College of Engineering

Academic Year 2023/24 - Semester 1

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
ENG4091	Engineering Principles 1	4	20	10
ENG4093	Engineering Practice	4	20	10
ENG4124	Mathematical Modelling 1	4	20	10
ENG5092	Analogue and Digital Electronics	5	20	10
ENG5093	Mathematics for Signals and Systems	5	20	10
ENG5094	Engineering Electronic Systems	5	20	10
ENG5098	Thermodynamics and Fluid Mechanics	5	20	10
ENG5099	Numerical Analysis	5	20	10
ENG5100	Design and Materials	5	20	10
ENG5103	Operations Systems	5	20	10
ENG5104	Quality Systems	5	20	10
ENG6066	Digital Filters and Spectral Analysis	6	20	10
ENG6067	Embedded Systems and Control	6	20	10
ENG6071	Operations Management	6	20	10
ENG6072	Advanced Materials	6	20	10
ENG6074	Dynamics and Control	6	20	10
ENG6075	Computer Aided Engineering	6	20	10
ENG6078	Powertrain and Hybrid Vehicles	6	20	10

Module Specification

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Module Summary Information

1	**Module Title**	Engineering Principles 1
2	**Module Credits**	20
3	**Module Level**	4
4	**Module Code**	ENG4091
5	**Semester Taught**	1

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 next module in the theme, Engineering Principles 2, and then on to the second year of a 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 of mechanical science and electrical science.

This module will interact with modules in the other two themes in the common first year, relying 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
Units, Concepts of Scalars and Vectors Forces, Newton's Laws, Equilibrium, Equations of Linear Motion, Circular Motion, Friction, Direct and Shear Stresses, Strains, Hooke's Law, Poisson's Ratio, Thermal Stress and Strain, Compound bars

Introduction to Materials
Materials under Stress, Tensile Testing, Elasticity and Plasticity, Ductile and Brittle Materials,

Introduction to Work and Heat Transfer
Mechanical Work, Energy and Momentum, Conservation of Energy, Heat transfer principles, Simple Heat Exchangers

Introduction to Electrics and Electronics
Electrical SI Units, Bohr's Atom, Electrons, Charge Voltage, Current and Resistance
DC Circuits, Ohm's Law and Resistor Networks (Series and Parallel), Electric Power and Kirchhoff's Law, Network Analysis, Mesh and Branch Current
AC Circuits, Periodic AC Signals, Electromagnetics, Capacitors, Inductors, Behaviour and Characteristics of Resistors, Inductors and Capacitors with AC Source, Phase and Magnitude Response for Simple Electronic Circuits

8	Module Learning Outcomes On successful completion of the module, students will be able to:	
	1	Analyse pin-jointed frames and static analysis of beams.
	2	Apply Energy conservation and friction principles to solve problems in engineering applications.
	3	Employ network analysis on AC and DC passive circuits.
	4	Analyse the behaviour and properties of DC transient response circuits.
	5	Plan and complete a range of practical labs and activities. Analyse and record data in an appropriate manner.

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

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.

Module Specification

Return to Module List

Module Summary Information

1	**Module Title**	Engineering Practice
2	**Module Credits**	20
3	**Module Level**	4
4	**Module Code**	ENG4093
5	**Semester Taught**	1

6	**Module Overview**

The module aims to provide the professional skills needed to enable you to progress to the next stage of the practical theme, onto your next module, Integrated Engineering Project, then into the second year of an engineering degree.

The subject material will be delivered in two core streams: a PC-based stream, which will include the use of software to support project planning, communication and analysis, and a project-space stream, where you can integrate learning from across all elements of the semester.

You will develop practical professional engineering skills; including skills 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 the knowledge of mathematical techniques, and the theoretical underpinning of the engineering principles, design and professional skills.

7	**Indicative Content**

Professional Skills

Health and safety, introduction to engineering project (CDIO), introduction to graphical representation techniques, project planning, research tools, writing of technical reports and referencing, presentation skills and preparation, mathematical modelling tools, developing CVs, job and internship applications.

8	**Module Learning Outcomes** **On successful completion of the module, you will be able to:**	
	1	Understand the basic CDIO process.
	2	Work collaboratively in teams with individual accountability to successfully complete projects.
	3	Record and critically reflect on the learning undertaken as an individual, and on the work undertaken as a team.

