CALENDAR 2009

FACULTY OF ENGINEERING

UNDERGRADUATE

PROGRAMMES

Potchefstroom Campus

This Calendar was originally published in Afrikaans.
Correspondence may be conducted in either Afrikaans or English.

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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.puk.ac.za/jaarboek/index_e.html.

Please take cognisance 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.

Warning against plagiarism: Assignments are individual tasks and not group activities (unless explicitly indicated as group activities). For further details see: http://www.puk.ac.za/beheer-bestuur/beleid-reels/index_e.html

Language medium for teaching-learning: Full-time undergraduate programmes for B.Eng. viz. Chemical Engineering, Chemical Engineering with specialization in Minerals Processing, Electrical and Electronic Engineering, Computer and Electronic Engineering and Mechanical Engineering are presented in Afrikaans.

Interpreting from Afrikaans to English is available for the entire programme.

Examinations, assessments and correspondence in all programmes may be conducted in Afrikaans or English, according to the preference of the student.

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.

OFFICIALS
DEAN

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Mrs MCJ Potgieter, BA (Communication) (PU for CHE), BBibl (Hons) (PU for CHE).

SCHOOL DIRECTORS AND MANAGERS: FACULTY OF ENGINEERING

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Prof FB Waanders, PrEng., PrSciNat, PhD (PU for CHE).

School of Electrical, Electronic and Computer Engineering
Prof JA de Kock, PrEng, PhD (Stellenbosch).

School of Mechanical Engineering
Prof CP Storm, PhD, MEng (PU for CHE).

Post-Graduate School of Nuclear Science and Engineering
Acting Chair: Vacant.

Centre for Research and Continued Engineering Development (Pretoria)
Manager: Prof EH Mathews, PrEng, PhD.

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Manager: Prof PW Stoker, PrEng, PhD (Eng).

EDUCATION AND QUALITY AFFAIRS

Prof ASJ Helberg, DEng (RAU).

RESEARCH DIRECTOR

Energy systems
Prof G van Schoor, PrEng, DEng (RAU).

SCHOOL DIRECTORS: FACULTY OF NATURAL SCIENCES

School of Physical and Chemical Sciences
Prof. C.A. Strydom, Pr.Sci.Nat., Ph.D. (UP).

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Compiled by Mrs MCJ Potgieter, BA (Communication), BBibl (Hons) (PU for CHE)
Administrative Manager
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20 October 2008

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I.1 RULES: FACULTY OF ENGINEERING

I.1.1 GENERAL

Engineering refers to the practice of the organising of the design, construction and operation of artefacts (products, processes or systems) which transform the physical world around us, in order to satisfy certain identified needs. Engineers study science and use it to solve problems of practical importance, typically by a process known as creative synthesis or design. Engineers are members of a profession and are responsible for the discerning application of their knowledge with a view to the sustainable economic progress and welfare of humanity.

Although engineering as a profession has its origin in the earliest development of humankind, it was only in the middle of the nineteenth century that scientific methodology was first systematically applied to solve engineering problems and when a start was made with the establishment of engineering schools, leading to engineering being recognized as a “learned profession”.

With the impact of technology on our society engineering plays an increasingly important role with respect to economic development. Excellent work opportunities exist for engineers in almost all sectors of the economy, both locally and overseas.

The following BEng degree programmes are offered by the Faculty of Engineering:

- Chemical Engineering
- Chemical Engineering with specialization in Minerals Processing
- Electrical and Electronic Engineering
- Computer and Electronic Engineering
- Mechanical Engineering

The Faculty strives to

* instil scientific innovative thought as well as generally forming the student to empower him/her to fulfil his/her vocation and to be proficient;
* deliver high-level manpower, equipped with the knowledge to succeed in a broad technological environment, with emphasis on the application of proven engineering and operational principles;
* exploit and develop by research new knowledge which will contribute to the development of the country and all its people;
* be a recognized centre of expertise, with high standards and with a unique character;
* cultivate a spirit of innovation and entrepreneurship in students.

The Faculty offers research opportunities to promising persons who wish to pursue a research career after completion of the Bachelors degree (BEng) and are interested in postgraduate study towards a master's degree (MEng) and/or the doctorate (PhD) in Engineering. In the Faculty of Engineering there are research centres of excellence, enjoying support from industry and statutory

bodies. The Faculty may also award the higher doctorate (DEng) for outstanding research conducted without direct supervision.

For information regarding postgraduate study, you are referred to the Postgraduate Calendar.

I.1.2 PROFESSIONAL STATUS

The Bachelors degree awarded in the Faculty of Engineering is recognized by:

a) The Engineering Council of South Africa (ECSA) as a qualifying degree for registration as professional engineer (PrEng) in terms of the Engineering Profession Act (Act nr 46 of 2000).

b) The following Engineering societies for membership:

SA Institute of Chemical Engineering (SACHI)
SA Institute of Electrical Engineering (SAIChE)
SA Institute of Mechanical Engineering (SAIMI)
SA Institute of Mining and Metallurgy (SAIMM)

c) Other local universities and universities abroad for advanced postgraduate study.

In terms of the Engineering Profession Act, ECSA requires that a graduate engineer has to undergo in-service training for a period of three years under the guidance of a professional engineer before registration as a Professional Engineer is possible. This period may be shortened with one year after obtaining an advanced university degree.

In terms of the Washington Accord, reached in June 2000, and of which South Africa is a signatory, the BEng degree awarded by this Faculty is also recognized in the USA, Canada, Australia, New Zealand, the UK and Hong Kong as a qualifying degree for registration as a professional engineer in those countries. Visit www.ecsa.co.za for more information.

I.1.3 AUTHORITY OF THE A RULES

The Faculty Rules must be read in conjunction with, and subject to, the A Rules of the University. The General Academic Rules appear on the website http://www.nwu.ac.za under “General”/”General Calendar”/”Rules”. Printed copies of these Rules may be consulted in the Ferdinand Postma Library and at the Director: Administration and Operations.

I.1.4 EVALUATION OF ACADEMIC LITERACY

a) In order to evaluate their ability to function in an academic environment, all undergraduate students who register at the University for the first time must report for a compusory skills test in academic literacy, at a time and place determined by the University. The purpose of this test is to identify students who, due to inadequate academic skills, may fail to complete their study programme within the stipulated period.

b) The test will be written in the language in which the programme is presented and for which the student has registered [Afrikaans or English]. With the exception of students who are identified as borderline cases by the test, each student has only one opportunity to write the test. Students who are regarded as borderline cases, will be granted a second opportunity to write the test.

c) Students who are regarded as borderline cases, must register for the module AGLA111 [Afrikaans] or AGLE111 [English]. These modules are not calculated in terms of curriculum credits, but the credits earned in this way are regarded as additional credits.

d) Admission to the examination for AGLA111 / AGLE111 requires a participation mark of 35%. Students who are not admitted to the examination for AGLA111 / AGLE111 or, who fail the relevant examination as well as two or more other modules, will have to be re-evaluated by the Evaluation Committee if they want to continue their studies in the following semester. In order to avoid the termination of studies, AGLA111/AGLE111 must be completed at the end of the student's second historic year, at the very latest.

e) Engineering programmes include the compusory module FIAP172 (24 credits), which include the outcomes of AGLA121 / AGLE121. Engineering students who failed the module AGLA111 / AGLE111, but passed FIAP172, may have the result of AGLA111 / AGLE111 condoned by the relevant School Director to allow for a pass mark in the module.

f) Students who have already successfully completed a module [s] / course[s] equivalent to AGLA111, 121 / AGLE111, 121 at another institution and can provide proof of this qualification, may apply in writing to the Head of the Centre for Academic and Professional Language Practice for formal recognition.

I.1.5 SCHOOLS AND FOCUS AREAS IN THE FACULTY

The Faculty of Engineering consists of four Schools. At the head of each school is the Director who is assisted by programme leaders. The schools are responsible for teaching the undergraduate, honours and taught magister's programmes. The schools and the programmes offered in each school are shown in the following table:

SCHOOL	PROGRAMMES
School of Chemical and Minerals Engineering	• Chemical Engineering • Chemical Engineering with specialization in Minerals Processing
School of Electrical , Electronic and Computer Engineering	• Electrical and Electronic Engineering • Computer and Electronic Engineering
School of Mechanical Engineering	• Mechanical Engineering
Postgraduate School of Nuclear Science and Engineering	• MSc in Nuclear Engineering • MEng in Nuclear Engineering

Research in the Faculty is managed by the research focus areas (RFAs). There are currently two focus areas for research and training of masters and doctoral students, namely Energy Systems and Separation Science and Technology. The Master's and PhD programmes are presented within the RFAs in six research directions (sub-programmes).

I.1.6 QUALIFICATIONS, PROGRAMMES AND CURRICULA

In the Faculty of Engineering different qualifications (degrees) can be obtained. A particular qualification can be obtained in one of nine programmes. In each programme a set curriculum is followed.

Information on and the Rules for the different qualifications, study directions/ programmes and curricula for undergraduate study, are expounded in this Calendar.

I.1.6.1 Degrees

The Faculty of Engineering of the University is entitled to award the following degrees:

Qualification and abbreviation	Programme / Curriculum(s)	Qualification / Curriculum codes
Bachelor of Engineering (BEng)	*Qualification code 700 105* **Programme**	
	• Chemical Engineering	I101P
	• Chemical Engineering with specialization in Minerals Processing	I102P
Bachelor of Engineering (BEng)	*Qualification code 700 107* **Programme**	
	• Electrical and Electronic Engineering	I201P
	• Computer and Electronic Engineering	I202P
Bachelor of Engineering (BEng)	*Qualification code 700 109* **Programme**	
	• Mechanical Engineering	I301P
Bachelor of Science (BSc Engineering Science)	Field: Engineering Science *Qualification code 200 113* **Programme**	
	• Chemical Engineering or Minerals Processing	I401P
	• Electrical or Computer Engineering	I402P
	• Mechanical Engineering	I403P
	• Computer Science and Computer Engineering This programme is being phased out. No new enrolments will be accepted as from 2009.	I404P

The following BSc (Hons) degrees are also offered full-time in four programmes in the field of Engineering Science:

Qualification and abbreviation	Programme	Degree / Curriculum codes
Bachelor of Science with Honours (BSc (Hons))	Field: Engineering Science *Qualification code 202 104*	
	Programme • Chemical Engineering or Minerals Processing	I601P
	• Electrical or Computer Engineering	I602P
	• Mechanical Engineering	I603P
	• Computer Science and Computer Engineering	I604P

I.1.7 MODULES AND CREDITS

Modules (subjects) to which certain credits have been allocated, are offered. Each module has to be passed separately (General Rule A.1.12).

Each module has a code and a descriptive name, e.g. ENTR421. The meaning of the number code is explained in General Rule A.1.36.

Modules are divided according to level of complexity, which is also related to the year of study in which the modules are taken in a certain programme, if that programme is completed in the minimum of study time.

Together with each qualification and programme, a number of possible curricula are described, from which the student has to choose one. It is also indicated how the modules in each curriculum are distributed over the different semesters of each study year.

The curricula are designed for the minimum study time of four years (BEng) or three years (BSc), as applicable for the relevant qualification. A student may apply to spread the modules of a programme over a longer period. Exceeding the maximum study time of a programme as a result of unsatisfactory progress by the student, will only be allowed in exceptional cases.

The order in which the modules in a programme is taken, is not arbitrary, but designed to ensure that subsequent learning always builds on previous learning.

I.1.8 LIST OF PROGRAMME MODULES

The list of modules from which the curricula of all the programmes are compiled, and the credit value of each module is given in the table below. The requirements with respect to assumed learning (see A.1.6) are given for each module in I.8 (module outcomes) at the end of each module description, as well as in the last column in the table.

Regarding the requirements with respect to assumed prior learning of Engineering modules, the following apply:

a) Where a first semester module in a certain year level is a prerequisite for assumed prior learning of a second semester module, or a module from one year level is a prerequisite with respect to assumed prior learning of a module of the following year level, a pass mark (module mark) of at least 50% has to be achieved in that prerequisite module, before the following module may be taken.

b) An auxiliary module has to be taken in the same semester as the module on which it has a bearing.

Module code	Descriptive name of module	Cr	Type	Requirements regarding assumed learning
Biochemistry				
BCHI411	Biotechnology	16	H	None
BCHI611	Biotechnology	16	H	None
Chemistry				
CHEN111	Chemical Principles	8	H	None
CHEN121	Introductory Organic Chemistry	8	H	CHEN111
CHEN122	Introductory Inorganic Physical Chemistry	8	H	CHEN111
CHEN212	Physical Chemistry II	8	H	CHEN111 CHEN121 CHEN122
CHEN222	Inorganic Chemistry II	8	H	CHEN111 CHEN121 CHEN122
CHEN223	Organic Chemistry II	8	H	CHEN111 CHEN121 CHEN122
Physics				
FSKN111	Mechanics	8	H	None
FSKN121	Electricity and Magnetism I	8	H	FSKN111 WISK111
FSKN123	Modern Physics	8	H	FSKN111
FSKN211	Electricity and Magnetism II	8	H	FSKN121 WISK121
FSKN311	Electromagnetism	8	H	FSKN211 WISK211

Module code	Descriptive name of module	Cr	Type	Requirements regarding assumed learning
Engineering modules				
CEMI212	Process Principles I	16	H	CHEN121 WISK121
CEMI222	Chemical Thermodynamics I	16	H	CEMI212
CEMI223	Process Principles II	16	H	CHEN111 CHEN121 CEMI212
CEMI311	Transport Phenomena I	16	H	CEMI223
CEMI313	Chemical Thermodynamics II	16	H	CEMI222 CEMI223
CEMI321	Transport Phenomena II	16	H	CEMI223 CEMI311
CEMI322	Separation Processes I	16	H	CEMI313
CEMI323	Chemical Reactor Theory I	16	H	CHEN212 CEMI223
CEMI324	Applied Computer Methods	16	H	CEMI222 CEMI223
CEMI327	Plant Design I	16	H	CEMI223 Student must be able to complete year level 3
CEMI411	Separation Processes II	16	H	CEMI313 CEMI322
CEMI412	Plant Operation	16	H	CEMI327
CEMI413	Particle Systems	16	H	CEMI212
CEMI414	Process Control	16	H	CEMI312
CEMI415	Chemical Reactor Theory II	16	H	CEMI223 CEMI323
CEMI418	Ore dressing	16	H	Co-required: CEMI413
CEMI419	Pyrometallurgy	16	H	None
CEMI427	Plant Design II	32	H	CEMI327 Student must be able to complete degree

Module code	Descriptive name of module	Cr	Type	Requirements regarding assumed learning
CEMI429	Project	16	H	Student has to be in final year and be able to complete degree
CEMI471	Vacation training seniors	8	X	None
CEMI611	Separation Processes II	16	H	CEMI313 CEMI322
CEMI613	Particle Systems	16	H	CEMI212
CEMI614	Process Control	16	H	CEMI312
CEMI615	Chemical Reactor Theory II	16	H	CEMI223 CEMI323
CEMI618	Ore Dressing	16	H	Co-required: CEMI613
CEMI619	Pyrometallurgy	16	H	None
CEMI621	Transport Phenomena II	16	H	CEMI223 CEMI311
CEMI629	Project	16	H	Student has to be in final year and be able to complete degree
CMKI311	Communications for Engineers	8	H	None
EEII321	Power Systems I	16	H	EERI221 EERI311
EEII327	Electrical Design	16	H	Student must be able to complete year level 3
EEII411	Power Systems II	16	H	EEII321
EEII412	Electromagnetics III	16	H	FSKN311
EEII421	Power Electronics	16	H	EERI311 EERI321
EEII611	Power Systems II	16	H	
EEII612	Electromagnetics III	16	H	
EEII621	Power Electronics	16	H	
EERI121	Computer Engineering I	16	H	None

Module code	Descriptive name of module	Cr	Type	Requirements regarding assumed learning
EERI211	Computer Engineering II	16	H	EERI121 WISK111 WISK121 WISK122 FSKN111 FSKN121 FSKN123
EERI212	Electrotechnics	16	H	WISK111 WISK121 WISK122 FSKN111 FSKN121
EERI221	Electrical Systems I	16	H	EERI212
EERI222	Signal Theory I	16	H	EERI212 TGWS211 TGWS212 WISK212 Co-required: WISK222
EERI223	Electronics I	16	H	EERI212 FSKN111 FSKN121 WISK121 WISK122 WISK212
EERI227	Linear Systems	8	H	EERI212 WISK212 Co-required: WISK222
EERI228	Measure and Control	16	H	EERI212
EERI311	Electrical Systems II	16	H	EERI212 EERI221 WISK221
EERI312	Signal Theory II	16	H	EERI222 EERI227
EERI321	Control Theory I	16	H	EERI212
EERI322	Electronics II	16	H	EERI223
EERI323	Engineering Programming I	16	H	ITRW119 ITRW129 EERI121 EERI211
EERI412	Electronics III	16	H	EERI322
EERI413	Signal Theory III	16	H	EERI312

Module code	Descriptive name of module	Cr	Type	Requirements regarding assumed learning
EERI418	Control Theory II	16	H	EERI321
EERI419	Project	8	H	EERI311 EERI312 EERI322 EEII327 or REII321/327 EERI421 (E/E) Student has to be in final year and be able to complete degree
EERI423	Telecommunication Systems	16	H	EERI412 EERI413
EERI429	Project	16	H	EERI311 EERI312 EERI322 EEII327 or REII321/327 EERI413 (E/E) Student has to be in final year and be able to complete degree
EERI471	Vacation training seniors	8	X	None
EERI612	Electronics III	16	H	EERI322
EERI613	Signal Theory III	16	H	EERI312
EERI618	Control Theory II	16	H	EERI321
EERI623	Telecommunication Systems	16	H	EERI412 EERI413
EERI629	Project	16	H	Student has to be in final year and be able to complete degree
FIAP172	Professional Practice I	16	H	None
FIAP271	Professional Practice II	16	H	FIAP172
MATI121	Materials Science I	16	H	None
MATI212	Engineering Materials I	16	H	MATI121
MATI411	Failure of Materials	16	H	MATI212

Module code	Descriptive name of module	Cr	Type	Requirements regarding assumed learning
MATI611	Failure of Materials	16	H	
MEGI111	Engineering Graphics I	16	H	None
MEGI121	Engineering Graphics II	16	H	MEGI111
MEGI211	Strength of Materials I	16	H	WISK121 TGWS121
MEGI222	Thermodynamics I	16	H	None
MEGI224	Applied Computer Methods	16	H	MEGI211
MEGI271	Workshop Practice (Vacation training)	8	X	None
MEGI311	Thermodynamics II	16	H	MEGI222
MEGI312	Fluid Mechanics I	16	H	MEGI222 WISK211
MEGI313	Strength of Materials II	16	H	MEGI211
MEGI321	Fluid Mechanics II	8	H	MEGI312
MEGI322	Structural Analysis	16	H	MEGI313 TGWS222
MEGI327	Mechanical Design	16	H	MEGI313
MEGI411	Thermal Machines	16	H	MEGI311 MEGI321
MEGI412	Heat Transfer	16	H	MEGI321
MEGI413	Fluid Machines	16	H	MEGI321
MEGI414	Airconditioning	16	H	MEGI311 MEGI321
MEGI417	System Design	16	H	None
MEGI421	Machine Dynamics	16	H	None
MEGI422	Introduction to Nuclear Power Systems	16	H	MEGI412
MEGI423	Manufacturing Technology	16	H	MATI212
MEGI427	Thermal Fluid Systems Design	16	H	MEGI411 MEGI412
MEGI471	Vacation training seniors	8	X	None
MEGI472	Introduction to Project Management	8	H	Student has to be registered for final year project
MEGI479	Project	16	H	Student has to be in final year

