UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

SCHOOL OF ENGINEERING

DEPARTMENT OF MECHANICAL AND AERONAUTICAL ENGINEERING

DEPARTMENTAL STUDY GUIDE

DEPARTMENTAL WEBSITE ADDRESS:
www.me.up.ac.za

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PLEASE NOTE:
It is imperative that each student read through and take note of all sections of this document, as well as conduct an on-line Assessment quiz which is available on any of the following ClickUp course modules:
MGC110; MOW217; MOW312; MTV 410. Access to further course material will not be granted if this is not done.

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1. MISSION AND VISION OF THE DEPARTMENT

The mission of the Department of Mechanical and Aeronautical Engineering is to prepare engineers for success and leadership that is recognised internationally for its quality in the conception, design, implementation, and operation of mechanical and aeronautical related engineering systems and processes.

Our vision is to provide students with an education that is recognized internationally for academic excellence and a focus on quality that stresses the fundamentals, and is focused on real world systems and products. It will provide an integrated education that provides experiential learning through a rich offering of team-based design-build-operate projects, both in the classroom and a state-of-the-art learning laboratory.

2. GENERAL DEPARTMENTAL ADMINISTRATION AND REGULATIONS

2.1. Professionalism and integrity

To study or work at a tertiary educational institution is a privilege and is to be valued. Professionalism and integrity should be the hallmark of all dealings. Following are clear guidelines in this regard.

General interpersonal behaviour:

It is expected from students in the department to be professional in all their communication and relationships with each other and staff members. This implies:

1. Honesty, courtesy, respect and integrity in dealings with fellow students as well as lecturers during and outside of lectures.
2. We greet each other.
3. Students are to make a point of being on time for class as well as to hand in assignments and projects by the expected date.
4. Lecturers are to be well prepared, punctual and to behave fairly toward all students. Furthermore, they are to be good communicators and strive to high standards in terms of their own research as well as toward offering high quality education.
5. It is expected that all staff and students similarly conduct themselves in a professional manner outside of the university, as we are all ambassadors of the University of Pretoria.
6. Read your e-mail every day. Your e-mail will be sent to your University e-mail address (no other address).

Departmental administration:

The department is to be well organized, communicate regulations and policies in a clear and courteous manner, and afford grievances the proper attention.

Campus and university facilities:

1. The University is to ensure that buildings are in good condition while being clean and neat.
2. Students and staff should take pride in helping to keep the university facilities neat and in good condition.

2.2. Course-related information and formal communication

Facilities have been provided for all mechanical engineering courses on the World Wide Web. It is to be used as the platform for obtaining course-related information as well as effecting formal communication. The following sites/facilities have been developed exclusively for this purpose:

- Mechanical and Aeronautical Engineering website: http://www.me.up.ac.za/ (Current Students). Here the students may obtain information on
  - **Plagiarism regulations and forms**
  - **Dept. Study Guide**
  - **Time-tables (lectures, tests, day time-table, exam)**
  - **Prescribed books**
  - **Regulations with regards to the use of calculators**
  - **Workshop regulations**
  - **Thesis and Design (final year students)**
- Student online : http://www.up.ac.za . Here students may obtain
  - **Study guides**
  - **Course notes**
  - **Grades**
  - **Time-tables**
  - **Assignments and memoranda**
  - **Contact detail of the lecturer**
  - **Information pertaining to facilities provided for student-lecturer communication.**
- E-mail may be used for the following modes of written communication: lecturer to all students, lecturer to a specific student and student to lecturer.

In all electronic communication (e-mail and web-based), the following etiquette is to be followed:

- Use the subject line correctly: descriptive title followed by the date by which a response is required.
- For students, please observe the rule of thumb, which states: *Ask three then ask me*. This is not because the staff are unfriendly or do not encourage student-lecturer communication! It is to establish a culture of professional electronic communication.

2.3. Workshop use and safety measures

All students and staff are bound by the Occupational Health and Safety Act when using the laboratories and workshops for practical sessions, projects and assignments. Please carefully read the regulations (link to http://www.me.up.ac.za/)and indicate your agreement/disagreement by completing the on-line Assessment quiz which is available on any of the following ClickUp course modules: MGC110; MOW217; MOW312; MTV410.

