FACULTY OF ENGINEERING

MODULE DESCRIPTION FORM

EE107 - ELECTRONIC AND ELECTRICAL PRINCIPLES 1

Module Code: EE107	**Module Title:** Electronic and Electrical Principles 1	
Module Registrar: P. McGlone		
Other Lecturers Involved: {OTHERS}	**Credit Weighting** 20	**Semester:** 1/2
Compulsory/optional/elective class: NE	**Academic Level:** 1	

Pre-requisites: Higher Physics and Maths, or equivalents

MODULE FORMAT AND DELIVERY (HOURS):

Lectures	Tutorial	Assignments	Laboratories	Private Study	Total
66	50			84	200

EDUCATIONAL AIM *THIS MODULE AIMS TO:*

Develop a firm grounding in the understanding, analysis and design of analogue and digital circuits.

LEARNING OUTCOMES *ON COMPLETION OF THE MODULE, THE STUDENT IS EXPECTED TO BE ABLE TO;*

LO 1: Demonstrate the ability to apply fundamental circuit analysis techniques to DC and AC circuits.
LO 2: Understand the fundamentals of amplifiers and feedback, and the basic principles and design of operational amplifier circuits.
LO 3: Demonstrate an understanding of combinational logic circuit design, analysis and synthesis.
LO 4: Understand the behaviour, design and application of specific combinational and sequential logic circuits.

(UK SPEC suggests no more than 4 learning outcomes per module. Statements must be broad and be syllabus free and link in with the intended learning outcomes on the programme specifications.)

SYLLABUS *THE MODULE WILL TEACH THE FOLLOWING:*

Fundamentals:- Units of measurement, SI units, symbols and notations; charge flow and current; voltage drop; resistivity, resistance and Ohm's law, I-V characteristics of resistors; I-V characteristics of non-linear devices; open and short circuits; power and energy.
DC Circuits:- Kirchhoff's laws; the application of Ohm's and Kirchhoff's laws to DC circuit analysis, series, parallel and series-parallel resistive circuits; voltage division and current division; Thévenin's Theorem, Norton's Theorem and source conversion; maximum power transfer theorem; circuit analysis using superposition; mesh analysis of circuits.
AC Circuits:- Phasors and complex algebra; properties of capacitors and inductors; reactance of capacitors and inductors; impedance and admittance; phasor diagrams; extension of DC circuit analysis techniques to AC circuits; RMS values, power and energy, power factor.
Passive Circuits:- Input impedance; output impedance; insertion losses; voltage transfer function, frequency response of magnitude and phase.
Amplifier Fundamentals:- Gain, input and output impedance; amplifier modelling; amplifiers in cascade; frequency response. Feedback:- Introduction to negative feedback, multiple feedback configurations.
Operational Amplifiers:- Introduction to the operational amplifier, the differential stage, inverting and non-inverting configurations, common amplifier circuits.
Introduction to Digital Systems:- Binary, decimal and hexadecimal numbering systems; arithmetical operations and negative numbers in binary; comparisons and relationships between analogue and digital systems.
Digital Analysis:- Boolean algebra, Karnaugh and inverse maps; minimisation of Boolean expressions, basic logic gates, analysis of circuits containing logic gates; timing diagrams and propagation delay.
Design:- Design procedures; design of combinational logic circuits; use of "don't care" terms; Binary Coded Decimal (BCD); minterms and maxterms; design of circuits containing only NAND or only NOR gates; design of basic digital systems.
MSI Devices and Sequential Logic:- Introduction to the adder, comparator, multiplexer and decoder devices; active-low and active-high inputs and outputs; introduction to sequential circuits, S-R latches and flip-flops, D latches and flip-flops, J-K flip-flops and counters.

