The University Of Sheffield.

Electronic & Electrical Engineering.

EEE260 COURSEWORK YEAR 2

Credits: 20

Course Description including Aims

This module is an academic year laboratory based module containing both set laboratory experiments and more open ended project work (including an industrial project, known as SHIPS). The module aims are

1. To develop skills in experimental technique in a variety of different areas. To inculcate good lab book-keeping practice.
2. To expose students to a variety of measuring instruments ranging from very basic to very sophisticated.
3. To give students some experience of basic device fabrication processes.
4. Further to develop skills in observation of, and interpretation of, the physical behaviour of electronic systems.
5. To begin to appreciate the role of models and modelling in the technical design process, including the role of CAD in design evaluation.
6. Further to develop skills in the reporting and presentation of technical information.
7. To develop a critical attitude in students towards their own observations and those of others.
8. To be aware of experimental errors.
9. To develop the ability to search the literature for relevant information and make critical assessments of that information.
10. To introduce students to the dynamics of team working
11. To give students the opportunity to work in groups on a problem presented to them by a local industrial company and to report their conclusions to company representatives both orally and in the form of a written report.

Outline Syllabus

AC Machines; Amplifiers; LabView; Semiconductors; Transmission Lines; Signals and Systems (MATLAB based); Design Project; SHIPS industrial project

Time Allocation

150 contact hours of laboratory and project work over 2 semesters.

Recommended Previous Courses

EEE160 “Coursework Year 1” or equivalent practical experience

Assessment

Continuous via various types of report and oral presentation and peer assessment.
The assessment of the module covers the laboratory exercises and the design exercises only. The students who take EEE260 also have to be involved in, and attend the SHIPS aspect but the assessment

of the module does not include SHIPS as EEE262's assessment does. However, to progress to 3rd year a student who takes EEE260 must have gained a satisfactory grading in SHIPS.

Recommended Books

Ellis, S. & Dick, P.	*Introduction to Organisational Behaviour* (1st or 2nd ed)	McGraw Hill
Kitchin, Duncan	*An introduction to organisational behaviour for managers and engineers :.. - 1st ed.*	Butterworth-Heinemann
Rickards, T	*Creativity and problem solving at work*	Gower

Objectives

On successful completion of this module students will be able to

1 choose appropriate measurement techniques for normal experimental environments

2 use oscilloscopes and other instruments capable of automated measurement, understand the way those measurements are taken and hence appreciate some limitations of automatic measurement systems.

3 use LABVIEW to manage an experiment

4 use MATLAB as a modeling tool

5 fabricate a simple semiconductor device and evaluate its performance

6 make technical design decisions in a design project where cost and time impose constraints

7 report the results of experimental and design work in clear and concise written form

8 present orally the results of project work to a peer group and to industrial visitors

9 search the literature for relevant information and make critical assessments of that information

10 use computer and analytical models in the technical design process

11 maintain an accurate record of their experimental activities in a lab book

12 appreciate and demonstrate some of the qualities that make a graduate employable.

14 write an objective description of an industrial problem to be solved, together with the constraints associated with any solution, and a description of the company that provided the problem.

15 harness the creative resources of a group in order to generate ideas and solve problems.

16 communicate effectively both with colleagues and with other engineering professionals using written and oral methods.

17 appreciate the realities of solving technical problems subject to realistic constraints.

18 demonstrate skills in time-management and group working whilst tackling a time-limited task.

19 reflect on their performance to identify strengths and skills developed.

20 Appreciate that creativity can lead to enterprise.

Detailed Syllabus

The first semester's work includes six experiments varying between three and ten hours in length which are conducted in small groups.

1. **AC Machines**: this 10 hour laboratory exercise is concerned with the characterisation and testing of an induction motor and a synchronous motor. An assessed report is required for this laboratory exercise.
2. **Amplifiers**: this 10 hour laboratory exercise looks at the measurement of pulses, the characteristics of op-amp circuits and the design and operation of power-amplifiers (A, B, and A/B). Students attending this laboratory exercise will be marked as being Satisfactory/Un-satisfactory.
3. **LabView System Modelling**: this 10 hour laboratory involves the design, implementation, and testing of various system models using LabView. It is assessed by submission of LabView Code..
4. **Semiconductors**: In this 10 hour laboratory students design, fabricate and evaluate a Schottky diode.

An assessed report is required for this laboratory exercise.