Module code	Descriptive name of module	Cr	Type	Requirements regarding assumed learning
				and be able to complete degree
MEGI611	Thermal Machines	16	H	
MEGI612	Heat Transfer	16	H	
MEGI613	Fluid Machines	16	H	
MEGI621	Machine Dynamics	16	H	
MEGI623	Manufacturing Technology	16	H	
MEGI627	Thermal Fluid Systems Design	16	H	
MEGI629	Project	16	H	
MGII327	Machine design	16	H	TGWS211
MMEI321	Engineering Economics	8	H	None
NUCI322	Nuclear Materials	16	H	MATI212
NUCI327	Nuclear Engineering I	16	H	MEGI311 MEGI312
REII321	Computer Engineering III	16	H	EERI211
REII327	Computer Engineering Design	16	H	Student must be able to complete year level 3
REII411	Computer Engineering IV	16	H	REII321
REII413	Engineering Programming II	16	H	EERI323
REII422	Software Engineering	16	H	EERI323
REII611	Computer Engineering IV	16	H	REII321
REII613	Engineering Programming II	16	H	EERI323
REII622	Software Engineering	16	H	EERI323
Computer Science and Information Systems				
ITRW111	Introduction to Programming (Excel)	8	H	None
ITRW119	Programming for Engineers (C++) I	8	H	None
ITRW128	Graphical User Interface Programming I	8	H	ITRW111 or ITRW119

Module code	Descriptive name of module	Cr	Type	Requirements regarding assumed learning
ITRW129	Programming for Engineers (C++) II	8	H	ITRW119
ITRW212	Programming II	16	H	ITRW122
ITRW213	Systems Analysis I	16	H	ITRW121 or ITRW122
ITRW222	Data Structures and Algorithms	16	H	ITRW212
ITRW225	System Analysis and Design II	16	H	ITRW213
ITRW311	Databases I	16	H	ITRW224 or ITRW225
ITRW312	Artificial Intelligence	8	H	
ITRW313	Expert Systems	8	H	ITRW121 or ITRW122
ITRW315	Communication Skills	8	H	None
ITRW321	Databases II	16	H	ITRW311
ITRW322	Network Programming and Internet	16	H	ITRW222
ITRW323	Operating Systems	16	H	ITRW222
ITRW613	Databases I	16	H	
ITRW614	Information Systems Engineering I	16	H	
ITRW615	Computer Security I	16	H	
ITRW616	Artificial Intelligence I	16	H	
ITRW617	Image Processing I	16	H	
ITRW623	Databases II	16	H	
ITRW624	Information Systems Engineering II	16	H	
ITRW625	Computer Security II	16	H	
ITRW626	Artificial Intelligence II	16	H	
ITRW627	Image Processing II	16	H	
Statistics				
STTK312	Engineering Statistics	16	H	None
Applied Mathematics				
TGWS121	Statics	8	H	WISK112

Module code	Descriptive name of module	Cr	Type	Requirements regarding assumed learning
TGWS211	Dynamics I	8	H	WISK121 TGWS121 FSKN111
TGWS212	Differential Equations and Numerical Methods	8	H	WISK121
TGWS221	Dynamics II	8	H	TGWS212 TGWS121 FSKN111
TGWS222	Numerical Analysis	8	H	WISK121
TGWS312	Partial Differential Equations (Numerical)	8	H	WISK221
TGWS321	Dynamics III	16	H	TGWS211
Prescribed modules				
ENTR221	Creative Entrepreneurship	8	X	None
AGLE111#	Introduction to Academic Literacy	12	X	None
AGLE121*	Academic Literacy	12	X	AFLE111
Philosophy of Science				
WTNL221	Philosophy of Science I	8	X	None
WTIL311	Philosophy of Science II	8	X	None
Mathematics				
WISK111	Analysis I	8	H	None
WISK112	Co-ordinate Geometry	8	H	None
WISK121	Analysis II	8	H	WISK111
WISK122	Introductory Algebra	8	H	WISK112
WISK211	Analysis III	8	H	WISK121
WISK212	Linear Algebra I	8	H	WISK122
WISK221	Analysis IV	8	H	WISK211
WISK222	Linear Algebra II	8	H	WISK212
WISK312	Linear Algebra III	8	H	WISK222

Students who have not passed the compulsory skills test in academic literacy, must register for the module AGLE111.

*All Engineering programmes include the compulsory module FIAP172 (24 credits), which includes the outcomes of AGLE121. See I.1.4 for rules in connection with Academic Literacy.

I.1.9 RELATIONSHIP BETWEEN CREDITS, TEACHING PERIODS AND EXAMINATION PAPERS

According to General Rule A.1.12 the following Rule applies to the relationship between the credits of a module and the number of theoretical periods and practical periods (where applicable):

A module of which the credit value is 8 (16) takes up a maximum of 2 (4) theoretical periods of 45 minutes each during the first three semesters of a curriculum (the two semesters at the first year level and the first semester at the second year level) and a practical session of a maximum of 1½ (3) hours per week at the first year level.

In the second semester at the second year level and in the first and second semesters at the third year level a module with a credit value of 8 (16; 24) usually takes up 1 (2; 3) theoretical periods of 45 minutes each and on second, third and fourth year levels a practical session of 1 (1½; 1½) hours per week. In cases where more than one module of a specific subject is found in the same semester of a curriculum, that subject will not have more than 4 theoretical periods in that semester. Depending on the nature of the different subjects, deviations from this general rule might occur. A brief description of the learning outcomes of each module can be found in the last part of this Calendar. In each study guide complete information is provided in this regard

In summary, for the modules of the Faculty of Engineering, the following general guidelines apply:

YI	16 CREDIT MODULES				8 CREDIT MODULES			
	L	Pr	T	Ex	L	Pr	T	Ex
I	4	3	2 hours	3 hours	2	2	2 hours	2 hours
II	4/3	3	2 hours	3 hours	2	2	2 hours	2 hours
III	3	3	2 hours	3 hours	2	2	2 hours	2 hours
IV	3	3	2 hours	3 hours	2	2	2 hours	2 hours

YI = year level; L = lecture; Pr = practical; T = test duration ; Ex = exam duration

I.1.9.1 Relation between credits and examination papers

The time for an examination paper of an 8 credit module is usually two hours and the duration of examination papers that carry 16, 24 or 32 credits, is usually three hours.

I.1.10 RECOGNITION OF PRIOR LEARNING

a) North-West University accepts the principles underlying outcomes-based, source-based and lifelong learning, in which considerations of articulation and mobility play a significant role, and subscribes to the view that recognition of prior learning, whether acquired by formal education programmes at this or other institutions, or informally (by experience), is

an indispensable element in deciding on admission to and awarding credits in an explicitly selected teaching-learning programme of North-West University.

b) The recognition of prior learning concerns the provable knowledge and learning that an applicant has acquired, whether by having completed formal education programmes, or by experience. At all times the question will be what the level of the skills is, and skills will be assessed in the context of the exit level skills required by the intended teaching-learning programme or modules in the programme, or the status for which the applicant applies, and not merely by virtue of the experience recorded by the applicant. Recognition of prior learning will therefore take place in terms of applied competencies demonstrated by the applicant in his/her application, taking into consideration the exit-level outcomes that have to be obtained by means of the selected teaching-learning programme.

c) North-West University accepts that recognition of prior learning must take place in a valid, trustworthy and fair way, within the normal existing policy on awarding credits to potential and existing students, whether they are from this or another institution.

d) For processing an application for recognition of prior learning, a non-refundable administrative levy is payable as determined by the University from time to time.

e) In terms of A.5.7.1 a student entering the University with a view to study further, after completing only part of a qualification at another institution of higher education, has to apply in writing to the relevant Faculty in order to obtain recognition of modules passed, with the proviso that not more than half of the number of modules required by the curriculum in question, may be recognized. The student may repeat those modules for which recognition are not granted.

I.1.11 ADMISSION REQUIREMENTS FOR UNDERGRADUATE STUDY (POTCHEFSTROOM CAMPUS)

A student, who wishes to register at the University or re-register after an interruption of his/her study, must apply for admission.

This also applies to students from other universities wishing to continue their studies at North-West University. (I.1.11.3). Applications for admission to all programmes close on 30 June (for residence applications) and 30 November if residence accommodation is not required.

Please take cognisance 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. Owing to the capacity limitations and the high demand from students for admission to particular fields of study, students will be selected on the basis of their scholastic achievements for admission to these fields.

I.1.11.1 First Year of Study

No student will be allowed to study for the degrees of BEng or BSc in the Faculty of Engineering, except if he/she complies with the requirements contained in General Rule A.4.2, which stipulates that the School End Certificates must be endorsed to state that the minimum statutory requirements

for admission to B-degree studies at a university in the RSA have been complied with – i.e. full matriculation exemption/conditional exemption).

Due to the fact of the General Rules and Faculty Rules as contained in the relevant yearbook and with specific reference to Rule A .4.2 (which determines that the National Senior Certificate is obtained and that the minimum statutory requirements for admission to B.degree studies as a university in the RSA have been complied with – i.e. **a pass on level 4 in four designated Subjects**).The University reserves the right to apply the following selection model, on the basis of which consideration will be given to candidates applications.

SCREENING MODEL: DETERMINATION OF THE APS-SCORE	
NSC-rating code	**APS-score**
7 (90-100%)	**8**
7 (80-89%)	**7**
6 (70-79%)	**6**
5 (60-69%)	**5**
4 (50-59%)	**4**
3 (40-49%)	**3**
2 (30-39%)	**2**
1 (0-29%)	**1**

APS : Achievement Point Score

1. The results of 6 subjects are used to determine the APS score.
2. The achievement in Life Orientation (LO) will not be rated in computing the APS-score. A achievement level of 5 in LO and higher will be regarded as a recommendation for admission in boundary cases and admission to certain programmes.
3. A student who achieves one or two APS scale points less than required for a specific study course, may at the discretion of Senate be admitted conditionally to a particular field of study. Such a student must prove by successful completion of a Senate-approved admission examination, registered with the Matriculation Board, that he/she has the ability to be admitted to university studies.
4. A student who 4. achieves three or four APS scale points less than required for a specific study course, may after the successful completion of a Senate-approved admission examination and a Senate-approved bridging programme, be admitted by way of a Senatediscretionary exemption to a particular field of study.
5. A student who obtains Discretionary Exemption may be admitted to certain study programmes on certain conditions.

ADMISSION REQUIREMENT FOR THE CAMBRIDGE SYSTEM

It is not clear if the admission requirements of the different systems mentioned below will stay the same. It is determined by the Matriculation Board.

Information is subject to change. Contact the Admissions Section for the latest information.

Full exemption on the basis of HIGCSE and IGCSE level examinations of UCLES.

The Matriculation Board will issue a certificate of full exemption if the following requirements are met:

1. Must pass 5 subjects. Must pass in 4 x HIGCSE (=HG subjects) and 1 x IGCSE (=SG subjects).
2. Must have English 1st or 2nd language.
3. At least one subject from group 1 or 2.
4. At least two subjects from group 3, 4, 5. (Must have at least 4 different groups).
5. Must pass at least Mathematics on IGCSE to get any subject from group 5 recognised as HIGCSE.

GROUP I	A First Language approved by the Committee of Principals.
GROUP II	A Second Language approved by the Committee of Principals.
GROUP III	A Third Language approved by the Committee of Principals, not taken into account for purposes of Group I or Group II, Biology, Physics and Chemistry or Mathematics.
GROUP IV	Geography, Biology (if not taken into account under Group III), History, Physics and Chemistry (if not taken into account under Group III) or Mathematics (if not taken into account under Group III).
GROUP V	Design and Technology, Computer Science or Accountancy.

CONVERSION TABLE							
APS Count	**RSA T-subj.**	**RSA SS-subj.**	**A-level = Gr 13**	**HIGCSE**	**AS-level**	**IGCSE = Gr 11**	**O-level = Gr 11**
8			A				
7	7		B	1	A		
6	6	7	C	2	B		
5	5	6	D	3	C		
4	4	5			D	A	A
3	3	4			E	B	B
2	2	3		4 Con-verted to a pass at IGCSE level		C	C
1	1	2					

ACE – SCHOOL OF TOMORROW

Implications for holders of the local ACE School of Tomorrow Grade 12 College Entrance Certificate taking the New SAT/AARP is that they also have to be successful in a Senate approved admission test in order to qualify for dmission to first degree studies in accordance with the Senate Discresionary Admission Route.

Information is subject to change. Contact the Admission Section for the latest information.

I.1.12 CALCULATION OF APS-SCORE IN THE FACULTY OF ENGINEERING

1. APS Score: The results obtained in four Designated Subjects and two NSC subjects are used in the computation of the APS-score. Life Orientation is excluded.
2. Language Requirement: a Pass at level 4 (50-59%) in the language of instruction on either the Home or First Additional Language level.
3. The languages of instruction for these programs are Afrikaans, but it is simultaneously translated in English.

Degree		Required NSC subjects	APS
BEng (4 yr*)*			
School of Chemical and Minerals Engineering	7001051	Math. Level 6 (70-79%) and Physical Sciences level 5 (60-69%). Afrikaans or English level 4 (50-59%)	31
1. Chemical Engineering	I101P		
2. Chemical Engineering with specialization in Minerals Processing	I102P		
School of Electrical and Electronic Engineering	7001071	Math. Level 6 (70-79%) and Physical Sciences level 5 (60-69%). Afrikaans or English level 4 (50-59%)	31
3. Electrical & Electronic Eng.	I201P		
4. Computer & Electronic Eng.	I202P		
School of Mechanical Engineering	7001091	Math. Level 6 (70-79%) and Physical Sciences level 5 (60-69%). Afrikaans or English level 4 (50-59%) .	31
5. Mechanical Engineering	I301P		

Degree		Required NSC subjects	APS
BSc in Engineering Science (3 yr)	2001131	Math. Level 6 (70-79%) and Physical Sciences level 5 (60-69%). Afrikaans or English level 4 (50-59%)	31
1. Chemical Engineering or Minerals Processing Engineering	I401P		
2. Electrical or Computer Engineering	I402P		
3. Mechanical Engineering	I403P		

Technikon diplomaeds seeking admission to the Faculty, must contact the Admissions Office. Each application will be considered on merit.

I.1.12.1 Admission requirements: application for selection to switch from BSc to BEng

Prospective students, who do not comply with the admission requirements for B Eng. or BSc programs offered by the Faculty, register on year level 1 of a BSc program in the Faculty of Natural Sciences. At the end of his/her first year a new application for admission to a program offered by the Faculty of Engineering can be submitted. Admission is subject to performance and the requirement that all the first year modules are passed.

In terms of A.5.7.2 a student who desires to change to another curriculum has to apply, in writing, to the relevant Faculty for recognition of modules already passed and which form part of the curriculum to which he/she wants to change.

I.1.12.2 Joining from another university

a) Students who started their studies in Engineering at another university and who are desirous to continue their studies at this University, are strongly advised to complete only the first year level of the programme at that university before applying to continue with the second level programme at this University.

b) Applications from students who started their engineering studies at another university and who wish to continue at this university, will only be considered if the first year of study has successfully been completed at the previous university. An application to continue with the second year of the BEng programs at this university, will be considered.

c) Students who studied Engineering at another university are subject to selection. Their applications for admittance to one of the BEng programmes will be treated *ad hoc*.

d) Students who studied Engineering at another university and who were not allowed to continue at that university, will not be allowed to register for any BEng programme at NWU.

e) Applications for admission to one of the BEng programmes for a particular year, close on 31 October of the previous year and application for recognition of modules on the grounds of corresponding modules passed at another university, must be directed to the Dean before the beginning of the academic year.

f) Students who started their studies in Engineering at another university and who are desirous to continue their studies at this University must, at the start of their study at the other university, already have complied with the admission requirements of the Faculty of Engineering of the NWU.

I.1.12.3 Selection

Selection takes place before admission to any program in the Faculty of Engineering. The number of students admitted per school, may be limited.

I.1.13 REGISTRATION

"Registration" is the prescribed completed process which a student has to follow in order to be registered as a student of the University (General Rules A.1.52 and A.5).

A student who has been admitted to the University must register per semester, or annually, for the duration of a specific curriculum at the time and place determined by the University for that purpose, by paying the prescribed registration fee, completing the registration form and affixing the required signatures on the registration form. The student must hand in the registration form at the Registration Division and proof of registration will then be issued to him/her (Rule A.5.5.1).

I.1.13.1 Registration for additional modules

In terms of A.5.8.3: In no semester the number of credits for which a student is registered may exceed the normal number of credits per semester by more than 16 credits. As far as Engineering programs are concerned, a maximum of 96 credits may be taken per semester.

I.1.14 EXAMINATIONS (ONLY FOR FIRST BACHELOR'S DEGREES)

Examination opportunities and relevant rules are in accordance with General Rule A.8.

I.1.14.1 Composition of the participation mark

The participation mark for a module (General Rules A.1.5 and A.8.7.4) is compiled from marks for tests, assignments and practical work. For every teaching-learning task (class tests, assignments, exercises, etc.) which is performed by means of formative assessment in a module, a mark is allocated. A student's participation mark is the weighed mean of all these marks.

The relationship between theory and practical work in calculating the participation marks of the modules, are given in the relevant study guides.

I.1.14.2 Admission to examinations

a) Admission to examinations in any module is granted by acquiring a proof of participation (General Rules A.1.41 and A.8.6).

b) In terms of Rule A.8.6 proof of participation will only be issued to a student in the Faculty of Engineering if he/she -

   i) has complied with the specific requirements of the module as set out in the relevant study guide;

   ii) where applicable, has completed the practical work required for a module; and

iii) has obtained a participation mark of at least 25% for every first level module and 40% for every second and third level module.

c) Proof of participation obtained for a module for the first examination opportunity is transferred without any change to the second examination opportunity (General Rule A.8.1.1).

I.1.14.3 Number of examination opportunities

The number of examination opportunities is regulated by General Rule A.8.1. An implication of this rule is that a student, who, after both examination opportunities, has failed the module, irrespective of whether one or both of those opportunities were utilised, must repeat the module. He/she will not be entitled to exemption from class attendance.

I.1.14.4 Module mark

The module mark for every module is calculated from the participation mark and the examination mark in the ratio of 1:1 (General Rules A.1.38 and A.8.7.4).

I.1.14.5 Pass requirements of a module and a curriculum

a) The terms and conditions for passing modules and curricula are set out in General Rules A.8.4 - A.8.7.

b) The subminimum for examinations is 40% for every module (General Rules A.8.7.5). An exception is RINL111, for which it is 50%.

c) The pass mark required for a module in which an examination is written, is 50%

I.1.14.6 Repetition of modules

In terms of A.10.2 a module which has been failed, may be repeated once. As far as Engineering is concerned, it will be considered, in exceptional cases, that the concession be reconsidered, and that a module may be repeated a second time, on the condition that a student may not register for more than 64 credits per semester, that no clashes occur in the timetables of the additional modules taken and that it will be the final opportunity for repetition of the module in question.

Furthermore, it will apply that if a module is terminated only after the semester test, it will be considered to have been taken during that semester.

I.1.14.7 Medical certificates for absence

No medical certificate is required for missed examinations: students must avail themselves of the first and/or the second examination opportunity.

Regarding absence from a semester test due to illness, a valid medical certificate, which attests to the students inability to write the test, has to be handed in. This certificate has to be submitted to the school director within five working days of the consultation with the doctor, or the date of the test, whichever was first.

I.1.15 ASSUMED LEARNING-BASED PROGRESS IN A CURRICULUM

In compiling each curriculum, care has been taken that assumed learning, i.e. prior knowledge and the general level of insight and experience necessary to

comfortably take the modules that are prescribed in a specific semester of a curriculum, has been acquired in the preceding semesters. A student, having failed one or more modules in a preceding semester, will therefore probably not be adequately equipped to take the modules of the following semester. Such students are URGENTLY advised to consult the director of the relevant school BEFOREHAND, to find out which modules of the semester concerned they may take with a reasonable expectancy of success.

The aim of the rules below is to make sure that a student will in any semester only take those modules of which he/she has at least the minimum prior knowledge

a) When students change from one curriculum to another the entrance level in the new curriculum will have to be determined in consultation with the director of the school under which the relevant curriculum falls

b) A module in any subject may only be taken if it conforms to the requirements regarding the assumed learning, as indicated in the list of modules of the relevant subject.