ASSESSMENT OF LEARNING OUTCOMES - CRITERIA

LO 1:
C 1: Describe and employ circuit analysis tools such as voltage and current division, Kirchhoff's laws.
C 2: Demonstrate ability to use simplification techniques such as source conversion and reduction.
C 3: Apply mesh analysis, superposition, Thevenin's and Norton's theorems to solve circuits.
C 4: Manipulate complex numbers in the solution of AC problems using phasors.
LO 2:
C 1: Understand the fundamentals of amplifiers and feedback.
C 2: Understand and apply top-down design to amplifier circuits.
C 3: Demonstate the ability to design operational amplifier circuits.
C 4: Analyse the behaviour of circuits by way of finding their transfer function in standard form.
LO 3:
C 1: Understand and apply the laws of Boolean algebra to simplify expressions.
C 2: Employ truth tables, Karnaugh and inverse maps to the solution of combinational logic problems.
C 3: Analyse combinational logic circuits and build Boolean expressions and truth tables describing the overall behaviour.
C 4: Apply design procedures to synthesise digital circuits, including: minterms; maxterms; don't care terms; implementation using universal NAND and NOR gates.
LO 4:
C 1: Show an understanding of various MSI circuits, including adders, comparators, multiplexers, decoders.
C 2: Employ MSI circuits appropriately in the design of digital circuits and solution of basic digital problems.
C 3: Show an understanding of sequential logic circuits including S-R Latches, J-K flip-flops, counters.
C 4: Employ sequential logic circuits in the design of digital circuits and solution of basic digital problems.

THE STANDARDS SET FOR EACH CRITERION PER MODULE LEARNING OUTCOME TO ACHIEVE A PASS GRADE ARE INDICATED ON THE ASSESSMENT SHEET FOR ALL ASSESSMENT.

12 PRINCIPLES OF ASSESSMENT FEEDBACK

Students sit a formative class test (multiple-choice quiz), via myplace in week 7 of semester 1, with feedback provided by worked solutions made available on myplace. Formal feedback on the summative class tests is provided in lectures or tutorials. In all cases, students then have the opportunity to discuss the solutions with teaching staff in tutorials, completing the feedback loop.

(on Learning & Teaching web pages: *www.strath.ac.uk/learnteach/teaching/staff/assessfeedback/12principles/*)

ASSESSMENT METHOD(S) INCLUDING PERCENTAGE BREAKDOWN AND DURATION OF EXAMS

To Pass the module, students need to gain a summative mark of;						
Examination	**Duration**	2	**Weighting %**	70	**Learning Outcomes**	LO1-LO4
Coursework	**Number**	2	**Weighting %**	30	**Learning Outcomes**	LO1-LO4
Project	**Number**		**Weighting %**		**Learning Outcomes**	

COURSEWORK / SUBMISSIONS DEADLINES:

RESIT ASSESSMENT PROCEDURES: EXAMINATION

ADDITIONAL INFORMATION RELEVANT TO COURSE DELIVERY AND ASSESSMENT

The coursework consists of two summative class tests - in the exam period at the end of semester 1, and in week 6 of semester 2 - each worth 15% of the final mark. Class tests are used to assess interim progress.

RECOMMENDED READING

Robert L Boylestad, "Introductory Circuit Analysis", Latest Edition, Pearson Education ISBN-13 978-1292098951
Thomas L Floyd, "Digital Fundamentals", Latest Edition, Pearson Education ISBN-13 978-1292075983

ADDITIONAL STUDENT FEEDBACK; SPE**CIFY DETAILS OF WHEN ADDITIONAL FEEDBACK WILL BE PROVIDED.**

Semester		**Week**	9	**Nature**	Full worked solutions for formative quiz made available on myplace.
Semester		**Week**	1	**Nature**	Worked solutions for S1 class test in lecture or tutorial slots.
Semester		**Week**	8	**Nature**	Worked solutions for S2 class test in either lecture or tutorial slots.
Semester		**Week**		**Nature**	
Semester		**Week**		**Nature**	
Semester		**Week**		**Nature**	
Further comments about feedback		Specific feedback on problem-solving skills is available to students via weekly tutorials, also supported by weekly small-group tutorials.			

