School of Electrical and Information Engineering
University of the Witwatersrand, Johannesburg
ELEN4000A/4011AA – Design II

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1. Course Background

The ELEN4000/4011 Design course provides the students with a hands-on, project-based learning in a topic of their choices. The students research, design and implement a system, product prototype or process (as specified by the chosen topic), which constitutes a complex engineering problem. This work requires engineering knowledge and problem solving, using analysis, synthesis and performance evaluation methods. The knowledge required by and achieved from this problem solving include both fundamental and special to the topic at hand.

An emphasis is placed on the social, economic or environmental implications of the project as well as sustainability. The course requires the student to work effectively as a group and individually, in all stages of the project. The course has two deliverables, 1) a long technical report, in a specified format, reporting on the engineering activity in the project, of the student as an individual and the group, 2) A short non-technical report on impacts of an engineering solution and improvements in reducing the negative impacts.

2. Course Objectives

The fourth year design project is one of two 'capstone' courses that culminate the B.Sc. (Eng) programme. Successful performance in this course comprises the ability to gather information relevant to a design task in the selected field and to apply it to synthesize a realistic system that meets the specification. Students will also have to apply their knowledge and skills acquired during their undergraduate courses as well as their abilities in problem solving and communication. The design is to be carried out in a context similar to an engineer at an entry level to the engineering profession performing and reporting to an experienced engineer who would take decisions based on the report; professional engineering values thus apply.

3. Course Outcomes

On successful completion of this course, the student is capable of the following ECSA exit outcome levels as indicated in Table 1:

Table 1: ECSA Exit Outcome Levels (ELOs)

ELO	Description of the ELOs
3	Design a component, system, product or process, the achievement of which requires engineering knowledge and constitutes a complex engineering problem
1	Solve problems using analysis, synthesis and evaluation at various levels, including complex engineering problems
2	Use specialist and fundamental engineering knowledge, supported by mathematics and natural sciences, in the solution of engineering problems, including a complex engineering problem
5	Select, use effectively and evaluate the results produced by appropriate tools and methods for the problem at hand

7a	Identify and address social, economic or environmental impacts in the course of engineering activity
7b	Identify, analyse, and evaluate the sustainability of an engineering solution
8a	Work effectively as an individual in the planning and execution of a project
6a	Report on an engineering activity in the form of a long technical report or paper that meets stated format requirements
6b	Communicate with non-technical and affected parties on impacts of an engineering solution and amelioration of negative impacts in a short report.

4. Course Content

(The content of this course is published in the document entitled *Rules & Syllabuses: Faculty of Engineering and the Built Environment*.)

This course consists of an extended design project from a chosen field on which a comprehensive report is to be submitted by each student. This report will be assessed on the merits of the work reported and its suitability as a technical communication document.

5. Prior Knowledge Assumed

Some of the projects may have additional pre-requisite conditions – if any, these will be communicated when the project topics are published. The prerequisites and co-requisites to register for this course are defined in the current *Rules & Syllabuses: Faculty of Engineering and the Built Environment*.

6. Assessment

6.1 Some Learning Guideline Elements

The design project report is the only assessment component of this course. The marking grid used in assessing the project report, according to the criteria, is available on the course website and may be distributed to the students as a separate document.

- Each student is required to submit an individual and original design report.
- Each student is required to acknowledge the contributions of others to the design.
- Assessment of the student is carried out primarily on the basis of the project report (Long technical report and Appendix A which is the non-technical report). The internal examiners will, in addition, have monitored progress during the project. Students will be required to make use of an engineer's notebook.

Once the internal examiner has marked the design reports, an external examiner independently assesses each project. The course brief and outline and the student's project report are made available to the external examiner for this process. Finally, a third moderating process is used to achieve a final mark for each individual student.

6.2 Summative Assessment

Table 2: Summative assessment contributions

Summative Assessment Contributor	Duration h	Component Yes/No	Method & Weight %	Calculator Type 0/1/2/3	Permitted Supporting Material
Design report (long technical and non-technical report/Appendix A)	240	No	100%	3	Unlimited

6.2 Assessment Methods

The student will purely be assessed on the design project technical and non-technical reports they would have written. A rubric which assesses all the ELOs as listed in Table 1 will be used. The student performance on each ELO will be rated as either, deficient, acceptable, good and excellent. The final mark will depend on all the rating on the ELOs. There are four ratings as described in Table 3. A deficient mark will result in an FCOM.