I.1.16 TERMINATION OF STUDIES

In terms of General Rule A.9.1.1 the Rules following below apply in the Faculty of Engineering.

a) A student who has obtained *less* than half of the credits of year level 1 of a curriculum must apply for readmission. If this application is successful the student will have to plan his/her curriculum for the second study year in consultation with the school director or his delegate.

b) A student who, having completed his/her second historic study year, has as yet not obtained half of the prescribed credits of the first two years of a curriculum, must apply for readmission. If the application is successful, the student will not be permitted to take any modules from year level three in his/her historic third study year, but he/she will only be allowed to register for the lacking modules of year levels 1 and 2.

c) A BEng student who, having completed his/her third historic study year, has as yet not obtained all the credits of the first two study years of the curriculum, must apply for admission to one of the BSc programmes. If this application is successful, the student's curriculum for his/her fourth study year will have to be planned in consultation with the director of the relevant school. Continuation of the BEng study will be considered only in exceptional cases.

I.2 RULES FOR THE DEGREE OF BACHELOR OF ENGINEERING

This qualification may be taken in one of five programmes. The programmes which are described in detail below may be taken full-time only.

During their studies students may only, with the consent of the school directors involved, change from one programme to another or change the programmes for which they are registered.

I.2.1 MINIMUM AND MAXIMUM DURATION

The minimum full-time study period for the degree is four years and the maximum time for the completion of the degree is six years.

I.2.2 RECOGNITION OF PRIOR LEARNING

For this qualification the requirements regarding prior learning are described in I.1.8 and I.1.10.

I.2.3 EXAMINATION

The examination opportunities and relevant rules are in compliance with General Rule A.8.

For examination admission requirements, calculation of the participation mark, module mark, passing requirements of the programme, *et cetera*, the student is referred to I.1.13.

I.2.4 COMPOSITION OF THE CURRICULUM

I.2.4.1 Introduction

The curricula of all the undergraduate engineering programmes are compiled in order to comply with the exit level outcomes required by the Engineering Council of South Africa, namely:

- engineering problem solving;
- application of scientific and engineering knowledge;
- engineering design;
- investigations, experimentation and data analysis;
- engineering methods, skills and tools, including information technology;
- professional and technical communication;
- impact of engineering activity;
- individual, team and multidisciplinary working;
- independent learning ability;
- engineering professionalism.

The curriculum for the first study year consists mainly of basic natural science modules, namely Chemistry, Mathematics, Applied Mathematics, Physics and Computer Programming. Certain introductory engineering modules are also presented in the first study year.

In the second study year more engineering science modules are offered, together with selected natural science modules, which differ for the different branches.

The curricula for the third and fourth study year consist mainly of engineering science modules with a few science and management modules. In the final year the emphasis is on design and synthesis, with design and project modules fulfilling an important part.

While formal modules in computer science and information technology are offered up to second year level, great emphasis is placed on computer applications in engineering throughout the curriculum.

I.2.4.2 Programme outcomes

At the end of his/her studies the student will have scientific knowledge and insight stretching across one or more areas. This will include factual knowledge, but especially also knowledge of and insight into concepts, structures, procedures, models, theories, principles, research methods and the place and boundaries of science in human existence.

At the end of the study the student will be able to demonstrate:

- competence to identify, assess, formulate and solve convergent and divergent engineering problems creatively and innovatively;
- competence to apply knowledge of mathematics, basic science and engineering sciences from first principles to solve engineering problems;
- competence to perform creative, procedural and non-procedural design and synthesis of components, systems, engineering works, products or processes;
- competence to design and conduct investigations and experiments;
- competence to use appropriate engineering methods, skills and tools, including those based on information technology
- competence to communicate effectively, both orally and in writing with engineering audiences and the community at large;
- critical awareness of the impact of engineering activity on the social, industrial and physical environment;
- competence to work effectively as an individual, in teams and in multidisciplinary environments;
- competence to engage in independent learning through well-developed learning skills;
- critical awareness of the need to act professionally and ethically and to exercise judgement and take responsibility within own limits of competence.

I.2.4.3 Articulation possibilities

After the successful completion of a programme those graduates who performed satisfactorily, will have direct access to the master's study in one of the core modules of the programme.

Credit will be given for modules passed in other faculties or at other universities, provided those modules contribute to the outcomes and total credit requirements of the relevant programme.

The basic and applied skills which the graduates, with this qualification, will have acquired in the mathematical, computer and basic scientific and engineering disciplines, will equip them to continue with learning in various specialized areas at other institutions.

I.2.4.4 Practical training in industry during study period

Specified training in industry during December/January or July is compulsory for all students. Arrangements in this regard will be made with the assistance of the Faculty administration. Complete information about arrangements will be made available to all students at the beginning of each study year, and every student is expected to make application according to the Rules. The training consists of the following:

I.2.4.4.1 Vacation training for first years (Workshop Practice)

During the first study year, or at the end of the first study year, students are required to attend a two-week module in Workshop Practice. A short report on the training received by students, privately or with their sponsors, must be handed in when returning to the University. Students register for this module at the University, only after completion and handing in of the report.

Bursars must preferably complete the module at their sponsor's facilities. Non-bursars may complete the module with any company/person, provided prior permission is obtained from the Faculty.

I.2.4.4.2 Occupational safety course

It is expected of all students in their second study year to complete a course in occupational safety (NCE course). After the successful completion of the course, a certificate will be issued which will have to be handed in, together with a report.

I.2.4.4.3 Vacation training for seniors (discipline-specific)

During, or after completion of the third study year, a student has to undergo discipline-specific training with a minimum duration of six weeks.

If a student can prove that he/she has been unsuccessful to arrange vacation training at a company, a special concession will be made to him/her to receive accelerated vacation training at a Faculty-approved company during the July vacation. No remuneration will be receivable and, possibly, costs will be incurred in arranging the training.

A report on the training, as well as an employer's report, has to be handed in when the student returns to the University. Students register for this module at the University, only after completion and handing in of the report. The completion of a short course in occupational safety, presented at the University is a precondition for the module.

I.3 SCHOOL OF CHEMICAL AND MINERALS ENGINEERING

Two BEng programmes, Chemical Engineering and Chemical Engineering with specialization in Minerals Processing, are offered in the School.

Chemical Engineering involves the research, development, construction, operation and management of those industrial processes in which raw materials are transformed to products with a higher economic value by chemical or physical means. These processes are concerned with the areas of plastics, synthetic fibres, oil refining, explosives, food processing, fertilisers, pharmaceutical drugs and nuclear installations. The modern chemical engineer may be involved in any stage, from the conception phase of a process to the sale of the final product.

Minerals Processing is an area of specialization in Chemical Engineering concerned with the physical and chemical processes by which, especially metals, are extracted from ores.

I.3.1 PROGRAMME RULES

I.3.1.1 Changing a programme

During their study, students may only change their programme with the consent of the relevant School Director.

I.3.1.2 Total credit value of programmes

The curricula of the programmes in this branch of engineering consist of modules with a total credit value of at least **684** for Chemical Engineering and **656** for Chemical Engineering with specialization in Minerals Processing.

In the following programme curricula, the total number of credit points is spread over four study years.

I.3.1.3 Prescribed modules

In the curriculum of each programme there are a number of compulsory modules: FIAP172, FIAP271 and the Philosophy of Science modules WTNL221 and WTIL311. A fixed curriculum is followed for both branches and there are no elective modules.

I.3.2 CURRICULA

I.3.2.1 Curriculum I101P: Chemical Engineering

Curriculum code I101P

Qualification code 700 105

This curriculum is composed as follows:

YEAR LEVEL I					
First semester			**Second semester**		
Code	**Descriptive Name**	**Cr**	**Code**	**Descriptive Name**	**Cr**
FIAP172	Professional Practice I	24	FIAP172	Professional Practice I (continued)	
CHEN111	Chemical principles	8	CHEN121	Introductory Organic Chemistry	8
FSKN111	Mechanics	8	CHEN122	Int. Inorg. Physical Chemistry	8
ITRW111	Introduction to Programming (Excel)	8	FSKN121	Electricity and Magnetism I	8
MEGI111	Engineering Graphics I	16	FSKN123	Modern Physics	8
WISK111	Analysis I	8	ITRW128	Programming for Engineers (Visual Basic)	8
WISK112	Co-ordinate Geometry	8	MATI121	Materials Science I	16
Total:		**88**	TGWS121	Statics	8
			WISK121	Analysis II	8
			WISK122	Introductory Algebra	8
			Total:		**80**
Total Level I: 168					
YEAR LEVEL II					
First semester			**Second semester**		
Code	**Descriptive Name**	**Cr**	**Code**	**Descriptive Name**	**Cr**
FIAP271	Professional Practice II	24	FIAP271	Professional Practice II (continued)	
CEMI212	Process Principles I	16	CEMI222	Chemical Thermodynamics I	16
CHEN212	Physical Chemistry II	8	CEMI223	Process Principles II	16
EERI212	Electrotechnics	16	CHEN222	Inorganic Chemistry II	8
TGWS211	Dynamics I	8	CHEN223	Organic Chemistry II	8
TGWS212	Differential equations and numerical methods	8	TGWS222	Numerical Analysis	8
WISK211	Analysis III	8	WISK222	Linear Algebra II	8
WISK212	Linear Algebra I	8	WISK221	Analysis IV	8

YEAR LEVEL II (CONTINUED)					
First semester			**Second semester**		
Code	**Descriptive Name**	**Cr**	**Code**	**Descriptive Name**	**Cr**
Total:		**96**	WTNL221	Philosophy of Science I	8
			MEGI271	Workshop Practice (vacation training)	8
			Total:		**88**
Total Level II: 184					
YEAR LEVEL III					
First semester			**Second semester**		
Code	**Descriptive Name**	**Cr**	**Code**	**Descriptive Name**	**Cr**
CEMI311	Transport Phenomena I	16	CEMI321	Transport Phenomena II	16
CEMI313	Chemical Thermodynamics II	16	CEMI322	Separation Processes I	16
CMKI311	Communications for Engineers	8	CEMI323	Chemical Reactor ReactorTheory I	16
STTK312	Engineering Statistics	16	CEMI324	Applied Computer Methods	16
TGWS312	Partial diff equations (numerical)	8	CEMI327	Plant Design I	16
WTIL311	Philosophy of Science II	8	MMEI321	Engineering Economics	8
Total:		**72**	**Total:**		**88**
Total Level III: 160					
YEAR LEVEL IV					
First semester			**Second semester**		
Code	**Descriptive Name**	**Cr**	**Code**	**Descriptive Name**	**Cr**
BCHI411	Biotechnology	16	CEMI427	Plant Design II	32
CEMI411	Separation Processes II	16	CEMI429	Project	16
CEMI412	Plant Operation	16	CEMI471	Vacation Training seniors	8
CEMI413	Particle Systems	16	**Total:**		**56**
CEMI414	Process Control	16			
CEMI415	Chemical Reactor Theory II	16			
Total:		**96**			
Total Level IV: 152					
TOTAL FOR PROGRAMME I101P: 684					

I.3.2.2 Curriculum I102P: Chemical Engineering with specialization in Minerals Processing

Curriculum code I 102P

Qualification code 700 105

This curriculum is composed as follows:

YEAR LEVEL I					
First semester			**Second semester**		
Code	**Descriptive Name**	**Cr**	**Code**	**Descriptive Name**	**Cr**
FIAP172	Professional Practice I	24	FIAP172	Professional Practice I (continued)	
CHEN111	Chemical principles	8	CHEN121	Introductory Organic Chemistry	8
FSKN111	Mechanics	8	CHEN122	Int. Inorg. Physical Chemistry	8
ITRW111	Introduction to Programming (Excel)	8	FSKN121	Electricity and Magnetism I	8
MEGI111	Engineering Graphics I	16	FSKN123	Modern Physics	8
WISK111	Analysis I	8	ITRW128	Graphical User Interface Programming I	8
WISK112	Co-ordinate Geometry	8	MATI121	Materials Science I	16
Total:		**80**	TGWS121	Statics	8
			WISK121	Analysis II	8
			WISK122	Introductory Algebra	8
			Total:		**80**
Total Level I: 160					
YEAR LEVEL II					
First semester			**Second semester**		
Code	**Descriptive Name**	**Cr**	**Code**	**Descriptive Name**	**Cr**
FIAP271	Professional Practice II	24	FIAP271	Professional Practice II (continued)	
CEMI212	Process Principles I	16	CEMI222	Chemical Thermodynamics I	16
CHEN212	Physical Chemistry II	8	CEMI223	Process Principles II	16
EERI212	Electrotechnics	16	CHEN222	Inorganic Chemistry II	8

YEAR LEVEL II (CONTINUED)					
First semester			**Second semester**		
Code	**Descriptive Name**	**Cr**	**Code**	**Descriptive Name**	**Cr**
TGWS211	Dynamics I	8	CHEN223	Organic Chemistry II	8
TGWS212	Differential equations and numerical methods	8	TGWS222	Numerical Analysis	8
WISK211	Analysis III	8	WISK222	Linear Algebra II	8
WISK212	Linear Algebra I	8	WISK221	Analysis IV	8
Total:		**96**	WTNL221	Philosophy of Science I	8
			MEGI271	Workshop Practice (vacation training)	8
			Total:		**88**
Total Level II: 184					
YEAR LEVEL III					
First semester			**Second semester**		
Code	**Descriptive Name**	**Cr**	**Code**	**Descriptive Name**	**Cr**
CEMI311	Transport Phenomena I	16	CEMI321	Transport Phenomena II	16
CEMI313	Chemical Thermodynamics II	16	CEMI322	Separation Processes I	16
CMKI311	Communications for Engineers	8	CEMI323	Chemical Reactor Theory I	16
STTK312	Engineering Statistics	16	CEMI327	Plant Design I	16
TGWS312	Partial diff equations (numerical)	8	CEMI324	Applied Computer Methods	16
WTIL311	Philosophy of Science II	8	MMEI321	Engineering Economics	8
Total:		**72**	**Total:**		**88**
Total Level III: 160					

YEAR LEVEL IV					
First semester			**Second semester**		
Code	**Descriptive Name**	**Cr**	**Code**	**Descriptive Name**	**Cr**
CEMI411	Separation Processes II	16	CEMI427	Plant Design II	32
CEMI412	Plant Operation	16	CEMI429	Project	16
CEMI413	Particle Systems	16	CEMI471	Vacation Training seniors	8
CEMI414	Process Control	16	**Total:**		**56**
CEMI418	Ore Dressing	16			
CEMI419	Pyrometallurgy	16			
Total:		**96**			
Total Level IV: 152					
TOTAL FOR PROGRAMME I102P: 656					

I.4 SCHOOL OF ELECTRICAL, ELECTRONIC AND COMPUTER ENGINEERING

Two BEng programmes, one in Electrical and Electronic Engineering and another in Computer and Electronic Engineering are offered in the School.

Electrical Engineering is mainly involved in the generation, control, transmission, conditioning and application of electricity and the modelling, design, manufacture, commissioning and maintenance of electrical systems. Because new components and methods are continually developed, emphasis is placed on the updating and improvement of existing techniques and equipment.

The computer engineer is mainly concerned with the development of software and microelectronic circuits for application in computer systems, which again has wide applications in all branches of Electrical, Electronic and Computer Engineering. Microprocessors and digital systems nowadays form the core of the most electrical and electronic equipment in industry, consumer market, the medical field, telecommunication, process control, power distribution systems, transport systems, avionics and in specialized applications e.g. artificial intelligence systems, which are becoming more common.

I.4.1 PROGRAMME RULES

I.4.1.1 Changing a programme

During their study, students may only change their programme with the consent of the relevant School Director.

I.4.1.2 Total credit value of programmes

The curricula of the programmes in this branch of engineering consist of modules with a total credit value of at least **656** for Electrical and Electronic Engineering and **656** for Computer and Electronic Engineering.

In the following programme curricula, the total number of credit points is spread over four study years.

I.4.1.3 Prescribed modules

In the curriculum of each programme there are a number of compulsory modules: FIAP172, MMEI321, CMKI311, ENTR221 and the Philosophy of Science modules WTNL221 and WTIL311. A fixed curriculum is followed for both branches and there are no elective modules.

I.4.2 CURRICULA

I.4.2.1 Curriculum I201P: Electrical and Electronic Engineering

Curriculum code I 201P

Qualification code 700 107

This curriculum is composed as follows:

YEAR LEVEL I					
First semester			Second semester		
Code	**Descriptive Name**	**Cr**	**Code**	**Descriptive Name**	**Cr**
FIAP172	Professional Practice I	24	FIAP172	Professional Practice I (continued)	
CHEN111	Chemical principles	8	EERI121	Computer Engineering I	16
FSKN111	Mechanics	8	FSKN121	Electricity and Magnetism I	8
ITRW119	Programming for engineers(C++)I	8	FSKN123	Modern Physics	8
MEGI111	Engineering Graphics I	16	ITRW129	Programming for engineers(C++)II	8
WISK111	Analysis I	8	MATI121	Materials Science I	16
WISK112	Co-ordinate Geometry	8	TGWS121	Statics	8
Total:		**80**	WISK121	Analysis II	8
			WISK122	Introductory Algebra	8
			Total:		**80**
Total Level I: 160					
YEAR LEVEL II					
First semester			Second semester		
Code	**Descriptive Name**	**Cr**	**Code**	**Descriptive Name**	**Cr**
EERI211	Computer Engineering II	16	EERI221	Electrical Systems I	16
EERI212	Electrotechnics	16	EERI222	Signal Theory I	16
FSKN211	Electricity and Magnetism II	8	EERI223	Electronics I	16
TGWS211	Dynamics I	8	EERI227	Linear Systems	8
TGWS212	Differential equations and numerical methods	8	ENTR221	Creative Entrepreneurship	8
WISK211	Analysis III	8	TGWS222	Numerical Analysis	8
WISK212	Linear Algebra I	8	WISK222	Linear Algebra II	8
MEGI271	Workshop Practice (vacation training)	8	WISK221	Analysis IV	8
Total:		**80**	WTNL221	Philosophy of Science I	8
			Total:		**96**
Total Level II: 176					

YEAR LEVEL III					
First semester			**Second semester**		
Code	**Descriptive Name**	**Cr**	**Code**	**Descriptive Name**	**Cr**
CMKI311	Communications for Engineers	8	EEII321	Power Systems I	16
EERI311	Electrical Systems II	16	EEII327	Electrical Design	16
EERI312	Signal Theory II	16	EERI321	Control Theory I	16
FSKN311	Electromagnetism	8	EERI322	Electronics II	16
STTK312	Statistics for engineers	16	EERI323	Engineering Programming I	16
TGWS312	Partial diff equations (numerical)	8	MMEI321	Engineering Economics	8
WTIL311	Philosophy of Science II	8	**Total:**		**88**
Total:		**80**			
Total Level III: 168					
YEAR LEVEL IV					
First semester			**Second semester**		
Code	**Descriptive Name**	**Cr**	**Code**	**Descriptive Name**	**Cr**
EEII411	Power Systems II	16	EEII421	Power Electronics	16
EEII412	Electromagnetics III	16	EERI423	Telecommunication Systems	16
EERI412	Electronics III	16	EERI429	Project	16
EERI413	Signal Theory III	16	EERI471	Vacation Training seniors	8
EERI418	Control Theory II	16	**Total:**		**56**
EERI419	Project	8			
MEGI472	Introduction to Project Management	8			
Total:		**96**			
Total Level IV: 152					
TOTAL FOR PROGRAMME I201P: 656					

I.4.2.2 Curriculum I202P: Computer and Electronic Engineering

Curriculum code I 202P

Qualification code 700 107

This curriculum is composed as follows:

YEAR LEVEL I					
First semester			**Second semester**		
Code	**Descriptive Name**	**Cr**	**Code**	**Descriptive Name**	**Cr**
FIAP172	Professional Practice I	24	FIAP172	Professional Practice I (continued)	
CHEN111	Chemical principles	8	EERI121	Computer Engineering I	16
FSKN111	Mechanics	8	FSKN121	Electricity and Magnetism I	8
ITRW119	Programming for engineers (C++) I	8	FSKN123	Modern Physics	8
MEGI111	Engineering Graphics I	16	ITRW129	Programming for engineers (C++) II	8
WISK111	Analysis I	8	MATI121	Materials Science I	16
WISK112	Co-ordinate Geometry	8	TGWS121	Statics	8
Total:		**80**	WISK121	Analysis II	8
			WISK122	Introductory Algebra	8
			Total:		**80**
Total Level I: 160					
YEAR LEVEL II					
First semester			**Second semester**		
Code	**Descriptive Name**	**Cr**	**Code**	**Descriptive Name**	**Cr**
EERI211	Computer Engineering II	16	EERI221	Electrical Systems I	16
EERI212	Electrotechnics	16	EERI222	Signal Theory I	16
FSKN211	Electricity and Magnetism II	8	EERI223	Electronics I	16
TGWS211	Dynamics I	8	EERI227	Linear Systems	8
TGWS212	Differential equations and numerical methods	8	ENTR221	Creative Entrepreneurship	8
WISK211	Analysis III	8	TGWS222	Numerical Analysis	8

YEAR LEVEL II (CONTINUED)					
First semester			**Second semester**		
Code	**Descriptive Name**	**Cr**	**Code**	**Descriptive Name**	**Cr**
WISK212	Linear Algebra I	8	WISK222	Linear Algebra II	8
Total:		**72**	WISK221	Analysis IV	8
			WTNL221	Philosophy of Science I	8
			MEGI271	Workshop Practice (vacation tr)	8
			Total:		**104**
Total Level II: 176					
YEAR LEVEL III					
First semester			**Second semester**		
Code	**Descriptive Name**	**Cr**	**Code**	**Descriptive Name**	**Cr**
CMKI311	Communications for Engineers	8	EERI321	Control Theory I	16
EERI311	Electrical Systems II	16	EERI322	Electronics II	16
EERI312	Signal Theory II	16	EERI323	Engineering Programming I	16
FSKN311	Electromagnetism	8	MMEI321	Engineering Economics	8
STTK312	Engineering Statistics	16	REII321	Computer Engineering III	16
TGWS312	Partial diff equations (numerical)	8	REII327	Computer Engineering Design	16
WTIL311	Philosophy of Science II	8	**Total:**		**88**
Total:		**80**			
Total Level III: 168					
YEAR LEVEL IV					
First semester			**Second semester**		
Code	**Descriptive Name**	**Cr**	**Code**	**Descriptive Name**	**Cr**
EERI412	Electronics III	16	EERI423	Telecommunication Systems	16
EERI413	Signal Theory III	16	EERI429	Project	16
EERI418	Control Theory II	16	REII422	Software Engineering	16

YEAR LEVEL IV (CONTINUED)					
First semester			**Second semester**		
Code	**Descriptive Name**	**Cr**	**Code**	**Descriptive Name**	**Cr**
EERI419	Project	8	EERI471	Vacation Training seniors	8
MEGI472	Introduction to Project Management	8	**Total:**		**56**
REII411	Computer Engineering IV	16			
REII413	Engineering Programming II	16			
Total:		**96**			
Total Level IV: 152					
TOTAL FOR PROGRAMME I202P: 656					

I.5 SCHOOL OF MECHANICAL ENGINEERING

One BEng programme, Mechanical Engineering, is offered in this School.

The mechanical engineer is involved with the development, design, operation and maintenance of energy transformation systems, transport systems, manufacturing systems and industrial installations. As a result of the emphasis placed today on industrial development, the role of the mechanical engineer is increasing in importance.

The Mechanical Engineering programme maintains a good balance between training in the basic sciences, engineering science and design. Strong emphasis is placed on creative synthesis (design), in order to enable engineers to apply their knowledge in finding solutions for complicated technological problems.

I.5.1 PROGRAMME RULES

I.5.1.1 Changing a programme

During their study, students may only change their programme with the consent of the relevant School Director.

I.5.1.2 Total credit of the programme

The curriculum of the programme for Mechanical Engineering consists of modules with a total credit value of at least **664**.

In the following programme curricula the total number of credit points is spread over four study years.

I.5.1.3 Prescribed modules

In the curriculum of this programme there are a number of compulsory modules: FIAP172, MMEI321, CMKI311, ENTR221 and the Philosophy of Science modules WTNL221 and WTIL311. A fixed curriculum is followed for this program and there are no elective modules.

I.5.2 CURRICULA

I.5.2.1 Curriculum I301P: Mechanical Engineering

Curriculum code I 301P

Qualification code 700 109

This curriculum is composed as follows:

YEAR LEVEL I					
First semester			Second semester		
Code	**Descriptive Name**	**Cr**	**Code**	**Descriptive Name**	**Cr**
FIAP172	Professional Practice I	24	FIAP172	Professional Practice I (continued)	24
CHEN111	Chemical principles	8	FSKN121	Electricity and Magnetism I	8

YEAR LEVEL I (CONTINUED)					
First semester			**Second semester**		
Code	**Descriptive Name**	**Cr**	**Code**	**Descriptive Name**	**Cr**
FSKN111	Mechanics	8	FSKN123	Modern Physics	8
ITRW111	Introduction to Programming (Excel)	8	ITRW128	Graphical User Interface Programming I	8
MEGI111	Engineering Graphics I	16	MATI121	Materials Science I	16
WISK111	Analysis I	8	MEGI121	Engineering Graphics II	16
WISK112	Co-ordinate Geometry	8	WISK121	Analysis II	8
Total:		**80**	WISK122	Introductory Algebra	8
			TGWS121	Statics	8
			Total:		**80**
Total Level I: 160					
YEAR LEVEL II					
First semester			**Second semester**		
Code	**Descriptive Name**	**Cr**	**Code**	**Descriptive Name**	**Cr**
MEGI211	Strength of Materials I	16	MEGI222	Thermodynamics I	16
MATI212	Engineering Materials I	16	MEGI224	Applied Computer Methods	16
EERI212	Electrotechnics	16	EERI228	Measure and Control	16
WISK211	Analysis III	8	WISK221	Analysis IV	8
WISK212	Linear Algebra I	8	TGWS221	Dynamics II	8
TGWS211	Dynamics I	8	TGWS222	Numerical Analysis	8
TGWS212	Differential equations and numerical methods	8	WTNL221	Philosophy of Science I	8
Total:		**80**	ENTR221	Creative Entrepreneurship	8
			MEGI271	Workshop Practice (vacation training)	8
			Total:		**96**
Total Level II: 176					

YEAR LEVEL III					
First semester			**Second semester**		
Code	**Descriptive Name**	**Cr**	**Code**	**Descriptive Name**	**Cr**
MEGI311	Thermodynamics II	16	EERI321	Control Theory I	16
MEGI312	Fluid Mechanics I	16	MEGI321	Fluid Mechanics II	8
MEGI313	Strength of Materials II	16	MEGI327	Mechanical Design	16
CMKI311	Communications for Engineers	8	MMEI321	Engineering Economics	8
TGWS312	Partial diff quations (numerical)	8	MEGI322	Structural Analysis **and**	16
STTK312	Engineering Statistics	16	MGII327	Machine Design **or**	16
WTIL311	Philosophy of Science II	8	NUCI322	Nuclear Materials **and**	16
Total:		**88**	NUCI327	Nuclear Engineering I	16
			Total:		**80**
Total Level III: 168					
YEAR LEVEL IV					
First semester			**Second semester**		
Code	**Descriptive Name**	**Cr**	**Code**	**Descriptive Name**	**Cr**
MATI411	Failure of Materials **or**	16	MEGI421	Machine Dynamics **or**	16
MEGI414	Airconditioning	16	MEGI422	Introduction to nuclear power systems	16
MEGI411	Thermal Machines	16	MEGI423	Manufacturing Technology	16
MEGI412	Heat Transfer	16	MEGI427	Thermal Fluid Systems Design	16
MEGI413	Fluid Machines	16	MEGI471	Vacation Training seniors	8
MEGI417	System Design	16	**Total:**		**56**
MEGI479	Project	16			
MEGI472	Introduction to Project Management	8			
Total:		**104**			
Total Level IV: 160					
TOTAL FOR PROGRAMME I301P: 664					

I.6 RULES FOR THE DEGREE OF BACHELOR OF SCIENCE (AND BSc (HONOURS)) IN ENGINEERING SCIENCE

From 2002 the Faculty offers four BSc programmes in Engineering Science. (On successful completion of this degree a student may be admitted to a BSc (Hons) programme). The purpose of these qualifications is to extend the opportunity to follow a career in a technological environment to more students and to establish an earlier exit level for students who initially started studies in engineering.

These qualifications can be obtained in one of four branches, with curricula specified in more detail below, and can only be taken full-time.

These curricula are subject to the same Rules as for the BSc degree in the Faculty of Natural Sciences.

I.6.1 MINIMUM AND MAXIMUM DURATION

The minimum duration of the study for this BSc degree is three years and the maximum duration for completing the degree is four years.

I.6.2 REQUIREMENTS FOR PRIOR LEARNING

The requirements for this qualification with respect to prior learning are described in I.1.8 and in I. 1.10.

I.6.3 EXAMINATION

The examination opportunities and related Rules correspond to General Rule A.8.

For examination admission requirements, calculation of the participation mark, module mark, pass requirements for the programme, etc., the student is referred to I.1.13.

I.6.4 PROGRAMME RULES

The following branches are offered for BSc Engineering Science:

- Chemical Engineering or Minerals Processing (I401P and I601P)
- Electrical or Computer Engineering (I402P and I602P)
- Mechanical Engineering (I403P and I603P)
- Computer Science and Computer Engineering (I404P and I604)

I.6.4.1 Changing a programme

During their study, students may only change their programme with the consent of the relevant School Director.

I.6.4.2 Total credit value of programmes

The curricula consist of modules with the following total credit values:

a) Chemical Engineering and Minerals Processing

   i) BSc, Curriculum code I401P, three years, at least **424**

   ii) BSc(Hons), Curriculum code I601P, one year, at least **120**

b) Electrical and Computer Engineering

i) BSc, Curriculum code I402P, three years, at least **440**

ii) BSc(Hons)(, Curriculum code I602P, one year, at least **128**

c) Mechanical Engineering

i) BSc, Curriculum code I403P, three years, at least **424**

ii) BSc(Hons), Curriculum code I603P, for one year, at least **128**

d) Computer Science and Computer Engineering

i) BSc, Curriculum code I404P, three years, at least **420**

ii) BSc(Hons), Curriculum code I606P, one year, at least **128**

I.6.5 PROGRAMME OUTCOMES

I.6.5.1 General

On completion of the study the student will be able to integrate the basic knowledge and techniques of the core modules of the programme to investigate relevant natural processes and to solve problems related thereto.

I.6.5.2 Knowledge

The student has to command a thorough knowledge of the core modules of the programme in order to apply this knowledge, to understand physical reality in terms of this knowledge; and to be able to continue with postgraduate studies in some of the core modules.

I.6.5.3 Skills

The student will have the following skills:

the ability to unlock knowledge and information, electronically and otherwise, in the interest of lifelong learning; to perform mathematical-analytical and mathematical-numerical data processing, problem solving and modelling; be capable to process scientific information and evaluate it and report on it, where applicable; have basic laboratory skills; be able to work in groups and, where it is needed, assume leadership.

I.6.5.4 Values

The student must have acquired the following values:

understand the normative aspects of the practice of science and thereby, in scientific investigations reveal responsibility for fellow humans and the environment; scientific honesty and integrity.

I.6.5.5 Articulation possibilities

a) After successful completion of a programme students who performed satisfactorily have direct access to the honours programmes in some of the core modules of the programme.

b) Credit will be given for modules passed in other faculties or at other universities, provided those modules contribute to the outcomes and total credit requirements of the relevant programme.

c) The basic and applied skills which the graduates with this qualification will have acquired in the mathematical, computer and basic scientific and engineering disciplines, will equip them to continue with learning in various specialized areas.

I.6.5.6 Prescribed modules

In the curriculum of each programme there are a number of compulsory modules: FIAP172, FIAP271, MMEI321, CMKI311, ENTR221 and the Philosophy of Science modules WTNL221 and WTIL311. A fixed curriculum is followed for each branch.

I.6.5.7 Curricula

I.6.5.7.1 Curriculum I401P: BSc Engineering Science

Branch: Chemical Engineering or Minerals Processing

Curriculum code I401 P

Qualification code 200 113

This curriculum is composed as follows:

YEAR LEVEL I					
First semester			**Second semester**		
Code	**Name**	**Cr**	**Code**	**Name**	**Cr**
FIAP172	Professional Practice I	24	FIAP172	Professional Practice I (continued)	
CHEN111	Chemical Principles	8	CHEN121	Introductory Organic Chemistry	8
FSKN111	Mechanics	8	CHEN122	Int. Inorganic Physical Chemistry	8
ITRW111	Introduction tot Programming (Excel)	8	ITRW128	Graphical User Interface Programming I	8
MEGI111	Engineering Graphics I	16	MATI121	Materials Science I	16
WISK111	Analysis I	8	TGWS121	Statics	8
WISK112	Co-ordinate Geometry	8	WISK121	Analysis II	8
Total:		**80**	WISK122	Introductory Algebra	8
			Total:		**64**
Total Level I: 144					
YEAR LEVEL II					
First semester			**Second semester**		
Code	**Name**	**Cr**	**Code**	**Name**	**Cr**
FIAP271	Professional Practice II	24	FIAP271	Professional Practice II (continued)	
CEMI212	Process Principles I	16	CEMI222	Chemical Thermodynamics I	16

YEAR LEVEL II (CONTINUED)					
First semester			**Second semester**		
Code	**Name**	**Cr**	**Code**	**Name**	**Cr**
CHEN212	Physical Chemistry II	8	CEMI223	Process Principles II	16
TGWS211	Dynamics I	8	CHEN222	Inorganic Chemistry II	8
TGWS212	Differential Equations and Numerical Methods	8	CHEN223	Organic Chemistry II	8
WISK211	Analysis III	8	TGWS222	Numerical Analysis	8
WISK212	Linear Algebra I	8	WISK221	Analysis IV	8
Total:		**80**	WTNL221	Philosophy of Science I	8
			Total:		**72**
Total Level II: 152					
YEAR LEVEL III					
First semester			**Second semester**		
Code	**Name**	**Cr**	**Code**	**Name**	**Cr**
CEMI311	Transport Phenomena I	16	CEMI322	Separation Processes I	16
CEMI313	Chemical Thermodynamics II	16	CEMI323	Chemical Reactor Theory I	16
CMKI311	Communications for Engineers	8	CEMI324	Applied Computer Methods	16
TGWS312	Partial Differential Equations (Numerical)	8	**Total:**		**48**
WTIL311	Philosophy of Science II	8			
Total:		**56**			
Total Level III: 104					
TOTAL NUMBER OF CREDITS FOR PROGRAMME I401P: 400					

I.6.5.7.2 Curriculum I601P: BSc(Hons) Engineering Science

Branch: Chemical Engineering or Minerals Processing

Curriculum code I601 P

Qualification code 202 104

This curriculum is composed as follows:

BSC (HONS) ENGINEERING SCIENCE Chemical or Minerals Engineering					
First semester			**Second semester**		
Code	**Name**	**Cr**	**Code**	**Name**	**Cr**
CEMI611	Separation Processes II	16	CEMI621	Transport Phenomena II	16
CEMI613	Particle Systems	16	CEMI629	Project	24
CEMI614	Process Control	16			
BCHI611	Biotechnology (C) **or**	16			
CEMI618	Ore Dressing (M)	16			
CEMI615	Chemical Reactor Theory (C) **or**	16			
CEMI619	Pyrometallurgy (M)	16			
Total:		**80**	**Total:**		**40**
TOTAL HONS.: 120					

I.6.5.7.3 Curriculum I 402P: BSc Engineering Science

Branch: Electrical or Computer Engineering

Curriculum code I402 P

Qualification code 200 113

This curriculum is composed as follows:

YEAR LEVEL I					
First semester			**Second semester**		
Code	**Name**	**Cr**	**Code**	**Name**	**Cr**
FIAP172	Professional Practice I	24	FIAP172	Professional Practice I (continued)	
CHEN111	Chemical Principles	8	EERI121	Computer Engineering I	16
FSKN111	Mechanics	8	FSKN121	Electricity and Magnetism	8
WISK111	Analysis I	8	FSKN123	Modern Physics	8
WISK112	Co-ordinate Geometry	8	WISK121	Analysis II	8
MEGI111	Engineering Graphics I	16	WISK122	Introductory Algebra	8
ITRW119	Programming for Engineers I (C++)	8	ITRW129	Programming for Engineers II (C++)	8
Total:		**80**	TGWS121	Statics	8
			Total:		**64**
Total Level I: 144					

YEAR LEVEL II					
First semester			Second semester		
Code	**Name**	**Cr**	**Code**	**Name**	**Cr**
EERI211	Computer Engineering II	16	EERI221	Electrical Systems I	16
EERI212	Electrotechnics	16	EERI222	Signal Theory I	16
FSKN211	Electricity and Magnetism II	8	EERI223	Electronics I	16
TGWS211	Dynamics I	8	EERI227	Linear Systems	8
TGWS212	Differential Equations and Numerical Methods	8	TGWS222	Numerical Analysis	8
WISK211	Analysis III	8	WISK221	Analysis IV	8
WISK212	Linear Algebra I	8	WISK222	Linear Algebra II	8
Total:		**72**	WTNL221	Philosophy of Science I	8
			ENTR221	Creative Entrepreneurship	8
			Total:		**96**
Total Level II: 168					
YEAR LEVEL III					
First semester			Second semester		
Code	**Name**	**Cr**	**Code**	**Name**	**Cr**
CMKI311	Communications for Engineers	8	EERI321	Control Theory I	16
EERI311	Electrical Systems II	16	EERI322	Electronics II	16
EERI312	Signal Theory II	16	EERI323	Engineering Programming I	16
FSKN311	Electromagnetism	8	EEII321	Power Systems I (E) **or**	16
TGWS312	Partial Differential Equations (Numerical)	8	REII321	Computer Engineering III (C)	16
WTIL311	Philosophy of Science II	8	**Total:**		**64**
Total:		**64**			
Total Level III: 128					
TOTAL NUMBER OF CREDITS FOR PROGRAMME I402P: 440					

I.6.5.7.4 Curriculum I602P: BSc(Hons) Engineering Science

Branch: Electrical or Computer Engineering

Curriculum code I602 P

Qualification code 202 104

This curriculum is composed as follows:

BSC(HONS) ENGINEERING SCIENCE Electrical or Computer Engineering					
First semester			**Second semester**		
Code	**Name**	**Cr**	**Code**	**Name**	**Cr**
EERI612	Electronics III	16	EERI623	Telecommunication Systems	16
EERI613	Signal Theory III	16	EEII621	Power Electronics (E) **or**	16
EERI618	Control Theory II	16	REII622	Software Engineering (C)	
EEII611	Power Systems II (E) **or**	16	EERI629	Project	16
REII611	Computer Engineering IV (C)	16	**Total:**		**48**
EEII612	Electromagnetics III (E) **or**	16			
REII613	Engineering Programming II (C)	16			
Total:		**80**			
TOTAL HONS.: 128					

I.6.5.7.5 Curriculum I403P: BSc Engineering Science

Branch: Mechanical Engineering

Curriculum code I403 P

Qualification code 200 113

This curriculum is composed as follows:

YEAR LEVEL I					
First semester			**Second semester**		
Code	**Name**	**Cr**	**Code**	**Name**	**Cr**
FIAP172	Professional Practice I	24	FIAP172	Professional Practice I (continued)	
CHEN111	Chemical Principles	8	FSKN121	Electricity and Magnetism	8
FSKN111	Mechanics	8	FSKN123	Modern Physics	8
ITRW111	Introduction to Programming (Excel)	8	ITRW128	Graphical User Interface Programming I	8
MEGI111	Engineering Graphics I	16	MATI121	Materials Science I	16
WISK111	Analysis I	8	TGWS121	Statics	8

YEAR LEVEL I (CONTINUED)					
First semester			Second semester		
Code	**Name**	**Cr**	**Code**	**Name**	**Cr**
WISK112	Co-ordinate Geometry	8	WISK121	Analysis II	8
Total:		**80**	WISK122	Introductory Algebra	8
			Total:		**64**
Total Level I: 144					
YEAR LEVEL II					
First semester			Second semester		
Code	**Name**	**Cr**	**Code**	**Name**	**Cr**
EERI212	Electrotechnics	16	ENTR221	Creative Entrepreneurship	8
MATI212	Engineering Materials I	16	MEGI222	Thermodynamics I	16
MEGI211	Strength of Materials I	16	MEGI224	Applied Computer Methods	16
TGWS211	Dynamics I	8	TGWS221	Dynamics II	8
TGWS212	Differential Equations and Numerical Methods	8	TGWS222	Numerical Analysis	8
WISK211	Analysis III	8	WISK221	Analysis IV	8
WISK212	Linear Algebra I	8	WTNL221	Philosophy of Science I	8
Total:		**80**	**Total:**		**72**
Total Level II: 152					
YEAR LEVEL III					
First semester			Second semester		
Code	**Name**	**Cr**	**Code**	**Name**	**Cr**
CMKI311	Communications for Engineers	8	EERI321	Control Theory I	16
MEGI311	Thermodynamics II	16	MEGI321	Fluid Mechanics II	8
MEGI312	Fluid Mechanics I	16	MEGI322	Structural Analysis	16
MEGI313	Strength of Materials II	16	TGWS321	Dynamics III	16
TGWS312	Partial Differential Equations (Numerical)	8	**Total:**		**56**
WTIL311	Philosophy of Science II	8			
Total:		**72**			
Total Level III: 128					
TOTAL NUMBER OF CREDITS FOR PROGRAMME I403P: 424					

I.6.5.7.6 Curriculum I603P: BSc(Hons) Engineering Science

Branch: Mechanical Engineering

Curriculum code I603 P

Qualification code 202 104

This curriculum is composed as follows:

BSC(HONS) ENGINEERING SCIENCE Mechanical Engineering					
First semester			**Second semester**		
Code	**Name**	**Cr**	**Code**	**Name**	**Cr**
MATI611	Failure of Materials	16	MEGI621	Machine Dynamics	16
MEGI611	Thermal Machines	16	MEGI623	Manufacturing Technology	16
MEGI612	Heat Transfer	16	MEGI627	Thermal Fluid Systems Design	16
MEGI613	Fluid Machines	16	MEGI629	Project	16
Total:		**64**	**Total:**		**64**
TOTAL HONS.: 128					

I.6.5.7.7 Curriculum I404P: BSc Engineering Science

Branch: Computer Science and Computer Engineering

This programme is being phased out. No new enrolments will be accepted as from 2009.

