College of Engineering

Academic Year 2023/24 - Semester 2

Please note: although we will try our best to avoid it, there may be timetable clashes when choosing modules across different levels and different courses (so you might have to choose alternative modules).

Click on the module name to see the module specification.

Module Code	Name	Level Code	BCU Module Credits	ECTS
ENG4094	Engineering Principles 2	4	20	10
ENG4096	Integrated Engineering Project	4	20	10
ENG4125	Mathematical Modelling 2	4	20	10
ENG5095	Microcontroller System Design and Programming	5	20	10
ENG5096	Electronics Project	5	20	10
ENG5097	Leading Engineering Endeavours	5	20	10
ENG5101	Design and Manufacture	5	20	10
ENG5102	Mechanical Science	5	20	10
ENG5105	Manufacturing Automation and Control	5	20	10
ENG6068	Communication Systems and Networks	6	20	10
ENG6070	Product Lifecycle Management	6	20	10
ENG6073	Advanced Manufacturing	6	20	10
ENG6076	Vehicle Electronics and Control	6	20	10
ENG6077	Body and Chassis Performance	6	20	10
ENG6079	Thermodynamics and Energy Systems	6	20	10
ENG6084	Advanced Mechanics	6	20	10
ENG6206	Analogue Electronic Circuits	6	20	10

Module Specification

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Module Summary Information

1	**Module Title**	Engineering Principles 2
2	**Module Credits**	20
3	**Module Level**	4
4	**Module Code**	ENG4094
5	**Semester Taught**	2

6	**Module Overview**

The module aims to provide the underpinning knowledge and problem-solving skills in engineering science to enable you to progress to the second year of a wide range of engineering degrees. The theoretical and practical aspects of engineering science are delivered in the common first year, under Engineering Principles modules. The subject material will be delivered in two coherent streams one of which contains predominantly mechanical science and the other contains predominantly electrical science. Each stream includes laboratory exercises.

This module will interact with modules in the other two themes in the common first year in that it will rely on knowledge of mathematical techniques developed in the maths/professional skills theme and will provide theoretical underpinning for the experimental activities.

7	**Indicative Content**

Introduction to Mechanics
Pin Jointed Frames, Simple Torsion of Circular Sections, Shear Force and Bending Moment Diagrams, Bending Stresses

Introduction to Geometric Properties
Geometric Properties of Sections, Second Moment of Inertia

Introduction to Digital Electronics
Numbering Systems, Decimal, Binary, Octal, Hexadecimal, Digital Logic Gates, Boolean Expressions, Combinational Logic, Karnaugh Maps, Flip Flops, Latches, Adders, Subtractors, Sequential Logic Registers, Counters, Shift Registers, Operational Amplifiers, Semi-conductor Materials, Diodes, Rectification, Magnetic Fields, Transformers, Simple Power Supplies, Bipolar Junction Transistors, Classification of Amplifiers, Biasing of Transistor Amplifier Circuits

8	**Module Learning Outcomes** **On successful completion of the module, students will be able to:**	
	1	Demonstrate the principles of bending and torsion in components and geometric properties of sections.
	2	Analyse the material behaviour under different types of stresses.
	3	Analyse the behaviour of combinational and sequential logic gate circuits.
	4	Compute and describe the characteristics of semiconductor devices and systems.

	5	Organise and complete a range of practical labs and activities. Analyse and present findings in an appropriate manner

9	**Module Assessment**		
Learning Outcome Number *(from table 8)*	**Coursework**	**Exam**	**In-Person**
1-4	25% (Module Quizzes)	50%	
5	25% Lab report		

10	**Breakdown Learning and Teaching Activities**	
Learning Activities	**Hours**	**Details of Duration, Frequency and other comments**
Scheduled Learning (SL) includes lectures, practical classes and workshops as specified in timetable	108	2 x 1hr lecture x12, 2 x 2hr tutorial x12) (1hr lecture in Lab + 2hr lab) x12
Directed Learning (DL) includes placements, work-based learning, peer group learning external visits, on-line activity, Graduate+, peer learning, as directed on VLE	56	Grad+, on-line activity as directed on Moodle.
Private Study (PS) includes preparation for exams	36	Completion of class activity, further reading and assessment preparation.
Total Study Hours:	200	

11	Key Texts and Online Learning Resources

Essential (Books/Journals/Specific chapters/Journal Articles)

Brooks, R., Howe, A., Kennedy, A., McWilliam, S. 2013. An Introduction to Mechanical Engineering Part 1, Hodder Education.

Recommended

Floyd, T.L (2013), Digital Fundamentals, 10th Ed., Pearson.

Floyd, T.L (2013), Electronics Devices (Conventional Current Version), 9th Ed., Pearson.

Hearn E.J., (1997) Mechanics of Materials vol 1, Butterworth-Heinemann ISBN: 0750632658.

Benham, P.P., Crawford, R.J., & Armstrong, C.G., (1996), Mechanics of Engineering Materials, Longman, ISBN 058225164-8.

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Module Summary Information

1	**Module Title**	Integrated Engineering Project
2	**Module Credits**	20
3	**Module Level**	4
4	**Module Code**	ENG4096
5	**Semester Taught**	2

5	**Module Overview**

The module aims to provide professional skills to enable you to progress on to the second year of an engineering degree.

The subject material will be delivered in three coherent themes:

1. Mechanical and electrical laboratory exercises.
2. APC-based stream including the use of software to support project planning, design, communication and analysis.
3. A project-based approach to integrate learning from across all elements of the semester.

You will develop practical professional engineering skills including those required for conceiving, designing, implementing and operating (CDIO) engineering solutions.

This module will interact with modules in the other two themes in the first year, relying on knowledge of mathematical techniques and the theoretical underpinning of the engineering principles, design and professional skills theme.

7	**Indicative Content**

Professional Skills
Introduction to engineering project through CDIO, further research tools, avoiding plagiarism, critical analysis, CAD part design and mathematical modelling tools.

8	**Module Learning Outcomes** **On successful completion of the module, students will be able to:**	
	1	Analyse design proposals and select the best solution from a range of options, then utilise CAD for effective communication.
	2	Develop an ability to manage a group project by controlling time and resources, setting milestones and reflecting upon its success.

9	Module Assessment		
Learning Outcome Number *(from table 8)*	**Coursework**	**Exam**	**In-Person**
1-2	**30%**		**70%**

10	Breakdown Learning and Teaching Activities		
Learning Activities		**Hours**	**Details of Duration, Frequency and other comments**
Scheduled Learning (SL) includes lectures, practical classes and workshops as specified in timetable		84	1 x 1 hr lecture x 12, 1 x 3hr pc session x 12, 1 x 3 hr workshop session x12)
Directed Learning (DL) includes placements, work-based learning, peer group learning external visits, on-line activity, Graduate+, peer learning, as directed on VLE		56	Grad+, on-line activity as directed on Moodle.
Private Study (PS) includes preparation for exams		60	Completion of class activity, further reading and assessment preparation.
Total Study Hours:		200	

11	Key Texts and Online Learning Resources

Recommended

Brooks, R., Howe, A., Kennedy, A., McWilliam, S. 2013. An Introduction to Mechanical Engineering Part 1, Hodder Education.

Background

Floyd, T.L (2013), *Digital Fundamentals,* 10th Ed., Pearson
Floyd, T.L (2013), *Electronics Devices (Conventional Current Version),* 9th Ed., Pearson
Hearn E.J., (1997) Mechanics of Materials vol 1, Butterworth-Heinemann, ISBN: 0750632658.
Benham, P.P., Crawford, R.J., & Armstrong, C.G., (1996), *Mechanics of Engineering Materials,* Longman, ISBN 058225164-8.