5. **Transmission Lines**: In this 4 to 8 hour laboratory exercise the characteristics of a transmission line driven by a sinusoidal signal are explored and the idea of reflection and standing waves introduced. Students attending this laboratory exercise are marked as being Satisfactory/Un-satisfactory.
6. **Signals and Systems**: This 10 hour laboratory, uses the facilities of MATLAB to investigate the dependency of non-sinusoidal periodic waveforms on the parameters of the harmonics in the frequency spectrum, to observe aliasing of sampled-signals, and investigate first and second order system responses. Students attending this laboratory exercise will be marked as being Satisfactroy/Un-satisfactory.

Intensive workshop: The graduate labour market, Employability, Team roles & team building, Project planning, Introducing the Work Experience Portfolio.

SHIPS industrial project (first semester) take, but not assessed for these students:

Students, working in their tutor groups, visit and industrial partner where they are given a technical challenge (with realistic physical/commercial constraints) to research and propose solutions to. They produce an individual short report after their visit. They continue to investigate this problem over seven weeks concluding by delivering a stand-up presentation of outcomes to their industrial partners plus write a group final technical report.

The following lectures are given in support of SHIPS.

1) Introduction to the SHIPS program: what it is, why we do it and how it operates.
2) Introduction to library research skills.
3) Collective ideas generation and problem solving ('ideas shower' – formerly known as 'brainstorming') Ideas selection.
4) Project planning: goal setting, milestones, deliverables, time-planning and critical paths.
5) Writing technical reports: knowing the audience, language, structure, graphics.
6) Giving oral presentations: knowing the audience, language, structure, delivery, visual aids.
7) Brief introduction to the topic of Enterprise

The second semester's work consists of a design project and an industrial group project. The design project is an extended, 42 hour practical which will allows students to approach designing electronic or electrical devices or systems from a specification. Unlike previous experiments the route chosen to achieve the end results may be completely different from group to group as each group's work is researched and executed independently. The project runs over seven weeks and the current list of projects available is:

1. **Microcontroller System Design**: This design exercise is concerned with the hardware and software design of a small microcontroller-based system intended to operate as a programmable lock. The software is implemented and tested using In-Circuit-Emulation and a prototype system. Each group is expected to submit a single report and deliver a group presentation following this design exercise.
2. **Digital Design of a Simple Microprocessor**: This design exercise is concerned with the design and simulation of a small programmable processor based around a Field Programmable Gate Array (FPGA). Each student is expected to submit a report and deliver a group presentation following this design exercise.
3. **Yagi Antenna Design**: This design exercise is concerned with the design of a Yagi antenna and testing of a prototype in an anechoic chamber. Each group is expected to submit a single report and deliver a group presentation following this design exercise.
4. **Printed Antenna for Mobile Communications**:: This design exercise is concerned with the design, construct and evaluation of a small printed antenna suitable for a handheld communication device. Each group is expected to submit a single report following this design exercise.
5. **Power Electronics**: This design exercise is concerned with the design, implementation, and test of a

Switch Mode DC-DC Converter. Each group is expected to submit a single report and deliver a group presentation following this design exercise.

6. **Brushless DC Generator Design**: This design exercise is concerned with the design, fabrication and test of a brushlesspermanent magnet generator. Each group is expected to submit a single report and deliver a group presentation following this design exercise.
7. **MOSFET Power Amplifier**: This design exercise is concerned with the design and implementation of an audio power amplifier for Hi-Fi applications. Each group is expected to submit a single report following this design exercise and and deliver a group presentation.
8. **Surface Acoustic Wave Filter**: This design exercise is concerned with the design, fabrication, and evaluation of a band-pass filter implemented using a Surface-Acoustic-Wave device. Each group is expected to submit a single report and deliver a group presentation following this design exercise.
9. **Solar Cell**: This design exercise is concerned with the design, fabrication and evaluation of a photo-voltaic solar cell. Each group is expected to submit a single report and deliver a group presentation following this design exercise.