9	Module Assessment		
Learning Outcome Number *(from table 8)*	**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		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

Return to Module List

Module Summary Information

1	**Module Title**	Mathematical Modelling 1
2	**Module Credits**	20
3	**Module Level**	4
4	**Module Code**	ENG4124
5	**Semester Taught**	1

6	**Module Overview**

Mathematics plays a key role in establishing and grounding the skills of an engineer, and the ability to communicate the ideas of engineering that are expected of an engineering graduates.

The primary aim of this module is to provide the fundamental mathematical knowledge and techniques needed in order to enable you to use and apply such mathematical techniques for the evaluation, analysis, modelling and solution of realistic engineering problems. Application of these data sets has to include their interpretation both to and from the mathematical language. In addition, this module will introduce students to mathematical modelling software package. This will be used to plot, annotate basic signals and write simple programs to compute mathematical problems.

This module will develop your ability to both work on and communicate engineering realities to a wider audience, at a professional standard.

7	**Indicative Content**

This module covers:
Differentiation, Maxima and minima, Curve fitting, Statistics and probability, Normal and Poisson distribution, Integration, Vectors and complex numbers.
Algebra in MATLAB, Basics in programming, Vectors and matrices, plotting and graphics

8		**Module Learning Outcomes** **On successful completion of the module, students will be able to:**
	1	Employ statistical techniques to formulate solutions to engineering problems
	2	Apply integration and differentiation techniques to compute the characteristics of signals
	3	Discuss and apply complex numbers to solve engineering problems
	4	Recall techniques used to compute solutions using mathematical modelling software package.

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)

- Bird, J, O. (2010) *Higher Engineering Mathematics*; 6th ed., Oxford: Newnes.
- James, G. (2010) Modern engineering mathematics; 4th ed., Harlow: Prentice Hall
- Stroud, K. A. (2007) *Engineering mathematics*. 6th ed., Basingstoke: Palgrave Macmillan
- Cross, N. (2008) *Engineering design methods: Strategies for product design*. 4th edn. Chichester, United Kingdom: Wiley-Blackwell (an imprint of John Wiley & Sons Ltd).
- Fox, M. (2015) *MATLAB: For starters*. United States: Createspace Independent Publishing Platform.
- Hunt, B. R., Lipsman, R. L., Rosenberg, J. M. and Park (2014) *A guide to MATLAB: For beginners and experienced users: Updated for MATLAB 8 and Simulink 8*. 3rd edn. Cambridge, United Kingdom: Cambridge University Press.

Recommended

Alam, S. N. (2013) *Understanding Matlab: A textbook for beginners*. India: I K International Publishing House Pvt.

Assistant Professor of Philosophy David Palmer (2016) *MATLAB for beginners*. United States: Createspace Independent Publishing Platform.

Bryan, G. (2016) *MATLAB essentials*. United States: Createspace Independent Publishing Platform.

Cross, N. (2008) *Engineering design methods: Strategies for product design*. 4th edn. Chichester, United Kingdom: Wiley-Blackwell (an imprint of John Wiley & Sons Ltd).

Dym, C. L., Little, P., Orwin, E. J. and Spjut, E. R. (2008) *Engineering design: A project-based introduction*. 3rd edn. Chichester, United Kingdom: Wiley, John & Sons.

Hunt, B. R., Lipsman, R. L., Rosenberg, J. M. and Park (2014) *A guide to MATLAB: For beginners and experienced users: Updated for MATLAB 8 and Simulink 8*. 3rd edn. Cambridge, United Kingdom: Cambridge University Press.

Parker, D. (2015) *MATLAB for beginners*. United States: Createspace Independent Publishing Platform.

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

Module Summary Information

Return to Module List

1	**Module Title**	Analogue and Digital Electronics
2	**Module Credits**	20
3	**Module Level**	5
4	**Module Code**	ENG5092
5	**Semester Taught**	1

6	**Module Overview**

This module introduces you to the fundamentals of analogue and digital electronics using a circuit approach.

It has been designed to give you a usable level of electronics theory to demonstrate key concepts.

7	**Indicative Content**

Digital Circuit Design:
Combinational and Sequential logic design Combinational, asynchronous and synchronous design; sequential and non-sequential counters; sequence detectors.

Specification and modelling: Mealy and Moore models, finite state machines (FSMs); algorithmic state machine (ASM) notation and use in the specification and design of sequential circuits.

