nuclear reactor design, and the nuclear technology management aspects, such as nuclear Project Management, nuclear policy and financial management.

The present programme focuses on the theoretical knowledge underlying the said technical aspects, especially nuclear reactor design, while another programme will focus on the technology management aspects.

This programme provides learners with:

- a broader and more in-depth knowledge of Nuclear Engineering sciences;
- advanced education in the field of Nuclear Engineering;
- problem-solving ability;
- integration of knowledge across fields;
- the ability to execute a project in the field of Nuclear Engineering and to communicate the results orally and in writing.

ENG.2.2.1.1 List of modules

Module code	Descriptive name	Credits
NUCL 511	Nuclear Engineering I	16
NUCL 512	Radiation and the Environment	16
NUCI 521	Introduction to Thermal-Fluid Sciences	16
NUCI 578	Nuclear Engineering II	16
NUCL 525	Nuclear Project Management	16
NUCL 526	Nuclear Reactor Safety	16
NUCI 574	Nuclear Engineering Project	16
NUCI 577	Reactor Analysis	16

ENG.2.2.2 Curriculum outcomes

On completion of the qualification, the student should be able to demonstrate:

- A comprehensive and systematic knowledge base in nuclear engineering, as well as a depth of knowledge in nuclear physics and thermal fluid sciences.
- A coherent and critical understanding of the principles and theories of nuclear engineering; an ability to critique current research and advanced scholarship in an area of nuclear engineering; an ability to make sound theoretical judgements based on evidence and an ability to think epistemologically (i.e. from a sound knowledge framework).

- An ability to identify, analyse and deal with complex and/or real world problems and issues using evidence-based solutions and theory-driven arguments in the field of nuclear engineering.
- Efficient and effective information-retrieval and processing skills; the identification, critical analysis, synthesis and independent evaluation of quantitative and/or qualitative data; an ability to conduct research.
- An ability to present and communicate academic professional work effectively.

ENG.2.2.3 Compilation of curriculum

In accordance with General Academic Rule 3.1.1., the postgraduate diploma consists of a number of modules with a total credit value of 128 at NQF level 8.

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

The curriculum comprises of 8 core modules.

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

ENG.2.3 POSTGRADUATE DIPLOMA IN NUCLEAR SCIENCE AND TECHNOLOGY WITH NUCLEAR TECHNOLOGY MANAGEMENT

ENG.2.3.1 Curriculum: I501P

Qualification code: 7DC D02
Delivery mode: Distance

This programme supplies students all the theoretical knowledge required by the NWU's new research Masters of Science in Engineering Sciences with Nuclear Engineering and **Nuclear Technology Management**, which the International Atomic Energy Agency (IAEA) assisted the NWU in developing and recently endorsed.

The field of Nuclear Engineering comprises the technical aspects, such as nuclear reactor design, and the nuclear technology management aspects, such as Nuclear Project Management, nuclear policy and nuclear economics.

The most of the modules of the present programme overlap with those of the Postgraduate Diploma in Nuclear Science and Technology and, therefore, it supplies similar technical Nuclear Engineering knowledge. Therefore it also meets the minimum admission requirements of the Masters of Science in Engineering Sciences with Nuclear Engineering. However, it focusses more on Nuclear Technology Management, namely: nuclear policy, nuclear technology management and nuclear economics and financial management aspects.

This programme provides learners with:

- a broader and more in-depth knowledge of Nuclear Engineering sciences;
- advanced education in the field of Nuclear Engineering;
- problem-solving ability;
- integration of knowledge across fields;
- the ability to execute a project in the field of Nuclear Engineering and to communicate the results orally and in writing.
- advanced education in the field of Nuclear Technology management, including Nuclear Project Management, nuclear policy and the economics of nuclear projects;

ENG.2.3.1.1 List of modules

Module code	Descriptive name	Credits
NUCL 511	Nuclear Engineering I	16
NUCL 512	Radiation and the Environment	16
NUCL 513	Nuclear Reactor Technology	16
NUCL 514	PWR Technology	16
NUCL 525	Nuclear Project Management	16
NUCL 526	Nuclear Reactor Safety	16
NUCL 527	Nuclear Energy Policy and Business	16
NUCL 528	Research methodology	16

