Maynooth University
National University of Ireland Maynooth

MAYNOOTH UNIVERSITY ENGINEERING & COMPUTER SCIENCE INTERNATIONAL SUMMER SCHOOL

SYLLABI FOR CLASSES

PLEASE NOTE THAT ALL SYLLABI MAY BE SUBJECT TO SLIGHT CHANGE OR MODIFICATION

CONTENTS

Electric Circuits Engineering

EE215SS

5 ECTS Credits

Module Name	Electric Circuits 2
Module Code	EE215
Module Co-ordinator	Refer to Excel document *Module_Co-ordinators*
Department	Electronic Engineering
Module Level	2
Credit rating	5 ECTS credits
Pre-requisites	None

Aims	To provide an in-depth knowledge of RLC circuits and filter design.
Learning Outcomes	At the end of the course, the student should be able to: 1. Explain conceptually what resonance and bandwidth mean in the context of RLC networks. 2. List and draw the frequency specifications of the four basic types of filters. 3. Draw a bode plot of a network function. 4. Design and build a passive filter based on a Butterworth response. 5. Use RLC circuits to modulate bandwidth and resonance as needed. 6. Use Matlab to analysis signals with the appropriate filter hardware. 7. Design, build and analysis a filter circuit in a lab environment.

Time Allowance for Constituent Elements	
Lectures	24 hours
Tutorials	10 hours

Laboratory and exam	21 hours
Class Test	2 hours
Independent study	66 hours
Semester Examination	2 hours

Indicative Syllabus

- RLC resonance, bandwidth and Q-factor
- Passive filter design – Low Pass, High Pass, Band stop and band pass filters
- RLC filter effects stage, Butterworth filters
- Bode plots
- Realisation of various filter specifications
- Stability of filter circuits
- Oscillators
- ADC and DAC circuitry

Assessment Criteria

Semester Examination	60%
Laboratory (6)	15%
Laboratory Exam (1)	15%
Class Test (2)	10%

Penalties: Missed labs and class test cannot be repeated, in general.

Pass Standard and any Special Requirements for Passing Modules: The Pass Mark is 40% - students are not required to pass the written and continuous components separately.

Supplemental Examination: 1 x 2 hour written examination (Autumn). The continuous assessment mark is carried forward as there is no facility for repeating the continuous assessment elements of the course.

Assessment Philosophy

The class tests and examination paper are designed to cover learning outcomes 1- 5. All questions in the class test are compulsory, while the final examination paper has a compulsory question that covers all aspects of the syllabus. The lab sessions cover learning outcomes 5 -7 and encourage teamwork.

It should be noted that the laboratory exam will be individually assessed in the form a different problem given to each student.

Course Text	"Electromagnetics with Applications", Kraus and Fleisch, McGraw-Hill
References	• "Engineering Electromagnetics", Hayt and Buck, McGraw-Hill • "Electromagnetic Fields and Waves", Lorrain and Carson, Freeman

Programmes currently utilising module	**Compulsory**
BE in Electronic Engineering	Yes
BSc in Science (Engineering Science)	Yes

Algorithms & Data Structures I

Computer Science

CS210SS

5 ECTS Credits

Overview

Introduction to algorithms and data structures. Review of elementary programming concepts suitable for the implementation of abstract data types (operators, types and expressions; control of flow; methods; recursion; input & output); Algorithms for searching: linear, bounded linear and binary searches; Algorithms for sorting: selection, insertion, bubble and quick sorts; Fundamental linear data structures: stacks, queues, linked lists; Object-oriented programming: encapsulation and information hiding, classes, interfaces, class hierarchies, inheritance, polymorphism, basic exception handling; Analysis of basic algorithms.

Learning Outcomes

On successful completion of the module, students should be able to:

- Recognize the importance of program complexity
- Describe a variety of structures for storing data such as arrays, linked lists, stacks and queues
- Explain a range of algorithms involving searching and sorting
- Identify data structuring strategies appropriate to a given context
- Design, develop, test and debug object-oriented programs in Java
- Apply data structuring techniques to the design of computer programs

Teaching & Learning Methods

48 Lecture hours,

Assessment

50% for Continuous assessment exercises and 50% for a final written exam
The Pass standard is 40%

Software Design
Computer Science

CS264SS

5 ECTS Credits

Overview

In the course students will be introduced to principles and practices of object oriented software analysis, design, and programming using C++. The course will be delivered in two halves. The first half will focus on taking students from the basics of C++, through to objected oriented and generic programming. Topics covered will include (i) basic C++ syntax and program structure, (ii) primitive and abstract data-types, (iii) arrays, pointers, and dynamic memory management, (iv) object oriented programming (encapsulation, inheritance, polymorphism, etc.), and (v) generic programming and the STL. Note that the course assumes that students already have a good level of programming competency, but that they have not previously programmed in C++.