Analogue Circuit Design:
Amplifier Circuits: Amplification: amplifier's gain and frequency response. Design and analytical analysis of single and multi-stage amplifiers. Small signal amplifier configurations, Output Circuits, Buffer circuits, Darlington pair. Op-Amp Modelling of non-ideal properties. Difference amplifier, Comparators. Difference

Filter Design: Passive Filters; Specification of filters, and implementation using operational amplifiers. Design of Sallen-Key, multiple feedback filters.

8	**Module Learning Outcomes** **On successful completion of the module, you will be able to:**	
	1	Evaluate the operation of components and subsystems as applied to the amplification and processing of analogue signals.
	2	Apply basic concepts to evaluate the design and operation of electrical filter circuits.
	3	Design and create combinational and sequential logic circuits using standard gates and flip-flops.
	4	Recognise, interpret and differentiate between Mealy and Moore finite state machines.

9	Module Assessment		
Learning Outcome			
	Coursework	**Exam**	**In-Person**
1-4	**40%**		
1-4		**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 x 8 and 4*2hr Lab
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)

Storey, N., (2013), *Electronics: A Systems Approach*, 5th Ed, Pearson.

Malvino, AP and Bates, D.J, (2006), *Electronic Principles with Simulation* CD, 8th Ed, McGraw-Hill Higher Education.

Boylestad, R.L and Nashelsky, L (2008), *Electronic Devices and Circuit Theory: International Edition*, 10thEd, Prentice Hall.

Floyd, T.L (2008), *Digital Fundamentals*, 10th Ed., Prentice Hall.

Tocci, R.J, Widner, N.S. and Moss, *G Digital Systems: Principles and Applications*, 11thEd. Prentice Hall.

Recommended

Bell, D.A, (2007), *Fundamentals of Electronic Devices and Circuits*, 5th Ed, Oxford University.

Floyd, T.L (2011), *Electronics Devices (Conventional Current Version)*, 11thEd. Prentice Hall.

Reid,K and Dueck,R (2008), *Introduction to Digital Electronics*, Delmar- Cengage Learning.

Background

IET Digital Library: *IET Circuits, Device & Systems*: http://digital-library.theiet.org/content/journals/iet-cds

Module Specification

Return to Module List

Module Summary Information

1	**Module Title**	Mathematics for Signals and Systems
2	**Module Credits**	20
3	**Module Level**	5
4	**Module Code**	ENG5093
5	**Semester Taught**	1

6	**Module Overview**

This module introduces the concepts and techniques for describing and analysing continuous time signals and systems. It also introduces the fundamentals of feedback control systems, covering techniques for the analysis and design of such systems.

Information is the basic thread of life and signals are the medium by which information is passed. This module will focus on the classification and mathematical modelling of signals and systems in the context of Electrical and Biomedical Engineering.

You will be introduced to analytical techniques to transform signals from time to frequency domain and vice versa, while mathematical techniques will be used and contextualised for actual system hardware.

At the end of this module, you will be able to determine a systems response and their applications in Electricals and Biomedical Engineering.

7	**Indicative Content**

On successfully completing the module, you will be able to:

- Demonstrate the basic techniques used to describe continuous time signals and systems.
- Demonstrate familiarity with time and frequency domain representation and description of signals and systems.
- Demonstrate an understanding of basic transform techniques used to convert between time and frequency domain descriptions of signals and systems.
- Demonstrate the application of Fourier and Laplace Transform techniques for analysing the behaviour of signals and systems.
- Describe and evaluate the fundamental limitations on the performance of communication systems by applying quantitative metrics for communications, Shannon's capacity theorem and bandwidth efficiency.
- Calculate the theoretical capacity of a channel as a function of bandwidth and Signal-to-Noise Ratio.
- Outline the practical challenges associated with different modulation methods.
- Apply engineering trade-offs in using different modulation techniques and be able to select appropriate techniques for different applications.
- Demonstrate an ability to use MATLAB as a tool for analysing the behaviour of continuous time signals and systems.

8	Module Learning Outcomes On successful completion of the module, you will be able to:	
	1	Describe mathematical principles and theorems for signal processing and linear systems.
	2	Apply theoretical models of mathematical representation for frequency-domain analysis of continuous-time signals
	3	Apply transform techniques to describe and analyse the behaviour of signals and continuous-time linear systems.
	4	Demonstrate an ability to use software as a tool for analysing the behaviour of continuous-time signals and systems.

