Department of Design, Manufacture and Engineering Management

MODULE DESCRIPTION FORM

56 324 ENGINEERING INNOVATION AND MANAGEMENT

Module Registrar: David Mackay	**Taught To (Course):**, EEE, CES, EME	
Other Lecturers Involved: Dr Nuran Acur ; Ms Marisa Smith	**Credit Weighting:** 10	**Semester:** 2
Assumed Prerequisites: Basic business classes	**Academic Level:** 3	

Module Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Project	Private Study	**Total**
24	6	6	50	14	100

Educational Aim

This module aims to provide engineering students with an understanding of the importance of innovation in today's business environment. The module aims to also develop understanding and skills in the area of innovation management, including the management of intellectual property.

Learning Outcomes

On completion of the module the student is expected to be able to

LO1 Show appreciation of the innovation process, management activities and commercial approaches to product development

LO2 Demonstrate knowledge and understanding of intellectual property and its protection

LO3 Show appreciation of key commercialisation topics such as business and project planning, marketing and financial planning.

Syllabus

Week	Contents	Week	Contents
1	Introduction and overview What is Innovation? The Importance of Innovation	2	Key Issues in Innovation Management Introductory Case Study Approaches to Creativity
3	Creativity Workshop Collaborative working & decision making	4	Identifying Intellectual Property Introduction to Project Management
5	Introduction to Business Strategy Innovation Strategy	6	Introduction to Business Organisation Leading and Managing Innovation
7	Introduction to Business Start-up & Business Plans Introduction to Business Finances	8	Innovation finances – making a case Introduction to Marketing
9	Marketing Innovation Presenting commercial ideas	10	Selling Innovative ideas Recap and summary
11	Final Presentations	12	Final Presentations

Assessment of Learning Outcomes

Criteria

For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning

LO1 Show appreciation of the innovation process, management activities and commercial approaches to product development
C1 Assess the importance of innovation, the relevance to engineers and management activities
C2 Demonstrate an understanding of commercial aspects of innovation and the challenges facing innovators
C3 Demonstrate an appreciation of creativity techniques available to facilitate innovation

LO2 Demonstrate knowledge and understanding of intellectual property and its protection
C1 Differentiate between different types of intellectual property
C2 Propose routes to protect intellectual property
C3 Identify intellectual property in new ideas

LO3 Appreciation of key commercialisation topics such as business and project planning, marketing and financial planning.
C1 Evaluate options for commercialisation and recommend most appropriate route given the situation
C2 Construct a commercial proposal using functional tools such as gantt charts, SWOT analysis, NPV/ROR, to present key points
C2 Effectively communicate innovative ideas adopting a funder-centric approach

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

	Examinations			**Courseworks**		**Projects**	
	Number	Duration	***Max Marks***	Number	***Max Marks***	Number	***Max Marks***
	0	0	0	3*	100	0	0
L/Outcomes				LO1, 2 & 3			

* counting the final presentation as a coursework

PLEASE NOTE:
Students need to gain a summative mark of 40% to pass the module. Students who fail the module at the first attempt will be re-examined during the August diet. This re-examination will consist entirely of exam.

Main Text Books

Extensive reading list posted on webct in "Important module information"

Core text – "Managing Innovation" by Tidd, Bessant & Pavitt ISBN-13: 978-0471496151

Session: 2008/2009

APPROVED

Director of Teaching and Learning Signature: Mr G Mair

Date of Approval: June 2008

MODULE TIMETABLE

Module Code:	56324	**Module Title:**	Engineering Innovation and Management

Brief Description of Assessment:

1. Overview of Innovation, Creativity and Intellectual Property (30%)
2. Commercial Proposal incorporating key innovation/commercialisation tools (40%)
3. Product Pitch Presentation (30%)

Assessment Timing:-

Indicate on the table below the Start/Submission dates for each Assignment/Project and the timing of each Exam/Class Test(s).

	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	WK12	Exam Period
Semester Two	All cw issued					CW1 due Tuesday 12 noon						CW2 due Tuesday 12 noon Presentation date TBA	

University of Strathclyde Engineering

FACULTY OF ENGINEERING

MODULE DESCRIPTION FORM

EE311 - ELECTRONIC & ELECTRICAL PRINCIPLES 3

Module Code: EE311	**Module Title:** Electronic & Electrical Principles 3	
Module Registrar: Prof G Burt		
Other Lecturers Involved: Dr W. H. Siew, Dr A Dysko, Prof I Glesk, Dr T Wang	**Credit Weighting** 20	**Semester:** 1 2
Compulsory/optional/elective class: C	**Academic Level:** 3	

Pre-requisites: EE272 Enginering Science 2, EE269 Electronic and Electrical Principles 2

MODULE FORMAT AND DELIVERY (HOURS):

Lectures	Tutorial	Assignments	Laboratories	Private Study	Total
48	12	5	16	119	200

EDUCATIONAL AIM *THIS MODULE AIMS TO:*

This course promotes detailed understanding of the electrical and electromagnetic principles and their deployment in a range of engineering applications associated with electromagnetic waves propagation in bounded and unbounded media; and in electric power generation (both conventional and renewable), power distribution and energy utilisation; electric transportation systems; the propagation of electromagnetic waves in free space, in insulating and conducting lossless and lossy media, and optical fiber.

Students will gain an appreciation of the fundamental principles, engineering solutions, and social and economic implications of such applications.

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

C 1: Student will be able to use the fundamental operating principles of electrical power systems to design appropriate networks and analyse their steady state performance under normal and faulted conditions.

C 2: Student will be able to describe the construction and design of transmission lines, transformers and electric machines and perform an assessment of their steady state performance.

C 3: Student will be able to use the fundamental principles based on Maxwell's theory to analyze the propagation of unbounded electromagnetic waves under different conditions in conducting and insulating media, lossless and lossy media. The propagation of the EM wave for the purpous of data communication will be examined in single and multi mode optical fibers.