Module Specification

Module Summary Information

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1	**Module Title**	Mathematical Modelling 2
2	**Module Credits**	20
3	**Module Level**	4
4	**Module Code**	ENG4125
5	**Semester Taught**	2

6	**Module Overview**

The module will introduce, solve, and contextualise first order and second order differential equations.

Systems represented by differential equations can either have zero input or non-zero input applied. Both homogeneous (zero input) and non-homogeneous (non-zero input) differential equations will be considered.

Various techniques will be used to solve differential equations. This module will also include an introduction to writing programmes using mathematical modelling software packages.

7	**Indicative Content**

Solving first order differential equations (homogeneous and non-homogeneous) using: separating variables and integrating factors.

Solving second order differential equations (homogeneous and non-homogeneous) using: methods of undetermined coefficients (Trial Method), Laplace transforms (derivative property) and systems of coupled equations.

Solving differential equations to obtain general solution and/or particular solutions.

Solving a system of first order differential equations using matrices, eigenvalues and eigenvectors.

Introduce and use variables, constants, data structures, conditional statements, and loops.

8	**Module Learning Outcomes** **On successful completion of the module, you will be able to:**	
	1	Apply techniques to solve 1st and 2nd order linear differential equations (homogeneous and non-homogeneous).
	2	Apply techniques to solve a system of coupled differential equations using matrices.
	3	Interpret basic data structures and algorithms as applied to mathematical modelling of dynamic systems.

9	Module Assessment		
Learning Outcome Number *(from table 8)*	**Coursework**	**Exam**	**In-Person**
1 - 4	**30%**	**70%**	

10	Breakdown Learning and Teaching Activities	
Learning Activities	**Hours**	**Details of Duration, Frequency and other comments**
Scheduled Learning (SL) includes lectures, practical classes and workshops as specified in timetable	72	I 2hr lecture x12, 2hr tutorial x12, 2 hr peer workshop x 12)
Directed Learning (DL) includes placements, work-based learning, peer group learning external visits, on-line activity, Graduate+, peer learning, as directed on VLE	56	Grad+, on-line activity as directed on Moodle.
Private Study (PS) includes preparation for exams	72	Completion of class activity, further reading and assessment preparation.
Total Study Hours:	200	

11 Key Texts and Online Learning Resources

Essential (Books/Journals/Specific chapters/Journal Articles)

Hunt, Brian R. et al. A Guide to MATLAB: for Beginners and Experienced Users. Third edition. Cambridge: Cambridge University Press, 2014. Print.
Stroud, K. A., and Dexter J. Booth. Engineering Mathematics. Eighth edition. London, England: Macmillan international, 2020. Print.

The Essential Manager's Handbook (2016) United Kingdom: DK.

Recommended
Croft, Anthony et al. Engineering Mathematics. Harlow, United Kingdom: Pearson Education, Limited, 2017. Print.
Alam, Syed Nasimul, and Syed Samsul Alam. Understanding Matlab: a Textbook for Beginners. New Delhi: I.K. International Publishing HousePvt. Ltd, 2013. Print.
King, Andrew P. Matlab Programming for Biomedical Engineers, and Scientists. Amsterdam: Academic Press, 2017. Print.

Background

http://www.wolframalpha.com/ Interactive mathematics applets

http://integrals.wolfram.com/index.jsp Online integration http://library.wolfram.com/webMathematica/Education/WalkD.jsp Online differentiation

Module Specification

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Module Summary Information

1	**Module Title**	Microcontroller System Design and Programming
2	**Module Credits**	20
3	**Module Level**	5
4	**Module Code**	ENG5095
5	**Semester Taught**	2

6	**Module Overview**
The development of knowledge in analogue and digital electronics, real-time embedded systems and programming, and robotics and control are specified in the aims of the programme. Microcontroller System Design and Programming is an introduction to programming in the C language, and to hardware and software tools and techniques for embedded systems design with microcontrollers.	

7	**Indicative Content**
To introduce the architecture, operation, and programming of a microcontroller, its on-board peripherals and interfacing to its input and output ports. Topics: Basic computer architecture, Digital and Analogue interfacing, Transducers, Open loop and on/off control.	

8	**Module Learning Outcomes** **On successful completion of the module, you will be able to:**	
	1	Explain the basic hardware architecture of an embedded system.
	2	Employ peripheral devices of microcontrollers for embedded applications.
	3	Choose and use suitable transducers and actuators for a given application.
	4	Develop C programmes and implement basic real-time monitoring/control applications.

9	**Module Assessment**		
Learning Outcome			
	Coursework	**Exam**	**In-Person**
1-4			**40%**
1, 2 and 3	**60%**		

10	Breakdown Learning and Teaching Activities	
Learning Activities	**Hours**	**Details of Duration, Frequency and other comments**
Scheduled Learning (SL) includes lectures, practical classes and workshops as specified in timetable	**48**	2hr lecture x12 2hr tutorial/lab x12
Directed Learning (DL) includes placements, work-based learning, peer group learning external visits, on-line activity, Graduate+, peer learning, as directed on VLE	**32**	Grad+, on-line activity as directed on Moodle
Private Study (PS) includes preparation for exams	**120**	Completion of class activity, further reading and assessment
Total Study Hours:	**200**	

11	Key Texts and Online Learning Resources

Purchase
None.

Essential (Books/Journals/Specific chapters/Journal Articles)
None.

Recommended

- Wilmshurst, T (2009), *Designing PIC Embedded Systems with PIC microcontrollers, Principles and Applications,* Newnes.
- Goldsmith, S (1993), *A practical guide to real-time systems development,* Prentice-Hall.
- Cooling, J (2002), *Software Engineering for real-time systems,* Addison-Wesley.
- Stuart R. Ball (2000), *Embedded Microprocessor Systems, Real World Design,* Second Edition; Newnes.
- Jack G. Ganssle (2000) *The Art of Designing Embedded Systems,* Newnes.

Background
None.

Module Specification

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Module Summary Information

1	**Module Title**	Electronics Project
2	**Module Credits**	20
3	**Module Level**	5
4	**Module Code**	ENG5096
5	**Semester Taught**	*2*

6	**Module Overview**

The Electronic Engineering course is designed to produce graduates with highly developed skills in electronic systems design, who will have the technical and management capability required by employers in a rapidly changing technological landscape.

The aim of this module is to integrate skills and knowledge gained from your course into one practical project. The endpoint of this project will be a wheeled robot capable of competing in a robotic competition, with the intention of entering a national or international competition.

You will utilise the skills gained from other modules to design, build and test a Printed Circuit Board (PCB). You will construct and test an embedded controller board, debugging it using point-to-point continuity checks, signal checks using multi-meter and oscilloscope, and writing test routines to fully prove functionality.

7	**Indicative Content**

Develop a simple embedded system.
Design and build basic electronic and sensory circuits (PCB design).
Use basic test equipment such as a multi-meter or oscilloscope.
Programme microcontroller and debug system.

8	**Module Learning Outcomes** **On successful completion of the module, students will be able to:**	
	1	Apply theory, simulation and construction techniques to investigate electronic circuits and systems as part of an engineering design problem.
	2	Employ laboratory test equipment, ECAD packages and device/component data sheets appropriately.
	3	Evaluate the concepts of electronic system integration, programming, testing and hardware debugging.
	4	Explain information concisely by written technical report and oral presentation.