9	Module Assessment		
Learning Outcome Number *(from table 8)*	**Coursework**	**Exam**	**In-Person**
1- 4	**40%**	**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)**	

- Stroud, K. A. (2020) Advanced Engineering Mathematics. 6th edition. Basingstoke: Palgrave Macmillan
- Alkin, O. (2014) Signals and Systems: A MATLAB Integrated Approach. Bosa Roca: CRC Press.

Recommended

- Stroud, K. A., and Dexter J. Booth. Engineering Mathematics. Eighth edition. London, England: Macmillan international, 2020. Print.
- Oppenheim, A.V. and Willsky, A.S. (2014) Signals and Systems, second edition. Pearson Recommended
- Croft, A. and Davison, R. (2008) Mathematics for Engineers. 3rd edn. Harlow: Pearson Prentice Hall.
- Smith, S. (2003) Digital Signal Processing: a practical guide for engineers and scientists. London: Newnes.

E-books and online resources

- ENG5093 BCU Library Reading List.
  Reading lists can be access through https://www.bcu.ac.uk/library
- Full online book Digital Signal Processing: a practical guide for engineers and scientist
- MATLAB online https://matlab.mathworks.com/

Module Specification

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Module Summary Information

1	**Module Title**	Engineering Electronic Systems
2	**Module Credits**	20
3	**Module Level**	5
4	**Module Code**	ENG5094
5	**Semester Taught**	1

6	**Module Overview**

This module provides you with introductory knowledge and practical experience in engineering electronic systems.

The module covers various aspects of embedded systems, which involve the fusion of hardware and firmware and encompass multiple fields of electronic engineering.

On the software side, you will be introduced to the fundamentals of the C programming language for engineers, focusing on variables, constants, input and output operations, operators, expressions, conditional structures, control structures, functions, arrays, strings, and pointers.

On the hardware side, you will work with different types of microcontrollers, sensors, and actuators through laboratory activities.

Additionally, the module will introduce the concept of Internet of Things (IoT) systems and their technologies, equipping you with the necessary knowledge and hands-on skills to design and build IoT-based smart systems for various applications including healthcare monitoring, environmental monitoring, smart home, smart transportation, smart agriculture, and smart city. Throughout the module, you will engage in practical experiments and projects to reinforce your understanding and develop your problem-solving abilities in the field of engineering electronic systems.

7	**Indicative Content**

Architecture of microprocessor/microcontroller, introduction to C programming language and Integrated Development Environment (IDE) environment.

Voltage, current and resistance measurements using meters and oscilloscopes.

Microcontrollers, sensors, actuators, and Integrated Circuits (ICs) selection.

Smart systems design, development, prototyping and analysis.

Internet of Things applications, automation, monitoring, and control.

8	Module Learning Outcomes On successful completion of the module, you will be able to:	
	1	Demonstrate proficiency in an appropriate programming language for engineering applications.
	2	Apply the principles of embedded systems to solve complex engineering problems, considering the fusion between hardware and firmware.
	3.	Design and develop IoT-based smart systems prototypes for monitoring, controlling and/or automating various electronics and biomedical applications.
	4.	Develop practical expertise through hands-on activities involving various microcontrollers, sensors, actuators and relevant software tools.

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

- Paul Deitel, Harvey M. Deitel, C How to Program With Case Studies Introducing Applications

and Systems Programming, 9th Edition, Pearson Education, 2022.

Recommended

- Behrouz A. Forouzan, Richard F. Gilberg, Computer Science A Structured Programming Approach Using C, 3rd Edition, Cengage, 2018
- Shibu Kizhakke Vallathai, Introduction To Embedded Systems, 2nd Ed, McGraw Hill Education, 2017.
- Rajesh Singh, Anita Gehlot, Lovi Raj Gupta, Bhupendra Singh, and Mahendra Swain, Internet Of Things With Raspberry Pi And Arduino, 1st Edition, CRC Press, 2020
- Abhik Chaudhuri, Internet of Things, for Things, and by Things, 1st Edition, CRC Press, 2019.