C 4: Students will be able to decide when to use wave theory when considering bounded transmission. They will also be able to carry out performance and power flow analyses using wave theory for transmission within lossless lines that are terminated with impedances.

(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:*

(1) Theory of electric & magnetic fields. Maxwell's equations, and vector algebra in rectangular, cylindrical, spherical co-ordinate systems. Long Transmission Lines: wavelength, propagation modes, lumped-element model, line equations, wave propagation, lossless lines, voltage reflection coefficient, standing waves, input impedance, power flow on a lossless line, transients.

(2) Fundamental operating principles of electrical power systems. Network design for the supply of electrical loads in utility, more-electric aircraft, and full-electric ship propulsion applications. Developments in renewable and advanced generation technologies, and their influence on the operation of power networks.

(3) Simple electrical properties of materials: conductors, dielectrics, boundary conditions. Maxwell's equations in free space and plane-wave propagation for unbounded free space, lossless and lossy media. Basic understanding of single and multi mode fiber transmission.

(4) Construction, operating principles & use of power transformers, transmission lines and electric machines including their steady-state performance calculations. Operation and performance of selected power electronic circuits.

(5) Power flow using the Poynting vector. Reflection and transmission of waves at boundaries under normal incidence, and Snell's laws interpretation in those terms.

(6) Network behaviour analysis under normal and fault conditions using per-unit methods, and the implications of faults on networks and electrical equipment design.

During the two semesters, the laboratories are scheduled as follows:

- 3 x 2 hour electromagnetics laboratories, (semester 1)

- 6 x 2 hour power systems laboratories (semester 2), with the last laboratory visit given over to the laboratory based assessment

ASSESSMENT OF LEARNING OUTCOMES - CRITERIA

For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

[Note: Criteria break the LO down into 'teachable' elements but do not become syllabus orientated i.e. no mention of CAD package names, components etc.]

LO1

C 1: The ability to calculate currents, voltages and power flows in a simple network (single phase or symmetrical 3 phase) and the ability to asses steady state symmetrical fault levels using per unit system.

LO2

C 1: The ability to describe the construction and design principles of transmission lines, transformers and electric machines and the ability to calculate voltage regulation and losses in power lines and transformers.

LO3

C 1: The ability to analyze and mathematically describe the propagation of EM wave under different conditions in unbounded media - free space, lossless and lossy media, good conductors, insulators, and the concept of data transmssion based on optical fibers.

LO4

C 1: The ability to calculate characteristic impedance; propagation constants; voltage and current reflection coefficients; phase velocity; wavelength; standing wave ratio and positions where maxima and minima occur; input impedance; impedance matching and power flow for steady-state conditions. In transient conditions, the ability to draw the required Bewley-lattice diagram and to use the diagram for analysis.

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

Please state briefly how these are incorporated in this module.

Through the participation in the lecture session the students will gain the necessary theoretical background and fundamental knowledge. The tutorial sessions will be instrumental in gaining analytical skills to perform calculations related to the analyses of bounded and unbounded propagation under different scenarios and the design and performance of simple power networks and system components. The laboratory sessions will

provide a suitable environment where the student will be able to gain practical skills and verify empirically some of the taught principles and analytical tools.

(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;					**40%**	
Examination	**Duration**	3	**Weighting %**	60	**Learning Outcomes**	C1 C2 C3 C4
Coursework	**Number**	4	**Weighting %**	40	**Learning Outcomes**	C1 C2 C3 C4
Project	**Number**	0	**Weighting %**	0	**Learning Outcomes**	

COURSEWORK / SUBMISSIONS DEADLINES: 2 class tests in Semester 1; 1 class test in Semester 2; 1 laboratory assessment conducted in the last power lab visit.

RESIT ASSESSMENT PROCEDURES: Examination of similar form to 1st diet

ADDITIONAL INFORMATION RELEVANT TO COURSE DELIVERY AND ASSESSMENT

RECOMMENDED READING

The recommended texts are:

'Electromagnetics for Engineers' by F.T. Ulaby (Pearson Education) ISBN13: 9780136086857 or the e-book equivalent (mandatory purchase)

AND

"Electric Machinery and Power System Fundamentals", Stephen Chapman, McGraw-Hill, ISBN: 0071226206 (recommended)

Further support can be obtained from:

"Hughes Electrical Technology", Edward Hughes, Ian McKenzie-Smith, John Hiley, Keith Brown, Pearson, ISBN: 0131143972

"Electrical Machines, Drives, and Power Systems", Theodore Wildi, Prentice Hall, ISBN: 0-13-177691-6

"Electric Power Systems", B.M.Weedy & B.J.Cory, Wiley, ISBN: 0-471-97677-6.

ADDITIONAL STUDENT FEEDBACK; SPECIFY DETAILS OF WHEN ADDITIONAL FEEDBACK WILL BE PROVIDED.

Semester	S1	**Week**	9	**Nature**	The marks of class test one will be provided individually with overall feedback given verbally and/or in writing on the VLE to the class
Semester	S2	**Week**	1	**Nature**	The marks of class test two will be provided individually with overall feedback given verbally and/or in writing on the VLE to the class
Semester	S2	**Week**	10	**Nature**	The marks of class test three will be provided individually with overall feedback given verbally and/or in writing on the VLE to the class
Further comments about feedback		Feedback on laboratory performance will be provided by the teaching staff during the laboratory sessions.			

SIGNATURE (COURSE DIRECTOR):

DATE OF LAST MODIFICATIONS: 02/04/2013

MODULE TIMETABLE

Module Code: EE311	**Module Title:** Electronic & Electrical Principles 3

Brief Description of Assessment

There will be two (approx.45 min) class tests (indicated below as Quiz) in semester 1 conducted as per the timetable. These will cover problem solving and application knowledge for the electromagnetics and electrical principles respectively.

In semester 2 there will be one further class test covering the semester 2 elecromagnetics material and one laboratory based practical test (indicated as Project) covering the electrical power laboratory. The laboratory assessment will be conducted in groups, and is scheduled for the last visit to the laboratory.