Curriculum code I404 P

Qualification code 200 113

This curriculum is composed as follows:

YEAR LEVEL I: Completed in 2008.

YEAR LEVEL II					
First semester			**Second semester**		
Code	**Name**	**Cr**	**Code**	**Name**	**Cr**
EERI211	Computer Engineering II	16	ENTR221	Creative Entrepreneurship	8
ITRW212	Graphical Interface Programming II	16	ITRW222	Data Structures and Algorithms	16
ITRW213	Systems Analysis	16	ITRW225	Systems Analysis and Design	16
TGWS212	Differential Equations and Numerical Methods	8	TGWS222	Numerical Analysis	8
WISK211	Analysis III	8	WISK222	Linear Algebra II	8
WISK212	Linear Algebra I	8	WISK221	Analysis IV	8
Total:		**72**	WTNL221	Philosophy of Science I	8
			Total:		**72**
TOTAL LEVEL II: 144					

YEAR LEVEL III					
First semester			**Second semester**		
Code	**Name**	**Cr**	**Code**	**Name**	**Cr**
ITRW311	Databases I	16	EERI323	Engineering Programming I	16
ITRW312	Artificial Intelligence	8	REII321	Computer Engineering III	16
ITRW313	Expert Systems	8	ITRW321	Databases II	16
ITRW315	Communication Skills	8	ITRW322	Network Programming and Internet	16
TGWS312	Partial Differential Equations (Numerical)	8	ITRW323	Operating Systems	16
WISK312	Linear Algebra III	8	**Total:**		**80**
WTIL311	Philosophy of Science II	8			
Total:		**64**			
Total Level III: 144					
TOTAL NUMBER OF CREDITS FOR PROGRAMME I404P: 420					

I.6.5.7.8 Curriculum I604P: BSc(Hons) Engineering Science

Branch: Computer Science and Computer Engineering

Curriculum code I604 P

Qualification code 202 104

This curriculum is composed as follows:

BSC(HONS) ENGINEERING SCIENCE Computer Science and Computer Engineering					
First semester			**Second semester**		
Code	**Name**	**Cr**	**Code**	**Name**	**Cr**
ITRW613	Databases I	16	REII622	Software Engineering	16
REII613	Engineering Programming II	16	EERI629	Project	16
Choose two from the following list:			Choose two from the following list:		
ITRW614	Information Systems Engineering I	16	ITRW623	Databases II	16
ITRW615	Computer Security I	16	ITRW624	Information Systems Engineering II	16
ITRW616	Artificial Intelligence I	16	ITRW625	Computer Security II	16
ITRW617	Image Processing I	16	ITRW626	Artificial Intelligence II	16
Total:		**64**	ITRW627	Image Processing II	16
			Total:		**64**
TOTAL HONS.: 128					

I.6.5.8 Examination

The examination opportunities and relevant Rules are in compliance with General Rule A.8.

For examination admission requirements, calculation of the participation mark, module mark, pass requirements for the programme, etc., the student is referred to I.1.13.

I.7 OTHER REGULATIONS

I.7.1 AWARDING THE DEGREE WITH DISTINCTION

In order to receive the degree of Bachelor in Engineering with distinction, a student must complete the degree in four years and achieve a weighed mean percentage of 75% for all the modules over the four years of study.

I.7.2 EQUIPMENT

A lecturer has the right, with the consent of the Director, to expect students to acquire certain basic equipment, computer equipment, software, components or consumable if the use of such equipment or material will enhance the value of the module. In considering the possible enhancement of the value of the module, the lecturer will keep the financial implications in mind.

From the second year of study every student has to possess a personal computer (PC). The computer has to be Windows compatible with a hard disk and colour monitor. All assignments in all modules in the Faculty have to be completed, using a word processing package.

I.7.3 NETWORK SERVICES

It is expected of all fourth year students in the Faculty of Engineering to have full access to international e-mail, Internet and WWW in order to facilitate the completion of their mini-theses.

Access to these services will be supplied by the LAN of each school and via the Uninet with the co-operation and under the final supervision of the division Information Technology Potchefstroom Campus.

All Regulations issued by the University, and revised from time to time, with respect to the use of the computer facilities of the University, will also be applicable to students and the services utilized by them. Regulations issued by the Faculty of Engineering, and revised from time to time, are also relevant. Any transgression of these Regulations may lead to disciplinary steps.

I.7.4 USE OF POCKET CALCULATORS DURING EXAMINATIONS

The following policy with respect to calculators has been approved:

a) prescribed calculators may be used, but are not supplied centrally;

b) if the calculators in question cannot be described adequately, the examiner must be present in person in order to check the calculators;

c) the chief invigilator must, at the start of each examination session/test, direct the candidates' attention specifically to the requirement that only calculators indicated on the examination paper may be used.;

d) no student may borrow a calculator from another student during an examination/test session and

e) any deviation from these Regulations will constitute an infringement of the examination and test Regulations.

f) Regarding the use of non-standard calculators during examinations, the following applies:

In exceptional cases, permission for the use of non-standard calculators may be given. An application with motivation to this effect has to be handed in two weeks before the commencement of the examination. In each case measures must be taken to clear the memory of the calculator before it is taken into the examination hall. On each examination paper it must be stated whether a pocket calculator with memory may be used and, if so, that the memory must be cleared. The student and the invigilator must ascertain this and they then have to sign a statement to this effect.

I.8 UNDERGRADUATE MODULE OUTCOMES

BCHI411 BIOTECHNOLOGY

3 hours

At the end of this module the student will have knowledge of the basic molecular biology and recombinant DNA technology: flow of genetic information in the biosphere; concept of the gene and gene expression; genetic manipulation of organisms. Biological production of specific compounds; fermentation and secondary metabolites: substrate utilization and product formation by cells; biological reactors, product reclamation and purification; mixed microbic populations, water purification, bio films and biological corrosion.

Prerequisite: None.

BCHI611 = BCHI 411 BIOTECHNOLOGY

CHEMISTRY

CHEN111 CHEMICAL PRINCIPLES

2 hours

At the end of this module the student will have acquired basic knowledge and insight to handle scientific methods, to write and name chemical formulae and to balance reaction equations; to use stoichiometric and other calculations in determining an unknown quantity; to explain tendencies and relationships according to the Periodic Table (main groups) and to name important properties of substances; to classify substances, to write reaction equations and to give explanations for phenomena observed, to handle laboratory equipment and to take safety measures.

Prerequisite: None.

CHEN121 INTRODUCTORY ORGANIC CHEMISTRY

2 hours

At the end of this module the student will have acquired basic knowledge and insight to classify and name organic compounds; to be familiar with the physical properties and chemical reactions of the following types of compounds: unsaturated hydrocarbons, alkyl halides, alcohols, carbonyl compounds, carboxylic acids and their derivatives and a few aromatic compounds; to describe the mechanism of selected organic reactions; to know important compounds and a few of their reactions.

Prerequisite: CHEN111.

CHEN122 INTRODUCTORY INORGANIC CHEMISTRY

2 hours

At the end of this module the student will have acquired basic knowledge and insight to represent the principles underlying solutions, chemical equilibrium, acids and bases, formation of precipitates and electron transfer and to perform appropriate calculations; and to discuss chemical processes in practice and in nature. *Prerequisite:* CHEN111.

CHEN212 PHYSICAL CHEMISTRY II

2 hours

The thermodynamic and kinetic methods of approach in studying chemical and/or biological processes are presented at an introductory level in this module. On completion of this module the student (1) will have command of the conceptual background, theoretical knowledge and operating competency to determine and interpret thermodynamic quantities; (2) will be familiar with basic kinetic concepts and have the ability to calculate kinetic quantities from which he/she will also be able to make mechanistic deductions.

Prerequisite: CHEN111; CHEN121 and CHEN122.

CHEN222 INORGANIC CHEMISTRY II

2 hours

With this module the student acquires basic knowledge and insight to describe the atomic structure of the s- and p-group elements and the bonding theories applicable to these elements; to learn and understand the chemical reactions of the more important s- and p-group elements and to be able to apply the tendencies in the periodic table; to acquire laboratory skills in a variety of synthesis techniques for the s- and p- group compounds and to act responsibly in a laboratory..

Prerequisite: CHEN111; CHEN121 and CHEN122.

CHEN223 ORGANIC CHEMISTRY II

2 hours

At the end of the module the student will be familiar with the basic principles of aromaticity, have knowledge of the chemistry of the most important aromatic compounds, as well as the ability to explain the reaction mechanisms of electrophilic and nucleophilic aromatic substitution reactions. The student will have the ability to predict synthesis routes for aromatic compounds on the basis of his/her knowledge and ability to apply permanent and time-dependent electronic effects in order to explain orientation and reactivity. The student will be able to synthesise certain aromatic compounds, as he/she has mastered the necessary laboratory techniques and skills.

Prerequisite: CHEN111; CHEN121 and CHEN122.

PHYSICS

FSKN111 MECHANICS

2 hours

At the end of this module students will have a formal mathematical knowledge of the fundamental concepts of physics, such as: kinematics in one and two dimensions; Newton's laws of motion; gravitation, work, energy, power, linear momentum, systems of particles, collisions, rotational motion, moments of inertia, statics and waves. In the practica the students will have developed skills in measuring, processing and reporting natural science processes that are selected to be wider than only the area of physics.

Prerequisite: None.

FSKN121 ELECTRICITY AND MAGNETISM I

2 hours

At the end of this module students will have a formal, mathematical knowledge of electromagnetism. It is acquired by means of differential and integral calculus. The topics consist of electrostatics, direct currents, magnetostatics, electromagnetic induction and alternating currents. In the practica further skills are acquired in measuring, processing and reporting of natural science and engineering processes.

Prerequisite: FSKN111 and WISK111.

FSKN123 MODERN PHYSICS

2 hours

At the end of this module students will have been introduced to optics and topics from atomic and nuclear physics, such as introductory quantum theory, quantum theory of radiation, atomic spectra, X-rays, de Broglie waves and radioactivity. In the accompanying practica students acquire experience in measuring, processing and reporting natural science processes.

Prerequisite: FSKN111.

FSKN211 ELECTRICITY AND MAGNETISM II

2 hours

At the end of these module students will have been comprehensively introduced to the experimental laws of electrostatics and magnetostatics in vacuum and matter, as well as electrodynamics. Students learn to apply the laws to a variety of problems by calculating electrostatic potentials and fields and magneto static fields. In the practica (only for B.Sc. students) new knowledge is applied to measure these phenomena, investigate their conformity to scientific laws and to analyse and present results and reports with the aid of computer methods.

Prerequisite: FSKN121 and WISK121.

FSKN311 ELECTROMAGNETISM

2 hours

In this module, following directly on FSKN211, the Maxwell equations are derived for vacuum and for matter. At the end the students will have learnt a number of solutions to these equations in vacuum, non-conductors and conductors, including wave guides and optical fibres. In the practica (only for B.Sc. students) introductory electronics is studied with reference to the following topics: semiconductors, rectifiers, transistors, common emitter amplifiers, the transistor as switch and negative feedback.

Prerequisite: FSKN211 and WISK211.

ENGINEERING MODULES

CEMI212 PROCESS PRINCIPLES I

3 hours

After completion of this module the student will be able to convert units, distinguish between different systems and solve problems involving the most important process variables. The

student will have insight and knowledge to do material balances ands solve complex multiple system problems, with or without chemical reactions.

Prerequisite: CHEN121 and WISK121.

CEMI222 CHEMICAL THERMODYNAMICS I

3 hours

After completion of this module the student will have knowledge and insight to calculate chemical thermodynamic properties of gases and liquids, to obtain properties from databases to solve problems, to use the basic laws of thermodynamics and to apply them in the analysis of chemical thermodynamic systems, to be able to calculate the behaviour of ideal and non-ideal gases and to perform energy balances of certain processes of importance to the chemical engineer.

Prerequisite: CEMI212.

CEMI223 PROCESS PRINCIPLES II

3 hours

After completion of this module, the student will be able to understand the concept of energy, work and heat, and be able to identify the different forms of energy, be able to use thermodynamic tables; to set up and solve energy balances over closed and open system, with and without chemical reactions, while accounting for phase changes, solutions or mixing. The student will be able to combine and solve material and energy balances simultaneously for simple systems.

Prerequisite: CHEN111, CHEN121 and CEMI212.

CEMI 311 TRANSPORT PRINCIPLES I

3 hours

After completion of this module the student must have knowledge and insight: of micro and macro conservation laws of mass, momentum and energy transport and be able to use them in calculations, in the concept of momentum flow in laminar and turbulent flow systems and to use them for detail flow characterisation, to be able to calculate forces over flat, spherical and cylindrical packings for laminar and turbulent flow, to do pressure drop calculations over all equipment in pipe systems and to be able to use the Bernoulli equations for flow calculations.

Prerequisite: CEMI223.

CEMI313 CHEMICAL THERMODYNAMICS II

3 hours

After completion of this module, the student will have the knowledge and insight to calculate the thermodynamic properties of non-ideal organic fluids for vapour-liquid equilibrium, to calculate the vapour-liquid equilibrium for binary and multi-component organic system, to apply the theory of reaction equilibrium to the determination of the yield of a chemical reaction and calculate the equilibrium of ionic systems that us encountered in hydrometallurgical processes

Prerequisite: CEMI222 and CEMI223.

CEMI321 TRANSPORT PRINCIPLES II

3 hours

After completion of this module, the student will have the knowledge and insight into the mechanisms of conduction, convection and radiation, calculate the heat transfer rate for steady state and non-steady state conduction, use differential equations and analytic as well we numerical and graphical techniques to solve conduction problems, do a dimension analysis for convection systems and solve natural and forced convection problems, calculate heat transfer coefficients for convection systems, solve the heat transfer for simultaneous conduction and convection systems, apply the concept of black and grey bodies to the solving of radiation problems, understand and apply various radiation laws to calculate and solve the heat transfer rate through radiation of different systems, to apply Fick's law to the use of shell balances to solve steady-state and non-steady state diffusion problems, apply the concept of mass transfer coefficients to solve different models for mass-transfer operations, to calculate the mass transfer coefficients for flow over a flat plate, spheres, cylinders and packed beds using the different analogies between mass, momentum and heat transfer, calculate the mass transfer rate of different transport processes.

Prerequisite: CEMI212, CEMI223 and CEMI311.

CEMI322 SEPARATION PROCESSES I

3 hours

After completion of this module, the student has acquired knowledge and insight to distinguish between separation processes for the separation of liquid mixtures, to select the relevant equilibrium relations for the separation of gas/liquid systems with the aid of distillation, absorption, stripping and liquid extraction and to apply the basic principles of these processes for the separation of binary and multi component mixtures and to be able to use advanced computer programs for the design of industrial type multi component separation columns.

Prerequisite: CEMI313.

CEMI323 CHEMICAL REACTOR THEORY I

3 hours

After completion of this module, the student has acquired knowledge and insight to complete chemical equilibrium calculation for multitude of reactor systems that could consist of more then one phase and including volume change during the reaction, the theory of kinetics of homogeneous reactions can apply for industrial applicable reaction systems, the theory of kinetics of homogeneous reactions can apply to handle catalytic reactions, the design equations of batch and flow reactors can use to design isothermal and non-isothermal ideal reactors, simple models for non-ideal flow can used to estimate the conversion in a non-ideal reactor and models can develop to describe the flow pattern in side a reactor.

Prerequisite: CHEN212 and CEMI223.

CEMI324 APPLIED COMPUTER METHODS

5 hours

After completion of this module the student will have knowledge and insight of all the components in a control loop. He/she will be able to use the fundamental knowledge of mass and energy balances to evaluate dynamic processes and use this knowledge to simulate these processes using simulation packages (Simulink and/or Hysys). He/she should know the

principles used in feedback control and be able to apply them to design a simple feedback controller.

Prerequisite: CEMI222 and CEMI223.

CEMI327 PROCESS DESIGN I

3 hours

After completion of this module, the student has acquired knowledge and insight to search and document relevant information obtained for design, to complete a conceptual design for a plant by using a systematic hierarchy approach, using optimizing techniques to optimize a plant, to design a plant and know how to run it in compliance with legislation and considering waste management and economic requirements.

Prerequisite: CEMI223. Student must be able to complete year level 3.

CEMI411 SEPARATION PROCESSES II

3 hours

After completion of this module the student will have the knowledge and insights to construct and interpret Kellogg diagrams to obtain the necessary equilibrium data for roasting, to construct and interpret Pourbaix diagrams for different systems, and to set up and describe different leaching reactions and processes, to describe the mechanisms for pressure and bacterial leaching, to determine the resin occupation, capacity limit and bed volumes of an ion exchange system using the basic ion exchange principles, and to set up basic separation configurations with a minimum calculated cost and energy use, to determine the number of stages required for liquid-liquid extraction by using tridiagonal diagrams, to use precipitation as a metal recovery method and to describe an electro winning process and do the calculations involved, of membrane structures, manufacturing and processes, and to do the basic calculations for the use of membrane processes, to understand water and wastewater purification systems and to do the necessary calculations.

Prerequisite: CEMI313 and CEMI322.

CEMI412 PLANT PRACTICE

3 hours

After completion of this module the student will have knowledge and insight to conduct loss management, reliability and maintenance analyses and do an audit for a plant, conduct a full environmental impact assessment on existing and new plant, to design and manage a plant with respect to law requirements, conduct a full economic evaluation on a plant design, to develop a project management plan for a plant and to run a plant using optimizing and energy integration techniques

Prerequisite: CEMI327.