ENG.2.3.2 Curriculum outcomes

On completion of the qualification, the student should be able to demonstrate:

- A comprehensive and systematic knowledge base in nuclear engineering, as well as a depth of knowledge in nuclear physics and thermal fluid sciences.
- A coherent and critical understanding of the principles and theories of nuclear engineering; an ability to critique current research and advanced scholarship in an area of nuclear engineering; an ability to make sound theoretical judgements based on evidence and an ability to think epistemologically (i.e. from a sound knowledge framework).
- An ability to identify, analyse and deal with complex and/or real world problems and issues using evidence-based solutions and theory-driven arguments in the field of nuclear engineering.
- Efficient and effective information-retrieval and processing skills; the identification, critical analysis, synthesis and independent evaluation of quantitative and/or qualitative data; an ability to conduct research.
- In depth knowledge of Nuclear Technology Management, namely: nuclear policy, nuclear technology management and nuclear economics and financial management aspects and the ability to apply it to practical problems in this field.
- An ability to present and communicate academic professional work effectively.

ENG.2.3.3 Compilation of curriculum

In accordance with General Academic Rule 3.1.1., the postgraduate diploma consists of a number of modules with a total credit value of 128 at NQF level 8.

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

The curriculum comprises of 8 core modules.

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

ENG.2.4 POSTGRADUATE DIPLOMA IN INDUSTRIAL ENGINEERING

ENG.2.4.1 Curriculum: I501P

Qualification code: 7DB D01
Delivery mode: Distance

The Postgraduate Diploma in Industrial Engineering is designed to equip individuals with the necessary skills for a modern industrial engineering career.

In today's complex and dynamic world, the skills of industrial engineering are more valuable than ever before. Industrial engineering is uniquely positioned to tackle many of the challenges faced by local and global organisations by improving service delivery, increasing competitiveness and addressing efficiency and capacity constraints.

This programme is targeted at individuals who aspire to advance their career or change direction by gaining specialised knowledge and skills in industrial engineering.

The programme is also designed for individuals without an appropriate undergraduate qualification in industrial engineering to transition to advanced postgraduate studies in industrial engineering.

The programme consists of 10 modules. These modules include a strong foundation of the sciences associated with operations management, quality and process engineering. These skills are then strengthened with quantitative skills by teaching data and decision science and modelling and simulation. This is enriched with strategic skills in business process engineering, operational excellence and supply chain management.

Although the PGDip is a distance learning programme, careful design incorporates practical examples and case studies, group interaction and workplace learning to ensure that the diploma is relevant and practical and deepens engagement and learning.

ENG.2.4.1.1 List of modules

Module code	Descriptive name	Credits	Pre-requisite module
INGB 511	Industrial Thinking and Philosophies	12	
INGB 512	Introduction to Software Engineering	12	
INGB 513	Operations Excellence	12	
INGB 514	Quality Management	12	
INGB 515	Decision Support Systems	12	INGB 522
INGB 521	Business Process Engineering	12	
INGB 522	Introduction to Data and Decision Sciences	12	INGB 512
INGB 523	Operations Management and Supply Chains	12	
INGB 524	Modelling and Simulation	12	INGB 515
INGB 525	Engineering Investigation and Problem Solving	12	

ENG.2.4.2 Curriculum outcomes

On completion of the qualification, the student should be able to demonstrate:

- integrated and applied knowledge of and engagement in various sub-disciplines of Industrial Engineering and a critical understanding and application of the theory, methods and techniques relevant to the field of Industrial Engineering and Operations Management;
- the ability to critically interrogate multiple sources of knowledge such as case studies, journal articles and other supplementary sources of knowledge within the discipline of Industrial Engineering, and critically evaluate and review that knowledge and the manner in which the knowledge was produced with a view to address specific problems encountered in the working environment;
- the ability to select, apply and critically judge the effectiveness of the implementation of a range of appropriate industrial analysis, design methodologies and intervention techniques with a view to make workplace improvements;
- advanced ability to effectively implement Industrial Engineering techniques with a view to bring about operational excellence;
- the ability to conduct oneself ethically and professionally in a workplace environment with specific focus on acknowledging one's competencies in a given problematic situation;
- the ability to analyse, select and effectively apply carefully supervised industrial thinking method of enquiry to reflect on and then address complex operational or abstract strategic problems and contribute to positive change within practice;
- the ability to communicate effectively in a variety of formats (oral, written, visual and electronic) to diverse audiences and for various workplace purposes;
- the ability to interact and collaborate effectively with others, and to work as part of a team, in diverse social, cultural and professional contexts;
- the ability to be a self-directed and lifelong learner, who is able to work independently, utilise resources effectively and exercise initiative;
- the strong ability to articulate a clear vision and goals, and to motivate others to achieve them.

ENG.2.4.3 Compilation of curriculum

In accordance with General Academic Rule 3.1.1., the postgraduate diploma consists of a number of modules with a total credit value of 120 at NQF level 8.

One credit represents 10 notional study hours, which suggests that a student should expect to spend at least 1200 study hours on the programme.

The curriculum comprises of 10 core modules.

Components	Composition	Credits
10 x Modules	Core (Compulsory)	12 each
Total credits for the curriculum		**120**

ENG.3 THE DEGREE MASTER OF ENGINEERING

ENG.3.1 RULES FOR THE DEGREE MASTER OF ENGINEERING

ENG.3.1.1 Duration

Refer to General Academic Rule 1.14.

The minimum term of study is **one (1) year**.

ENG.3.1.2 Minimum admission requirements for the qualification

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

ENG.3.1.3 Composition of the programme

In accordance with General Academic Rule 4.2.2., the master's degree consists of a total number of 180 credits. Each credit represents 10 hours of notional study

In accordance with General Academic Rule 4.2.3., the faculty of Engineering offers a general master's degree in the form of a research master's degree by dissertation with a minimum of 180 credits for research;

UNIT FOR ENERGY AND TECHNOLOGY SYSTEMS			
Programme	**Module code**	**Descriptive name**	**Credits**
Chemical Engineering	CEMI 871	Dissertation	180
Computer, Electrical & Electronic Engineering	EERI 871	Dissertation	180
Electrical and Electronic Engineering with Electromechanical Engineering	EEEM 871	Dissertation	180
Industrial Engineering	INGB 871	Dissertation	180
Mechanical Engineering	MEGI 871	Dissertation	180
Mechanical Engineering with Electromechanical Engineering	MEEM 871	Dissertation	180
Nuclear Engineering	NUCE 871	Dissertation	180

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 General Academic Rule 1.14.

The minimum term of study is **one (1) year**.

ENG.4.1.2 Minimum admission requirements for the qualification

Chemical, Computer, Electrical, Electronic, Industrial, Mechanical and Development and Management Engineering:

a) Applicable BSc (Hons) degree; or
b) Applicable four (4) year bachelor's degree (*ECSA-accredited*) in engineering; or
c) Another recognised qualification that allows the student to attain equivalent status and which has been approved by the Higher Degrees Committee; or

Nuclear Engineering:

a) Postgraduate Diploma in Nuclear Science and Technology; or
b) Postgraduate Diploma in Nuclear Science and Technology with Nuclear Technology Management; or
c) Applicable BSc (Hons) degree that provides the required theoretical knowledge in Nuclear Engineering; or
d) Applicable four (4) year bachelor's degree (ECSA-accredited) in engineering that provides the required theoretical knowledge in Nuclear Engineering; or
e) Another recognised qualification that allows the student to attain equivalent status and which has been approved by the Higher Degrees Committee.

Nuclear Engineering and Nuclear Technology Management:

a) NWU's Postgraduate Diploma in Nuclear Science and Technology with Nuclear Technology Management; or
b) Applicable BSc (Hons) degree that provides the required theoretical knowledge in Nuclear Engineering and Nuclear Technology Management; or
c) Applicable four (4) year bachelor's degree (ECSA-accredited) in engineering that provides the required theoretical knowledge in Nuclear Engineering and Nuclear Technology Management; or
d) Another recognised qualification that allows the student to attain equivalent status and which has been approved by the Higher Degrees Committee. However it should be noted that the endorsement of the International Atomic Energy Agency (IAE) can only be obtained if students has the NWU's Postgraduate Diploma in Nuclear Science and Technology with Nuclear Technology Management, or another similar qualification which is endorsed by the IAEA.

