ELEN4000/4011 Electrical Engineering Design II Project

Module code: ELEN4000/4011	**Pre-requisites:** None
Module name: Electrical Engineering Design II Project	**Co-requisites:** None
SAQA Course credits: 24	
ECSA Course credits: 24	**Date of Last Revision:** 28.01.2018

Module 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.

Module outcomes

On successful completion of this course, the student should be capable of:

- Analysing the requirements and synthesizing a significant engineering design under limited instruction and supervision, and drawing conclusions by reasoning from theories or engineering concepts appropriate to the design.
- Applying, in a careful and professional manner, the principles of systematic design, justification, critique and validation.
- Communicating the design approach, simulations, estimations, assumptions and conclusions at a level, and in a form, expected in an engineering career.

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.

Skills

On successful completion of this course, the student should be capable of:

- Analysing the requirements and synthesizing a significant engineering design under limited instruction and supervision, and drawing conclusions by reasoning from theories or engineering concepts appropriate to the design.
- Applying, in a careful and professional manner, the principles of systematic design, justification, critique and validation.
- Communicating the design approach, simulations, estimations, assumptions and conclusions at a level, and in a form, expected in an engineering career.

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.

Documentation Required

Full requirements with regards to the project report will be discussed with the students by the respective supervisors. The detailed structure and style of the documentation is likely to conform to the current practice in the particular field of research. A number of generic requirements exist and apply to all design project reports:

1. The project report must include analysis of the problem and a clear statement of the design objectives;

2. The logical approach to the design and in particular, the analysis and synthesis of the requirements in the specification must be presented;

3. A critical overview of the relevant current implementations must be presented;

4. A critical assessment of the results achieved and of the overall project must be presented;

5. Graphs, tables, diagrams and other illustrative material are an important part of the presentation and must be clear and in a satisfactory format;

6. Detailed information may be presented in a format prescribed in the problem specification. Where no format is prescribed, information must be presented in a clear and accessible way;

7. Use of the English language must be satisfactory;

8. An engineer's notebook must be used to record minutes of meetings, etc.

Components of the Assessment

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

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. 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.

Assessment Criteria

A requirement of the course is that the design projects are undertaken and executed by students individually. Projects are designed in scope, complexity and duration to be performed by a single student. The design project is required to be the student's own work.

Assessment will address the essential performance items listed in Section 2. In particular, the student is required to satisfy two requirements:

1. The design process and the evaluation of the design outcomes or results shall be

satisfactory according to performance items listed below;

2. The documentation shall be written satisfactorily, in accordance with the *Blue Book*.

A student performing acceptably in (1) but not in (2) may be granted, under exceptional circumstances, the opportunity to re-write and re-submit the documentation.

The student is assessed on their performance of these essential actions:

- Analyses and understands the purpose and nature of the design, including the documentation requirements;
- Assembles and evaluates information required for the design;
- Identifies and applies simulation programs and other design tools using their own initiative;
- Adopts and utilizes effective problem-solving strategies;
- Develops a balanced programme, leaving adequate time for evaluation of the design outcomes and results, and for the preparation of the documentation;
- Completes the necessary tasks e.g. assembling of information, analysis, synthesis and validation, and compilation of the report;
- Manages the project according to schedule and submits the documents on time;
- Critically evaluates the design approach and outcomes;
- Communicates all aspects of the design at the required level and to the required professional standard in a formal report;
- Produces documentation in the required form and to the required professional standard.

The marking of the design project report will implement an assessment the criteria above. A student will receive an FCOM if the project report is rated as Deficient (Mark lower than 40 according to the University's marks system.

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:

1. Obtain guidance during the project;
2. Attend lectures associated with the project as required by the supervisor;
3. Provide regular feedback on progress of their project;
4. 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 report submission is done online via Sakai.

Since the project report is the only and final examination, 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 report. 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.