CEMI413 PARTICLE SYSTEMS

3 hours

After completion of this module the student will have the knowledge and insight to describe populations of particles in terms of their physical and chemical properties, to design screens and other apparatus to classify particles in terms of size and or density, to design systems to store and convey particles, to describe slurries in terms of physical properties such as density and viscosity, to design mixer tanks, piping systems and pumps to transport slurries, to design and describe waste dumps, to design settling dams, thickeners, filters and thermal dryers, to describe the operating aspects of all the above mentioned processes, to understand and

describe the interaction between the different processes, to use laboratory equipment to obtain information, experimentally, on the above mentioned processes for later use in design and optimisation thereof.

Prerequisite: CEMI212.

CEMI414 PROCESS CONTROL

3 hours

After completion of this module, the student will have the knowledge and insight to implement advanced control systems, like cascade, feed-forward, GM, ratio control, etc. The student will be able to implement control strategies for selected unit processes; analyse multivariable systems in order to specify and design control systems; and design and implement plant wide control from first principles.

Prerequisite: CEMI312.

CEMI415 CHEMICAL REACTOR THEORY II

3 hours

After completion of this module, the student will have the knowledge and insight design reactors for multiple reactions as well as parallel and series reactions, design and analyse reactors for heterogeneous reactions with complex reaction kinetics, deactivating and poisoned catalysts, design reactor-regeneration systems for deactivating catalysts, design and analyse reactors for non-catalytic heterogeneous reactions, design reaction tanks and towers for gas-liquid reactions with absorption, design multiphase reactors and design and analyse bio-chemical reactors.

Prerequisite: CEMI223 and CEMI323.

CEMI418 ORE DRESSING

3 hours

After completion of this module, the student will have the knowledge and insight to understand and design minerals processes; to simulate these processes using available computer simulation tools; to understand the principles of separation equilibrium and kinetics; to apply process control and techno-economic analyses on minerals processes; to understand and model the liberation of minerals from ore, to design grinding circuits; to understand and design froth flotation processes, ore sorters, gravity separators, dense medium separators, magnetic separators, and electrostatic separators, to understand the principles of and design coal beneficiation processes, to gain insight into the relationship between unit processes and process steps; to understand and use laboratory equipment to gain information about certain unit processes, with the ultimate aim to design and optimise minerals processing plants.

Co-required: CEMI413.

CEMI419 PYROMETALLURGY

3 hours

After completion of the module the student will be able to distinguish between oxide/non oxide and acid/basic/neutral refractories, to discuss and classify furnaces on a classification system and perform simple furnace design procedures from given data, to solve pyrometallurgical problems with the aid of Ellingham and Kellogg diagrams, to make predictions of pyrometallurgical plant conditions, to distinguish between various ore preparation processes, to understand direct and indirect reduction of hematite and to be able to interpret and conduct relevant calculations. The student will be able to describe and explain the reduction of copper

ore, carbothermal reduction of ferro-alloys and explain the relationships for electrolytic reduction of alumina, to use the information given to explain distillation as used in chloride metallurgy and to relate from the vapour pressure of metals the possibilities of zinc production. The student will be able to conduct a literature research on a specific subject and present the findings in paper and in the class situation.

Prerequisite: None.

CEMI427 PROCESS DESIGN II

Written and oral report

After completion of this module, the student will have the knowledge and insight to perform a literature study relevant to the design project; to appraise available technology and to select the most appropriate; to synthesise a process using available methods to produce a product from certain raw materials, to perform various levels of techno-economic evaluations, to investigate and consider other aspects of process design, e.g. environmental, safety, process control, etc.; to set up and optimise material and energy balances; to specify a complete equipment specification list; to compose and submit a complete design document (including an executive summary) to describe, motivate and defend the chosen process design; and to make a professional oral presentation.

Prerequisite: Student must be in final year, and must be completing the degree; CEMI327.

CEMI429 PROJECT

Report.

After completion of this module the knowledge of the student regarding an experimental investigation (chemical or mineral) will lead to a meaningful synthesis of the project. The investigation will consist of the following: a literature survey; planning and execution of experimental work; the processing and interpretation of data; a written report; an oral presentation and a poster presentation. The student will be able to identify a research problem; to use literature and other sources to understand the field of study; to plan and execute a laboratory investigation; to use established research methodology to write a report and to give an oral presentation on the results obtained. The student will also have theoretical knowledge about analytical apparatus and will be able to use it.

Prerequisite: Student must be in his/her final year of study and be able to complete his/her degree.

CEMI471 VACATION TRAINING SENIORS

Participation (Industry: report)

This is a compulsory attendance module for a period of six weeks during the vacation. Students are exposed during vacation training to the daily operation of an appropriate plant, installation or laboratory. Typical engineering problems which are connected with the work place concerned must be investigated under the guidance of an engineer in charge.

After successful completion of the module the student will have a better understanding of the skills a professional engineer needs and the process of engineering and problem solution. The student will be able to take his/her place in industry and will be able to apply safety requirements in the work place. An occupational safety course (NOSA) will be completed during the second year of study at the University before the start of the vacation training in industry.

Prerequisite: None.

CEMI611 = CEMI411 SEPARATION PROCESSES II

CEMI613 = CEMI413 PARTICLE SYSTEMS

CEMI614 = CEMI414 PROCESS CONTROL

CEMI615 = CEMI415 CHEMICAL REACTOR THEORY II

CEMI618 = CEMI418 ORE DRESSING

CEMI619 = CEMI419 PYROMETALLURGY

CEMI621 = CEMI321 TRANSPORT PRINCIPLES II

CEMI629 = CEMI429 PROJECT

CMKI311 COMMUNICATIONS FOR ENGINEERS

2 hours

On successful completion of this module the student will have the knowledge to orally communicate effectively in the engineering environment, will be conversant with different forms of written communication, trained in the use of readability measurements and other aids, communicate the results of investigations in an acceptable way in the form of technical rapports and to lead meetings according to accepted procedures.
Prerequisite: None.

EEII321 POWER SYSTEMS I

3 hours

In this module the student acquires the ability to perform power system calculations, define and use the elementary power functions, analyse transmission line systems, calculate current/time grading for protection circuits and to design protection circuits. The skills developed in this module serve as an introduction to power system synthesis, where the individual components of power systems are assembled and analysed together in order to test the satisfactory operation of power systems.

Prerequisite: EERI221 and EEII311.

EEII327 ELECTRICAL DESIGN

Demonstration, Report

The student will master the principles of product development, synthesis the knowledge he/she has acquired in other subjects and acquire new technical knowledge specific to the problem. The student will demonstrate that he/she mastered the skills to analyze a problem, define a user-need and technical specification, perform a design and implement a suitable technical specification combining knowledge from different fields in the synthesis process, devise a test plan to test compliance with the specification, compile a report containing a description of the problem statement, the specification, the design and the implementation and to present the results to a technical audience.

Prerequisite: Student must be able to complete year level 3.

EEII411 POWER SYSTEMS II

3 hours

The student obtains knowledge of the principles and requirements to operate a power system safely and economically within stability limits. Formulation of the power flow problem, solution thereof with the Jacobi, Gauss-Seidel and Newton methods. Symmetrical and asymmetrical fault current analysis. Formulation of swing equation and equal area technique. Requirements and principles of generator voltage control, load frequency control, economic dispatch. Transient conditions and wave propagation in transmission systems.

Prerequisite: EEII321.

EEII412 ELECTROMAGNETICS III

3 hours

At the end of the module the student will have a thorough knowledge of the principles of transmission and reflection of electromagnetic waves, waveguides, the modelling of transmission lines and waveguides as electrical components, the radiation patterns of antennas and the electrical and magnetic fields in various applications. In this module the students obtain the ability to use the principles of transmission and reflection to set up waveguide equations, to model transmission lines and waveguides as electrical components, to calculate the radiation patterns of antennas and to calculate the electrical and magnetic fields in various applications. The student will, furthermore, be able to set up and solve electromagnetic problems numerically, thus being able to use computer packages to solve electromagnetic problems.

Prerequisite: FSKN311.

EEII421 POWER ELECTRONICS

3 hours

In this module the student will master the functioning of various power electronic switches, including diodes, transistors, MOSFETs, thyristors and IGBTs, and of various converter topologies and Matlab, and the student will understand the physics and switching transients of different switches, calculate the losses associated with different switches, apply switches in various converter topologies and successfully build a converter to control an electrical machine.

Prerequisite: EERI311 and EERI321.

EEII611 = EEII411 POWER SYSTEMS II

EEII612 = EEII412 ELECTROMAGNETICS III

EEII621 = EEII421 POWER ELECTRONICS

EERI121 COMPUTER ENGINEERING I

3 hours

After completing this module the student will have acquired knowledge about binary and octal number systems, logic gates, Boolean algebra and simplification, Karnaugh map simplification, gates and their time relationships, as well as knowledge of various combinational circuits, e.g. decoding and encoding and mathematical circuits. The student will also be knowledgeable on synchronous circuits, flip-flop circuits and their time characteristics, random circuit adder designs, time division multiplexing, A/D, D/A converters and coupling,

memory systems and microcomputer structures, buses and time signals, codes, e.g. ASCII, Grey, EBCDIC. Students will be conversant with the relevant theory, with respect to analysis, evaluation, consultation practice, simulation, synthesis and troubleshooting in circuits and systems of circuits. Students will be conversant with and be able to apply high-level software in industrial

Prerequisite: None.

EERI211 COMPUTER ENGINEERING II

3 hours

After successfully completing this module the student will be able to identify and evaluate the difference between embedded microprocessors and general microprocessors as in the Intel 80x86 family, as well as the difference between von Neuman en Harvard architectures. Furthermore, the student will have the ability to specify and design embedded hardware for a given task and to design and codify software for a given task in machine language or C. The student will make use of IN and OUT interfaces on the level of specification, design and programming and will develop software for both polled and interrupt driven systems. The student will use address space optimally taking into consideration space and speed criteria.

Prerequisite: EERI121; WISK111; WISK121; WISK122; FSKN111; FSKN121 and FSKN123.

EERI212 ELECTROTECHNICS

3 hours

In this module the student acquires the knowledge to apply the laws of point element networks to solve resistance networks and more general AC networks by using different techniques. The student develops the ability to design and analyse various wave form circuits. Power calculations and phasor representations are also applied to solve typical problems.

Prerequisite: WISK111; WISK121; WISK122; FSKN111 and FSKN121.

EERI221 ELECTRICAL SYSTEMS I

3 hours

In this module the student will acquire the skills to solve magnetic circuits with non-linear elements. Also the student would have consolidated his/her knowledge of basic units and derived units. The student will be able to use the per-unit system of measuring as well as the fundamental principles of electricity, mechanics and heat to solve problems. Electromechanical energy conversion principles will be mastered. The models of DC machines are derived in terms of the circuit laws. The operation of machines under steady state conditions is analyzed by the use of network theory. Electrical network principles and active, reactive and complex power in single and three phase linear networks in steady state will be understood. The steady state operation of single and three phase networks will be analyzed mathematically.

Prerequisite: EERI212.

EERI222 SIGNAL THEORY I

3 hours

After successfully completing this module the student will be able describe basic signals using mathematical functions and to analyze signals using the Fourier series expansion and the Fourier transform. The student will be able to analyze linear time-independent systems, both on the time and frequency levels with a view to calculating the system reaction to arbitrary

input signals. The student will also have the ability to design low order passive Butterworth low-pass and high-pass filters.

Prerequisite: EERI212; TGWS211; TGWS212; and WISK212.

Co-required: WISK222.

EERI223 ELECTRONICS I

3 hours

After successfully completing this module the student will have acquired knowledge of operational amplifiers and basic analogue amplifier circuits. In this module the student develops the ability to use semiconductor physics to determine the properties of pn junctions, to use models of components in configurations, to design analogue amplifiers and to use operational amplifiers to facilitate general analogue functions.

Prerequisite: EERI212; FSKN111; FSKN121; WISK121; WISK122 and WISK212.

EERI227 LINEAR SYSTEMS

1,5 hours

After successfully completing this module the student will have acquired the skills to analyze analogue circuits using the Laplace transform and the convolution integral to determine the transfer function of analogue circuits. He/she also develops the insight to decide when to use a particular technique.

Prerequisite: EERI212 and WISK212.

Co-required: WISK222.

EERI228 MEASURE AND CONTROL

3 hours

After completion of this module the student should be able to demonstrate a thorough knowledge of the design and construction of basic instrumentation and control systems for process control; demonstrate skills in the design and construction of basic instrumentation and control systems and demonstrate skill in problem solving, teamwork and communication.

Prerequisite: EERI212

EERI311 ELECTRICAL SYSTEMS II

3 hours

In this module the student wil acquire the skills to analyse and specify single and three phase transformers. Additionally the student will be able to analyse and specify electrical machines (AC) and use principles of electromechanical energy conversion to construct mathematical models of these machines. The student will also determine the dynamic behaviour of machines as found in practice, interpret winding configurations, including space and time harmonics and operate synchronous machines in parallel with other synchronous machines.

Prerequisite: EERI212; EERI221 and WISK221.

EERI312 SIGNAL THEORY II

3 hours

After successfully completing this module the student will have expanded his/her knowledge with respect to signal theory by intensive study of the design of analogue filters. The student will know the properties of several approximation functions for filter design, as well as techniques to practically implement the approximation functions. The student will acquire the skills to analyze active circuits, plot Bode diagrams of circuits, to differentiate between different types of analogue filters and to design analogue filters by the use of different approximation functions. The student will also acquire the ability to implement, in various ways, the approximation functions with practical components.

Prerequisite: EERI222 and EERI227.

EERI321 CONTROL THEORY I

3 hours

In this module the student acquires the ability to perform power system calculations, to define and use elementary power functions, analyze transmission line systems and to design time discrimination protection circuits. The skills that will be developed serve as introduction to power system synthesis, where discrete components of power systems are combined and are analyzed together to test the acceptable functioning of the power system.

Prerequisite: EERI212.

EERI322 ELECTRONICS II

3 hours

After successfully completing this module the student will know advanced standard configurations of active components and will have mastered the skills to determine the frequency and time behaviour of electronic circuits. The student will be able to design and analyze feedback, multi-stage and power amplifiers as is used in integrated circuits. In addition to knowledge of electronic circuits, analogue communication systems are studied, including orthogonality, amplitude modulation, frequency modulation, phase modulation, pulse amplitude modulation, pulse width modulation, pulse position modulation and the influence of noise in analogue communication systems. The student is introduced to digital communication, e.g. ASK, PSK, FSK, QAM, including the influence of noise and the necessity of error correction.

Prerequisite: EERI223.

EERI 323 ENGINEERING PROGRAMMING I

1,5 hours

On successful completion of this module the student will be acquainted with the main elements of C++. This also involves the general principles of object oriented programming, i.e. objects, classes, inheritance and polymorphism. The student will also have knowledge of the different fields of engineering in which C++ software is used. The student will be acquainted with programming methods applicable in certain problem-solving techniques, e.g. simulation and modelling. The student will be able to apply his/her knowledge to solve engineering problems by the development of programmes in C++. The student will use programmes for simulation as a means to investigate problems and solutions. The student will be able to decide on the best programme and programme element to address a problem. The student will be able to develop software in accordance with best programming practice

Prerequisite: ITRW119, ITRW129; EERI121 and EERI211.

EERI412 ELECTRONICS III

3 hours

After the successful completion of this module the student will understand the basics of micro strip waveguides at radio frequencies. The student will also know the different design methods of radio frequency amplifiers. Knowledge on stability and noise in radio frequency amplifiers will also be obtained. The successful student will be able to analyze and design stable analog radio frequency amplifiers (specifically linear, quasi linear and nonlinear amplifiers) and lossless impedance matching networks with the aid of the Smith-chart.

Prerequisite: EERI322.

EERI413 SIGNAL THEORY III

3 hours

With this module the student extends his/her knowledge of signal theory by studying digital signal theory. The student knows the properties of discrete time systems, can analyse discrete time systems by making use of the z transform and can realize discrete time systems in various ways. The student can also determine the frequency content of discrete time in various ways and can design time filters.

Prerequisite: EERI312.

EERI418 CONTROL THEORY II

3 hours

After successful completion of this module the student will have sufficient knowledge of control theory to be able to do the following: Model control system components, apply the z-transform in the analysis of transfer functions and state space variables, derive stability criteria, apply frequency domain techniques to design control algorithms, verify designs through simulation, Model control system components, determine steady state errors and dynamic response, perform stability analyses, frequency response representations, controller design and simulate, state space modelling of systems. A basic knowledge of the application of Artificial Neural Networks and Fuzzy Logic Systems is acquired The student will be able to design state variable feedback control, use the z-transform in the analysis and design of control systems, analyse stability using Jury and Routh-Hurwitz, design digital controllers through frequency domain analyses, verify designs through simulation. Applications of Artificial Neural Networks and Fuzzy Logic Systems can be identified and designed in concept.

Prerequisite: EERI 321.

EERI419 PROJECT

Demonstration and written report

In this module the student must apply the knowledge he/she has gained in all previous courses to solve a chosen practical problem. If specific additional knowledge is required to solve the problem, the student must acquire this knowledge. The student acquires skills in this module to solve a practical engineering problem, as presented in practice, to the best of his/her ability. The skills will depend on the project, but the relevant outcomes of ECSA must be satisfied.

Prerequisite: EERI311; EERI312; EERI322; EEII327 or REII321/REII327 and EEII421 (E/E).
Co requirement: MEGI472 and student has to be in the final year and be able to complete the degree.

EERI423 TELECOMMUNICATION SYSTEMS

3 hours

After completing this module the student must have knowledge of the basic theoretical principles on which modern radio and optical communication systems are based. The student must also know and assess the different radio and optical communications standards. Furthermore, the student will be able to characterize, analyze and design radio frequency communication systems and their building blocks (including cellular communication networks, receiver and transmission circuits, mixers and low-noise amplifiers, phase-lock loops and frequency synthesizers). The student will also be skilled in the analysis of optical communication networks.

Prerequisite: EERI412 and EERI413.

EERI429 PROJECT

Demonstration, project report and 1 hour oral examination

In this module the student verifies the predicted results of EERI411 by using measurements and/or simulations as previously arranged with the relevant project lecturer.

After completion of this module the student will be able to execute the second part of the scientific design method; the process of engineering. It will entail the search for imaginative solutions to sub-problems and the integration of the solutions into a totality. The student will also report effectively on an engineering project, in the form of a written report, an oral presentation and a poster presentation. Project management will be mastered. This includes the planning of the project, the achievement of goals, regular feedback to the project leader and keeping track of expenses. A complete working set-up of the project must be demonstrated.

Prerequisite: EERI419.

EERI471 VACATION TRAINING SENIORS

Participation (Industries: report)

This is a compulsory module requiring vacational training for a period of six weeks during the University vacation. During this training period students are exposed to the day to day operation of an acceptable plant, installation or laboratory. Engineering problems arising from the activities of the workplace concerned have to be investigated by the student, under the supervision of the engineer in charge. After successful completion of this module, the student will have insight into the skills required of professional engineers, the process of engineering and problem solving and the application of safety measures. *Prerequisite:* MEGI271.

EERI612 = EERI412 ELECTRONICS III

EERI613 = EERI413 SIGNAL THEORY III

EERI618 = EERI418 CONTROL THEORY II

EERI623 = EERI423 TELECOMMUNICATION SYSTEMS

EERI629 = EERI429 PROJECT

FIAP172 PROFESSIONAL PRACTICE I

Project portfolio

After successful completion of the module the student should be able to demonstrate fundamental knowledge of the work that engineers do in various disciplines, as well as the curriculum that he/she intends to follow; demonstrate fundamental knowledge and the application thereof as it relates to a) the principles and theory of project management; b) the principles and theory of systems engineering; c) computer programs such as Word, Excel and PowerPoint; d) study-, listening-, reading- and writing strategies, as well as e) the academic vocabulary, and reading and writing of academic text in the field of engineering.