Indicate on the table below the Start/Submission dates for each Assignment/Project and the timing of each Exam/Class Test(s).

	Semester 1	Semester 2
Week 1		
Week 2		
Week 3		
Week 4		
Week 5		
Week 6	Quiz	
Week 7		Quiz
Week 8		
Week 9		
Week 10		
Week 11		
Week 12	Quiz	Project
Revision Week		
Exam Period		Examination

University of Strathclyde Engineering

FACULTY OF ENGINEERING

MODULE DESCRIPTION FORM

EE312 - INSTRUMENTATION & MICROCONTROLLERS

Module Code: EE312	**Module Title:** Instrumentation & Microcontrollers	
Module Registrar: SG Pierce		
Other Lecturers Involved: SG Pierce M Zagnoni, L Petropoulakis, James Windmill	**Credit Weighting** 20	**Semester:** 1 2
Compulsory/optional/elective class: C	**Academic Level:** 3	

Pre-requisites:

MODULE FORMAT AND DELIVERY (HOURS):

Lectures	Tutorial	Assignments	Laboratories	Private Study	Total
40	24	48	12	76	200

EDUCATIONAL AIM *THIS MODULE AIMS TO:*

INSTRUMENTATION

Aims

To develop techniques for system modelling based on block diagrams and transfer functions and to use such techniques in the context of analysis and design. To introduce students to instrumentation and measurement as an interdisciplinary engineering activity. To explain the basic principles of feedback and control systems.

Context

To enable understanding of the dependence of measurement and control on a wide variety of scientific and engineering disciplines; to provide appreciation of the universal application of measurement and control within the same range of disciplines.

To demonstrate engineering design as applied to instrumentation systems and control engineering; in particular, to explain the important contribution of electrical, mechanical and software engineering to this process.

MICROCONTROLLERS

To allow students to gain practical design, implementation and test experience of the techniques required to create combined hardware/software systems with an emphasis on measurement.

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

C 1: Understand basic concepts of measurement systems (input output behaviour, linearity, offsets, noise) applied to analog and digital components of instrumentation systems

C 2: Understand the concept and importance of feedback, particularly for control systems

C 3: Recognise the importance of physical constraints on measurement processes; understand physical constraints of transducer selection for specific applications

C 4: Learn to use microprocessors, analyse specifications, consider trade-offs, generate designs, acquire competence in interfacing to peripheral sensors and actuation devices.

(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:*

INSTRUMENTATION

General Treatment

Systematic procedures are developed to model behaviour of engineering systems, with particular reference to those employed for measurement and control. Initial treatment concentrates on the principles and limitations of transducers which convert the measurand of interest (a physical or mechanical quantity) into a useful analogue signal (usually electrical). A wide variety of specific instrumentation systems are discussed including those for the measurement of liquid level, displacement, strain and temperature. Static and dynamic behaviour, measurement errors, electronic signal processing and feedback systems are considered as general topics relevant to all applications. There is an extended case study about strain gauges as resistive transducers which can monitor a wide variety of mechanical variables such as force and pressure. Electrical bridge circuits are considered as an example of signal conditioning which can compensate for environmental influences such as temperature. Feedback is explored as a technique for both design of electronic circuits and control of engineering processes.

Lectures

PART A: BASIC PRONCIPLES

Introduction

Modelling of engineering systems

Analysis of measurement systems

PART B: CASE STUDIES OF MEASUREMENT SYSTEMS

Capacitive displacement transducers

Strain gauges: resistive transducers

Electrical bridge circuits

Strain gauges: signal conditioning

PART C: FEEDBACK AND CONTROL

Feedback systems: principles

Feedback systems: electronic applications

MICROCONTROLLERS

Overview of the product design cycle for dedicated systems.

Development of a system specification, using illustrative case studies.

Practical C language based tutorial sessions on microcontroller programming

Details on programming structure and implementation of hardware based operations on platform

Overview and design detail of the electronic building blocks

Overview and design detail to allow interfacing to sensors and motors

ASSESSMENT OF LEARNING OUTCOMES - CRITERIA

For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

[Note: Criteria break the LO down into 'teachable' elements but do not become syllabus orientated i.e. no mention of CAD package names, components etc.]

LO1

C 1: Ability to understand the practical constraints of a generalised measurement system, tested during class test and final examination

LO2

C 1: Demonstate understanding of simple feedback systems, tested at final examination

LO3

C 1: Practical understanding of constraints on a real measurement problem tested through instrumentation case study assignment.

LO4

C 1: Demonstrate basic programming of microcontroller systems and subsystems, tested through laboratory notebook completion, submitted coursework and examination

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

Please state briefly how these are incorporated in this module.

Feedback to students is through a combination of formal tutorials, online resource through MyPlace, and continuous assessment of coursework. Some non-assessed work is also provided in S1 to promote course engagement - feedback is provided through MyPlace and tutorials.

The module is assessed by examination and coursework . The microcontroller coursework is carried out as a series of laboratory sessions where the students are supervised by several members of staff. Feedback on what students do and how they could improve their designs and efficiency is given during these sessions. It is an interactive approach. A formal laboratory report write -up is submitted that is graded to assess performance during these laboratory sessions. A class test in November provides a structured exam condition test that is part of the formal assessment process - additionally this class test is treated fully in subsequent tutorials so that students gain feedback on formal examination style questions. A case study submission in S2 is used to test students' abaility to assess a single instrumentation topic in depth - feedback is provided through online MyPlace submission and grading. Final examination in May.