Explanatory notes for the above Nuclear Engineering admission requirements are available at the following link:

http://engineering.nwu.ac.za/nuclear-engineering/masters-degrees-nuclear-engineering

ENG.4.1.3 Composition of the programme

In accordance with General Academic Rule 4.2.2., the master's degree consists of a total number of 180 credits. Each credit represents 10 hours of notional study.

In accordance with General Academic Rule 4.2.3., the faculty of Engineering offers a general master's degree in the form of a research master's degree by dissertation with a minimum of 180 credits for research;

UNIT FOR ENERGY AND TECHNOLOGY SYSTEMS			
Programme	**Module code**	**Descriptive name**	**Credits**
Chemical Engineering	CEMI 871	Dissertation	180
Computer, Electrical & Electronic Engineering	EERI 871	Dissertation	180
Industrial Engineering	INGB 871	Dissertation	180
Mechanical Engineering	MEGI 871	Dissertation	180
Nuclear Engineering	NUCE 871	Dissertation	180
Nuclear Engineering and Nuclear Technology Management	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 General Academic Rule 1.14.

The minimum term of study is **two (2) year**.

ENG.5.1.2 Minimum 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.

ENG.5.1.3 Composition of programme

In accordance with General Academic Rule 5.2.2, a doctoral degree consist of a total number of 360 credits. Each credit represents 10 hours of notional study

The faculty of Engineering offers a doctoral degree in the form of a research thesis of 360 credits.

UNIT FOR ENERGY AND TECHNOLOGY SYSTEMS			
Programme	**Module Code**	**Descriptive Name**	**Credits**
Chemical Engineering	CEMI 972	Thesis	360
Computer Engineering	EREI 972	Thesis	360
Computer and Electronic Engineering	REEI 972	Thesis	360
Development and Management Engineering	IIOB 972	Thesis	360
Electrical Engineering	EERI 972	Thesis	360
Electronic Engineering	EEEI 972	Thesis	360
Electrical and Electronic Engineering	ELEI 972	Thesis	360
Industrial Engineering	INGB 972	Thesis	360
Mechanical Engineering	MEGI 972	Thesis	360
Nuclear Engineering	NUCI 972	Thesis	360

ENG.6 MODULE OUTCOMES

INGB 511	**NQF level: 8**

Title: Industrial Thinking and Philosophies

Purpose of the module:
The Industrial Engineer's worldview is distinct from most other professions, including other disciplines of engineering. This module serves as the bridge to learn the Industrial Engineering – lens. Students will gain an appreciation for what Industrial Engineers do, how they do it, what value system they have and how Industrial Engineers bring, create, improve and sustain value.

Module outcomes:
On completion of the module, the student should be able to demonstrate:

- Demonstrate the ability to critically differentiate between the sub-disciplines of Industrial Engineering and comprehend their different philosophies
- Understand the origins of the Industrial Engineering field and its progression into the modern era
- Understand what Industrial Engineering is, and what Industrial Engineers do in industry
- Understand the history of industry, traced through the four so-called "revolutions"
- Understand the importance of work, efficiency, effectiveness and productivity and the relationship to success
- Understand the importance of improvement

INGB 512	**NQF level: 8**

Title: Introduction to Software Engineering

Purpose of the module:
Being able to create computer code is a key skill of the Industrial Engineer of the future. This module introduces the student to Software Engineering which will serve as the basis for future modules in data science, Simulation and Modelling and Decision Support Systems.