The student should be able to demonstrate competency to apply, as member of a multi-disciplinary team, the engineering process of determination of need, analysis, design, manufacture and evaluation to a simple engineering problem or project, and to communicate the engineering process in an effective and ethical way, verbally and in writing and demonstrate competency to search and compile scientific information in the field of engineering and ancillary fields, to analyze text and interpret, synthesize, evaluate and use such content creatively to resolve problems and communicate outcomes in appropriate terminology and mathematical formulation as applicable to the field of engineering

Prerequisites: None.

FIAP271 PROFESSIONAL PRACTICE II

Project portfolio

After successful completion of the module the student should be able to demonstrate fundamental knowledge of elements of project management and economic and financial accounting, and be able to apply such knowledge to compile cost estimates, market analyses, risk analyses, profitability analyses and economic viability of non-complex projects in the engineering sector.

The student should be able to demonstrate skills to identify entrepreneurial opportunities and analyze and evaluate the sustainability of such, and to plan, implement, develop and manage a (simulated) organization, with due cognizance to economic, social, ethical and environmental responsibilities and demonstrate competency, as individual and member of a team, to apply project- and business management practices as evidenced by a comprehensive management plan, and to communicate to stakeholders the development and execution thereof verbally and in writing, using appropriate IT

Prerequisites: FIAP172.

MATI121 MATERIALS SCIENCE I

3 hours

After successfully completing this module the student will be able to evaluate the most important engineering materials with respect to their applicability in industry and to apply the principles of electrochemistry in the prevention of corrosion. The student will acquire knowledge of materials and engineering, structural properties of metals, ceramics, polymers and composites, analyze phase diagrams and understand mechanical, electrical and magnetic properties of materials and conduct comparative studies of metals, ceramics, polymers and composites.

Prerequisite: None.

MATI212 ENGINEERING MATERIALS I

3 hours

On successful completion of this module the student will be able to, on a basis of fundamental knowledge of the properties of metals, select suitable alloys for application in particular systems. The student will also have acquired fundamental knowledge of the principles of strengthening of metals and alloys, and be able to prescribe simple heat treatment procedures for further enhancing the properties of alloys.

Prerequisite: MATI121.

MATI411 FAILURE OF MATERIALS

3 hours

On successful completion of this module the student will have knowledge and understanding of the different mechanisms of failure of materials, and will be in a position to identify, describe, explain and prevent failure (and corrosion) exemplified by case studies; identify and describe wear and undertake calculations on failure, toughness, and strength of metals, composites, polymers and ceramics. Students will be subjected to the use of failure-mechanics as an approach to design against brittle and fatigue failure.

Prerequisite: MATI212.

MATI611 = MATI411 FAILURE OF MATERIALS

MEGI111 ENGINEERING GRAPHICS I

Examination: Theory/Sketch 1 hour, Practical 3 hours

On completion of this module the student will be able to make use of basic geometric forms to create and communicate design solutions via drawings and e-data; solve technical design problems by means of freehand sketches and computer aided design software.

Prerequisite: None.

MEGI121 ENGINEERING GRAPHICS II

Examination: Theory/Sketch 1,5 hours, Practical 4 hours

On completion of this module the student will be able to plan and execute design processes, to create geometric models on computer; generate manufacturing and assembly drawings and prepare design and tender documents.

The student will acquire knowledge on advanced engineering geometry and construction using computer aided design software; detail dimensioning and tolerancing; basic manufacturing processes; fastening processes in assembly and graphical detail assemblies and animation.

Prerequisite: MEGI111.

MEGI211 STRENGTH OF MATERIALS I

3 hours

After completion of this course, the student should be able apply the fundamental knowledge of axial stress and shear stress together with specialized knowledge such as failure theories to identify and solve structural problems. The student must also be able to use the knowledge obtained in the course to solve design problems creatively, use finite element software in the

solution of structural problems and communicate the results of these solutions through a design report, while working effectively in a team.

Prerequisite: WISK121 and TGWS121.

MEGI222 THERMODYNAMICS I

3 hours

After successful completion of this module, the student will understand the basic concepts of mechanical thermodynamics and be able to use it with the First and Second Law to solve problems for open and closed systems. By doing two practicals the student will learn how to analyse and interpret experimental data. The student will have developed a better understanding how the actual behaviour of a system and the abstract concepts related.

Prerequisite: None.

MEGI224 COMPUTER METHODS

3 hours

After successfully completing this module, the student will be equipped with the necessary knowledge and techniques in using existing engineering software for both thermal flow and structural analysis. The student will be familiarised with the following software: Engineering Equation Solver (EES), Flownex, and Nastran. This module gives support to modules in the third and forth study years where the programming knowledge and techniques learnt are required.

Prerequisite: MEGI211.

MEGI271 WORKSHOP TRAINING

Participating (Industry: report)

After successfully completing this module the student will have mastered the following skills: Fitting: Knowledge of and use of basic hand tools; marking, punching, drilling, sawing, filing, etc.; folding and soldering of plate metal. Welding: Different techniques, gas welding and electrical welding; penetration, overlap and tests. Electrician's work: Knowledge of equipment; conductors and insulators; making and soldering of joints in cables and conductors; knowledge of regulations (domestic and industrial); domestic circuits with one, two and three way switching; series and parallel connection of resistors; electric motors with switches and control equipment; electrical equipment and circuits. Electronic work: Students will learn basic principles by building a practical electronic circuit by using printed circuit boards and discrete electronic components. Machining: Purpose and use of drilling machines, sawing machines, lathes, planning machines en milling machines; tapered cutting, keyways; use of dividing head.

Prerequisite: None.

MEGI311 THERMODYNAMICS II

3 hours

After successfully completing the module the student will be able to solve problems relating to power and refrigeration systems, availability and irreversibility, moist air mixtures, thermodynamic relations, combustion and air conditioning. The student will be able to simulate systems using a software package and with the use of the package show how constituent parts of the system influence each other. The student will be able to evaluate the performance of systems and propose actions to improve their performance. *Prerequisite:* MEGI222.

MEGI312 FLUID MECHANICS I

3 hours

After successful completion of this module, the student shall be able to apply the fundamental

conservation laws for mass, linear momentum, angular momentum and energy in both integral and differential form together with the properties of fluids and flow fields as well as the most important non-dimensional parameters in order to solve practical problems in fluid statics and in steady-state incompressible fluid flow in pipes and ducts. The student shall also be able to simulate and design basic pipe systems with the aid of suitable software packages.

Prerequisite: MEGI222 and WISK211.

MEGI313 STRENGTH OF MATERIALS II

3 hours

After successful completion of the module the student will be able to apply fundamental knowledge of stresses, strains and displacements together with specialist knowledge of strength of materials to solve problems and to analyse and design basic components through structured and unstructured synthesis of the knowledge of strength of materials. This includes the acquisition of additional information by the student on his / her own (using appropriate engineering tools such as the computer packages Excel, Matlab and EES to solve strength of materials problems and to do designs).

Prerequisite: MEGI211.

MEGI321 FLUID MECHANICS II

3 hours

After successful completion if this module the student will be able to apply basic knowledge and the principles of general compressible flow, potential flow and boundary layer flow to solve fluid mechanics problems. He / she will be able to use the basic techniques of compressible flow for the solution of practice oriented problems. This includes the skill in the use of applicable engineering tools such as the computer packages Excel, EES (Engineering Equation Solver), and the specialist flow network solver FLOWNEX to solve fluid mechanics problems and perform designs

Prerequisite: MEGI312.

MEGI322 STRUCTURAL ANALYSIS

3 hours

After successful completion of the module the student will be able to identify and formulate structural analysis problems and to solve them in an innovative way. The student will be able to apply specialist knowledge of the flexibility, stiffness and finite element methods to analyse and solve engineering problems and to analyse and design basic structures through structured and unstructured synthesis of structural analysis knowledge. This includes skills in the use of appropriate engineering tools such as the computer packages Matlab, EES and a finite element code to simulate engineering problems.

Prerequisite: MEGI313 and TGWS222.

MEGI327 MECHANICAL DESIGN

4 hours

After successful completion of the module, the student shall be able to apply fundamental and specialist knowledge in the analysis of existing designs and the synthesis of new detail designs of mechanical systems; communicate effectively in writing with technical audiences through sketches, drawings and a formal detail design report; cooperate successfully in a team with other mechanical engineers; exercise life-long learning in the design and development of mechanical systems. The specialist knowledge includes bearings, gears, clutches and brakes, rotating shafts and axles, fastening components like bolted assemblies and weldments and helical springs.

Prerequisite: MEGI313.

MEGI411 THERMAL MACHINES

3 hours

After completion of this module the student should be able to apply fundamental knowledge concerning the performance of gas turbines and internal combustion engines together with specialist knowledge of fluid mechanics and thermodynamics to solve thermal machine problems. The student should be able to design a basic thermal machine through structured and unstructured synthesis and additional self obtained information. The student should also be capable to keep up to date with the latest technology available on the market. After completion of this module the student should be able to apply fundamental knowledge concerning the performance of gas turbines and internal combustion engines together with specialist knowledge of fluid mechanics and thermodynamics to solve thermal machine problems.

The student should be able to design a basic thermal machine through structured and unstructured synthesis and additional self obtained information. The student should also be capable to keep up to date with the latest technology available on the market.

Prerequisite: MEGI311 MEGI321.

MEGI412 HEAT TRANSFER

3 hours

After successful completion of this module, the student will be capable to apply the basic knowledge of heat transfer (including conduction, convection of external and internal flows, and thermal radiation) to solve practical problems. Furthermore be capable to design basic heat exchangers by applying the heat transfer knowledge obtained. The techniques obtained in using engineering software (Excel, EES) can be used to design or solve heat transfer problems.

Prerequisite: MEGI321.

MEGI413 FLUID MACHINES

3 hours

After successful completion of these modules the student should be able to apply the fundamentals of the performance of fluid machines together with specialist knowledge of fluid

dynamics and thermodynamics. The student should be able solve fluid machine problems, design basic fluid machine system using structured and unstructured synthesis and additional information that was self obtained, solve basic problems on the performance of fluid machine components, communicate more effectively through technical reports. The student should also stay in touch with the latest technologies that are available in the market.

Prerequisite: MEGI321.

MEGI414 AIR-CONDITIONING AND REFRIGERATION

3 hours

After completion of this module the student should be able to solve air-conditioning and refrigeration problems and design a refrigeration system (by combining a synthesis of knowledge with additional self-obtained information). It includes the use of tools such as Excel, as well as specialist programmes such as EES. The sudent should be able to understand the impact of the air-conditioning and refrigeration industry, as a result of the use of harmful refrigeration media and emissions, on the environment and should be able to stay abreast with the latest technology available on the market.

Prerequisite: MEGI311 and MEGI321.

MEGI417 SYSTEM DESIGN

3 hours

After successful completion of the module, the student shall be able to transform a user requirement into engineering specifications; by utilizing the structured, logical process of systems engineering, do a functional analysis and generate innovative and creative concepts; evaluate concepts; make a component breakdown structure of a system; employ different techniques for comparison of alternatives for decision making; attain a basic working experience of project management and scheduling software; effectively communicate both orally and in writing with technical and non-technical audiences during design reviews; cooperate successfully in a design team.

Prerequisite: None.

MEGI421 MACHINE DYNAMICS

3 hours

After completion of this module the student should be capable of applying fundamental knowledge of machine dynamics (vibrations) theory including natural and forced vibrations as well as specialist knowledge of the relevant numerical models. The student should be able to design simple vibration systems through structured and unstructured synthesis and additional self obtained information. The student should also be capable of keeping up to date with the latest technology available on the market. The student should understand the basic vibration measurement equipment used to obtain data on various vibration problems and apply knowledge on fault diagnosis of vibration systems and preventive maintenance that can be applied.

Prerequisite: None.

MEGI422 INTRODUCTION TO NUCLEAR POWER SYSTEMS

3 hours

Upon completion of this module, the student shall have the appropriate knowledge of the non-nuclear mechanical energy systems found in nuclear power generation cycles to critically analyse and evaluate such systems. The student shall be able to use analysing and evaluation

skills to solve industry related problems of the non-nuclear mechanical energy systems found in an unfamiliar context. The student should be familiar with relevant computer software in order to stay up to date in the modern computer era.

Prerequisite: MEGI412.

MEGI423 MANUFACTURING TECHNOLOGY

3 hours

After successful completion of this module the student will be able to solve engineering problems with regard to the manufacturing of products in a logical and systematic way. This includes aspects such as time, cost, quality and finish, knowledge with regard to material properties, manufacturing processes, amongst others casting processes, forming processes, joining processes and technology with regard to material surfaces. The student will acquire knowledge to be able to perform basic designs for manufacturing by learning to evaluate critical components, to optimize the manufacturing process and through critical evaluation take the lead in the planning and execution of manufacturing projects.

Prerequisite: MATI212.

MEGI427 THERMAL FLUID SYSTEM DESIGN

3 hours

After successful completion of this module, the student shall be able to design thermal-fluid system components by applying knowledge of thermodynamics, fluid mechanics and heat transfer, together with information about the performance of specific components including heat exchangers and turbo machines. The student shall also be able to apply suitable software for calculations, modelling and simulation of thermal-fluid system components and systems as required for design purposes.

Prerequisite: MEGI411 and MEGI412.

MEGI471 VACATION TRAINING SENIORS

Attendance (Industry: report)

This is a compulsory attendance module for a period of six weeks during the vacation. Students are exposed during vacation training to the daily operation of an appropriate plant, installation or laboratory. Typical engineering problems which are connected with the work place concerned must be investigated under the guidance of an engineer in charge.

After successful completion of the module the student will have a better understanding of the skills a professional engineer needs and the process of engineering and problem solution. The student will be able to take his / her place in industry and will be able to apply safety requirements in the work place. An occupational safety course (NOSA) will be completed during the second year of study at the University before the start of the vacation training in industry.

Prerequisite: None.

MEGI472 INTRODUCTION TO PROJECT MANAGEMENT

1,5 hours

After successful completion of this module the student will have fundamental knowledge of project management activities for all project management functions during each life cycle phase.

The student will be able to perform the activities of project management in the management of a final year project by amongst others employing toolkits which includes the set-up and updating of appropriate documentation and the use of appropriate software.

Prerequisite: Student must be registered for final year project.

MEGI479 PROJECT

Report and Presentation

After successful completion of the module, the student shall be able to apply the scientific design method, or the engineering process under leadership of a study leader. This entails the formulation of a problem in technical terms, the breakdown thereof into sub-problems and the formulation thereof in general terms. Information sources like the library and internet shall be used for research. The student shall be able to put forward feasible solutions for the sub-problems and the synthesis of the solutions to solve the original problem. The student shall plan and manage his project regarding technical content, schedule and costs. The student shall be able to communicate his project successfully through an oral and poster presentation as well as a written report.

Prerequisite: Student must be in his/her final year of study and be able to complete his/her degree.

MEGI611 = MEGI411 THERMAL MACHINES

MEGI612 = MEGI412 HEAT TRANSFER

MEGI613 = MEGI413 FLUID MACHINES

MEG621 = MEGI421 MACHINE DYNAMICS

MEG623 = MEGI423 MANUFACTURING TECHNOLOGY

MEGI627 = MEGI427 THERMAL FLUID SYSTEM DESIGN

MEGI629 = MEGI479 PROJECT

MGII327 MACHINE DESIGN

3 hours

After completion of this course the student must be able to analyze and design the different machine components such as cams, governors and universal joints through the structured and unstructured synthesis of machine design knowledge and the effective use of computer tools such as Excel. The student will also be able to communicate effectively through a written technical report.

Prerequisite: TGWS211.

MMEI321 ENGINEERING ECONOMY

3 hours

On successful completion of this module the student will have knowledge of the impact of engineering activities on the community by understanding where it fits into the economy, will be able to work effectively in a multidisciplinary team, be able to understand the role of factors in economic analysis and financial accounting en take the lead in the planning and execution of projects by conducting cost estimations, risk analysis, decision making and evaluation of economic viability and profitability. *Prerequisite:* None.

NUCI322 NUCLEAR MATERIALS

3 hours

After completion of this module the student should be able to demonstrate an extensive and systematic knowledge of the thermal behaviour of nuclear reactor fuel elements, of the restructuring, behaviour and redistribution of fission products and of pore migration and swelling; demonstrate the skills to perform stress analyses in fuel elements and to determine the mechanical performance of reactor materials; and show the ability to apply knowledge and skills to evaluate unknown concrete problems concerning the modern developments in reactor materials and to suggest ethically responsible solutions.

Prerequisite: MATI212.

NUCI327 NUCLEAR ENGINEERING I

3 hours

After completion of this module the student should be able to demonstrate an extensive and systematic knowledge of the thermo-hydraulic characteristics of power reactors, reactor heat generation, thermodynamics of nuclear energy conversion systems, the single-phase and two-phase flow mechanics and heat transfer of power reactors, as well as the single-phase and two-phase transport equations; demonstrate skills to do a thermal analysis of fuel elements and to use single-phase and two-phase transport equations to solve problems; and demonstrate the ability as an individual and/or member of a group to solve, with the aid of thermal design principles, identify and analyse unknown and complex real problems in nuclear engineering and suggest ethically responsible solutions, based on proven principles and theories.

Prerequisite: MEGI311 and MEGI312.

REII321 COMPUTER ENGINEERING III

3 hours

On successful completion of this module the student will be able to apply his/her knowledge to solve problems involving microprocessors by low-level programming directly on the hardware and also by high-level programming, using the API. The student will have the skills to program time-critical parts in assembly language algorithms. The student will have the ability to handle advanced peripherals by the use of suitable techniques.

Prerequisite: EERI211.

REII327 COMPUTER ENGINEERING DESIGN

3 hours

In this module the student will acquire the skills to analyze a problem, define a user need and technical specification, perform a design and implement a suitable technical specification combining knowledge from different fields in the synthesis process, devise a test plan to test compliance with the specification, compile a report containing a description of the problem statement, the specification, the design and the implementation and to present the results to a technical audience.

Prerequisite: Student must be able to complete year level 3.

REII411 COMPUTER ENGINEERING IV

3 hours

After successfully completing this module the student will be able to distinguish between all forms of simplex, half-duplex and full-duplex communication which can occur point-to-point, point-to-multipoint and multipoint-to-multipoint, to distinguish and make recommendations about analogue vs. digital communication modes and the two most frequently used standards in the computer communication field, namely IP en ISO, describe and apply knowledge about the OSI 7-layer structure on situation analysis and to perform engineering calculations and simulations concerning data rates, congestion in networks, optimal buffer sizes, automatic resend and the influence of algorithms.

Prerequisite: REII321.

REII413 ENGINEERING PROGRAMMING II

3 hours

After successfully completing this module the student will be able to comprehend data base definitions and terms, design and implement databases and to store, alter and delete information in databases. The student will be able to optimize software, administer the database and to make provision for possible problems and the repair of databases after failure. The student will also be able to use manipulation of databases and commercial applications based on databases to solve engineering problems and also use SCADA packages, which have a database-centered architecture. The student will be able to implement various interfaces to the database

Prerequisite: EERI323.

REII422 SOFTWARE ENGINEERING

3 hours

Upon successful completion of this module, the student will have knowledge of various phases in software engineering: Requirements analysis, specification, design, implementation, integration and maintenance, whether according to classical or modern two-dimensional approaches. Aspects such as planning and estimating, project management, life cycle models, teamwork, documentation and testing are done theoretically as well as with case studies. Upon completion of the module, the student will be able to implement and operate a software engineering process for a product. The classical as well as modern versions of the phases such as requirements, specification, design, implementation, integration and maintenance are given as practical assignments to test skills. Skills in software management are developed in teamwork. *Prerequisite:* EERI323.

REII611 = REII411 COMPUTER ENGINEERING IV

REII613 = REII413 ENGINEERING PROGRAMMING II

REII622 = REII422 SOFTWARE ENGINEERING

COMPUTER SCIENCE AND INFORMATION SYSTEMS

ITRW111 INTRODUCTION TOT PROGRAMMING (EXCEL)

2 hours

At the end of this module the student will have acquired basic knowledge and insight into the way a computer works, its different components and data storing and manipulation. The student will also have acquired knowledge of the utilisation and use of spreadsheets. The module serves as an introduction to programming. The student will have knowledge of spreadsheets, which includes tables, computations, transfer of data between different applications and application environments, functions and graphs to process and present data. On completion of the module the student will provide proof that he/she has the ability to apply the knowledge and insight he/she has acquired to problem solving with the aid of the computer.