9	Module Assessment			
Learning Outcome				
	Coursework	**Exam**	**In-Person**
1,2			**40%**
1, 2, 3 and 4	**60% (Report & Demonstration)**		

10	Breakdown Learning and Teaching Activities		
Learning Activities	**Hours**	**Details of Duration, Frequency and other comments**
Scheduled Learning (SL) includes lectures, practical classes and workshops as specified in timetable	**48**	*1 1hr lecture x12* *3hr tutorial/lab x12*
Directed Learning (DL) includes placements, work-based learning, peer group learning external visits, on-line activity, Graduate+, peer learning, as directed on VLE	**32**	*Grad+, on-line activity as directed on Moodle*
Private Study (PS) includes preparation for exams	**120**	*Completion of class activity, further reading and assessment*
Total Study Hours:	**200**	

11	Key Texts and Online Learning Resources

Purchase

None.

Essential (Books/Journals/Specific chapters/Journal Articles)

None.

Recommended

Floyd, T.L and Buchla, D (2012), *Analog Fundamentals: A Systems Approach*, Prentice Hall, ISBN-10: 0132933942.

Floyd, T.L, (2013), *Digital Fundamentals*, 10th Ed, Prentice Hall, ISBN-10: 0132933942.

Ulrich, K and Eppinger, S, (2011), *Product Design and Development*, 5th Ed, McGraw-Hill Professional, ISBN-10: 0071086951.

Background

None.

Module Specification

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Module Summary Information

1	**Module Title**	Leading Engineering Endeavours
2	**Module Credits**	20
3	**Module Level**	5
4	**Module Code**	ENG5097
5	**Semester Taught**	2

6	**Module Overview**

An interdisciplinary module, you will work with students from all fields of engineering to develop skills in engineering leadership and experience creating a purposeful vision and delivering on that vision. This will set the professional skills for business in context by combining your technical course-specific knowledge with professional skills. It is proposed that the vehicle to deliver this will be the biomimicry global design challenge. http://challenge.biomimicry.org/. It is proposed that the University may enter the best teams to the Global challenge.

Delivery will include guest lectures, inviting industrial leaders, and a series of mini-lectures to cover key content, including Internationalisation. Each session will concentrate on facilitated group working to use and develop skills rather than through didactic teaching of them.

7	**Indicative Content**

Teamwork
Cross-functional teams, Leadership vs management, Project planning, Negotiation, compromise and conflict resolution.

Design
Developing a business case, concept development and selection, technical design analysis / simulation, prototyping, ethics, equity and responsibilities

8	**Module Learning Outcomes** **On successful completion of the module, students will be able to:**	
	1	Work proactively and effectively in interdisciplinary teams to plan and deliver the task.
	2	Create a purposeful vision considering context: external, societal, environmental, international enterprise and business.
	3	Apply engineering knowledge to deliver the team vision.
	4	Communicate effectively using appropriate media and style to the audience.

9	Module Assessment		
Learning Outcome			
	Coursework	**Exam**	**In-Person**
1-4	**100%**		

10	Breakdown Learning and Teaching Activities		
Learning Activities		**Hours**	**Details of Duration, Frequency and other comments**
Scheduled Learning (SL) includes lectures, practical classes and workshops as specified in timetable		**48**	*4hr SEMINAR x12*
Directed Learning (DL) includes placements, work-based learning, peer group learning external visits, on-line activity, Graduate+, peer learning, as directed on VLE		**32**	*Grad+, on-line activity as directed on Moodle*
Private Study (PS) includes preparation for exams		**120**	*Completion of class activity, further reading and assessment*
Total Study Hours:		**200**	

11	Key Texts and Online Learning Resources

None.

Essential (Books/Journals/Specific chapters/Journal Articles)
Dyson J. R, 2010. *Accounting for non-accounting students:* 8th Edition. Prentice Hall.
Blackwell, E, 2008. *How to prepare a business plan.* 5th Edition. Sunday Times Business Enterprise Series.

Recommended
The Biomimicry Institute, [online] Available at: < http://www.asknature.org/> [Accessed 4/11/2016].

Background
Harman, J., 2013. *The Shark's Paintbrush: Biomimicry and How Nature is Inspiring Innovation.* Barnes and Noble

Module Specification

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Module Summary Information

1	**Module Title**	Design and Manufacture
2	**Module Credits**	20
3	**Module Level**	5
4	**Module Code**	ENG5101
5	**Semester Taught**	2

6	**Module Overview**

This module develops your research skills, idea generation techniques, and ability to create CAD models and manufactured components.

You will also gain the ability to communicate design ideas and practical details, to evaluate and apply both tangible and subjective feedback, and to conceive, design, implement and operate practical solutions to design opportunities.

7	**Indicative Content**

Manufacture
Health and Safety, CNC Machining, Inspection, Limits, fits and tolerances, CAM systems application.

CAD
CAD drawings and standards, Component modelling, Assembly modelling.

8		**Module Learning Outcomes** **On successful completion of the module, students will be able to:**
	1	Apply CAD to the modelling of production-capable parts and the creation of assembly drawings.
	2	Evaluate the opportunities and limitations of CAD in the development of new products.
	3	Employ CAM simulations and machine tool programmes to create components that form part of a fully justified design solution.
	4	Appraise quality issues, tolerances and manufacturing processes through the creation of a CAD-based engineering assembly.

9	**Module Assessment**		
Learning Outcome			
	Coursework	**Exam**	**In-Person**
1-4	**70%**		**30%**

10	Breakdown Learning and Teaching Activities		
Learning Activities		**Hours**	**Details of Duration, Frequency and other comments**
Scheduled Learning (SL) includes lectures, practical classes and workshops as specified in timetable		**48**	*2hr lecture x12* *2hr tutorial/lab x12*
Directed Learning (DL) includes placements, work-based learning, peer group learning external visits, on-line activity, Graduate+, peer learning, as directed on VLE		**32**	*Grad+, on-line activity as directed on Moodle*
Private Study (PS) includes preparation for exams		**120**	*Completion of class activity, further reading and assessment*
Total Study Hours:		**200**	

11	Key Texts and Online Learning Resources

Purchase

None.

Essential (Books/Journals/Specific chapters/Journal Articles)

Cozens, R. (2013) *CATIA V5 Workbook Release V5-6R2013*, SDC Publications
Smid, P. (2008) CNC Programming Handbook. 3rd ed. New York: Industrial Press.

Recommended

Groover, M. (2015) *Automation, Production Systems*, and Computer-Integrated Manufacturing. 4th Edition, Pearson.

Medland, A.J. (2012) *CAD/CAM in Practice: A Manager's Guide to Understanding and Using CAD/CAM*. Springer.

Pugh, S. (1990) *Total Design: Integrated Methods for Successful Product Engineering*. Prentice Hall.

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Module Summary Information

1	**Module Title**	Mechanical Science
2	**Module Credits**	20
3	**Module Level**	5
4	**Module Code**	ENG5102
5	**Semester Taught**	2

6	**Module Overview**

The Mechanical Science module applies the principles of engineering, physics, and materials science to the design, analysis, manufacture, and maintenance of mechanical systems and components. It is a branch of engineering that enables you to design, produce, and operate machinery. In keeping with the programme philosophy the module encourages learning through the practical application of fundamental mechanical science principles to the analysis and solution real world problems.