SIGNATURE (MODULE REGISTRAR):
DATE OF LAST MODIFICATIONS: 25/07/2019

MODULE TIMETABLE

Module Code: EE107	**Module Title:** Electronic and Electrical Principles 1
Brief Description of Assessment	
Two multiple-choice class tests are each worth 15% of the final mark. In each class test, there are 10 circuit analysis/analogue questions, and 5 digital questions, and students must answer all questions. The final exam at the end of semester 2 is worth 70% of the final mark; there are 3 sections, Digital, Circuits, and Analgoue, and students must answer 2 out of 3 questions in each section.	

On the table below indicate for each semester, the assessment activities experienced by a student taking this module ; start and due dates of assignment/project, lab sessions, quizzes, tests and examinations. Also indicate, under staff actions, the dates on which the assessments will be marked and feedback returned to students

	Semester 1			Semester 2	
	Student Action	**Staff Actions**		**Student Action**	**Staff Actions**
Week 1			**Week 1**		
Week 2			**Week 2**		
Week 3			**Week 3**		
Week 4			**Week 4**		
Week 5			**Week 5**		
Week 6			**Week 6**		
Week 7			**Week 7**		
Week 8			**Week 8**		
Week 9			**Week 9**		
Week 10			**Week 10**		
Week 11			**Week 11**		
Exam Period			**Revision Week**		
Review Week			**Exam Period**		

EXAMINATION & FINAL ASSESSMENT DETAILS

Provide details of the examination rubric used. For guidance, typically a 2-hour duration examination will require students to attempt THREE questions each representing effort approximately equivalent to 40 minutes duration while a 3-hour duration examination will require students to attempt FOUR questions of 40 minutes duration. Examination papers may be sectionalised and consist of a combination of mandatory and optional questions with the degree of choice being set by the examiner and appropriate to the Learning Objectives of the module.

Total # of questions set	9	**Total # to be attempted**	6	**Compulsory Questions**		**Sections**	
The examination is		**Book.**					

Provide a brief text description of the examination rubric adopted and explanation/justification for its use.

There are 3 sections, and students are instructed to answer 2 questions out of 3 in each of these sections. This provides students with a choice within each section, while ensuring that they must answer questions on each of the fundamental topics (digital, circuits, analogue), in which they will take related follow-on modules in 2nd year.

Mathematical Formula; Indicate if standard (for the module) equations or mathematical identities are provided;

Please comment upon the degree to which students are required to recall, prove and use detailed specific mathematical formula within the examination.

Being a fundamental class, students are expected to be able to recall basic equations and formulae, and utilise them appropriately in the class tests and examination.

LEARNING OUTCOMES - CRITERIA

*For all of the LO listed previously indicate explicitly the **prime** mode of assessment. For each Criteria, indicate the mode(s) of assessments, adding any appropriate clarification.*

LO1 *Class Test 1 used to check interim progress against material taught in semester 1, and to allow appropriate support to be arranged, via dedicated tutorials, and small group tutorials.*

- **C1.** Class Test 1 & Final Examination
- **C2.** Class Test 1 & Final Examination
- **C3.** Class Test 1 & Final Examination
- **C4.** Class Test 1 & Final Examination
- **C5.** Class Test 1 & Final Examination

LO2

- **C1.** Final Examination
- **C2.** Final Examination
- **C3.** Final Examination
- **C4.** Final Examination

LO3 *Class Test 1 used to check interim progress against material taught in semester 1, and to allow appropriate support to be arranged, via dedicated tutorials, and small group tutorials.*

- **C1.** Class Test 1 & Final Examination
- **C2.** Class Test 1 & Final Examination
- **C3.** Class Test 1 & Final Examination
- **C4.** Class Test 1 & Final Examination

LO4 *Class Test 2 used to check interim progress against material taught in first half of semester 2, and to allow appropriate support to be arranged, via dedicated tutorials, and small group tutorials.*

- **C1.** Class Test 2 & Final Examination
- **C2.** Class Test 2 & Final Examination
- **C3.** Class Test 2 & Final Examination
- **C4.** Class Test 2 & Final Examination