COURSE TITLE: Electronic Design Projects  

CODE: EE3C6B

LEVEL: Junior Sophister  
CREDITS: 10  
PREREQUISITES: None

LECTURER(s): Asst Prof Edmund Lalor,  
Asst Prof David Corrigan  
TEACHING SUPPORT:  
Mr. John Squires

TERMS: Semester 1 & 2  
DURATION (WEEKS): 24  
LABORATORIES: 20  
TUTORIALS: 0

AIMS/OBJECTIVES

Analogue Design Project (Semester 1)
The main purpose of the analogue design project is to develop the students’ practical knowledge of the design, simulation, implementation, and testing of analogue electronic circuits. Students learn to work in a group of usually three persons, who must manage the project, divide up the workload between them and apply a ‘divide-and-conquer’ approach to tackling a design task in electronic engineering. Thus, the project involves constructing circuits from components in modular form and testing and documenting each section before proceeding further. This simplifies the task of verifying and modifying the design.

Digital Design Project (Semester 2)
The main purposes of the project are:

- To develop the student’s practical knowledge of digital logic gates, circuits containing synchronous logic, and the use of microprocessors such as the PIC and Arduino.
- To gain further experience in the design, simulation, implementation and testing of digital circuits.
- To develop the ability to work on a project as a member of a team.
- To develop report writing skills

SYLLABUS

Analogue Design Project (Semester 1)
- Measurement of the input and output characteristics of an NPN junction transistor.
- Use of the transistor as a simple common emitter amplifier.
- Designing, building and testing a two-stage audio preamplifier.
- Design and construction of an instrumentation amplifier.
- Use of EAGLE PCB software for designing printed circuit boards
- Team-based project designing, building and testing an amplifier for a real-world application (e.g., audio amplification, biomedical signal amplification, etc.)
Digital Design Project (Semester 2)

- Fundamental building blocks of digital circuits from gates to system level devices.
- Frequently used important blocks like decoders, multiplexors, flip-flops, shift registers, counters and timers.
- Use of block diagrams, circuit schematics with MULTISIM, circuit simulation and testing.
- Use of micro-controllers (Arduino) to implement tests of various stages of the electronic circuit.
- Analysis and design of combinational and synchronous digital systems.
- Maintaining good engineering documentation.

RECOMMENDED TEXT(S)

Analogue Design Project (Semester 1)

Digital Design Project (Semester 2)

LEARNING OUTCOMES

Analogue Design Project (Semester 1)
On successful completion of this project the student will be able to:
1. Describe and plan a project involving analogue electronics.
2. Construct a hardware solution for an analogue electronics problem.
3. Sketch a schematic diagram of the circuit along with component values.
4. Select a definite test strategy to check each stage of the design.
5. Carry out a test and verification procedure, recording appropriate results.
6. Write a structured and comprehensive technical report on the project.
7. Work as part of a team.

Digital Design Project (Semester 2)
On successful completion of this project the student will be able to:
8. Describe and plan a project involving digital electronics.
10. Sketch a block diagram of the circuit along with user interfaces.
11. Select a definite test strategy to check each stage of the design.
12. Obtain and describe timing waveforms.
13. Write a structured comprehensive technical report on the project.
14. Work as part of a team.

**TEACHING STRATEGIES**

**Analogue Design Project (Semester 1)**

Students learn progressively more difficult design methods and tools as the weeks progress. The project is launched from introductory laboratory exercises with transistors and op-amps which include both construction of circuits and MULTISIM simulations. Support is on hand from the demonstrator and technical officers throughout the project.

The essential steps in the design procedure are explained and illustrated. In the first few weeks, the students are heavily assisted to design, simulate, construct, solder together and test a simple introductory audio amplifier. They see the important role of calculations in circuit design and the problems associated with testing the design by making use of MULTISIM. Students are then required to research, and construct a far more complex amplifier capable of amplifying a “real-world” signal such as an ECG signal or a music signal. This will require knowledge of instrumentation amplifiers and how they are configured from three op-amps. The performance of the simpler circuits will show their limitations and reveal the problems that need to be overcome.

**Digital Design Project (Semester 2)**

The hardware construction of two real working circuits is required – one introductory project, and one far more challenging circuit. The project is launched from introductory laboratory exercises with CMOS ICs. Support is on hand from the demonstrator and technical officers throughout the project.

**ASSESSMENT MODE(S)**

Both projects are worth 50% of the overall module mark. The breakdown for each module is as follows

**Analogue Design Project (Semester 1)**

The written report will constitute 60% and the practical in-lab work will contribute 40% of the overall project mark.

**Note:** While this is a group project, each student must submit an individual report.

**Digital Design Project (Semester 2)**

The written reports will constitute 60% and the in-lab practical work will contribute 40% of the overall project mark.

**Note:** While this is a group project, each student must submit an individual report.