The course is delivered by way of an introductory lecture to a particular real world problem, such as vibration, and the underlying mechanical science principles used to tackle the problem. You will then engage in interactive tutorials where you will practice applying underlying mechanical science principles to real world problems.

It is in the nature of Mechanical Science that it provides quantitative and objective analysis of mechanical components. It is important therefore that you will be able to demonstrate your ability to analyse and apply underlying principles of mechanical science to real world problems. You will therefore be assessed by a single one and a half hour closed book exam, where you will be able to demonstrate your individual ability to analyse a real world problem, and apply the relevant mechanical science principles to develop a solution to it.

7	**Indicative Content**

Structural Annalysis
Normal and Shear Stress, Combined Loading, Principal Stresses, Mohr's Stress Circle, Thin-walled Cylinders, Advanced Shear Forces and Bending Moment Diagrams, Macaulay's Method for Determinate Beams under Loading.

Failure of Materials
Failure Criteria, Tresca and von Mises Criteria, Fatigue.

Dynamics
Free and Forced Single Degree of Freedom Systems, Balancing of Shafts.

8	Module Learning Outcomes On successful completion of the module, students will be able to:	
	1	Analyse commonly encountered mechanical problems and identify the underlying mechanical science principles required to solve the problem.
	2	Develop simple analytical mathematical models based upon underlying mechanical science principles to quantitatively evaluate real world mechanical components.
	3	Make an objective evaluation of functionality of mechanical components based upon the results obtained from the application of underlying mechanical science principles and quantitative mathematical models derived from them.

9	Module Assessment		
Learning Outcome			
	Coursework	**Exam**	**In-Person**
1-3	**30%**	**70%**	

10	Breakdown Learning and Teaching Activities		
Learning Activities		**Hours**	**Details of Duration, Frequency and other comments**
Scheduled Learning (SL) includes lectures, practical classes and workshops as specified in timetable		**48**	*2hr lecture x12* *2hr tutorial/lab x12*
Directed Learning (DL) includes placements, work-based learning, peer group learning external visits, on-line activity, Graduate+, peer learning, as directed on VLE		**32**	*Grad+, on-line activity as directed on Moodle*
Private Study (PS) includes preparation for exams		**120**	*Completion of class activity, further reading and assessment*
Total Study Hours:		**200**	

11	Key Texts and Online Learning Resources
Purchase None. **Essential (Books/Journals/Specific chapters/Journal Articles)**	

- Michael Clifford, 2009. *An Introduction to Mechanical Engineering: Part 1 (Pt. 1).* 1 Edition. CRC Press.
- Michael Clifford, 2014. *An Introduction to Mechanical Engineering: Part 2 (Pt. 2).* 1 Edition. CRC Press.

Recommended

None.

Background

There are a great many textbooks on mechanical science each offering their own approach and style. You are encouraged to use the BCU library search facilities to explore the many text books that are available there, to find a book that suits your own learning style. The DeMystified series of books published by McGraw Hill are a good source of introductory material while the Schaum's Outline series can provide information on more advanced problems. There are other online resources such as Wiki, Google and You Tube. You are encouraged to exploit these sources but always ensure that you check the reliability of the material presented there with pier-reviewed material from reputable textbook.

Module Specification

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Module Summary Information

1	**Module Title**	Manufacturing Automation and Control
2	**Module Credits**	20
3	**Module Level**	5
4	**Module Code**	ENG5105
5	**Semester Taught**	2

6	**Module Overview**
This module aims to provide you with an understanding of and practical experience in the techniques used in controlling manufacturing applications. Topics include inspection, machine tool control, flexible and dedicated automation, and work holding systems, supply of power and services and health and safety issues.	

7	**Indicative Content**
Health and safety; Risk management; Noise and lighting; Compressed air; Hydraulic systems; Encoder design and construction; Robot configurations; Stepper motor theory; BASIC language programming of microcontrollers to control servo motors.	

8	**Module Learning Outcomes** **On successful completion of the module, you will be able to:**	
	1	Interpret health and safety literature to create a risk assessment for an industrial environment.
	2	Assess the requirements for manufacturing services.
	3	Describe basic robot configurations, evaluate encoder types and estimate stepper motor torques.
	4	Analyse microprocessor programming, servo motor control and sensors.

9	**Module Assessment**		
Learning Outcome			
	Coursework	**Exam**	**In-Person**
1-4		**70%**	**30%**

10	**Breakdown Learning and Teaching Activities**		
Learning Activities		**Hours**	**Details of Duration, Frequency and other comments**
Scheduled Learning (SL) includes lectures, practical classes and workshops as specified in timetable		**48**	2 x 1 hr lecture x 12 2 hr tutorials x12

Directed Learning (DL) includes placements, work-based learning, peer group learning external visits, on-line activity, Graduate+, peer learning, as directed on VLE	**32**	Grad+, on-line activity as directed on Moodle.
Private Study (PS) includes preparation for exams	**120**	Completion of class activity, further reading and assessment
Total Study Hours:	**200**	

11	**Key Texts and Online Learning Resources**

Purchase

None.

Essential (Books/Journals/Specific chapters/Journal Articles)

None.

Recommended

- Overby, A. (2010). *CNC Machining Handbook: Building, Programming, and Implementation,* Tab Electronics.
- Hocken, R. and Pereira, P. (2011). *Coordinate Measuring Machines and Systems,* second edition, CRC Press.
- Wilson, M. (2014). *Implementation of Robot Systems: An introduction to robotics, automation, and successful systems integration in manufacturing,* Butterworth-Heinemann.
- Lincoln, D. (2011). *Programming and Customizing the PICAXE Microcontroller,* McGraw-Hill/TAB Electronics.
- Hackett, R. (2010). *PICAXE Microcontroller Projects for the Evil Genius,* McGraw-Hill/TAB Electronics.
- http://www.hse.gov.uk/guidance/index.htm

Background

None.

Module Specification

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Module Summary Information

1	**Module Title**	Communication Systems and Networks
2	**Module Credits**	20
3	**Module Level**	6
4	**Module Code**	ENG6068
5	**Semester Taught**	2

6	**Module Overview**

Rationale

The module provides you with an understanding and knowledge in the principles and applications of telecommunications and information networks. The module will focus on case studies of particular applications in wired and wireless communications systems and in high speed networking. Telecommunication and networking technologies are key components of modern revolutionary technologies. This module provides you with the knowledge to understand modern communication systems and the functions of the Internet. In addition, you will gain related analytical skills that can be applied in designing modern communication systems and information networks.

Alignment with Programme Philosophy and Aims

The module assists the main programme philosophy of fulfilling the academic component of the MEng Electronic Engineering by introducing you to three important processing stages of modern communication systems which are transmission structure for quality of robust transmission, wireless communication for efficient modulation of signal transmission and telecommunication networks architectures for providing comprehensive knowledge of different architectural and technical aspects of current and future interworking techniques.

A key feature is the balanced approach between fundamental theory of communications system, wireless communications and networks: modelling point-to-point communications; elements of optical communication systems; elements of satellite communications which include fundamental problems of multiple access channel, broadcast channel and two-way channel.

On successful completion of this module, you will be able to:

1. To develop a solid understanding of typical point-to-point communication systems, the function of individual subsystems and the interactions among them;

2. To build a clear and good knowledge information networking technologies and protocols that used in the modern internet.

This introduces methods of creating, implementing and testing of telecommunications and information networks concentrating on a systems approach. Emphasis will be on understanding modern communication systems and the functions of the Internet. In addition, you will gain related analytical skills that can be applied in designing modern communication systems and information networks.