Module outcomes:
On completion of the module, the student should be able to:

- Show familiarity with computers' functionalities, jargon and operations
- Display an ability to create problem abstractions and to capture these in common algorithms
- Write simple code that makes use of and manipulates variables and data, by using common operators, functions, lists, libraries and dictionaries

INGB 513	NQF level: 8

Title: Operations Excellence

Purpose of the module:
Improving organisations makes use of well-developed improvement philosophies, including Lean, Six Sigma, Systems Thinking, and Theory of Constraints. This module introduces students to these philosophies, guides students through selection and execution and loops back to human factors for implementation.

Module outcomes:
On completion of the module, the student should be able to:

- Demonstrate familiarity with, and understand the key improvement philosophies
- Plan and execute continuous improvement initiatives
- Understanding of the impact of continuous improvement
- Appreciate an Industrial Engineer's role in positively influencing people
- Understanding leadership, teamwork, and individual behaviours in organisations

INGB 514	NQF level: 8

Title: Quality Management

Purpose of the module:
Quality is a field of importance to all organisations, from primary industries like agriculture and extractive industries like mining, to secondary – processing and manufacturing businesses to tertiary service-oriented businesses. The importance of good quality in systems must be emphasised. This module equips students with a specialised skill set in the theoretical and practical tools necessary to manage quality in organisations and across value chains.

Module outcomes:
On completion of the module, the student should be able to:

- Understand the philosophies related to quality management and be able to systematically select the correct philosophy for an organisation
- Describe and identify costs associated with quality and build business cases for investments in quality-directed programmes
- Design a quality management and control/assurance process
- Suggesting approaches to achieve systematic quality improvements through processes, systems, and other dimensions
- Ensure that customer-focused interventions produce system-wide benefit and that decisions are evidence-based
- Read, interpret and construct statistical process control tools to scientifically manage quality
- Synthesise the elements of the Total Quality Management philosophy as appropriate for the context

INGB 515	NQF level: 8

Title: Decision Support Systems

Purpose of the module:
Making strong, evidence-based decisions is a key competence of engineers broadly. Basing decisions on strong data and analysis allows engineers to make better decisions, with broad impact. In this module, students are introduced to the key philosophies, tools, software and approaches to building strong evidentiary chains to make good decisions, and to back these up scientifically.

Module outcomes:
On completion of the module, the student should be able to:

- Understand the open-ended nature of problems that may be faced in organisations
- Understand the characteristics of user-friendliness of tools to ensure technical competence is no limitation for decision makers
- Identify suitable problems, and propose data collection and processing streams for these
- Design data rationalisation strategies to summarise complex data sets into usable information
- Design and deliver reporting platforms, including dashboards for management decision support

INGB 521	NQF level: 8

Title: Business Process Engineering

Purpose of the module:
Making businesses better is probably the most central role of the Industrial Engineer. Business Process Reengineering is a loosely collected set of philosophies and techniques that can be used to gain efficiency, productivity, profitability and overall business success. This module equips students with a general set of competencies to achieve this aim.

Module outcomes:
On completion of the module, the student should be able to:

- Observe, record and interpret a current state in a business
- Design alternative approaches to improve operational behaviour
- Innovate and propose alternative strategies on the macro and the micro level
- Communicate improvement initiatives up and down the chain of command

INGB 522	NQF level: 8

Title: Introduction to Data and Decision Sciences

Purpose of the module:
Evidence-based decisions are better decisions. In the abundance of data and the overwhelming amount of information and opinion, gathering suitable data, processing it correctly to build valid evidence is a key skill of modern Engineers. This module equips students with the basic skills to start rigorously analysing data and communicating supported findings.
Module outcomes:
On completion of the module, the student should be able to demonstrate:

- Understand the nature of data, the different types and classifications of data
- Suggest an appropriate method for data analysis based on this
- Prepare data analytic models
- Prepare suitable visualisations and communicate the findings of the analysis
- Apply the human touch to data and interpret the findings appropriately

INGB 523	NQF level: 8

Title: Operations Management and Supply Chain

Purpose of the module:
Understanding operations and supply chains scientifically is one of the most important areas in which the Industrial Engineering skill set is of importance. This module equips students with the important skills that are used to deliver product to customer demand in an optimised, efficient, and high-quality way.