ECSA Exit Level Outcomes

	ELO 1	ELO 2	ELO 3	ELO 4	ELO 5	ELO 6	ELO 7	ELO 8	ELO 9	ELO 10	ELO 11
Is this ELO applicable?	No	No	Yes	No	No	Yes	Yes	No	Yes	Yes	No
On what level is it applicable?			Exit Level			Exit Level	Exit Level		Exit Level	Exit Level	

Description of assessment of applicable ELOs

- **ELO 3:** Design Competencies
- **ELO 6:** Design report
- **ELO 7:** Impact of solution
- **ELO 9:** Unfamiliar design context
- **ELO 10:** Engineering professionalism

Evidence of performance in these five of ECSA's exit level outcomes (ELO 3, 6, 7, 9 and 10) is explicitly assessed. Failure to provide evidence in any of these results in outright failure of the course.

The student is expected to perform a major design and to produce a major individual design report.
The student's design product and process is rated on the following factors:
1. Analyses and understands specification, including documentation requirements
2. Assembles and evaluates information required for design
3. Identifies and develops solutions
4. Completes necessary tasks: analysis, synthesis, optimisation
5. Evaluates and uses design tools
6. Identifies, makes and evaluates key decisions
7. Adopts and uses an effective problem-solving strategy
8. Manages project according to schedule and delivers documentation on time
9. Critically evaluates design and design process against specification

The students are required to attain at least an average rating of Acceptable on the average on a five point scale: Unacceptable/Poor/Acceptable/ Good/Excellent.

The students write a major technical report in the Design and Laboratory Projects. The report is assessed against the following outcomes:
1. Background and problem understanding
2. Quality of the engineering output
3. Critical analysis and evaluation
4. Technical communication

The students are explicitly required to consider the sustainability and impact of their design solution on society and the environment. The design report must contain evidence that this aspect has been considered, otherwise the student cannot pass this course.

Ethical behaviour is expected in the following ways:
1. Students must exercise judgement within the limits of their own competence
2. Deliverables must be submitted according to the schedule
3. Students must behave ethically and exercise judgement in resolving issues and disputes within their team
4. A zero-tolerance approach to plagiarism is practiced.
5. Students are expected to expected to critically evaluate their own work.

In addition, students are specifically required report on how tasks are divided between team members and to reflect on teamwork.

Detailed 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.

Project Scope, Complexity and Duration

Project supervisors are required to compile and outline problem specifications for the Design topic that satisfy the following requirements:

1. Requires significant technical design investigation;
2. Contains a mix of practical constraints and uncertainties;
3. Presents a substantial challenge;
4. Requires critical analysis and assumptions to be made that are justifiable;
5. May require the use of computer simulations and the evaluation of results there from;
6. Requires knowledge at final-year level from the formal courses, although not necessarily completely contained in the courses;
7. Must be capable of being completed, including the documentation, with a commitment of full-time work over the project period;
8. Provide an intellectual challenge while at the same time not be so extensive that there is no time to do justice to the design.

Topic Allocation

Students are required to choose a first, second and third choice topic from the available projects. Several important comments must be noted with regards to the allocation process:

- The process will be as fair and as transparent as possible. Students are encouraged to arrange a meeting with the course coordinator to seek clarification on any decisions or any part of the process.
- Where possible, students will be allocated their first choice topic for their project. However, some projects may be extremely popular and in this case, students may be allocated

their second or third choice.

- Students must have the pre-requisite courses (if any) for the project topics they choose.

The School reserves the right to withdraw or alter project proposals should circumstances require such action.

Prescribed Text / Reading

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.

Prior Knowledge Assumed

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

Course schedule	**(12) (1-0-0) (2 terms)**
Diagonal	E
Semester	2
Weeks per semester	6
Duration of lecture/tutorial period	45min = 0.75 hr
Number of lectures per week	1
Number of tutorials per month	0
Hours of practicals/labs per semester	0
Other non-contact time per semester (hr)	240

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