2.3.1 General workshop arrangements

Only students and staff with bona fide UP assignments, for example research projects (MRN412, MRN422, postgraduate), practicals and assignments will be allowed to use the workshop. No private work or personal projects are allowed.

Operating hours are weekdays from 07:30 to 16:00. No person will be allowed to work after hours and over weekends without proper supervision. This will only be allowed when absolutely necessary and after making approved arrangements.

Make sure that you allow enough time for manufacturing of the required components for your project. Try to do as much manufacturing as possible early in the semester because there is a limit on the resources available in the workshops. This implies proper planning of the tasks, material and equipment you will require to achieve your aims.

2.3.2 Workshop contact information

The staff members responsible for the workshop are:

- Mr Peet Kruger: Tel: 012 420 2088, e-mail: peet.kruger@up.ac.za
- Mr Edwin Mohale: Tel: 012 420 3514, e-mail: edwin.mohale@up.ac.za

2.3.3 Minimum requirements to access the workshop

The minimum requirements to access the workshop are:

- Wear closed shoes of proper strong construction that can protect feet from shavings and bumping against small obstacles (i.e. hand tools that may be dropped)
- Long hair must be tied down
- No loose clothing may be worn
- Students are responsible for keeping their work area clean and neat

- No eating or drinking allowed
- Suitable personal protective equipment (PPE), depending on the task you are performing as well the tasks performed by people around you, is required. You need to perform a risk assessment before starting on any task and use the appropriate PPE. Please ask the staff member if you are unsure. PPE can include protective clothing (e.g. overalls or dust coats), safety shoes, eye protection, respiratory system protection (e.g. dust masks), hearing protection, gloves etc.

Please remember at all times that you are working with, or in the vicinity of potentially dangerous equipment that can cause harm to yourself or people around you.

The workshop staff take the safety of students and staff as the first priority. You will be denied access if your conduct jeopardises safety in any way.

2.3.4 Ways to use the workshop

You can engage with the workshop in different ways. The first option (manufacturing service) is to ask workshop staff to do manufacturing for you. The second option (self service) is to use the training opportunities that are available to upskill yourself so that you can do your own manufacturing. We encourage you to manufacture your own parts (i.e. use the self service option) wherever possible and ask the staff to assist with more complicated operations.

2.3.5 Manufacturing service

In order to utilise the manufacturing service you need to do the following:

- Plan and schedule early. The manufacturing service operates on a first-come, first served basis. Capacity is limited and during peak times (usually towards the end of the semester) delays can occur.
- Make proper detail manufacturing drawings. In some cases, e.g., where CNC machines will be used, you may have to provide a CAD solids model of your parts and assemblies
- Your study leader, supervisor or lecturer needs to check and sign your drawings to indicate that you have permission to proceed with manufacturing
- Report to workshop staff with signed drawings and material (in some cases material may be available in the workshop)
- The job will be assigned to one of the staff members and you will be given an indication of when it should be finished

2.3.6 Self service

To gain access to the workshops in order to do your own manufacturing, all students and staff are required to watch an introductory video that can be found online at:
https://www.youtube.com/watch?v=tZAWydc3czE

After watching the video, you must make appointment with the workshop staff to write a test on basic workshop safety. After passing the test, you will be issued with a workshop card. Specific training on machines will be given by the workshop staff as the need arises. Please ask for assistance or help when in doubt.

2.4. Plagiarism

Each student must be aware of the importance of avoiding plagiarism during the writing of reports and assignments. More information on this important topic is available on http://www.library.up.ac.za/plagiarism/ . For each assignment (group or individual) and each practical report (group or individual), the appropriate cover page with anti-plagiarism checks (available on this site) must be completed and attached. Please carefully read the regulations (link to http://www.me.up.ac.za/) and indicate your agreement/disagreement by completing the on-line Assessment quiz which is available on any of the following ClickUp course modules: MGC110; MOW217; MOW312; MTV 410.

2.4.1 Overview of Plagiarism

You commit plagiarism when, in any written work, you use another person's words, ideas or opinions without acknowledging these as being from that other person. You do this when you copy the work word-by-word (verbatim); or submit someone else's work in a slightly altered form (such as changing a word with one meaning to another word with the same meaning); and you do not acknowledge the source in a way that shows from whom or where you took the words, ideas or reasoning.

You must provide references whenever you quote (use the exact words), paraphrase (use the ideas of another person, in your own words) or summarize (use the main points of another's opinions, theories or data).