Table 3: Description of the rating method for the ELOs

Rating	General Interpretation
Deficient	One or more major flaws.
Acceptable	No more than minor flaws, otherwise complete; no distinguishing features.
Good	Shows insight; some distinguishing feature(s).
Excellent	Exceptional insight and multiple distinguishing features.

This is described in the School's document entitled Application of Rule G.13 and Calculator Requirements on the School notice board.

The marking grid used in assessing the project reports, according to the criteria, is available on the course website and may be distributed to the students as a separate document.

- Each student is required to submit an individual and original design report, a long technical report including a non-technical report as Appendix A.
- Each student is required to acknowledge the contributions of others to the design.
- Assessment of the student is carried out primarily on the basis of the project report. The internal examiners will, in addition, have monitored progress during the project. Students will be required to make use of an engineer's notebook.

Once the internal examiner has marked the design reports, an external examiner independently assesses each project. The course brief and outline and the student's project report are made available to the external examiner for this process. Finally, a third moderating process is used to achieve a final mark for each individual student.

7. Satisfactory Performance (SP) Requirements

Rule G.13 and the School's documents entitled Application of Rule G.13 and Calculator Requirements and the School's Red Book (see the School notice board) apply.

To meet SP requirements, students are required to meet weekly with their project supervisors to:

- Obtain guidance during the project;
- Attend lectures associated with the project as required by the supervisor;
- Provide regular feedback on progress of their project;
- Record minutes and information in an engineer's notebook.

Students must make use of an engineer's notebook, throughout the duration of the project, to record notes during meetings held with their project supervisors. Submission of the engineer's notebook may be requested by the project supervisor. The final reports submission is done online via Sakai.

Late submission carries a heavy penalty mark, in strict accordance with the School's late submission policy published in the Red Book. This policy will be repeatedly referred to. Requests for late submission are normally only accepted on medical grounds supported by a medical certificate submitted to the Faculty's reception before the date of submission of the project reports unless convincing circumstances did not allow. Failure to comply with the above without a valid medical excuse may count against one's SP.

A repeat student must be available full-time during the complete period of the project and is required to attend all meetings of the course. Failure to do so will not be deemed SP.

Students must show evidence of satisfactory performance on all the ECSA exit outcomes as described in Table 1. These outcomes will be explicitly be assessed. Failure to provide evidence in any of the outcomes will result in failure of the course. Students are expected to attain at least an average rating of acceptable from the ratings of the ELOs (see Table 3 for rating descriptions). There is a zero tolerance on plagiarism.

The student is expected to perform a major design and to produce a major individual technical design report. The student's design product and process is rated on the following factors:

- Analyses and understands specification, including documentation requirements
- Assembles and evaluates information required for design
- Identifies and develops solutions
- Completes necessary tasks: analysis, synthesis, optimization
- Evaluates and uses design tools
- Identifies, makes and evaluates key decisions
- Adopts and uses an effective problem-solving strategy
- Manages project according to schedule and delivers documentation on time
- Critically evaluates design and design process against specification

Reporting Format:

Please follow the basic guideline for report writing in the school's blue book. A clear cover page must indicate project title, the student name, student number and submission date.

- The long technical report must be a standard one column report with a maximum of 15 pages (excluding cover page, table of contents pages and appendixes/supporting material), with a font size of 11. Students can place supporting material after Appendix A.
- The short non-technical report may **not exceed 2 pages**, font size of 11. Should be included in the long technical report as Appendix A.

8. Teaching and Learning Process

8.1 Teaching and Learning Approach

The students will be guided by their project supervisor. See section 7 for further details. Refer to the *Key dates for 4th years -2018* document published by the school for key dates and deadlines related to this course.

8.2 Information to Support the Course

There is no prescribed textbook for this course. The project supervisor will advise on essential reading and provide design specifications, requirements, standards and guidelines where necessary.

8.3 Learning Activities and Arrangements

The following is the list of the learning activities for the course:

a. Problem-based learning
b. Writing-intensive learning
c. Peer group activity

Project/Assignment:

The project supervisor will provide the project brief which will stipulate when and how submissions are made. Draw attention to the School's policy on timely submission of projects as per the *School's Red Book* will be enforced and must be read by the student.

Consultation:

Students can send an e-mail to the course coordinators to arrange consultation time.

9. Course Home Page

Further information and announcements regarding the course are posted on the course home page, https://bit.ly/2MSlLCp

All students are expected to consult the course home page at regular intervals.