(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;					**40%**	
Examination	**Duration**	4	**Weighting %**	65	**Learning Outcomes**	1, 2, 3, 4
Coursework	**Number**	2	**Weighting %**	35	**Learning Outcomes**	1, 2, 3, 4
Project	**Number**		**Weighting %**		**Learning Outcomes**	

COURSEWORK / SUBMISSIONS DEADLINES:

Microcontroller laboratory report (start of S2)

Instrumentation Case Study (end of S2)

RESIT ASSESSMENT PROCEDURES: Examination of similar form to 1st diet

ADDITIONAL INFORMATION RELEVANT TO COURSE DELIVERY AND ASSESSMENT

RECOMMENDED READING

Bentley J P, Principles of measurement systems

Pearson (4th edition, 2005)

ISBN-10: 0-13-043028-5,

Valvano J.W, Embedded Microcomputer Systems – Real Time Interfacing,

Cengage Learning/Global Engineering, 3rd Edition 2012

ISBN10: 1-111-42626-0

Supplementary Books

Horowitz P, Hill W, The Art of Electronics
Cambridge University Press (2nd Edition 1989)
ISBN-10: 0521370957

Transducer Interfacing Handbook
Editor: Daniel H Sheingold, Analog Devices Inc. 1980.
ISBN 0-916550-05-2

Kernighan BW and Ritchie DM, The C programming Language
Prentice-Hall 1988, ISBN 0-13-110362-8

Stuart R. Ball Embedded Microprocessor Systems
Newnes 2002 (3rd Ed)
ISBN 0 7506 7534 9

Steve Heath Embedded Systems Design
Newnes 2002 (2nd Ed)
ISBN 0 7506 5546 1

ADDITIONAL STUDENT FEEDBACK; SPECIFY DETAILS OF WHEN ADDITIONAL FEEDBACK WILL BE PROVIDED.

Semester	S1	**Week**	10	**Nature**	Feedback from class test
Semester	S2	**Week**	2	**Nature**	Feedback from coursework
Semester	S2	**Week**	12	**Nature**	Feedback from coursework
Further comments about feedback					

SIGNATURE (COURSE DIRECTOR):

DATE OF LAST MODIFICATIONS: 02/04/2013

MODULE TIMETABLE

Module Code: EE312	**Module Title:** Instrumentation & Microcontrollers

Brief Description of Assessment

Assignment 1: Measurement is everywhere

Assignment 2: Tank liquid level

Assignment 3: Tyre pressure monitoring

Assignment 4: Temperature measurement in petroleum industry

Formal microcontroller laboratory report:

Formal Instrumentation case study

Indicate on the table below the Start/Submission dates for each Assignment/Project and the timing of each Exam/Class Test(s).

	Semester 1	**Semester 2**
Week 1	Assignment	Assignment
Week 2		
Week 3	Assignment	
Week 4		
Week 5	Assignment	
Week 6	Assignment	
Week 7		
Week 8	Examination	
Week 9		
Week 10		Assignment
Week 11		
Week 12		
Revision Week		
Exam Period		Examination

FACULTY OF ENGINEERING

MODULE DESCRIPTION FORM

EM301 - ENGINEERING ANALYSIS

Module Code: EM301		**Module Title:** Engineering Analysis	
Module Registrar: Stuart Galloway			
Other Lecturers Involved: Bruce Stephen		**Credit Weighting** 20	**Semester:** 1 2
Compulsory/optional/elective class: C		**Academic Level:** 3	

Pre-requisites: 2ND year Mathematics courses

MODULE FORMAT AND DELIVERY (HOURS):

Lectures	Tutorial	Assignments	Laboratories	Private Study	Total
44	44	3	4	105	200

EDUCATIONAL AIM *THIS MODULE AIMS TO:*

It is important for students to see mathematics and statistics in the context of the computational problems they will be exposed to in their discipline.

The aim of this course is to further develop student skills and abilities in advanced mathematical concepts in the field of engineering. This will be achieved through contextualised problem solving using applicable mathematical and statistical techniques and tools on problems of moderate complexity.

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

LO 1: Learner will be able to formulate appropriate models of engineering systems

LO 2: Learner will be able to understand, analyse and solve engineering systems models

LO 3: Learner will be able to understand and apply statistical concepts in an engineering domain

LO 4: Learner will be able use mathematical/statistical software tools to model and analyse engineering models and data

(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:*

Mathematical Software tools

- computer simulation, solvers and computer algebra, statistical software

Introduction to Optimisation

- Concepts of optimisation
  - Constraints
  - Problem formulation
  - Optimisation in engineering
- Solving Linear programmes
  - Geometric interpretation
  - Feasible and infeasible solutions
  - Simplex method
  - Convexity
- Integer and mix-integer programming
- Non-linear programming: single variable optimisation
- Hill climbing methods
- Lagrangain relaxation
- Modern optimisation techniques

Applied Statistics

- Visualisation of data : Scatter plots, time series plots, histograms
- Probability density, expectation and variance
- Applications of the Gaussian distribution
- Visualisation of statistics: Box plots, QQ plots, contour density plots
- Multivariate statistics and dependency
- Introduction to Hypothesis testing
- Errors and analysis of errors (MAPE, SSE, MSE, MAE, Sensitivity, Specificity, TP+FP rates, Confusion Matrices)

ASSESSMENT OF LEARNING OUTCOMES - CRITERIA

For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

[Note: Criteria break the LO down into 'teachable' elements but do not become syllabus orientated i.e. no mention of CAD package names, components etc.]

LO1

C 1: Ability to formulate and solve constrained and unconstrained optimisation problems

LO2

C 1: Gain knowledge of practical application of applications of optimisation

LO3

C 1: Gain a good working knowledge of basic statistical techniques and visualisation

LO4

C 1: Gain practical knowledge of mathematical and statistical software

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

Please state briefly how these are incorporated in this module.

Through the use of exemplars in lectures and supporting materials students will be able to understand the idea of good practice and performance in this field.

Through the use of laboratory based teaching students will get good support and feedback that will enable learners to self-correct their work.

An emphasis will be placed on learners to develop and demonstrate a wide range of mathematical and statistical skills, qualities and understanding during this course.