Background

None

Module Specification

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Module Summary Information

1	**Module Title**	Thermodynamics and Fluid Mechanics
2	**Module Credits**	20
3	**Module Level**	5
4	**Module Code**	ENG5098
5	**Semester Taught**	1

6	**Module Overview**

The module aims to provide a basic understanding of thermodynamic and fluid mechanic concepts. The understanding of the transfer of energy within thermodynamic systems and the incurred losses is vital to improve efficiencies of such systems, especially in light of growing environmental concerns and increased economic cost.

The knowledge and understanding will be gained through a balanced mixture of lectures and tutorials, whereby the learning will be supported by experiments.

7	**Indicative Content**

Introduction to Thermodynamic
Concepts and definitions, open and closed systems, state, process, properties, phases, units, 1st law of thermodynamic, energy conservation, enthalpy, 2nd law of thermodynamics, pure substance with / without phase change, ideal gases, specific heats, internal energy, enthalpy, entropy, process of ideal gases, gas laws

Heat Engines and Heat Pumps
heat engine concept, thermodynamic cycles for power and refrigeration (Carnot cycle), COP, thermodynamic cycles and processes, poly-tropic relations, adiabatic / reversible processes, efficiencies, air standard cycles (Carnot, Otto, Diesel, Dual), thermodynamic properties and diagrams. use of thermodynamic properties of fluid tables

Fluid Mechanics
flow energy, non-flow energy equation & steady flow energy equation, fluid motion and momentum, continuity and Bernoulli equation, fluid parameters and flow conditions, laminar and turbulent flow, flow in pipes, friction factors, head loss, pressure and temperature measurement

Heat Transfer
Heat transfer and heat exchangers

8	Module Learning Outcomes On successful completion of the module, students will be able to:	
	1	Calculate thermal properties and energy transfers for non-flow and steady flow processes.
	2	Apply the basic laws of thermodynamics to solve engineering problems involving energy conservation and heat transfer.
	3	Use laboratory instrumentation to measure characteristics of basic thermal systems.
	4	Understand the basic ideal cycles and the performance criteria for engines.

9	Module Assessment			
Learning Outcome				
	Coursework		Exam	In-Person
1-4			60%	
1-4	40%			

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

Michael J. Moran (Author), Howard N. Shapiro (Author) (2003) *Introduction to Thermal Systems Engineering: Thermodynamics, Fluid Mechanics and Heat Transfer Hardcover*, ISBN-13: 978-0471204909.

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

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.

Recommended

None

Background

None

Module Specification

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Module Summary Information

1	**Module Title**	Numerical Analysis
2	**Module Credits**	20
3	**Module Level**	5
4	**Module Code**	ENG5099
5	**Semester Taught**	1

6	**Module Overview**

The module introduces the mathematical concepts such as transform calculus and matrix theory used to solve systems of first and second order differential equations underpinning the engineering disciplines undertaken within the Faculty.

This provides you with the capability of modelling systems using both the transfer function and state-space paradigms. In particular, you will be able to model linear systems in continuous and discrete time as well as by frequency response methods.

Teaching and assessment will comprise not only traditional lectures and tutorials but also provide training in industry standard software for problem solving within coursework assessment.

7	**Indicative Content**

Introduction to numerical analysis for data analysis, the solution of simultaneous equations, differentiation and integration. We will apply numerical analysis to some real engineering problems such as vibration, thermal heat flow and data.

The application of matrices to least squares fitting of experimental data.

The use of the Trapezoidal method and Simpson rule for numerical integration.

The use of Euler method to solve linear differential equations.

The use of matrices to solve differential equations.

The Eigenvalue problem in vibration.

8	**Module Learning Outcomes** **On successful completion of the module, students will be able to:**	
	1	Analyse experimental data and identify underlying equations.
	2	Solve integration problems using Trapezoidal and Simpson's methods.
	3	Use matrices to solve vibration and heat flow engineering problems.
	4	Use Euler's method to solve linear differential equations found in engineering.

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
Stroud, K.A. Booth Dexter J. (2013), Engineering Mathematics, 7th edition Engineering

Essential (Books/Journals/Specific chapters/Journal Articles)
Atherton, D. P. (2009) Control Engineering - An introduction with the use of Matlab, ISBN: 978-87-403-0473-2

Recommended
Control Tutorials for Matlab: http://ctms.engin.umich.edu/

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

Module Specification

Return to Module List

Module Summary Information

1	**Module Title**	Design and Materials
2	**Module Credits**	20
3	**Module Level**	5
4	**Module Code**	ENG5100
5	**Semester Taught**	1

6	**Module Overview**

The module provides you with the opportunity to learn about design, sustainable development, teamwork and communication whilst contributing towards industry relevant projects.