7	Indicative Content

Communications Channel
Signals and spectra. The communications channel and standard models for the channel. Modulation techniques

Radio Waves Propagation
Characteristics of radio wave propagation – losses, reflection, refraction, differention, Fresenel zones and tropospheric scatter. Direct, ground and sky wave. System engineering – frequency allocation, link budget and diversity. Maximum usable frequency

Aerials
Electromagnetic wave propagation. Aerials – basic properties, radiation resistance, polarisation, gain, beam width. Aerial types, diploes, Yagi and reflector aerials and their properties. Linear aerials. Aerial arrays.

Transmission Lines
Primary line constants, secondary, coefficient, velocity of propagation, characteristics impedance. Smith charts. Impedance matching. Stubs. Guided waves. Transmission impairments

Satellite Systems
Satellite orbits, Kepler elements. Link budget, figure of merit, Satellite Networks, multiple access, FDMA, TDMA, CDMA and OFDM, Line of sight. Microwave circuit techniques. Cellular Mobile communications techniques.

Noise
Noise sources, noise in the frequency and time domains. Signal-to-noise ratio, noise figure, noise temperature. Errors in digital systems, error correction and coding. BER calculation.

Data transmission
Pulse detection. Line codes and their desirable properties. Effect of bandwidth limitation, ISI. Multiplexing and de-multiplexing techniques. Pulse code modulation, principles, sampling, quantisation, A law and μ law encoding. Delta modulation, principles, adaptive systems, PCM comparison. Data and Computer communications standards. The OSI model: Data link layer protocol.

Networks
Introduction to networks: Network topologies. Wire and wireless network configuration.
LAN, WAN, MAN. Interconnects and gateways, Networking structures: topologies and transmission media. Ethernet. Broadband Multi-Services Networks: Asynchronous Transfer Mode (ATM). Principles & Applications. Higher Order Multiplexing: Principle of Add & Drop, PDH and SDH. Inverse Multiplexing

8	Module Learning Outcomes On successful completion of the module, students will be able to:	
	1	Apply and critically evaluate the characteristics of radio wave propagation.
	2	Identify, categorise and discuss the characteristics of electrical communication techniques and media.
	3	Critically evaluate the performance of various wireless communication systems
	4	Discuss, compare and contrast the design, implementation and characteristics use of a number of networking systems.

9	Module Assessment		
Learning Outcome			
	Coursework	**Exam**	**In-Person**
1-4	**30%**	**70%**	

10	Breakdown Learning and Teaching Activities		
Learning Activities		**Hours**	**Details of Duration, Frequency and other comments**
Scheduled Learning (SL) includes lectures, practical classes and workshops as specified in timetable		**48**	*2hr lecture x12* *2hr tutorial/lab x12*
Directed Learning (DL) includes placements, work-based learning, peer group learning external visits, on-line activity, Graduate+, peer learning, as directed on VLE		**32**	*Grad+, on-line activity as directed on Moodle*
Private Study (PS) includes preparation for exams		**120**	*Completion of class activity, further reading and assessment*
Total Study Hours:		**200**	

11	Key Texts and Online Learning Resources
Purchase *None.* **Essential (Books/Journals/Specific chapters/Journal Articles)** Stallings, W. (2015), *Wireless Communication & Networks*, 2nd edn, New York: Pearson.	

Beasley,J. and J, S. Miller, G.M, (2013*) Modern Electronic Communication Systems*. 9th edn. New York: Pearson.

Frenzel, L, E. (2007) *Principles of Electronic Communication Systems*. 3rd edn. Maidenhead: McGraw-Hill Higher Education.

Stallings, W. (2013), *Data & Computer Communications*, 10th edn, New York: Pearson.

Otung, I. (2001), *Communications Engineering Principles*, London, Palgrave Macmillan.

Stallings, W, and Beard, C. (2015) *Wireless Communication Networks & Systems*. New York: Pearson.

Recommended

Comer, D. (2009) *Computer Networks and Internets* 5th edn. Upper Saddle River, N.J. Pearson Prentice Hall.

Tomasi, W. (2003) *Electronic Communications Systems: fundamentals through Advance*. Clifton Park, NY: Pearson.

Halsall, F. (2005), *Computer Networking and Internet*, 5th edn. New York: Pearson.

Halsall, F. (2001), *Multimedia Communication: Applications*, Networks, Protocols, New York: Pearson.

Green, D.C. (2001) *Radio Communication*. 2nd edn. Harlow: Longman.

Stanley, W. and Jeffords, J.M., (2005), *Electronic Communications: Principles and Systems*. Cengage Learning.

Background

IEEE Communications Surveys & Tutorials: http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=9739

IET Digital Library: IET Communications: http://digital-library.theiet.org/content/journals/iet-com

Module Specification

Return to Module List

Module Summary Information

1	**Module Title**	Product Lifecycle Management
2	**Module Credits**	20
3	**Module Level**	6
4	**Module Code**	ENG6070
5	**Semester Taught**	2

6	**Module Overview**

Product Lifecycle Management (PLM) considers products and associated systems from concept to re-use, including design, manufacturing processes and routes, and production management, and places them in a global context which includes sustainability and climate change. This form of systems engineering is focused on meeting all requirements, primarily meeting customer needs, and coordinating the systems design process by involving all relevant disciplines. The core of PLM is in the creation and central management of all product data and the technology used to access this information and knowledge, and this module will help you become proficient in the philosophies, tools and techniques you will need to achieve this coherence. PLM as a discipline emerged from tools such as CAD, CAM and PDM, but can be viewed as the integration of these tools with methods, people and the processes through all stages of a product's life. It is not just about equipment, material processing and software technology but is also a business strategy. This module has a strong emphasis on the environment and on sustainability of business.

7	**Indicative Content**

The Product Lifecycle. Technical Requirements versus Business Requirements. Overview of Sustainability. Importance of Adaptation and Mitigation of Climate Change.

Design for "X". CAE Tools. FEA. CFD. DFManufacture. DFAssembly. DFPackaging. DFService. DTCost. DFReuse.

Data Management Systems & Activities. Design Automation. Quality Assurance in the Design Process. KBE. MRP/MRP2. PDMS. ERP. Data Transfer Considerations. Manufacturing 4.0. Big Data. Internet of Everything.

R&D. Defining the Market. NPI. Version Control. Change Management. Human Factors. Market Segmentation. Managing Customers' Expectations. Mass Customisation.

Manufacturing Process Design. Volumes. Workflow. JIT. Kanban. For Lean Manufacturing. Factory Layout. Tooling. Jigs & Fixtures. Flexible Tooling. Elimination of Waste & Non-Productive Time. Process FMEA.

Prototyping and Testing. Ramp-Up to Production. Assembly. Packaging. Service. Documentation.

Logistics. Internal Supply Chains. External Supply Chains. Decommissioning. Reuse.

Review of Sustainability. Security of Supply. Social, Economic and Business Considerations.

The Product Lifecycle. Technical Requirements versus Business Requirements. Overview of Sustainability. Importance of Adaptation and Mitigation of Climate Change.

Design for "X". CAE Tools. FEA. CFD. DFManufacture. DFAssembly. DFPackaging. DFService. DTCost. DFReuse.

Data Management Systems & Activities. Design Automation. Quality Assurance in the Design Process. KBE. MRP/MRP2. PDMS. ERP. Data Transfer Considerations. Manufacturing 4.0. Big Data. Internet of Everything.