It does not matter how much of the other person's work you use (whether it is one sentence or a whole paragraph), or whether you do it unintentionally or on purpose. If you present the work as your own without acknowledging the source, you are committing theft. Because of this, plagiarism is regarded as a very serious contravention of the University's rules, which can lead to expulsion from the University.

Even if another student gives you permission to use one of his or her past assignments or other research, to hand in as you own, you are not allowed to do it. It is another form of plagiarism. You are also not allowed to let anybody copy your work with the intention of passing it on as his/her work.

While academic staff is responsible for educating students about various appropriate systems of referencing, as well as how to avoid plagiarism, students need to take responsibility for their own academic career. Speak to your lecturer if you are at any stage uncertain as to what is required.

Information brochures on this topic are also available at the Academic Information Services and at the web link http://www.library.up.ac.za/plagiarism/.

2.4.2 Department Cover pages

To ensure that students are aware of the implications of plagiarism, the Faculty has prepared a cover page for all assignments.

- Cover page for individual assignments - http://www.me.up.ac.za/
- Cover page for group assignments – http://www.me.up.ac.za/

Please carefully read the above two cover page documents, indicate if you agree to use them at all times when handing in your assignments, and indicate your agreement/disagreement by completing the on-line Assessment quiz which is available on any of the following ClickUp course modules: MGC110; MOW217; MOW312; MTV 410.

2.5. Class representative duties

The class representative is responsible for:

1. The advancement of a healthy and constructive morale in the class. This includes the handling and solution of problems in the class and nurturing of a professional ethos.
2. Liaise with the relevant guidance lecturers on behalf of the students.
3. Participating in interviews with prospective administration personnel on request of the Dean's office (only final year students).
4. Expressing thanks to guest speakers on behalf of students.

2.6. Sick test guidelines

The standard practice of the Department is followed when students are absent from tests and exams:

1. Students are responsible to make their own arrangements with the department for the scheduling and writing of a sick test.
2. Prior to making application for a sick test, an original sickness certificate must be handed to the departmental administrative administrator **Ms K Kunene** in **Eng 3, room 6-65**, within **3** working days of the test that could not be written. No arrangements for the writing of a sick test will be made with a student prior to handing in of the above sickness certificate.
3. Only medical certificates issued by persons and practitioners registered with the Health Professions Council of South Africa and the Allied Health Professions Council of South Africa will be accepted.
4. Only medical certificates containing the practice number, address, contact details and signature of the particular practitioner who issued the certificate will be accepted.

5. The certificate must clearly identify the student and must reflect that a consultation took place and/or that the student was examined on a specific date.
6. It must furthermore indicate the specific days during which the student is unfit to participate in academic activities. A medical certificate is not accepted if it merely states that the student appeared ill or declared himself/herself unfit.
7. Please ensure that you, your parents, spouse, family, friends, etc. are aware of this policy and that they ensure that you visit a doctor if you are not yourself able to this. You cannot visit a doctor afterwards.
8. To ensure that everybody, including the doctor, follows these instructions, print items 3 – 7 for reference beforehand.

2.7. Vacation work

Although every effort is made to place students with employers for their vacation work, the university cannot guarantee that each student will be placed. Each student therefore ultimately has the responsibility to arrange his or her own work. Note that vacation work can be performed in any vacation period. For the second and third study years (MPY315 and MPY415 respectively), reports must be handed in by **28 February** of the following year. The format of the report is as stipulated on the relevant document at http://www.me.up.ac.za/). Further, the report is to be accompanied by the following documentation (which may be downloaded from the aforementioned site):

1. Individual assignment cover page.
2. Employer's report on practical training.
3. Feedback with regard to practical training.

2.8. Appeal process and adjustment of marks

After marks awarded for assignments, practical reports, class tests and semester tests are posted, students have a 14-day period within which they can appeal for an adjustment of marks due to errors in grading or other interpretation-related matters. Any adjustments will only be made at the discretion of the lecturer. After this 14-day period no marks will be altered.

Because of this ruling, semester marks are final once a student has received exam entrance. This means that semester marks cannot be adjusted after the exam to allow for borderline cases to be allowed re-examination or special examination entrance, or to allow for a pass with distinction.

2.9. University regulations

Please take note of the University's Faculty and examination regulations as documented in the yearbook.