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.

It is anticipated that the project vehicle for this module will be the Engineers without Borders Design for People Challenge.

7	**Indicative Content**

Materials

Metals: Stiffness and weight: Crystal structures. Density calcs, Ductile and brittle failure modes, Metals: Solidification mechanism. Effect of grain size, Metals: Alloying. Equilibrium, Metals: Non-equilibrium Steels, Heat treatment, Polymers: Classification and Structures, Polymers: Adhesives, Ceramics: Industrial ceramics and ceramic coatings, Composites: Basic theory, use of simple simulation, Corrosion resistant materials, Light-weight materials for engineering applications, High-temperature materials for engineering applications.

Design

Introduction to engineering project (CDIO) project management, design specification.
CAD skills: Surface modelling, sweeping techniques, lofting, blending components together, creating and manipulating large assemblies

8	Module Learning Outcomes On successful completion of the module, you will be able to:	
	1	Apply CAD to the production of complex parts
	2	Communicate innovative design solutions to technical and non-technical audiences.
	3	Interpret and analyse practical test results and use to predict material behaviour.
	4	Appraise the contexts in which engineering knowledge can be applied and hence demonstrate the ability to work with technical uncertainty.

9	Module Assessment		
Learning Outcome Number *(from table 8)*	**Coursework 60%**		**In-Person Presentation 40%**
1			**X**
2			**X**
3	**X**		
4	**X**		**X**

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*	2hr lecture x12 Design 2hr lecture x12 Materials Lab 2hr lecture x12 Materials Workshop
Directed Learning (DL) includes placements, work-based learning, peer group learning external visits, on-line activity, Graduate+, peer learning, as directed on VLE		*0*	
Private Study (PS) includes preparation for exams		*128*	CAD skills development Granta EduPack materials selection software
Total Study Hours:		*200*	

11	Key Texts and Online Learning Resources

Cozens, R. and Rethwisch, D. (2013) CATIA V5 Workbook Release V5-6R2013, SDC Publications

Callister, W. (2014) Materials Science and Engineering. John Wiley & Sons.

Ashby, M. (2015) Materials and Sustainable Development, Butterworth-Heinemann.

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

Module Specification

Return to Module List

Module Summary Information

1	**Module Title**	Operations Systems
2	**Module Credits**	20
3	**Module Level**	5
4	**Module Code**	ENG5103
5	**Semester Taught**	1

6	**Module Overview**
This module provides you with an understanding of the analysis, design and planning of manufacturing and other operating systems, and also an opportunity to investigate and select alternative strategies for the planning, scheduling and control of manufacturing and other operating systems. The module also covers the quality systems, tools and techniques available to an organisation.	

7	**Indicative Content**
Capacity Management; Linear programming (LP) Method; Inventory Control & Cost Optimisation; Advanced Cost Modelling in Inventory Analysis; Pareto Analysis; Forecasting models and techniques, errors; Generation Of Aggregate Plans; Master Production Schedule(MPS); Material Requirements Planning; Critical Path (CPA) Network Construction and Analysis, Bar Charts; Multiple Time Estates & Resource Smoothing	

8	**Module Learning Outcomes** **On successful completion of the module, students will be able to:**	
	1	Evaluate Capacity, Work Management and Analysis within a range of sectors including manufacturing and service industry.
	2	Apply the knowledge of organisational operations to the solution of problems relating to Planning, Scheduling and Control within an operations system.
	3	Analyse the operations within an organisation for the effective management of work flow through the transformation from raw material and components to finished product.
	4	Evaluate project planning techniques across a broad range of sectors including manufacturing and the service industry.

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**	*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)

Chase R, Aquilano N & Jacobs F, *Operations Management for competitive advantage*, McGraw-Hill/Irwin 2006. Shelf Mark: 658.5/Cha.

Recommended

Heizer J, *Operations Management*, Prentice Hall 2008. Shelf Mark: 658.5/Hei.

Wild R, *Operations Management*, Continuum 2002. Shelf Mark: 658.5/Wil.

Waters C D, *Operations Management*, Financial Times Prentice Hall 2002. Shelf Mark: 658.5/Wat.

Background

None.