The second half will cover the general principles object oriented analysis and design (OOA/D) and in particular the application of design patterns in developing well-structured, extensible, and reusable software systems.

Learning Outcomes

On successful completion of the module, students should be able to:

- Analyze, design, and implement software based solutions to problems using C++.
- Understand and apply dynamic memory management programming techniques in C++.
- Develop generic implementations of algorithms in C++.
- Compare and contrast different software designs based on principled quality criteria.
- Apply OOA/D techniques to the development of software solutions to real-world problems.
- Implement a selection of design patterns in C++.
- Understand and apply a selection of design patterns in their software solutions.

Teaching & Learning Methods

24 Lecture hours, 24 Laboratory hours

Assessment

50% for Continuous assessment exercises and 50% for a final written exam
The Pass standard is 40%

System Dynamics Engineering

EE211SS

5 ECTS Credits

Overview

- To analyze a range of both continuous and discrete time systems.
- To introduce the concept of state-space.
- To introduce frequency-domain system analysis.
- To further the use of Matlab and Simulink in laboratories

See full module descriptor at http://www.nuim.ie/electronic-engineering/current-students/module-descriptors

Learning Outcomes

On successful completion of the module, students should be able to:

- Develop mathematical models for a range of dynamical systems.
- Change between different mathematical model representations (differential equation, state-space and transfer function).
- Linearize a nonlinear system about an operating point.
- Calculate responses of simple dynamical systems.
- Analyze simple systems using Bode plots.
- 6. Use Matlab and Simulink to simulate and analyze a range of systems

Digital Systems Engineering

EE216SS

5 ECTS Credits

Module name & code	Digital Systems EE216
Revision Date	6th March 2024
Module Co-ordinator	Refer to Excel document *Module_Co-ordinators*
Department	Electronic Engineering
Credit rating	5 ECTS Credits
Pre-requisites	None

Aims	• To introduce students to the world of digital design. • To equip students with the necessary skills to tackle real-world problems in the design of complex digital systems.
Learning Outcomes	At the end of this module, the student will be able to: 1. Perform basic Boolean algebra. 2. Minimize logic using Karnaugh Maps. 3. Implement a logic circuit using only NAND / NOR gates. 4. Describe the operation of basic flip-flops. 5. Design combinational logic circuits using multiplexers as universal logic modules. 6. Analyze and design Finite State Machines. 7. Explain the basic operation of Analogue to Digital and Digital to Analogue converters.

Time Allowance for Constituent Elements	
Lectures / Tutorials	34 hours
Class tests (2 x 1 hr)	2 hours
Laboratory (up to 5 x 3 hr)	15 hours
Independent study	72 hours
Semester examination	2 hours

Indicative Syllabus

- Binary numbers & Binary representation
- Boolean algebra
- Minimization using Karnaugh maps
- Sequential Logic – SR, D, JK, T and Master-slave flipflops
- Finite State Machines – Mealy and Moore machines
- Implementation using NAND and NOR functions
- Memory (ROM and RAM) and storage devices.
- Analogue to Digital and Digital to Analogue converters.
- Multiplexers – Combinational logic design using Multiplexers/Decoders as Universal Logic Modules

Assessment Criteria	
Semester examination	70%

Laboratory reports (5) Class tests (2)	10% 20%

Penalties: Missed labs and class tests cannot be repeated, in general.

Pass Standard and any Special Requirements for Passing Modules: The Pass Mark is 40% - students are not required to pass the written and continuous components separately.

Supplemental Examination: 1 x 2 hour written examination (Autumn). The continuous assessment mark is carried forward as there is no facility for repeating the continuous assessment elements of the course.

Assessment Philosophy

The final examination and class tests are designed to assess all learning outcomes. All questions in all class tests are compulsory, while the examination paper has a compulsory question that covers all aspects of the syllabus. The laboratory covers learning outcomes 2 - 7 and also encourages teamwork.

Course Text	• Mano, M. Morris, *Digital design*, (2nd ed.), Prentice-Hall, 1991.
References	• Floyd, Thomas L., *Digital fundamentals*, (7th ed.), Prentice Hall, 1999. • Carter, John W. *Digital Designing with Programmable Logic Devices*, Prentice Hall, 1997. • Wakerly, John F. *Digital Design: Principles and Practices* (3rd ed.), Prentice Hall, 2001.

Programmes currently utilising module	**Compulsory**
BE in Electronic Engineering	Yes
BSc in Robotics and Intelligent Devices	Yes