2.10. Frequently asked information

- Vacation work: During the 2nd study year, 6 weeks' vacation work is to be undertaken for MPY315. This is to be followed by the submission of a **Technical and Personnel Management** report.
- Vacation work: During the 3rd study year, 6 weeks' vacation work is to be undertaken for MPY415. This is to be followed by the submission of a **Technical and Occupational Safety** report.
- The following information is available from the departmental web page http://www.me.up.ac.za/):
    - Prescribed textbooks
    - Time-tables: lectures, semester tests, exams, day roster
    - Forms: Related to vacation work, plagiarism
    - Class representatives: names and e-mail addresses
    - Guardian lecturers: Contact detail

3. Engineering Council of South Africa (ECSA) GENERAL OUTCOMES

At the Department of Mechanical and Aeronautical Engineering, our degree programme is internationally accredited through the *Washington Accord*, and we take great pride in training of some of the finest engineers in the world. As a result of the *Washington Accord,* our qualifications are recognised in the Australia, Canada, Hong-Kong, Ireland, Japan, New Zealand, South Africa, Turkey, United Kingdom, U.S.A, China, Taiwan, Japan, Korea, Malaysia and Singapore.

3.1. Exit-Level outcomes for Engineering Bachelor's Degrees *(Excerpt from ECSA Document No. E-02-PE:* Standards for Accredited University Bachelor's Degrees. Associated Assessment Criteria from *ECSA PE-61 Rev 2*)

"**Exit Level Outcomes"**
Exit level outcomes defined below are stated generically and may be assessed in various engineering disciplinary or cross-disciplinary contexts in a provider-based or simulate practice environment.
Words shown italicized have specific meaning defined in ECSA Document G-04.
General Range Statement: The competencies defined in the eleven exit-level outcomes may be demonstrated in a university-based, simulated workplace context. Competencies stated generically may be assessed in various engineering disciplinary or cross-disciplinary contexts.

Exit level outcome 1: Problem solving
Learning outcome: Identify, formulate, analyse and solve complex engineering problems creatively and innovatively.
Associated Assessment Criteria

The candidate applies in a number of varied instances, a systematic problem solving method including:
1. Analyses and defines the problem, identifies the criteria for an acceptable solution;
2. Identifies necessary information and applicable engineering and other knowledge and skills;
3. Generates and formulates possible approaches to solution of problem;
4. Models and analyses possible solution(s);
5. Evaluates possible solutions and selects best solution;
6. Formulates and presents the solution in an appropriate form.

Range Statement: Problems requires identification and analysis. Some cases occur in unfamiliar contexts. Problems are both *concrete* and *abstract* and may involve uncertainty. Solutions are based on theory and evidence, together with judgement where necessary. (From PE-61, not in E-02-PE Rev 4)

Exit level outcome 2: Application of scientific and engineering knowledge

Learning outcome: Apply knowledge of mathematics, natural sciences, engineering fundamentals and an engineering speciality to solve complex engineering problems.

Associated Assessment Criteria

The candidate:
1. Brings mathematical, numerical analysis and statistical knowledge and methods to bear on engineering problems by using an appropriate mix of:
a) Formal analysis and modelling of engineering components, systems or processes;
b) Communicating concepts, ideas and theories with the aid of mathematics;
c) Reasoning about and conceptualising engineering components, systems or processes using mathematical concepts;
d) Dealing with uncertainty and risk through the use of probability and statistics.
2. Uses physical laws and knowledge of the physical world as a foundation for the engineering sciences and the solution of engineering problems by an appropriate mix of:
a) Formal analysis and modelling of engineering components, systems or processes using principles and knowledge of the basic sciences;
b) Reasoning about and conceptualising engineering problems, components, systems or processes using principles of the basic sciences.
3. Uses the techniques, principles and laws of engineering science at a fundamental level and in at least one specialist area to:
a) Identify and solve open-ended engineering problems;
b) Identify and pursue engineering applications;
c) Work across engineering disciplinary boundaries through cross disciplinary literacy and shared fundamental knowledge.

Level descriptor: Knowledge of mathematics, natural sciences and engineering sciences is characterized by:

- A systematic, theory-based understanding of the natural sciences applicable to the discipline;
- Conceptually-based mathematics, numerical analysis, statistics and formal aspects of computer and information science to support analysis and modelling applicable to the discipline;

- A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline; and
- Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

Range Statement: Mathematics, natural science and engineering sciences are applied in formal analysis and modelling of engineering situations, and for reasoning about and conceptualizing engineering problems.