Through the use of group course work, learners will have the opportunity to work in cohesive learning environments that encourages personal development, group task setting/working and (aspirationally) enhance cross-cultural understandings

(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;					**40%**	
Examination	**Duration**	2	**Weighting %**	80	**Learning Outcomes**	LO1 LO2 LO3
Coursework	**Number**	2	**Weighting %**	10	**Learning Outcomes**	LO1 LO2 LO3 LO4
Project	**Number**	1	**Weighting %**	10	**Learning Outcomes**	LO1 LO2 LO3 LO4

Coursework / Submissions deadlines: Assessments will take place in Semester 1 Weeks 8 and Semester 2 Week 7

Resit Assessment Procedures: Examination

Additional Information relevant to Course Delivery and assessment

N/A

Recommended Reading

- Engineering Analysis Course notes
- Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons Inc

Additional Student Feedback; Specify details of when additional feedback will be provided.

Semester	S1	**Week**	4	**Nature**	Feedback general course mechanics
Semester	S1	**Week**	9	**Nature**	Individual and general feedback on Assessment 1
Semester	S2	**Week**	4	**Nature**	Feedback general course mechanics
Semester	S2	**Week**	7	**Nature**	Individual and general feedback on Assessment 2
Semester	S2	**Week**	11	**Nature**	Feedback on project
Semester		**Week**		**Nature**	
Further comments about feedback					

Signature (Module Registrar):

Date of Last Modifications: 18/03/2019

MODULE TIMETABLE

Module Code: EM301	**Module Title:** Engineering Analysis
Brief Description of Assessment	

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		Interim Feedback	**Week 4**		Interim Feedback
Week 5			**Week 5**		
Week 6			**Week 6**	Assignment	Quiz - Marked
Week 7			**Week 7**	Project	
Week 8	Assignment	Quiz - Marked	**Week 8**	Project	
Week 9			**Week 9**	Project	
Week 10			**Week 10**	Project	Assignment Marked
Week 11			**Week 11**		Feedback Provided
Exam Period			**Revision Week**	Presentation	
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	4	**Total # to be attempted**	3	**Compulsory Questions**	1 Question	**Sections**	Multiple
The examination is	CLOSED	**Book.**					

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

Paper has two sections:

Section A made of 20 multiple choice questions (10 optimisation/10 statistics) and Section B which consists of 4 longer questions.

Section A is compulsary and learners choose 3/4 questions from section B.

Section A is worth 25% of the available marks and Section B is 75%.

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

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

In general, learners will not be expected to recall any detailed formula; they will though be extected to be able to utilise statistical tables.

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 Assignments *A mixture of of te optimisation assignments and the final examination*

C1. Ability to formulate and solve constrained and unconstrained optimisation problems

LO2 Other *The project*

C1. Gain knowledge of practical application of applications of optimisation

LO3 Assignments

C1. Gain a good working knowledge of basic statistical technique

LO4 Other *Project*

C1. Gain practical knowledge of mathematical and statistical software

University of Strathclyde Engineering

FACULTY OF ENGINEERING

MODULE DESCRIPTION FORM

EE315 - ANALOGUE AND DIGITAL SYSTEMS

Module Code: EE315	**Module Title:** Analogue and Digital Systems	
Module Registrar: A. Gachagan		
Other Lecturers Involved: R. Stewart, J. Windmill, L. Crockett	**Credit Weighting** 20	**Semester:** 1 2
Compulsory/optional/elective class: O	**Academic Level:** 3	

Pre-requisites: EE269, EE270

MODULE FORMAT AND DELIVERY (HOURS):

Lectures	Tutorial	Assignments	Laboratories	Private Study	Total
48	24	30	12	86	200

EDUCATIONAL AIM *THIS MODULE AIMS TO:*

Expand the students' knowledge in the fundamental electrical and electronic engineering areas of analogue and digital design.

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

C 1: Understand the different types of digital devices available, and be able to design digital circuits.

C 2: Have experience of digital design entry, test, and implementation using industry standard EDA tools, with a focus on FPGAs.

C 3: Gain analytical skills for single and dual stage transistor amplifier circuit designs using the small signal equivalent model approach.

C 4: Have the ability to design amplifier circuits incorporating bipolar junction transistors

(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:*

ANALOGUE ELECTRONICS

1 - Physical operation of a bipolar junction transistor – review of p-n junction theory; description of p-n junction biasing requirements for transistor amplifier operation; define both n-p-n and p-n-p bipolar junction transistor configurations; describe the three standard transistor amplifier configurations.

2 - Transistor biasing requirements – detail four standard transistor amplifier biasing configurations; introduce the concept of stability and describe the transistor parameters which directly influence amplifier stability.

3 - Design of transistor bias circuits – define design concepts and relationships relevant to the design of transistor amplifier biasing circuitry; introduce the concept of dc and ac load lines; demonstrate how to implement dc and ac load line characteristics for the design of transistor biasing circuitry.

4 - Equivalent circuits for the bipolar transistor – describe the h-parameter equivalent model which is used to analyse small signal amplifier operation; derive equivalent h-parameter models for the three standard transistor amplifier configurations.

5 - Analysis of amplifier stages – analysis of common-emitter, common-collector and common-base amplifier configurations; derivation of voltage gain, current gain and input/output resistances for each configuration.

6 - Multi-stage transistor circuits – analysis of differential amplifier stage, including the concept of common-mode rejection, cascode amplifier and darlington pair; overview components which influence of amplifier frequency response; introduction of the miller effect concept.

DIGITAL SYSTEMS:

1 - Introduction - Characterstics and applications of FPGAs, ASICs, processors and other digital devices; Design entry techniques: HDLs (VHDL and Verilog), Schematics, Higher Level Languages (C, MATLAB etc.), block based tools; Design flow overview; FPGA architecture overview.

2 - Digital Circuit Elements - Registers, shift registers; FIFO buffers and flow control; Memories: ROMs, RAMs, addressing issues; Control elements: counters and state machines; Clock and reset circuitry.

3 - Design Considerations - Sampling and clock rates; Design optimisation (for area, speed or power); Constraints (timing, placement and pins); Critical path, pipelining and latency; Clock synthesis and distribution issues.