Module Specification

Return to Module List

Module Summary Information

1	**Module Title**	Quality Systems
2	**Module Credits**	20
3	**Module Level**	5
4	**Module Code**	ENG5104

5	**Module Overview**
This module aims to provide you with an understanding of the tools and techniques used in quality systems. Topics include Process Improvement, Process Capability, Improvement Techniques, Quality by Design, Mapping Techniques, Quality Costs, TQM and Standards (ISO 9000 etc).	

6	**Indicative Content**
Process Improvement - kaizan, 5S, value analysis; Process Improvement - OEE, FMEA, Poke-Yoke; Process Improvement - Process Capability, Business Process improvement; Improvement Techniques - quality circles, Gemba Gembutsu (5 Why); Improvement Techniques - the Severn Wastes (Muda), Balance Scorecard, Six Sigma; Quality by Design - Design of Experiments, Ishikawa' diagrams, Control Charts and Graphs (SPC); Quality by Design - Statistical Tolerancing, Quality Function Deployment; Mapping Techniques; Quality Costs; TQM; Standards (ISO9000, etc.); Acceptance Sampling.	

7	**Module Learning Outcomes** **On successful completion of the module, students will be able to:**	
	1	Evaluate the appropriate tools which would be deployed to improve business and process efficiency.
	2	Apply appropriate statistical techniques to the assessment of typical quality issues.
	3	Appraise how standards are developed and used.
	4	Assess the importance of quality management systems within a business.

8	**Module Assessment**		
Learning Outcome			
	Coursework	**Exam**	**In-Person**
1,3			**X**
2,4	**X**		

9	Breakdown Learning and Teaching Activities
Learning Activities	**Hours**
Scheduled Learning (SL) includes lectures, practical classes and workshops, peer group learning, Graduate+, as specified in timetable	48
Directed Learning (DL) includes placements, work-based learning, external visits, on-line activity, Graduate+, peer learning, as directed on VLE	32
Private Study (PS) includes preparation for exams	120
Total Study Hours:	200

Module Specification

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Module Summary Information

1	**Module Title**	Digital Filters and Spectral Analysis
2	**Module Credits**	20
3	**Module Level**	6
4	**Module Code**	ENG6066
5	**Semester Taught**	1

6	**Module Overview**

Digital filters have numerous advantages compared to analogue filters. These filters are implemented using hardware and firmware, compared to analogue filters which are implemented solely on hardware.

Successful completion of this module will allow you to be able to analyse the magnitude and phase responses of filters. Whilst this module is rich in analytical techniques and concepts, it will be always contextualised for practical hardware examples.

7	**Indicative Content**

Digital signal processing and basics concepts
Digital signal processing systems
Digital signal representation
Signal sampling and reconstruction theory, quantisation error and noise, encoding

Linear and discrete linear system
Analysis of discrete-time signals and discrete-time linear time-invariant systems
Convolution and discrete convolution process and properties

Spectrum Analysis of digital signal
Frequency analysis of discrete-time aperiodic and periodic signals
Discrete Fourier Transform, Fast Fourier Transform
Correlation, auto-correlation, and cross-correlation
Power Spectrum Density

Digital filter design and implementation
Structure and classification of digital Infinite impulse response (IIR) and Finite impulse response (FIR) filter design techniques
Pole – Zero design
Z-transforms and inverse Z-transforms, difference equations.

8	**Module Learning Outcomes** **On successful completion of the module, you will be able to:**	
	1	Determine and compute the solution for linear difference equations.
	2	Compute, compare and relate FIR and IIR impulse responses for digital filter design.
	3	Interpret the response of signals for both time and spectral analysis.
	4	Apply analytical techniques to transform discrete time domain signals into their signal spectra and vice versa.
	5	Identify, assess, and manage any effects of uncertainty on objectives.

9	Module Assessment		
Learning Outcome Number *(from table 8)*	Coursework	Exam	In-Person
1 - 4	**40%**	**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

Stroud, K. A., and Dexter J. Booth. Engineering Mathematics. Eighth edition. London, England: Macmillan international, 2020. Print.

Alkin, Oktay. Signals and Systems: A MATLAB Integrated Approach. Bosa Roca: CRC Press, 2014. Web.

Oppenheim, A.V. and Willsky, A.S. (2014) Signals and Systems, second edition. Pearson.

Sadiku, Matthew N. O., and Warsame Hassan Ali. Signals and Systems : a Primer with Matlab. Boca Raton: CRC Press, 2016. Print.