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Exit level outcome 3: Engineering Design

Learning outcome: Perform creative, procedural and non-procedural design and synthesis of components, systems, engineering works, products or processes.

Associated Assessment Criteria:

The candidate executes an acceptable design process encompassing the following:

1. Identifies and formulates the design problem to satisfy user needs, applicable standards, codes of practice and legislation;
2. Plans and manages the design process: focusses on important issues, recognises and deals with constraints;
3. Acquires and evaluates the requisite knowledge, information and resources: applies correct principles, evaluates and uses design tools;
4. Performs design tasks including analysis, quantitative modelling and optimisation;
5. Evaluates alternatives and preferred solution: exercises judgment, tests implementability and performs techno-economic analyses;
6. Assesses impacts and benefits of the design: social, legal, health, safety, and environmental;
7. Communicates the design logic and information.

Range Statement: Design problems used in exit-level assessment must conform to the definition of a complex engineering problem. A major design problem should be used to provide evidence. The design knowledge base and components, systems, engineering works, products or processes to be designed are dependent on the discipline or practice area.

Exit level outcome 4: Investigations, experiments and data analysis

Learning outcome: Demonstrate competence to design and conduct investigations and experiments.

Associated Assessment Criteria:

The candidate executes an acceptable process including but not restricted to:

1. Plans and conducts investigations and experiments;
2. Conducts a literature search and critically evaluates material;
3. Performs necessary analyses;
4. Selects and uses appropriate equipment or software;
5. Analyses, interprets and derives information from data;
6. Draws conclusions based on evidence;

7. Communicates the purpose, process and outcomes in a technical report.
Range Statement: The balance of investigation and experiment should be appropriate to the discipline. Research methodology to be applied in research or investigation where the student engages with selected knowledge in the research literature of the discipline.
Note: An investigation differs from a design in that the objective is to produce knowledge and understanding of a phenomenon and a recommended course of action rather than specifying how an artifact could be produced.

Exit level outcome 5: Engineering methods, skills and tools, including Information Technology
Learning outcome: Demonstrate competence to use appropriate engineering methods, *skills* and tools, including those based on information technology.
Associated Assessment Criteria:
The candidate:
1. Uses method, skill or tool effectively by:
a) Selecting and assessing the applicability and limitations of the method, skill or tool;
b) Properly applying the method, skill or tool;
c) Critically testing and assessing the end-results produced by the method, skill or tool.
2. Creates computer applications as required by the discipline.
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Range Statement: A range of methods, skills and tools appropriate to the disciplinary designation of the program including:
1. Discipline-specific tools, processes or procedures;
2. Computer packages for computation, modelling, simulation, and information handling;
3. Computers and networks and information infrastructures for accessing, processing, managing, and storing information to enhance personal productivity and teamwork;

Exit level outcome 6: Professional and technical communication
Learning outcome: Demonstrate competence to communicate effectively, both orally and in writing, with engineering audiences and the community at large.
Associated Assessment Criteria:
The candidate executes effective written communication as evidenced by:
1. Uses appropriate structure, style and language for purpose and audience;
2. Uses effective graphical support;
3. Applies methods of providing information for use by others involved in engineering activity;

4. Meets the requirements of the target audience.
The candidate executes effective oral communication as evidenced by:
1. Uses appropriate structure, style and language;
2. Uses appropriate visual materials;
3. Delivers fluently;
4. Meets the requirements of the intended audience.
Range Statement: Material to be communicated is in an academic or simulated professional context.
Audiences range from engineering peers, management and lay persons, using appropriate academic or professional discourse. Written reports range from short (300-1000 word plus tables diagrams) to long (10 000 to 15 000 words plus tables, diagrams and appendices), covering material at exit level.
Methods of providing information include the conventional methods of the discipline, for example engineering drawings, as well as subject-specific methods.

Exit level outcome 7: Sustainability and impact of Engineering activity
Learning outcome: Demonstrate critical awareness of the sustainability and impact of engineering activity on the social, industrial and physical environment.