4 - FPGA Architectures - History and development of FPGAs; Structure and features of FPGAs; Interfacing.

5 - FPGA Design Flow and Software Tools - Design entry case studies and exercises; Testing and simulation; Synthesis and implementation; Reports and other outputs; IP blocks; FPGA prototyping.

6 - VHDL - Designing clocked circuits; testbench designs and techniques; hierarchy and generics; subprograms and packages, and design reuse; VHDL design and simulation exercises.

7 - Fixed Point and Arithmetic Circuits - Fixed point number formats; Circuits for basic arithmetic; The cost of precision; Architectural support for high speed arithmetic on FPGAs.

8 - Design Management and Advanced Techniques - Developing specifications; Hierarchy, modules and interfaces; Documentation; Power consumption; Floorplanning and further FPGA design techinques.

ASSESSMENT OF LEARNING OUTCOMES - CRITERIA

For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

[Note: Criteria break the LO down into 'teachable' elements but do not become syllabus orientated i.e. no mention of CAD package names, components etc.]

LO1

C 1: The student should be able to describe different types of digital devices and compare them in terms of development time/cost, power consumption, flexibility, and other criteria.

C 2: The student should have a good awareness of common digital design submodules such as counters, buffers, and memory, and be able to design simple circuits.

C 3: The student should understand design management issues such as specification development, hierarchy, and test techniques.

LO2

C 1: The student should be able to create and test a digital design using computer aided design tools.

C 2: The student should be aware of the architecture of FPGAs, and be able to target their designs onto these devices.

C 3: The student should be aware of the practical issues of implementing designs, such as resource usage, timing performance, and interfacing issues.

LO3

C 1: The student should be able to identify the appropriate h-parameter equivalent model and use this to simplify a single-stage or multi-stage bipolar junction transistor amplifier circuit.

C 2: The student should be able to derive the voltage and currect gains and input and output resistances for a bipolar junction trasistor amplifier stage

LO4

C 1: The student should be able to bias a bipolar junction transistor using appropriate biasing circuitry

C 2: The student should be able to design a single stage bipolar junction transistor amplifier given a specific amplifier design criteria.

C 3: The student must be able to demonstrate that their amplifier design satifies the design criteria.

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

Please state briefly how these are incorporated in this module.

1. Course goals and assessment criteria are clearly explained in course handout, introductory lecture and MyPlace. Students will be made aware of what constitutes good performance, through lectures and handouts with examples of good practice

2. Students have significant private study time allocated for the assignments.

3. After coursework hand-ins, feedback will be provided to highlight aspects which were completed well, and areas for improvement in the future. This feedback will be given through MyPlace.

4. Tutorial sessions will be broken down into smaller groups to encourage learning through peer group interaction, in addition to conventional TA support.

5. MyPlace will be used to provide support materials, feedback on assignments to students and feedback from students on course related topics

(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;					**40%**	
Examination	**Duration**	3	**Weighting %**	60	**Learning Outcomes**	
Coursework	**Number**	4	**Weighting %**	40	**Learning Outcomes**	
Project	**Number**		**Weighting %**		**Learning Outcomes**	

Coursework / Submissions deadlines:

Analogue - S1:Wk8 and S1: Wk10;

Digital - S2: Week 3; S2: Week 8.

Resit Assessment Procedures: Examination of similar form to 1st diet

Additional Information relevant to Course Delivery and Assessment

RECOMMENDED READING

No compulsory text book for Analogue Electronics.

Support material can be found in :-

1. Electronic Devices and Circuits, Theodore F. Bogart, published by Merrill Publishing Company
2. Electronic Devices, Thomas L. Floyd, published by Merrill Publishing Company

DIGITAL Design, recommended reading:

1. FPGAs: Instant Access, Clive Maxfield, published by Newnes, 2008, or alternatively (3) below.
2. Students Guide to VHDL, Peter Ashenden, published by Morgan Kaufmann, 2008.
3. FPGAs 101, Gina Smith, published by Newnes, 2010.

ADDITIONAL STUDENT FEEDBACK; SPECIFY DETAILS OF WHEN ADDITIONAL FEEDBACK WILL BE PROVIDED.

Semester	S2	**Week**	8	**Nature**	Specific to performance in Digital Assignment 1
Semester	S1	**Week**	10	**Nature**	Specific to performance in Analogue Class Test 1
Semester	S1	**Week**	12	**Nature**	Specific to performance in Analogue Class Test 2
Further comments about feedback		Further feedback will be provided for Digital Assignment 2 prior to the May examination			

SIGNATURE (COURSE DIRECTOR):

DATE OF LAST MODIFICATIONS: 02/04/2013

MODULE TIMETABLE

Module Code: EE315	**Module Title:** Analogue and Digital Systems
Brief Description of Assessment	
Assessment will take the form of a final examination, and course work assignments during the semester.	

Indicate on the table below the Start/Submission dates for each Assignment/Project and the timing of each Exam/Class Test(s).

	Semester 1	Semester 2
Week 1		
Week 2		
Week 3		
Week 4		Assignment
Week 5		
Week 6		
Week 7		
Week 8	Examination	Assignment
Week 9		
Week 10	Examination	
Week 11		
Week 12		
Revision Week		
Exam Period		Examination

FACULTY OF ENGINEERING

MODULE DESCRIPTION FORM

EM310 - SIGNALS AND SYSTEMS

Module Code: EM310	**Module Title:** Signals and Systems		
Module Registrar: Dr. G. West			
Other Lecturers Involved: Dr C. Michie	**Credit Weighting** 10	**Semester:** 2	
Compulsory/optional/elective class: C	**Academic Level:** 3		

Pre-requisites: MM213, EE269

MODULE FORMAT AND DELIVERY (HOURS):

Lectures	Tutorial	Assignments	Laboratories	Private Study	Total
24	12	2	0	62	100

EDUCATIONAL AIM *THIS MODULE AIMS TO:*

The aim of this course is to introduce students to the fundamentals of continuous and discrete time signals and linear systems. At the end of this course, students should be able to mathematically and pragmatically define, analyse and design these systems.