Prerequisite: None.

ITRW119 PROGRAMMING FOR ENGINEERS I (C++)

2 hours

After successfully completing the module the student ought to have knowledge of and insight in the basic structure, data types, and functions, including structured problem solving and debugging, testing and execution of applications of the programming language C++. The student will have to demonstrate that he/she can apply the acquired the knowledge and insight to solve elementary problems in engineering, develop an algorithm to solve problems, codify the algorithm in C++, and to debug and test it on the computer.

Prerequisite: None.

ITRW128 GRAPHICAL USER INTERFACE PROGRAMMING

2 hours

After the successful completion of this module the student will possess the knowledge and skills in the graphical user interface environment to develop computerized applications in a visual, object-oriented computer programming language. Aspects such as graphical interface design, event driven programming, procedures and using matrixes in a user friendly graphical environment will be taught as a basis. The theory must be implemented to solve practical problem instances.

Prerequisite: ITRW119 or ITRW111.

ITRW129 PROGRAMMING FOR ENGINEERS II (C++)

2 hours

After successful completion of this module, the student should have the knowledge and insight regarding the programming language C++. Topics include functions, arrays, pointers, strings and file manipulation. The student will also acquire basic knowledge about data structures and object classes. The student will be able to show that he/she can apply the knowledge and insight obtained in solving engineering related problems as well as develop, implement, test and execute C++ algorithms using a computer.

Prerequisite: ITRW119.

ITRW212 GRAPHICAL INTERFACE PROGRAMMING II

3 hours

At the end of this module the student will have acquired basic knowledge and insight into object-directed programming (also for the Web) and problem solving, which include: debugging, testing and carrying out applications, file management, exception handling, inheritance, interfaces and polymorphism and Boolean Algebra. On completion of the course the student will provide proof that he/she has the ability to apply the knowledge and insight that he/she has acquired to problem solving with the aid of a computer.

Prerequisite: ITRW122.

ITRW213 SYSTEMS ANALYSIS I

3 hours

On successful completion of this module the student will be able to demonstrate: knowledge of the functions of the systems analyst and other role players in planning and analysing a system; knowledge of the early phases and activities in the life cycle of systems development and the ability to utilise these phases and activities; knowledge of several modelling techniques and the ability to apply them; the ability to think creatively and with a positive attitude to problem solving when planning and analysing a computerised system.

Prerequisite: ITRW121 of ITRW122.

ITRW222 DATA STRUCTURES AND ALGORITHMS

3 hours

On completion of this module the student will be able to compile and manipulate data structures, vectors, matrices, switched lists, stacks and queues. Object-orientated methods, for example inheritance and polymorphism, will be used to create abstract data types for the above-mentioned data structures. The student will be able to analyse the complexity (run time and memory usage) of algorithms and be familiar with several data management problems and their solution and analysis. The student will be able to practically apply object theory and data structures.

Prerequisite: ITRW212.

ITRW225 SYSTEMS ANALYSIS AND DESIGN II

3 hours

On successful completion of this module the student will be able to demonstrate: knowledge and insight of the functions of all of the role players in developing a system;

knowledge of the later phases in the life cycle of systems development and the ability to utilise these phases; knowledge of several modelling techniques of systems analysis and design and the ability to apply them; the ability to think creatively and with a positive attitude to problem solving in designing and developing a computerised system.

All this knowledge will be applied practically when working on a project in the context of a team. Suitable system documentation will be generated and it will also be submitted by making use of an oral presentation.

Prerequisite: ITRW213.

ITRW311 DATABASES I

3 hours

At the end of this module the student ought to have basic knowledge and insight into: the difference between file systems and databases; the relational database model versus hierarchical and object-orientated database models; entity relationship modelling; normalising of database models; database design; transaction management; management of simultaneous use; and SQL and Oracle PL/SQL. On completion of the module the student will be able to demonstrate that he/she has the ability to apply the acquired knowledge and insight to problem solving in his/her subject area and fields of application.

Prerequisite: ITRW224 or ITRW225.

ITRW312 ARTIFICIAL INTELLIGENCE

2 hours

At the end of this module the student will have been introduced to basic concepts in the field of artificial intelligence. The student has to be aware of important issues in the subject, as well as its historical foundations. Furthermore, the student must understand the basic techniques used in the field and have the ability to apply them to practical problems. The practical implementation of the techniques learnt takes place by writing programmes in an artificial intelligence language.

Prerequisite: None.

ITRW313 EXPERT SYSTEMS

2 hours

On completion of this module the student will have the ability to demonstrate that he/she has adequate knowledge with regard to knowledge-based programming techniques in designing and developing expert systems. Students will be able to use different strategies with regard to the presentation of knowledge and inference techniques and also to demonstrate that they have adequate knowledge and insight with regard to the phases of expert systems analysis and design, as well as regarding aids and methodologies. As a result of the acquired knowledge students will have the ability to think and act creatively and with a positive attitude to problem solving in designing and developing an expert system.

Prerequisite: ITRW121 of ITRW122.

ITRW315 COMMUNICATION SKILLS

2 hours

At the end of this module the student will have acquired basic knowledge and insight into the most important communication skills, including oral presentation and writing skills. Students will also be aware of the importance of interpersonal relationships, conflict management and other appropriate behavioural characteristics and will be able to present talks confidently and write reports structured correctly.

Prerequisite: None.

ITRW321 DATABASES II

3 hours

At the end of this module the student ought to have a basic knowledge and insight into distributed database management systems; object-orientated databases; client/server systems; data warehouses; databases and Internet; database management (theory as well as practical applications with Oracle). On completion of the module the student will be able to provide proof that he/she has the ability to apply the knowledge and insight acquired to problem solving in the subject area and its application fields

Prerequisite: ITRW311.

ITRW322 NETWORK PROGRAMMING AND INTERNET

3 hours

At the end of the module the student will have the ability to provide proof that he/she is familiar with the operation of the OSI, TCP/IP and IEEE (local area network) protocols, as well as topics independent of protocol, such as congestion control and routing. The student will further have mastered OSI, TCP/IP and IEEE (local area network) protocols by low-level implementation of the IEEE protocols in a high-level programming language. The student will have knowledge of the Internet, its operation, services and characteristics and have the ability to carry out practical assignments and the accompanying implementation on the Internet.

Prerequisite: ITRW222.

ITRW323 OPERATING SYSTEMS

3 hours

On successful completion of the module the student will have the ability to provide proof that he/she has adequate knowledge and insight into the principles according to which operation systems work. This comprises process control in a multiprogramming environment, concurrent processes, handling input and output, memory management, file systems and operating system security and the implementation of these aspects in a number of operating systems (e.g. UNIX and DOS/Windows).

Students will also develop practical skills in installing operating systems as well as the writing of programs to solve inter-process communication, synchronisation and mutual exclusion problems.

Prerequisite: ITRW222.

See the Calendar of the Faculty of Natural Sciences for postgraduate module outcomes:

ITRW613 DATA BASISES I

ITRW614 INFORMATION SYSTEM ENGINEERING

ITRW615 COMPUTER SECURITY I

ITRW616 ARTIFICIAL INTELLIGENCE I

ITRW617 IMAGE PROCESSING I

ITRW623 DATA BASES II

ITRW624 INFORMATION SYSTEM ENGINEERING II

ITRW625 COMPUTER SECURITY II

ITRW626 ARTIFICIAL INTELLIGENCE II

ITRW627 IMAGE PROCESSING II

STATISTICS AND OPERATIONAL RESEARCH

STTK312 ENGINEERING STATISTICS

3 hours

The successful completion of this module affords the student the opportunity to acquire substantial skills involving general descriptive statistics, statistical inference, experimental design, probability, the handling and interpretation of general statistical models and inferences for multiple random sampling with respect to various models and the use and interpretation of statistical computer packages.

Prerequisite: None.

APPLIED MATHEMATICS

TGWS121 STATICS

2 hours

At the end of this module the student will have acquired knowledge and insight into Newton's laws of motion and the concepts of force, vector product, moment, couple, rotational analogue of the second law of Newton and friction. The student will have skills to reduce a system of forces on a rigid body to a single force and apply these skills to solve statics problems, including problems presenting frictional phenomena, as well as the analysis of the rotation of planar bodies. *Prerequisite:* WISK112.

TGWS211 DYNAMICS I

2 hours

The student will have acquired knowledge and insight into the theory of the structure, solution and evaluation of mathematical models in connection with the dynamics of particles, systems

of particles and fixed bodies in a plane. These topics are treated with regard to fixed or moving origins and the student acquires skills in handling problems regarding these topics.

Prerequisite: WISK121; TGWS121 and FSKN111.

TGWS212 DIFFERENTIAL EQUATIONS AND NUMERICAL METHODS

2 hours

The student will have acquired knowledge and insight into first order ordinary differential equations, the Laplace transform and the methods of Euler, Heun and Runge-Kutta for the numerical solution of a single or a system of differential equations. The student will be skilled in solving some of the first order ordinary differential equations by separation of variables and reduction to exact differential equations and he/she will be able to use them in modelling real phenomena; will be able to solve linear differential equations with constant coefficients by means of the Laplace transform; and will have the ability to solve any type of ordinary initial value problem numerically with the aid of a computer. The student will have learnt how to use the software MATLAB in solving differential equations.

Prerequisite: WISK121

TGWS222 NUMERICAL ANALYSIS

2 hours

The student will have acquired knowledge and insight into the theory of the basic numerical methods of common mathematical problems. Amongst these methods are the solution of nonlinear equations, the determination of interpolation polynomials and the numerical determination of specific integrals. The student will have acquired skills to apply a variety of computer techniques to every type of problem. The student will have gained skills in solving non-linear equations by means of iterative techniques, determination of interpolation polynomials of Lagrange and Newton, numerical determination of certain integrals with the trapezium method, the Simpson rule, Romberg integration and Gauss quadrature and also in implementing these techniques on the computer.

Prerequisite: WISK121.

TGWS221 DYNAMICS II

2 hours

The student will have acquired knowledge and insight into the theory of flexible cables, internal forces and distortion of simple beams and the motion of satellites and planets. The student will have skills to determine strains in beams and cables under stress, and to determine the orbits and positions of satellites.

Prerequisite: TGWS212; TGWS121 and FSKN111.

TGWS222 NUMERICAL ANALYSIS

2 hours

The student will have acquired knowledge and insight into the theory of the basic numerical methods of common mathematical problems. Amongst these methods are the solution of non-linear equations, the determination of interpolation polynomials and the numerical determination of specific integrals. The student will have acquired skills to apply a variety of computer techniques to every type of problem. The student will have gained skills in solving non-linear equations by means of iterative techniques, determination of interpolation polynomials of Lagrange and Newton, numerical determination of certain integrals with the trapezium method, the Simpson rule, Romberg integration and Gauss quadrature and also in implementing these techniques on the computer. *Prerequisite:* WISK121.

TGWS312 PARTIAL DIFFERENTIAL EQUATIONS (NUMERICAL)

2 hours

The student will have acquired knowledge and insight into the accuracy of discretisations of ordinary and partial linear differential equations, will have become familiar with special characteristics of tridiagonal matrix calculation problems that result in ill-conditionedness and sparse systems of linear equations, convergence characteristics of iterative methods for systems linear equations and the stability characteristics of numerical methods, and in the implementation of iterative methods on the computer with MATLAB.

The student will have acquired skills by means of finite difference methods in the numerical solution of two-point boundary value problems, the heat equation, the potential equation and the wave equation and in the implementation of these on the computer.

Prerequisite: WISK221.

TGWS321 DYNAMICS III

3 hours

The student will have acquired knowledge and insight into the accuracy of discretisations of ordinary and partial linear differential equations, will have become familiar with special characteristics of tridiagonal matrix calculation problems that result in ill-conditionedness and sparse systems of linear equations, convergence characteristics of iterative methods for systems linear equations and the stability characteristics of numerical methods, and in the implementation of iterative methods on the computer with MATLAB.

The student will have acquired skills by means of finite difference methods in the numerical solution of two-point boundary value problems, the heat equation, the potential equation and the wave equation and in the implementation of these on the computer.

Prerequisite: TGWS211.

PRESCRIBED MODULES

AGLE1111 INTRODUCTION TO ACADEMIC LITERACY

Pc 1X2 1:1

On completion of this module the student should be able to demonstrate basic knowledge of learning strategies, academic vocabulary and register as well as the reading and writing of academic texts in order to function effectively in the academic environment; communicate effectively orally and in writing in an appropriate manner in an academic environment; understand, interpret, and evaluate basic academic texts and write appropriate academic genres in a coherent manner by making use of accurate and appropriate academic conventions and listen, speak, read and write accurately, fluently and appropriately in an ethical framework.

AGLE121: ACADEMIC LITERACY

Pc 1x2 1:1

Engineering programmes include the compusory module FIAP172 (24 credits), which include the outcomes of AGLE121. See I.1.4 for rules in connection with Academic Literacy.

ENTR221 CREATIVE ENTREPRENEURSHIP

2 hours

On completion of the module the student ought to have knowledge of the nature of university and academic studies; know him-/herself as a student; have knowledge of the different learning strategies that are in keeping with his/her personality and suited to the learning material in order to master, integrate and apply learning contents and to construct his/her own frames of knowledge; utilize contact opportunities with lecturers effectively; manage time effectively and adequately; prepare effectively for examinations and writing examinations better; function with an attitude of solving problems as an individual and in a group; be better equipped with life-skills and have command of a minimum level of reading skills.

Prerequisite: None.

PHILOSOPHY OF SCIENCE

WTNL221 PHILOSOPHY OF SCIENCE I

2 hours

On successful completion of the module students must demonstrate that they know and have the ability to explain the history, origin, nature and purpose of science; understand the relationship between norms and science; understand the influence of science and technology on the spiritual, cultural and material well-being of man and his environment; understand and discuss the coherence of science, its limitations and significance in the context of Christian and other value systems.

Prerequisite: None

WTIL311 PHILOSOPHY OF SCIENCE II

2 hours

After completion of this module students have to demonstrate that they: understand the relevant methodologies, theories and paradigms in science and technology and be able to evaluate them from Christian and other views; understand the basic issues in the contempory discussion about Science and Religion and be able to develop relevant problem solving strategies; understand the ethical consequences of doing science and technology at an institution with a Christian perspective and be able to evaluate them from other and Christian perspectives; and recognise (and formulate) contempory personal and social issues and deal with them.

Prerequisite: None.

MATHEMATICS

WISK111 ANALYSIS I

2 hours

At the end of this module the student will have consolidated his/her knowledge of techniques from school mathematics by completely mastering the rules of differentiation. The student will

know the properties of various mathematical functions, limits and continuity of functions and will also have mastered the proofs of a representative selection thereof. The student will have developed a competency to solve problems involving the properties of differentiation, integration and a synthesis of both.

Prerequisite: None.

WISK112 CO-ORDINATE GEOMETRY IN 2 OR 3 DIMENSIONS

1.5 hours

At the end of this module the student will have mastered the following main topics: solution possibilities of systems of linear equations; matrix computations and their application in the context of linear systems; vector algebra of geometric vectors and vector algebra of co-ordinate presentations of vectors, including dot product (or inner product) and cross product (or vector product); algebraic equations of conical sections in a plane, as well as straight lines, planes and quadratic surfaces in three-dimensional space. The student will have mastered the following computational techniques in this module: a systematic technique of solving systems linear equations; the basic computations of matrix algebra. The student will also have acquired the ability to manipulate three-dimensional vectors algebraically and to interpret the results; to describe lines, planes and other regular figures in two and three dimensions algebraically; to interpret the contents of certain equations in two or three variables geometrically.

Prerequisite: None.

WISK121 ANALYSIS II

2 hours

At the end of this module the student will have the ability to extend the concept of a limit to the limits of sequences; know definite integrals as limits of sums of area sections and to use them in area calculations. He/she will know and have the ability to prove the basic theorems of integral and differential calculus; to approximate functions by means of the Taylor series; to use the techniques of differentiation and integration in calculating the maxima and minima of functions in practical and theoretical situations and also in calculating the lengths of curves, as well as the surface areas and volumes of solids of revolution.

Prerequisite: WISK111.

WISK122 INTRODUCTORY ALGEBRA

2 hours

At the end of this module the student will have adequate knowledge of the typical properties of the real number system; the complex number system; the connection between first degree factors and roots of polynomials; the algebraic motivation for the existence of rational functions as well as forms for their factorisation into partial fractions; introductory combinatory concepts; the binomial theorem for natural exponents and the extension of the theorem to binomial series; mathematical induction and other basic techniques of proof. The student will have the ability to use the Euclidean algorithm and operations with complex numbers in different forms, synthetic division of polynomials and techniques for factorising rational functions into partial fractions. The student will also have the ability to analyse and compile basic structures of proof.

Prerequisite: WISK112.

WISK211 ANALYSIS III

2 hours

At the end of this module the student will have acquired knowledge and insight into all of the aspects of differential calculus of multivariable functions, including Taylor's theorem, directional derivatives and the gradient function; the theory of multiple integrals, parameterisation of curves and the introductory theory of line integrals. The student will have acquired skills in the computation of partial derivatives, directional derivatives and gradients; in applying double and triple integrals, as well as the calculation of their values; in applying line integrals and the computation of such integrals by means of parameterisation of curves. *Prerequisite:* WISK121.

WISK212 LINEAR ALGEBRA I

2 hours

At the end of this module the student will have acquired knowledge and insight into the solvability of systems of linear equations; criteria for the existence of inverses of matrices; subspaces of n-dimensional real vector spaces, as well as ordinary and orthogonal bases of such spaces; the basic properties of determinants; matrix eigenvalues and eigenvectors and diagonalisation of matrices. The student will have skills in: solutions of systems of linear equations in the context of vector spaces; matrix computations; determining bases for vector spaces; carrying out the Gram-Schmidt orthogonalisation process; determining eigenvalues and eigenvectors; basic diagonalisation processes; carrying out these matrix calculations with the aid of MATLAB and in interpreting the results.

Prerequisite: WISK122.

WISK221 ANALYSIS IV

2 hours

At the end of this module the student will already have acquired sufficient knowledge of and insight into the calculus of multivariable functions to embark confidently on further studies in related areas. The student will know convergence tests for series, as well as the basic theory of general first order and also linear n-th order differential equations. The student will demonstrate the ability to carry out applications-directed computations of line and surface integrals, apply convergence tests for series and solve general first order as well as n-th order linear differential equations.

Prerequisite: WISK211.

WISK222 LINEAR ALGEBRA II

2 hours

At the end of this module the student will have acquired knowledge and insight into the theory of general vector spaces and bases; inner products; vector norms; the Hessenberg matrix as a reduction form and its role in determining eigenvalues; the characteristic polynomial of a matrix and the Cayley-Hamilton theorem. The student will have acquired knowledge and insight into matrix and vector norms and stepwise orthogonal transformations on a matrix; will have learnt to carry out Householder transformations and QR-factorisation and to determine eigenvalues. The student will have obtained skills in determining general as well as orthogonal bases; in applying the Gram-Schmidt process; in calculating determinants and in orthogonal diagonalisation of symmetric matrices. The student will have learnt to carry out these computational techniques with MATLAB and to interpret the results. *Prerequisite:* WISK212.

WISK312 LINEAR ALGEBRA III

2 hours

At the end of this module the student will have acquired knowledge and insight into: the theory of linear transformations between general vector spaces and how they are connected to other vector space and matrix algebra concepts, such as eigenvalues and eigenvectors of a matrix and diagonalisation of matrices; direct sum decompositions and complement of a subspace; vector quotient spaces (factor spaces).

The student will have acquired skills in: interpreting vector space and matrix concepts in terms of linear transformations; applying eigenvalues and eigenvectors to obtain the appropriate bases; determining complementary subspaces; geometric interpretation and algebraic manipulation of lines and planes in quotient spaces.

Prerequisite: WISK222.

Final V1
20 October 2008
MCJ Potgieter