Associated Assessment Criteria:
The candidate identifies and deals with an appropriate combination of issues in:
1. The impact of technology on society;
2. Occupational and public health and safety;
3. Impacts on the physical environment;
4. The personal, social, cultural values and requirements of those affected by engineering activity.
Range Statement: The combination of social, workplace (industrial) and physical environmental factors must be appropriate to the discipline or other designation of the qualification. Comprehension of the role of engineering in society and identified issues in engineering practice in the discipline: health, safety and environmental protection; risk assessment and management and the impacts of engineering activity: economic, social, cultural, environmental and sustainability.

Exit level outcome 8: Individual, team and multidisciplinary working
Learning outcome: Demonstrate competence to work effectively as an individual, in teams and in multidisciplinary environments.
Associated Assessment Criteria:

The candidate demonstrates effective individual work by performing the following:
1. Identifies and focuses on objectives;
2. Works strategically;
3. Executes tasks effectively;
4. Delivers completed work on time.

The candidate demonstrates effective team work by the following:
1. Makes individual contribution to team activity;
2. Performs critical functions;
3. Enhances work of fellow team members;
4. Benefits from support of team members;
5. Communicates effectively with team members;
6. Delivers completed work on time.

The candidate demonstrates multidisciplinary work by the following:
1. Acquires a working knowledge of co-workers' discipline;
2. Uses a systems approach;
3. Communicates across disciplinary boundaries.

Range Statement: Multidisciplinary tasks require co-operation across at least one disciplinary boundary. Co-operating disciplines may be engineering disciplines with different fundamental bases other than that of the programme or may be outside engineering.

Exit level outcome 9: Independent learning ability

Learning outcome: Demonstrate competence to engage in independent learning through well developed learning skills.

Associated Assessment Criteria:

The candidate shows evidence of being an effective independent learner by the following:
1. Reflects on own learning and determines learning requirements and strategies;
2. Sources and evaluates information;
3. Accesses, comprehends and applies knowledge acquired outside formal instruction;
4. Critically challenges assumptions and embraces new thinking.

Range Statement: Operate independently in complex, ill-defined contexts requiring personal responsibility and initiative, accurately self-evaluate and take responsibility for learning requirements; be aware of social and ethical implications of applying knowledge in particular contexts.

Exit level outcome 10: Engineering Professionalism

Learning outcome: Demonstrate *critical awareness* of the need to act professionally and ethically and to exercise judgment and take responsibility within own limits of competence.

Associated Assessment Criteria:

The candidate exhibits professionalism by the following:

1. Being aware of requirements to maintain continued competence and to keep abreast of up-to date tools and techniques;
2. Displays understanding of the system of professional development.
3. Accepts responsibility for own actions;
4. Displays judgment in decision making during problem solving and design;
5. Limits decision making to area of current competence;
6. Reason about and make judgment on ethical aspects in case study context;
7. Discerns boundaries of competence in problem solving and design.

Range Statement: Evidence includes case studies typical of engineering practice situations in which the graduate is likely to participate. Ethics and the professional responsibility of an engineer and the contextual knowledge specified in the range statement of Exit Level outcome 7 is generally applicable here.

Exit-level Outcome 11: Engineering management

Learning outcome: Demonstrate knowledge and understanding of engineering management principles and economic decision-making.

Range Statement: Basic techniques from economics, business management; project management applied to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

The following table summarises, for each of the modules offered, the outcomes that are assessed

Code and Module Name	Assessment matrix: Development of students towards the exit-level outcomes												Contribution to total Credit for Programme						
	ECSA "Exit-Level Outcome" reached in Module*												CREDITS	Maths	Basic/Natural Science	Engineering Science	Design & Synthesis	Computer & IT	Compl. Studies
	1	2	3	4	4P	5	6	7	8	9	10	11							
MGC 110 Graphical communication						√	√						**16**			16			
WTW 158 Calculus		√											**16**	16					
EBN 111 Electricity and electronics	√	√			**P**								**16**		8	8			
FSK 116 Physics		√			**P**								**16**		16				
HAS 110 Humanities and social sciences							√	√		√			**8**						8
WTW 164 Calculus & Algebra		√											**16**	16					
CHM 172 General Chemistry		√			**P**								**16**		16				
SWK 122 Mechanics	√	√											**16**		16				
NMC 123 Materials Science	√	√			**P**								**16**		8	8			
HAS 120 Humanities and social sciences								√		√			**8**						8
WTW 258 Calculus		√											**8**	8					
WTW 256 Differential Equations		√											**8**	8					
MSD 210 Dynamics	√	√											**16**		16				
MPR 213 Programming and information technology						√√							**16**					16	
MOW 217 Manufacturing and design			√										**16**			8	8		
MJJ 210 Professional and technical communication							√√						**8**						8
JCP 203 Community-based Project.								√					**8**						8
WTW 238 Mathematics		√											**16**	16					
WTW 263 Numerical Methods	√	√											**8**	8					
BES 220 Engineering Statistics		√											**8**	8					
MOW 227 Structural Design			√										**16**			8	8		