Module outcomes:
On completion of the module, the student should be able to:

- Differentiate between “operations” and “supply chain” management
- Plan, schedule and balance the production and distribution of goods
- Design interventions to improve efficiency of processes and relating this to system-cost
- Choose a suitable forecasting technique and apply it in practice
- Design supply networks based on underlying best-practice first principles
- Manage stock holding philosophies to maximise system efficiency
- Manage purchasing, inventory control and warehousing

INGB 524	NQF level: 8

Title: Modelling and Simulation

Purpose of the module:
Complex systems can rarely be solved exactly - only optimised. Given the almost unlimited number of variables and conditions, making use of models, representative tools that simplify reality, and simulations – approaches that reduce the need to run experiments in practice. This leads to lower cost, higher impact decisions in shorter time with the ability to test solutions through simulation before taking the high-risk steps of practical experimentation. In this module, students will be equipped with specific skills in model development, simulation coding and being able to apply these to understand and drive real-world problems.

Module outcomes:
On completion of the module, the student should be able to:

- Understand the purpose of modelling and identifying a suitable scenario that will benefit from being modelled
- Show insight in selecting the details and characteristics that can be simplified
- Produce a model that will be a useful tool for understanding real world problems
- Create a simulation of a complex problem using suitable software
- Select suitable simulation strategies, choosing agent based, discrete event or System Dynamic simulations
- Interpret the results from simulations to advise leadership in decision making

INGB 525	NQF level: 8

Title: Engineering Investigation and Problem Solving

Purpose of the module:
This course is the capstone project for this qualification. In this course, the student will have to identify and solve a problem in their working environment, making use of the skills gained in the other courses of this qualification to deliver an Industrial Engineering solution to a complex, real-world problem.

Module outcomes:
On completion of the module, the student should be able to demonstrate:

- The ability to identify and demarcate an Industrial Engineering related problem and use theory driven tools to analyse and effectively address complex problems –The ability to critically judge ethical and professional aspects of a problem within different environments and contexts and conduct oneself in a way that upholds the values of the Industrial Engineering profession
- The ability to work with others when deploying Industrial Engineering solutions and judge the effectiveness of the implementation against a range of relevant key performance indicators and qualitative criteria

NUCL 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

NUCI 521	NQF level: 8
Title: Introduction to Thermal-Fluid Sciences	
Module outcomes: To provide students with the technical and theoretical knowledge regarding thermal fluid sciences which he/she will need to solve the thermal-flow problems in the modules that will follow. • *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 • *Heat transfer*: Conduction, convection and radiation heat transfer, heat exchangers	

NUCL 526	NQF level: 8
Title: Nuclear Reactor Safety	
Module outcomes: On completion of the module, the student should be able to demonstrate: • integrated knowledge of and engagement in aspects related to nuclear reactor safety and critical understanding and application of techniques and practices relevant to nuclear reactor safety • The ability to critically interrogate multiple sources of knowledge within the field of nuclear reactor safety and critically evaluate and review that knowledge with a view to apply relevant knowledge	

NUCI 574	NQF level: 8
Title: Nuclear Engineering Project	
Module outcomes: On completion of the module, the student should be able to demonstrate: • the ability to execute a research project in the field of nuclear engineering independently • and to write a concise scientific report on it	

NUCL 512	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
- 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
    - 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
- 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

NUCL 525	NQF level: 8

Title: Nuclear Project Management

Module outcomes:
To provide students with a broad overview of nuclear project management in order to provide them with the basic knowledge they need to function in the nuclear reactor industry. The following topics in nuclear engineering are covered:

- System Engineering Process
- Scheduling project execution
- Nuclear safety
- Cost estimation and cost-value analysis
- Planning project execution
- Project functional management
- The ability to apply this knowledge to a typical nuclear industry project

After completion of this module, the student should demonstrate:

- integrated knowledge of and the ability to apply and evaluate key terms, concepts, facts, principles, rule and theories of the Nuclear Project Management field
- critical understanding of the specialization area and how that knowledge relates to other fields
- problem-solving skills that encompass the ability to identify, analyse, evaluate, critically reflect on and address complex problems, related to Nuclear Project Management

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
- 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
- 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
- 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.