R&D. Defining the Market. NPI. Version Control. Change Management. Human Factors. Market Segmentation. Managing Customers' Expectations. Mass Customisation.

Manufacturing Process Design. Volumes. Workflow. JIT. Kanban. For Lean Manufacturing. Factory Layout. Tooling. Jigs & Fixtures. Flexible Tooling. Elimination of Waste & Non-Productive Time. Process FMEA.

Prototyping and Testing. Ramp-Up to Production. Assembly. Packaging. Service. Documentation.

Logistics. Internal Supply Chains. External Supply Chains. Decommissioning. Reuse.

Review of Sustainability. Security of Supply. Social, Economic and Business Considerations.

9	**Module Assessment**			
Learning Outcome Number	**Coursework**	**Exam**	**In-Person**
1			**30%**
2	**70%**		

10	**Breakdown Learning and Teaching Activities**		
Learning Activities	**Hours**	**Details of Duration, Frequency and other comments**
Scheduled Learning (SL) includes lectures, practical classes and workshops as specified in timetable	**48**	4hr tutorial/lab x12
Directed Learning (DL) includes placements, work-based learning, peer group learning external visits, on-line activity, Graduate+, peer learning, as directed on VLE	**32**	Grad+, on-line activity as directed on Moodle
Private Study (PS) includes preparation for exams	**120**	Completion of class activity, further reading and assessment

Total Study Hours:	**200**

11	**Key Texts and Online Learning Resources**

Purchase
None

Essential (Books/Journals/Specific chapters/Journal Articles)
None

Recommended

- Stark, J. *Global Product – Strategy, Product Lifecycle Management and the Billion Customer Question.* Springer 2007. Shelf Mark: 658.5/Sta
- Stark, J. *Product Lifecycle Management – 21st Century Paradigm for Product Realisation,* Springer 2011. Shelf Mark: 658.5/Sta

Background

Journals:

- Concurrent Engineering.
- Engineering.
- Engineering & Technology.
- The Engineer

Module Specification

Return to Module List

Module Summary Information

1	**Module Title**	Advanced Manufacturing
2	**Module Credits**	20
3	**Module Level**	6
4	**Module Code**	ENG6073
5	**Semester Taught**	2

6	**Module Overview**

If you are intending to work in a manufacturing environment you will need to develop an understanding of the techniques used in Computer Aided Manufacture of components and products. You will also require a working knowledge of the application of CAM and simulation technologies to form complete integrated systems for product manufacture. Topics include CAD, CAM and CNC data forms, simulation of machining operations, manufacturing cells, calibration, measurement and testing, 3-D System simulation; assembly systems; post processor configuration and application; advanced process simulation and product development.

7	**Indicative Content**

DFA – Choices of Assembly System based upon Product Characteristics.

Design for Environment

Design for Manufacture (Concurrent Costing)

High Speed Machining ; Multi Axis Machining

Machine tool calibration and testing

In-process and post-process gauging and measurement

Probes: Type and application. Reverse Engineering and Digitizing.

Scanning Techniques

Rapid Prototyping and Tooling

Facilities Requirements

8	Module Learning Outcomes On successful completion of the module, students will be able to:	
	1	Evaluate and employ appropriate 3D simulation techniques to analyse the production process.
	2	Critically appraise Computer Controlled Machines tools.
	3	Assess in - and post-process inspection and machine tool verification techniques.
	4	Appraise and specify appropriate advanced product development techniques.

9	Module Assessment		
Learning Outcome			
	Coursework	**Exam**	**In-Person**
1-4	**70%**		**30%**

10	Breakdown Learning and Teaching Activities		
Learning Activities		**Hours**	**Details of Duration, Frequency and other comments**
Scheduled Learning (SL) includes lectures, practical classes and workshops as specified in timetable		**48**	*4hr tutorial/lab x12*
Directed Learning (DL) includes placements, work-based learning, peer group learning external visits, on-line activity, Graduate+, peer learning, as directed on VLE		**32**	*Grad+, on-line activity as directed on Moodle*
Private Study (PS) includes preparation for exams		**120**	*Completion of class activity, further reading and assessment*
Total Study Hours:		**200**	

11	Key Texts and Online Learning Resources
Purchase None. **Essential (Books/Journals/Specific chapters/Journal Articles)** None.	

Recommended

- Boothroyd, G., Dewhurst, P. and Knight, W. (2010). Product Design for Manufacture and Assembly, 3 edition, CRC Press
- McCauley, C. (2016). Machinery's Handbook, 30th Edition, Industrial Press.
- Overby, A. (2010). CNC Machining Handbook: Building, Programming, and Implementation, Tab Electronics.
- Smid, P. (2008). CNC Programming Handbook, Industrial Press, Inc; 3Rev Ed edition.
- Chang, T., Wysk, R. and Wang, H. (2008). Computer- Aided Manufacturing, 3 edition, Prentice Hall.

Background

None.

Module Specification

Module Summary Information

Return to Module List

1	**Module Title**	Vehicle Electronics and Control
2	**Module Credits**	20
3	**Module Level**	6
4	**Module Code**	ENG6076
5	**Semester Taught**	2

6	**Module Overview**

The module presents the analysis, modelling and design of modern vehicle instrumentation and control systems. Industry-standard software will be used for the design and calibration of engine, vehicle, driveline and emissions after-treatment control systems using both time and frequency domain techniques.

Teaching and assessment will comprise not only use of industry standard software for the purposes of mathematical modelling, but also traditional lectures/tutorials assessed by examination.

7	**Indicative Content**

Vehicle Electronics
Block Diagrams and Feedback DC Motors, Bridge and Op-Amp Circuits, Static and Transient Specifications of 1st and 2nd Order Systems, DC-DC Converters, Power Electronics and CAN,

Vehicle Control
Steady State and PID Control, Power Steering Control, Engine Idle Speed Modelling and Control, Lambda Control, Driveline Control, Routh Stability, Frequency Response, Gain Criterion

8	**Module Learning Outcomes** **On successful completion of the module, you will be able to:**	
	1	Apply calibration methodology to vehicle electronic instrumentation to appropriate specifications.
	2	Develop models for engine, vehicle, driveline and emissions after-treatment control systems.
	3	Determine stability of vehicle control systems using frequency and time response techniques.
	4	Design regulators using proportional and integral controllers for vehicle speed and emissions.

9	**Module Assessment**		
Learning Outcome			
	Coursework	**Exam**	**In-Person**
1-4	**20%**	**80%**	

10	Breakdown Learning and Teaching Activities	
Learning Activities	**Hours**	**Details of Duration, Frequency and other comments**
Scheduled Learning (SL) includes lectures, practical classes and workshops as specified in timetable	**48**	2hr lecture x 12 2hr tutorial x 12
Directed Learning (DL) includes placements, work-based learning, peer group learning external visits, on-line activity, Graduate+, peer learning, as directed on VLE	**32**	General online activities: • On-line quizzes • Live Scripts
Private Study (PS) includes preparation for exams	**120**	Completion of class activities Further reading of book chapters and watching of videos Assessment preparation
Total Study Hours:	**200**	

11	Key Texts and Online Learning Resources

Purchase
None

Essential (Books/Journals/Specific chapters/Journal Articles)
Kiencke, U. and Nielsen, L., 2005, Vehicle Control Systems for Engine, Driveline and Vehicle

Nise, N. S. (2020). *Control systems engineering*. John Wiley & Sons
Ogata, K. (2010). *Modern control engineering* (Vol. 5). Upper Saddle River, NJ: Prentice hall

Recommended

Control Tutorials for Matlab: http://ctms.engin.umich.edu/Atherton, Derek P. Control Engineering - An introduction with the use of Matlab, ISBN 978-87-403-0473-2.