MTX 221 Thermodynamics	√	√											**16**		8	8			
BSS 310 Engineering management							√√					√√√	**8**						8
MOW 312 Machine Design			√						√√√				**16**				16		
MTX 311 Thermodynamics	√√	√√											**16**			16			
MSY 310 Structural Mechanics	√√√				**PPP**								**16**			16			
MTV 310 Thermoflow		√√√			**PPP**								**16**			16			
MIA 320 Engineering activity and group work								√√√	√√√				**8**						8
MOW 323 Simulation-based design			√√						√√√				**16**				16		
EIR 221 Electrical engineering	√√	√√		√√	**PPP**								**16**		8	8			
MVR 320 Vibrations and Noise	√√	√√			**PPP**								**16**			16			
MKM 321 Solid Mechanics		√√											**16**			16			
MKM 411 Computational dynamics						√√√							**16**			16			
MTV 410 Thermoflow		√√			**PPP**								**16**			16			
MOX 410 Design project 410			√√√				√√√						**16**				16		
MRN 412 Research project							√√√			√√√			**16**				16		
IPI 410 Engineering professionalism											√√√		**8**						8
MRN 422 Research project				√√√			√√√						**24**				24		
MBB 410 Control Systems	√√√				**PPP**								**16**			16			
MTV 420 Thermal and fluid machines		√√√			**PPP**								**16**			16			
MVE 420 Vehicle Engineering MLV 420 Aeronautics MII 420 Maintenance Engineering MKI 420 Nuclear Engineering MEG 421 Mechatronics MHM 420 Heat and mass transfer MUU 420 Fossil fuel power station MOO 420 Optimum design		√√											**16**			16			
Total	**1**	**2**	**3**	**4**	**4P**	**5**	**6**	**7**	**8**	**9**	**10**		**576**	**80**	**80**	**240**	**96**	**16**	**56**
ECSA minimum requirements													***560***	*56*	*56*	*180*	*72*	*-*	*56*

3.2. Knowledge Areas

The Bachelor's programme contains a coherent core of mathematics, basic sciences and fundamental engineering sciences that provides a viable platform for further studies and lifelong learning. The coherent core enables development in a traditional discipline or in an emerging field, and embraces both fundamental and core elements as defined by SAQA. Following are the list of knowledge areas with the associated SAQA credits required (the ECSA credits are sourced from ECSA document E-02-PE-rev4):

Knowledge area	Minimum ECSA - credits required	Credits in BEng (Mech)
1. Mathematical Sciences	56	80
2. Basic and Natural Sciences	56	96
3. Engineering Sciences	180	240
4. Design and Synthesis	72	104
5. Complementary studies	56	56
Subtotal	420	
Discretionary	≥140	
Total credits	≥560	**576**