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

LO 1: Show appreciation of continous and discrete time signals in both the time and frequency domains and their application in linear time-invariant systems

LO 2: Analyse and design LTI systems, including undertaking calculations covering concepts such as noise, convolution,FFT, DFT, digital filtering, quantisation and sampling

LO 3: Understand the role of analogue and digital signal processing systems in various real-world electrical and mechanical systems.

(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:*

ANALOGUE SIGNALS: Elementary signals, linear and logarithmic signal representation, linear time invariant (LTI) principles, noise, signal to noise ratio.

ANALYSIS OF ANALOGUE SIGNALS: Harmonic analysis – Fourier series, line spectra, harmonic distortion, nonlinearity. Convolution integral, Fourier transform, Laplace transform.

ANALOGUE SYSTEMS: Time-domain and frequency domain characterization, frequency response, impulse response, filtering, poles and zeros, stability.

DIGITAL SYSTEMS: Digital signal processing – ADCs DACs, signal conditioning, anti-alias and reconstruction filters Discrete equations and systems, signal flow graphs.

ANALYSIS OF DISCRETE SIGNALS AND SYSTEMS: The z-transform, poles and zeroes. Discrete Fourier transform (DFT) and the fast equivalent (FFT). Digital filter transfer functions. Finite Impulse Response (FIR) filters. Infinite Impulse Response (IIR) filters.

APPLICATIONS REVIEW: Signals and systems in instrumentation and condition monitoring applications.

ASSESSMENT OF LEARNING OUTCOMES - CRITERIA

For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

[Note: Criteria break the LO down into 'teachable' elements but do not become syllabus orientated i.e. no mention of CAD package names, components etc.]

LO1

C 1: The student should be able to describe and contrast contuniuos and discrete signals

C 2: The student should be able to transform signals between the time and frequency domains and understand the relative merits of considering the signals in both domains

LO2

C 1: The student should be able to describe the characteristics of various types of noise such as shot, flicker and thermal

C 2: The student should understand the effect of noise and amplification and be able to select and chain together multi-stage amplifiers to minimise the effects of noise

C 3: The student should understand the fundamentals of fourier transforms and use this to perform simple analyisis on waveforms such as pulse trains and saw tooths

C 4: The student should be able to tackle problems with digital signals including recognising issues with filtering and sampling

C 5: The students should understand the fundamentals of convolution and the application to solving LTI systems

LO3

C 1: The students should have an understanding of the application of amplification to sensors, vibration analysis of mechanical devices such as gearboxes and should be able to recognise examples of linear time invariant systems

LO4

C 1:

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

Please state briefly how these are incorporated in this module.

Course aims and objectives are clearly explained in the introductory lecture, and on myplace. Students are made aware of what constitutes good performance through advice in class and worked examples of good practice.

After the class test, a feedback session is held where the class test is reviewed, and areas where the students collectively struggled, or there were common mistakes are highlighted. The students are also offered the opportunity of one-to-one feedback on any specific issues they have with exam.

During tutorial sessions peer review learning is encouraged by both staff and TAs. The use of computers allows all the lecture material to be readily accessed and discussed in association with student led problems.

(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;					**40%**	
Examination	**Duration**	2	**Weighting %**	60	**Learning Outcomes**	
Coursework	**Number**	2	**Weighting %**	40	**Learning Outcomes**	
Project	**Number**		**Weighting %**		**Learning Outcomes**	

COURSEWORK / SUBMISSIONS DEADLINES: A class test and an assignment, each worth 20% of the class mark. Class test in week 5. Submission of coursework end of week 10

RESIT ASSESSMENT PROCEDURES: Examination

ADDITIONAL INFORMATION RELEVANT TO COURSE DELIVERY AND ASSESSMENT

RECOMMENDED READING

"Signals and systems", H. P. Hsu, 2nd ed., Schaum's Outlines, McGraw-Hill (New York), 2010 ISBN: 9780071634724

Many other textbooks and internet resources exist and students are encouraged to cross reference the class materials and notes with other sources.

ADDITIONAL STUDENT FEEDBACK; SPECIFY DETAILS OF WHEN ADDITIONAL FEEDBACK WILL BE PROVIDED.

Semester	S2	**Week**	7	**Nature**	Feedback on general performance in class test for cohort as whole. Opportunity for 1-to-1 feedback on specific questions if desired
Semester	S2	**Week**	11	**Nature**	Feedback on assignment
Semester		**Week**		**Nature**	
Semester		**Week**		**Nature**	
Semester		**Week**		**Nature**	
Semester		**Week**		**Nature**	
Further comments about feedback					

SIGNATURE (MODULE REGISTRAR):

DATE OF LAST MODIFICATIONS: 18/03/2019

MODULE TIMETABLE

Module Code: EM310	**Module Title:** Signals and Systems
Brief Description of Assessment	

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**	Assignment Start	
Week 4			**Week 4**		
Week 5			**Week 5**		
Week 6			**Week 6**	Assignment - Due	
Week 7			**Week 7**		
Week 8			**Week 8**	Test	Assignment Marked
Week 9			**Week 9**		Test - Marked
Week 10			**Week 10**		Feedback Provided
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	5	**Total # to be attempted**	3	**Compulsory Questions**	None - free choice	**Sections**	Single
The examination is	CLOSED	**Book.**					

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

Exam questions are designed to have multiple parts and each subsection will be treated in isolation (i.e. for a wrong answer in part a, part b will be assessed, where appropriate and possible, using the student derived result from part a

The rubric consists of full worked solutions, with assignations of the marks associated with each subsection.

The questions are split between analogue and digital, with the students having a free choice over which to answer. The feedback from previous years is that students appreciate the choice when weighed against the increased reading time under exam conditions.

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

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

The students are expected to have a working knowledge of the key formula, but for standard trignometric identiies and the formal defintion of the fourier series will be provided.

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 Final Examination

C1.