Control bootcamp by Steven Brunton: https://www.youtube.com/watch?v=Pi7l8mMjYVE

Background

Proceedings of the Journal of Systems and Control Engineering: http://pii.sagepub.com/

Module Specification

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Module Summary Information

1	**Module Title**	Body and Chassis Performance
2	**Module Credits**	20
3	**Module Level**	6
4	**Module Code**	ENG6077
5	**Semester Taught**	*2*

6	**Module Overview**

Automobile design is experiencing a period of dynamic change. Alternative power-trains, fuels, materials, safety needs, and consumer demands for increased refinement will have a profound effect upon body architecture. The emphasis for this module will be on gaining insight into auto body structural behaviour and the relationship to the vehicle.

Body structure element behaviour will be examined including thin walled members, panels, joints, spot welds, and local attachments.

Structural models for the primary requirements will be analysed in detail. These include global body bending, body torsion, crash-worthiness, and vibration behaviour.

The importance of bending and torsion stiffness on the perceived level of refinement will be discussed, and tools for analysis will be developed.

The interaction between structural topology and vehicle packaging and styling will be treated, including the need for trade-off analysis in configuration. Methods for selection of alternative body materials will be covered.

7	**Indicative Content**

- Mass balancing of vehicles, vehicle packaging, design of different vehicle structures for requirement
- Stresses and deformation of vehicle body structures and load path analysis, design and analysis of shear panels, buckling of beam structures of thin thickness
- Strengthening and optimisation of vehicle structures, joint design and influence on vehicle stiffness
- Joining techniques of structural vehicle components
- Review mechanics of materials knowledge.
- Customer description and package following template.
- Estimate structure mass and mass distribution.
- Work out handling balance of the proposed vehicle
- Work out vehicle ride dynamics and body modes
- Research common vehicle body structures.

- Interpret customer needs to create a flow down of requirements.
- Mass compounding.
- Package drawing following templates.
- Virtual visit a vehicle body in white manufacturing plant
- Structural load paths in vehicles: Simple Structural Surfaces (SSS) method.
- Make and use 3D physical models to study load paths in vehicles.
- Attempt to apply the SSS method to a vehicle body. Examine published SSS solutions.
- Design of shear panels and frames. Design for bending and torsion.
- Outline alternatives for car data bus networking.
- Investigate buckling phenomena
- Design of beams with thin-walled sections. Section design and sizes.
- Optimise a thin walled beam application for strength and stiffness.
- Identify examples of attachment points at a local vehicle end of life reprocessing centre.
- Local attachment - locate and secure suspension components.
- Virtual test attachment points in tensile test machine.
- Virtual visit a local vehicle end of life reprocessing centre.
- Masterclass on local attachment of suspension.
- Body chassis network architectures and data networking.
- Identify examples of joints
- Joint design - stiffness.
- Build 3D physical model of T joint
- Apply SSS method to T joint.
- Masterclass on joint design.
- Observe test of Ford T joint

8	**Module Learning Outcomes** **On successful completion of the module, students will be able to:**	
	1	Interpret, analyse and evaluate the requirements of the customer with respect to structural needs.
	2	Evaluate and adjust the vehicle mass using mass compounding.
	3	Determine numerical structural requirements.
	4	Apply first order models to size a body structure for a specific vehicle to check body bending, torsion, crash-worthiness, and thin-wall section sizing.

9	**Module Assessment**		
Learning Outcome			
	Coursework	**Exam**	**In-Person**
1-4	**20%**	**80%**	

10	Breakdown Learning and Teaching Activities	
Learning Activities	**Hours**	**Details of Duration, Frequency and other comments**
Scheduled Learning (SL) includes lectures, practical classes and workshops as specified in timetable	**48**	*2hr lecture x12* *2hr tutorial/lab x12*
Directed Learning (DL) includes placements, work-based learning, peer group learning external visits, on-line activity, Graduate+, peer learning, as directed on VLE	**32**	*Grad+, on-line activity as directed on Moodle*
Private Study (PS) includes preparation for exams	**120**	*Completion of class activity, further reading and assessment*
Total Study Hours:	**200**	

11	Key Texts and Online Learning Resources

Purchase

Fundamentals of automobile body structure design, Malen, Donald E, SAE Publications.

Essential (Books/Journals/Specific chapters/Journal Articles)

Race car design, Seward, Derek

Motor vehicle structures: concepts and fundamentals, Brown, Jason C; Serpento, Stan T; Robertson, A. John.

Vehicle dynamics, Simone Mola, GM College 1969.

Recommended

H-Point: the fundamentals of car design & packaging, Macey, Stuart, Wardle, Geoff

Background

Vehicle multiplex communication: serial data networking applied to vehicular engineering, Lupini, Christopher Albert

Module Specification

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Module Summary Information

1	**Module Title**	Thermodynamics and Energy Systems
2	**Module Credits**	20
3	**Module Level**	6
4	**Module Code**	ENG6079
5	**Semester Taught**	*2*

6	**Module Overview**

The dependency of the current economy of fossil fuels as source of power requires a shift in thinking by engineers and companies to design and develop more efficient machines, processes and systems. The module therefore aims to provide you with the knowledge and understanding required to analyse thermodynamic systems concerned with conversion processes between heat and work. In addition the issues and limitations of the energy generation process play also a vital part and how energy can be recovered from processes to improve the overall efficiency.

The module follows the Mechanical Engineering programme philosophy of developing your intellectual and practical competence in the thermodynamic, power generation and energy conversion aspects of mechanical engineering. Formal lectures, tutorials, hands-on experience in labs and solving of problem based scenarios will enhance the learning process.

7	**Indicative Content**

Heat Engines and Heat Pumps
Use of thermodynamics tables and charts, refrigeration cycles and advanced vapour cycle, Rankine with re-heating, means of increasing cycle efficiency, efficiencies and power requirements

Turbines
Combined gas-vapour cycles and momentum equation for steady flow, water turbines and momentum equation for steady flow, energy conversion in gas turbines, gas power cycles (open and closed systems), cycles with inter-cooling and reheating

Compressors
energy conversion in compressors, types and performance characteristics of positive displacement compressors

Air Conditioning
Air conditioning systems, psychrometric terms and chart, typical air conditioning plant

8	Module Learning Outcomes On successful completion of the module, students will be able to:	
	1	Critically evaluate the performance and efficiency of thermodynamic systems and the sustainability principles in energy generation and conversion processes.
	2	Synthesise solutions to engineering problems involving basic thermodynamics and fluid mechanics.
	3	Appraise the assumptions and limitations inherent in the application of thermodynamic system calculations.

9	Module Assessment		
Learning Outcome			
	Coursework	**Exam**	**In-Person**
1-3	**30%**	**70%**	

10	Breakdown Learning and Teaching Activities		
Learning Activities		**Hours**	**Details of Duration, Frequency and other comments**
Scheduled Learning (SL) includes lectures, practical classes and workshops as specified in timetable		**48**	*2hr lecture x12* *2hr tutorial/lab x12*
Directed Learning (DL) includes placements, work-based learning, peer group learning external visits, on-line activity, Graduate+, peer learning, as directed on VLE		**32**	*Grad+, on-line activity as directed on Moodle*
Private Study (PS) includes preparation for exams		**120**	*Completion of class activity, further reading and assessment*
Total Study Hours:		**200**	

11	Key Texts and Online Learning Resources

Purchase

None.