UK-SPEC/IET Learning Outcomes

Outcome Code	Supporting Statement
SM1p/SM1m	The set laboratory experiments require engagement with principles across a range of experimental topics. The design projects facilitate study to a greater depth in selected areas. Assessed continuously.
SM2p/SM2m	Processing and interpretation of experimental measurements demands the application of a range of mathematical tools. The design projects also require the application of maths to evaluate design ideas. Assessed continuously.
SM3p/SM3m	One of the labs (fabrication and evaluations of schottky barrier diode), the design projects and the SHIPS industrial project often require students to apply elementary engineering principles from other disciplines. Assessed continuously.
EA1p/EA1m	The interpretation of experimental results demands that engineering principles be applied effectively. Assessed continuously.
EA2p/EA2m	Most of the labs involve taking measurements and using analytical methods to develop or test models. Assessed continuously.
EA3p/EA3m	In some labs and in the design projects (and occasionally during SHIPS industrial projects) students use CAD and simulation software to verify that designs will meet the specification. Assessed continuously and by report.
EA6m	In the design projects (and often during the SHIPS industrial projects) students must extract the information they need about devices and components from books and from manufacturer's data, often working in unfamiliar territory. Assessed by report.
EA4p/EA4m	The design projects require students to break down their problems into manageable size parts which are then assembled to form a whole. This contributes to basic elements of system thinking. Assessed by report.
D2p, **D2m**	Design projects require interpretation of specifications and identification of constraints and thus contribute to aspects of this outcome. The SHIPS visit and associated individual Initial Visit Report requires students to define and identify constraints impinging upon problems set by industry during an industrial visit; a lecture supports this. Students are also told about risks-management (relating to project success) during the SHIPS support lecture series. Assessed by report.
D1p, **D1m**	Many SHIPS problems require some appreciation of customers' needs (where the customer is usually the industrial partner). These would be identified in the various reports that the students produce.

D8m	Following introduction to brainstorming in a lecture, video interviews with professional engineers and tutorial opportunities students have considerable opportunities to demonstrate ability to innovate during the conduct of their SHIPS project.
D5p, **D5m**	Students are encouraged to manage the design process and identify cost drivers when seeking solutions to problems posed by industry (as cost is usually a significant constraint) and to discuss them when completing the various assessed SHIPS reports. Further experience occurs during the Design Exercise
	As D2m
D4p, **D4m**	Consideration of fitness for purpose is key to evaluating possible solutions to problems posed by industry in SHIPS, discussed by students in their final project reports.
D5p, **D5m**	In the design project and in SHIPS, students must manage their time to achieve an outcome by a specified date, and by that date they must have evaluated their design against specifications. Assessed by report.
ET2p, **ET2m**	SHIPS projects enhance student awareness of the commercial and economic context of engineering decisions.
ET3p/ET3m	Project planning techniques such as Gantt charts and critical path analysis are briefly introduced in both SHIPS support lectures and associated tutorials along with video interviews with professional engineers discussing these and other issues. Team management lectures also touch on a variety of issues including leadership and international cultural differences.
ET1p, **ET1m**	Students are expected to observe the highest standards when it comes to acknowledging sources and identifying their own work. Assessed by report with the aid of Turnitin.
EP2p, **EP2m**	Students are exposed to state-of-the-art equipment and deal with a range of materials and devices in their lab programme. In addition, most SHIPS problems offer opportunities to enhance students' awareness of materials, equipment and processes.
EP3p, **EP3m**	The labs are designed to develop practical skills in experimental techniques including constructing circuits using components and soldering irons. Students also get experience of working in a clean room environment. Assessed continuously.
EP1p, **EP1m**	SHIPS projects enhance students' understanding in this area by involving real industrial problems. Assessed in the SHIPS reports.
EP10m	The SHIPS projects being sourced by local industry are inherently constrained by the very real trading environment of the industrial collaborators. Assessed in the various SHIPS reports
EP4p, **EP4m**	Using technical literature is an essential part of the design project process. In addition SHIPS projects offer opportunities to explore technical literature and online sources of information and interpret these in the context of seeking solutions to their projects. The effectiveness with which information has been extracted is assessed by report.
EP7p, **EP7m**	Students get an introduction to this issue when fault finding their designs. Assessed by report.
EP8p, **EP8m**	This is one of the key issues in the design projects – knowledge is incomplete, uncertainty is high. Giving students the idea that they must plan for different possibilities is important.
D3p/D3m	During the SHIPS projects students sometimes work with information that may be

	incomplete or uncertain and find themselves quantify the effect of this on their proposed solutions.
D6p, D6m	During the SHIPS projects students must communicate their work to technical and non-technical audiences by means of a written report and a stand-up presentation delivered to company visitors (who may include both technical and sometimes non-technically minded individuals). Assessed by report and continuous assessment (of the presentation).