4. CDIO and the NEW CURRICULUM

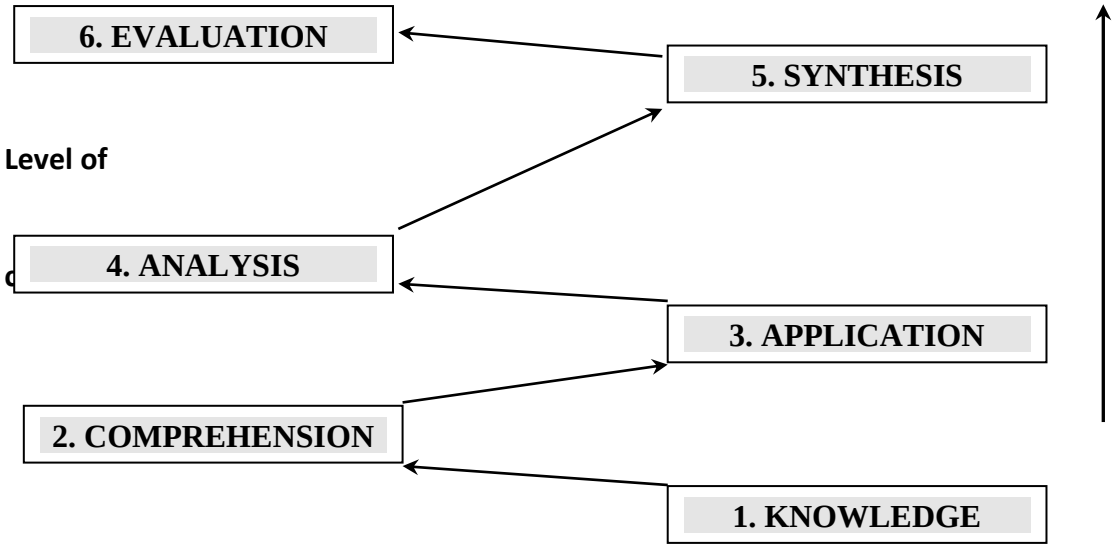
In recent years, it became apparent that engineering education and real-world demands on engineers have drifted apart. As a result, leading engineering schools in the U.S., Europe, Canada, U.K., Africa, Asia and New Zealand have formed a collaboration initiative to conceive and develop a new vision of engineering education: the CDIO INITIATIVE™. The CDIO initiative is an innovative educational framework for producing the next generation of engineers. It provides students with an education stressing engineering fundamentals set in the context of: Conceiving — Designing — Implementing — Operating real-world systems and products.

The CDIO initiative has been implemented in the Department of Mechanical and Aeronautical Engineering's undergraduate programme. As a result, the University of Pretoria has been selected as the first appointed CDIO regional centre (CDIO Regional Centre for Southern Africa) and is fast becoming one of the world trendsetters as far as the undergraduate engineering programme is concerned. Note that the second regional centre is M.I.T. (Northern American CDIO Regional Centre). This is a truly exciting development not only for the Department of Mechanical and Aeronautical Engineering at the University of Pretoria, but for the future of engineering education throughout the world. Further information on the initiative as well as the department's involvement is available on the CDIO homepage http://www.cdio.org/about .

5. COGNITIVE LEVELS ASSESSED

The criteria used for assessment are a list of specific skills to be mastered by the student in order to achieve the learning outcomes of a syllabus theme. During assessment (tests and the examination), students will be evaluated in terms of these criteria.

The statements used to define the criteria of assessment are classified in terms of a series of lower- to higher-order thinking skills (cognitive domains), in accordance with Bloom's *Taxonomy of Educational Objectives.* (Bloom, B.S. and Krathwohl, D.R. *Taxonomy of educational objectives. Handbook 1, Cognitive domain,* Addison-Wesley, 1984)



The characterisation of the cognitive domains is given in the table below.

Cognitive Domain	Definition	Typical Action Verbs
1. Knowledge	Remembering previously learned information	Arrange, define, describe, identify, label, list, match, name, outline
2. Comprehension	Understanding the meaning of information	Classify, discuss, estimate, explain, give example(s), identify, predict, report, review, select, summarize, interpret, "in your own words"
3. Application	Using the information appropriately in different situations	Apply, calculate, demonstrate, illustrate, interpret, modify, predict, prepare, produce, solve, use, manipulate, put into practice
4. Analysis	Breaking down the information into the component parts and seeing the relationships	Analyze, appraise, calculate, compare, criticise, derive, differentiate, choose, distinguish, examine, subdivide, organise, deduce
5. Synthesis	Putting the component parts together to form new products and ideas	Assemble, compose, construct, create, design, determine, develop, devise, formulate, propose, synthesise, plan, discuss, support
6. Evaluation	Making judgments of an idea, theory, opinion, etc., based on criteria	Appraise, assess, compare, conclude, defend, determine, evaluate, judge, justify, optimise, predict, criticise

The list of criteria of assessment for a study theme and its accompanying envisaged learning outcomes should contain statements applicable to all six levels of thinking. Accordingly, students will be evaluated in terms of a mix of all six levels of thinking skills. On the first-year level, a larger proportion of questions will be based on the lower levels (levels 1 to 3), whilst final-year examinations will contain a larger proportion of questions based on the higher-level thinking skills (levels 4 to 6).