Essential (Books/Journals/Specific chapters/Journal Articles)

Moran, M. J., Shapiro, H. N., Munson, B. R., & DeWitt, D. P. (2003). Introduction to thermal systems engineering: Thermodynamics, Fluid Mechanics, and Heat Transfer, John Wiley & Sons, ISBN-13: 978-0471204909.

Sonntag R.E. and Borgnakke C. (2007) Introduction to Engineering Thermodynamics, John Wiley, ISBN 0 471 73759 3.

Eastop T.D. and McConkey A. (1993) Applied Thermodynamics for Engineering and Technologists, Longmans, ISBN 0 582 44429 2.

Gengel Y.A. and Boles M.A. (2007) Thermodynamics; An Engineering Approach, McGraw Hill, ISBN 978 007 125771 8.

El-Wakil M.M. (1985) Power-Plant Technology, McGraw-Hill, ISBN 0 070 19288X.

Hodge B.K. (1985) Analysis and Design of Energy Systems, Prentice-Hall, ISBN 0 130 328146.

Long C, A. (1999) Essential Heat Transfer, Longman, ISBN 0 582 29279 4.

Recommended

None.

Background

None.

Module Specification

Return to Module List

Module Summary Information

1	**Module Title**	Advanced Mechanics
2	**Module Credits**	20
3	**Module Level**	6
4	**Module Code**	ENG6084
5	**Semester Taught**	*2*

6	**Module Overview**

Mechanical engineers solve problems of high and multidisciplinary complexity. Although computational solutions generally lead to reliable results, the engineer should always attempt to validate the findings by alternative methods. This requires a thorough understanding of the underlying problems, but also the approach of reasonable simplification of complex systems without compromising validity.

You will gain a sound understanding of analytical stress analysis to be able to employ alternative methods and assess numerical predictions.

Learning activities will be predominantly delivered through lectures and tutorials, where practice-based problems will be addressed. Laboratories will be used where appropriate to support the understanding of the subject and to strengthen the learning.

7	**Indicative Content**

- Deflection of structurally determinate and indeterminate members using Castigliano's Theorem, Unit Load method and Macaulay's Method
- Shear stress distribution in cross-sections due to bending
- Bending and Torsion of flexural members of non-symmetrical cross-sections
- Plastic deformation of beams with symmetric and non-symmetric cross-sections
- Stresses and strains in thick walled and compound cylinders under constant pressure loading
- Stress, strain and interference calculations for rotating discs
- Stresses and strains in axisymmetric plates in bending

8	**Module Learning Outcomes** **On successful completion of the module, you will be able to:**	
	1	Determine and analyse stresses and deformations in complex engineering components.
	2	Specify and apply appropriate stress analysis techniques in failure analysis to ensure safe design using a risk management approach to identify, evaluate and mitigate risks.

9	Module Assessment		
Learning Outcome			
	Coursework	**Exam**	**In-Person**
1-2	**30%**	**70%**	

10	Breakdown Learning and Teaching Activities		
Learning Activities		**Hours**	**Details of Duration, Frequency and other comments**
Scheduled Learning (SL) includes lectures, practical classes and workshops as specified in timetable		**48**	*2hr lecture x12* *2hr tutorial/lab x12*
Directed Learning (DL) includes placements, work-based learning, peer group learning external visits, on-line activity, Graduate+, peer learning, as directed on VLE		**32**	*Grad+, on-line activity as directed on Moodle*
Private Study (PS) includes preparation for exams		**120**	*Completion of class activity, further reading and assessment*
Total Study Hours:		**200**	

11	Key Texts and Online Learning Resources

Purchase

Clifford, M., & Brooks, R. (2010). An introduction to mechanical engineering. London: Hodder Education.

Essential (Books/Journals/Specific chapters/Journal Articles)

Hearn, E. J., (1997). Mechanics of materials: An introduction to the mechanics of elastic and plastic deformation of solids and structural materials (3rd ed.). Oxford; Boston; Butterworth-Heinemann.

Hannah, J., & Hillier, M. J. (1999). Mechanical engineering science (3rd ed.). Harlow: Longman.

Recommended

n/a

Background

https://www.theengineer.co.uk/
http://www.theiet.org/resources/journals/joe/
http://www.journals.elsevier.com/international-journal-of-engineering-science
http://www.sciencedirect.com/

Module Specification

Module Summary Information

Return to Module List

1	**Module Title**	Analogue Electronic Circuits
2	**Module Credits**	20
3	**Module Level**	6
4	**Module Code**	ENG6206
5	**Semester Taught**	2

6	**Module Overview**

This module introduces the principles of high frequency electronics and familiarises you with the theory and application of analogue building blocks for high-frequency applications.

It will enable you to gain an in-depth understanding of power electronic devices and analysing power electronic circuits.

7	**Indicative Content**

Electronic Circuits:

Small signal analysis and Two Port parameters, Frequency response, High frequency performance and the Miller Effect.
Amplifier Configurations: Tuned and Power Amplifier.

Oscillators Circuits and Frequency Synthesis.

Active Filters circuit configurations.

Basic RF and HF circuit techniques and applications.

Power Electronics:

Power electronics systems, Power semiconductor devices- diodes, bipolar junction transistors, Metal-Oxide-Semiconductor devices, their drive circuits and snubber circuits for switching devices.

The analysis and design of Linear and Switched-mode Power Electronic systems. Industrial Electronics applications.

8	**Module Learning Outcomes** **On successful completion of the module, you will be able to:**	
	1	Apply and critically evaluate parameters and techniques used in electronic communications circuits and systems.
	2	Critically analyse and synthesise communications circuits and describe their characteristics.

	3	Critically select, apply and evaluate device operations and circuit concepts in power electronics.
	4	Critically analyse and design different linear and switched mode power electronic systems, with a consideration of sustainable energy usage.

9	**Module Assessment**		
Learning Outcome Number *(from table 8)*	**Coursework**	**Exam**	**In-Person**
1-4	**X 30%**	**X 70%**	

10	**Breakdown Learning and Teaching Activities**	
Learning Activities	**Hours**	**Details of Duration, Frequency and other comments**
Scheduled Learning (SL) includes lectures, practical classes and workshops as specified in timetable	48	2hr Lecture x 12 2hr Tutorial/Lab x 12
Directed Learning (DL) includes placements, work-based learning, peer group learning external visits, on-line activity, Graduate+, peer learning, as directed on VLE	0	*N/A*
Private Study (PS) includes preparation for exams	152	Self-study, including the preparation of exams and other tests.
Total Study Hours:	200	

11	**Key Texts and Online Learning Resources**

Purchase

None.

Essential (Books/Journals/Specific chapters/Journal Articles)

Rashid, M, H., (2013), *Power Electronics: Devices, Circuits, and Applications*. 4th edn. Pearson. V. R.

Malvino, AP and Bates, D.J, (2015), *Electronic Principles with Simulation* CD, 8th Ed, McGraw-Hill Higher Education.

Moorthi, V, R., (2005), *Power Electronics: Devices, Circuits and Industrial Applications*. Oxford University Press.

Coleman, C, (2004) *An Introduction to Radio Frequency Engineering*, Cambridge University Press.

Recommended

Rizzoni, G and Kearns, J.A., (2015), *Principles and Applications of Electrical Engineering*. 6th edn. McGraw-Hill Education.

Background

IET Power Electronics: http://digital-library.theiet.org/content/journals/iet-pel