LO2 Final Examination

C1.

LO3 Final Examination

C1.

LO4 Other

C1.

FACULTY OF ENGINEERING

MODULE DESCRIPTION FORM

EM305 - ENGINEERING COMPUTING

Module Code: EM305		**Module Title:** Engineering Computing	
Module Registrar: Bruce Stephen			
Other Lecturers Involved: Emma Henderson		**Credit Weighting** 10	**Semester:** 1 2
Compulsory/optional/elective class: C		**Academic Level:** 3	

Pre-requisites: None

MODULE FORMAT AND DELIVERY (HOURS):

Lectures	Tutorial	Assignments	Laboratories	Private Study	Total
22	0	22	22	34	100

EDUCATIONAL AIM *THIS MODULE AIMS TO:*

This module aims to:

1) introduce the student to writing software using modern development tools

2) provide the student with an awareness of and skill in the use of a CAD software in the design of engineering systems.

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

LO 1: Understand the importance of programming skills in engineering

LO 2: Demonstrate a working knowledge of programming with a high level language

LO 3: Understand CAD modelling processes developed with software packages

LO 4: Be experienced in the use of CAD software as a design aid in a range of engineering problemsrner will be able to formulate appropriate models of engineering systems

(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:*

Semester 1 will give an introduction to software and the need for software skills in engineers. Variables, control flow, loops, lists, modules and using library functions. Developing functions, scope, execution order, data structures including objects. Software engineering skills of decomposing a problem and designing a solution. Bug location and correction.

The CAD section of this module will outline the CAD modelling process for mechanical systems in order to design a mechanical product and/or solve engineering problems. Activities based on machine components' design and/or selection will be done by the students in a studio/workshop environment. For the CAD section students will undertake one individual project which will involve the development of a specification for a product followed by the development of a model of that product's performance to predict and optimise its behaviour. Detailed designs will be developed based upon the products models

ASSESSMENT OF LEARNING OUTCOMES - CRITERIA

For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

[Note: Criteria break the LO down into 'teachable' elements but do not become syllabus orientated i.e. no mention of CAD package names, components etc.]

LO1

C 1: Sampling of knowledge through tutorial questions throughout semester 1; formal class test at the end of semester 1.

LO2

C 1: Sampling of knowledge through tutorial questions throughout semester 1; formal class test at the end of semester 1.

LO3

C 1: assessment of project work at the end of semester 2.

LO4

C 1: assessment of project work at the end of semester 2.

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

Please state briefly how these are incorporated in this module.

In semester 1, students will be issued new lab exercises every two weeks, and strongly encouraged to submit solutions for marking before the next exercises are issued. The final deadline for submissions of all solutions will be end of Week 12, semester 1. Submission consists of the student demonstrating answers to staff during lab time. In this way, continuous feedback will be provided to students throughout the semester. The final examination for semester 1 will test students' understanding of the concepts encountered through the semester.

Students need to gain a summative mark of 40% to pass the module. Semester 2 assesments will comprise a project undertaken of the course of the semester. Students who fail the module at the first attempt will be re-examined during the August diet. This re-examination will consist of an exam and/or a coursework depending on performance in each part of the course.

(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;					**40%**	
Examination	**Duration**	2	**Weighting %**	40	**Learning Outcomes**	LO1 LO2
Coursework	**Number**	1	**Weighting %**	10	**Learning Outcomes**	LO1 LO2

Project	Number	1	Weighting %	50	Learning Outcomes	LO3 LO4

COURSEWORK / SUBMISSIONS DEADLINES:	Assessments will take place in Semester 1 Weeks 11
RESIT ASSESSMENT PROCEDURES:	New Assignment

ADDITIONAL INFORMATION RELEVANT TO COURSE DELIVERY AND ASSESSMENT

N/A

RECOMMENDED READING

* Relevant texts on Python will be recommeded at the end of each lesson.

*"Mechanical Engineering Design" by J E Shigley and C R Mischke

* "Mechanics of Engineering Materials" by P B Benham, R J Crawford and C G Armstrong.

ADDITIONAL STUDENT FEEDBACK; SPECIFY DETAILS OF WHEN ADDITIONAL FEEDBACK WILL BE PROVIDED.

Semester	S1	**Week**		**Nature**	One to one advice on tutorial completion - given at each lab upon submission.
Semester	S2	**Week**		**Nature**	One to one advice on tutorial - given at each lab.
Semester	S2	**Week**	11	**Nature**	Provided when project work is formally assessed
Semester		**Week**		**Nature**	
Semester		**Week**		**Nature**	
Semester		**Week**		**Nature**	
Further comments about feedback					

SIGNATURE (MODULE REGISTRAR):
DATE OF LAST MODIFICATIONS: 18/03/2019

MODULE TIMETABLE

Module Code: EM305	**Module Title:** Engineering Computing
Brief Description of Assessment	

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	Laboratory		**Week 2**		
Week 3	Laboratory	Labs - Marked	**Week 3**		
Week 4	Laboratory	Labs - Marked	**Week 4**		
Week 5	Laboratory	Labs - Marked	**Week 5**		
Week 6	Laboratory	Labs - Marked	**Week 6**		
Week 7	Laboratory	Labs - Marked	**Week 7**		
Week 8	Laboratory	Labs - Marked	**Week 8**		
Week 9	Laboratory	Labs - Marked	**Week 9**		
Week 10	Laboratory	Labs - Marked	**Week 10**		Assignment Marked
Week 11		Labs - Marked	**Week 11**		Feedback Provided
Exam Period	Test		**Revision Week**		
Review Week		Test - Marked	**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	20	**Total # to be attempted**	20	**Compulsory Questions**	All - no choice	**Sections**	Single
The examination is	CLOSED	**Book.**					

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

Mathematical Formula; Indicate if standard (for the module) equations or mathematical identities are provided; No

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

Not required

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 Other

C1.		
LO2	Other	
C1.		
LO3	Assignments	
C1.		
LO4	Other	*Project*
C1.		