Smith, S. (2003) DSP: a practical guide for engineers and scientists. London: Newnes.

Module Specification

Return to Module List

Module Summary Information

1	**Module Title**	Embedded Systems and Control
2	**Module Credits**	20
3	**Module Level**	6
4	**Module Code**	ENG6067
5	**Semester Taught**	2

6	**Module Overview**

The MEng Electronic Engineering course aims to develop an understanding of the broad nature of electronic engineering through a themed approach encompassing analogue electronics, digital electronics, communications, embedded systems and business.

The aim of this module is to develop an appropriate knowledge of embedded systems such that on completion of the module you are able to specify, design, implement and test microprocessor-based hardware and software for real-time applications.

Embedded Systems and Control gives in-depth practical experience of designing and building real-time embedded systems, from both hardware and software perspectives. It has been designed to provide a high level of practical embedded systems knowledge which, when combined with the digital and analogue electronics knowledge gained from underpinning and parallel modules, will produce graduate electronic engineers capable of having an immediate impact in the industry.

7	**Indicative Content**

Systems engineering: Requirements definition, system specification.

Real-time system requirements: Hardware; processor choice, peripheral mapping, interrupts; Software analysis and design.

Control Systems; simple control theory and implementation.

Embedded target system design and implementation; design of schematic, programming and use in a real application.

8	**Module Learning Outcomes** **On successful completion of the module, you will be able to:**	
	1	Select, specify and apply appropriate microcontroller hardware for an embedded application.
	2	Design controllers based on a range of appropriate computational techniques.
	3	Design, develop and implement a real-time control algorithm for a particular application.
	4	Assess and evaluate the overall developed system and communicate the outcomes to a range of audiences.

9	Module Assessment		
Learning Outcome			
	Coursework	**Exam**	**In-Person**
1 and 2			**40%**
1, 2, 3 and 4	**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 Embedded Systems with PIC microcontrollers*. 2nd ed. Amsterdam: Newnes.
- Braunl, T. (2003). *Embedded Robotics, Mobile Robot Design and Applications with Embedded Systems.* Springer.
- Schildt, H. (2000). *C: The Complete Reference.* 4th ed. Berkeley: McGraw-Hill.

Background

- Ball, S. (2000). *Embedded Microprocessor Systems, Real World Design.* 2nd ed. Newnes.
- Ganssle J. (2000). *The Art of Designing Embedded Systems.* Newnes.

Module Specification

Return to Module List

Module Summary Information

1	**Module Title**	Operations Management
2	**Module Credits**	20
3	**Module Level**	6
4	**Module Code**	ENG6071
5	**Semester Taught**	1

6	**Module Overview**

The module provides you with an understanding of the factors which control and constrain the performance of manufacturing and other operational systems including topics such as Risk Analysis and Decision Making Process, Material Flow Analysis, Maintenance and Replacement, Development of a Manufacturing Strategy.

7	**Indicative Content**

Line Balancing: Single Line Product Applications

Multi / Mixed model Line Balancing

Decision Theory – Decision Trees

Capital Investment Appraisal I

Capital Investment Appraisal II

Manufacturing Strategies

Integrated Manufacturing Systems MRPII, Push Pull Systems, JIT

Integrated Manufacturing Systems – ERP, OPT

Supply Chain Management

Demand Dynamics

Simulation Techniques for the Supply Chain

Application of Simulation – Probability Modelling

8	Module Learning Outcomes On successful completion of the module, students will be able to:	
	1	Identify and critically evaluate manufacturing, maintenance and replacement strategies with respect to their relevance to company supply chain positioning.
	2	Analyse the performance of the material flow systems within a business, identifying key performance indicators, how they are measured and how improvements may be identified and implemented.
	3	Undertake a baseline audit to establish target performance indicators and recommend system improvements, measuring quality performance at different stages of the product and service life cycle.
	4	Evaluate the use of simulation and modelling techniques to logistics based problems in a range of industry sectors.

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**	*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)

Chase R, Aquilano N & Jacobs F, Operations Management for competitive advantage, McGraw-Hill/Irwin 2006. Shelf Mark: 658.5/Cha.

Recommended

Heizer J, Operations Management, Prentice Hall 2008. Shelf Mark: 658.5/Hei.

Wild R, Operations Management, Continuum 2002. Shelf Mark: 658.5/Wil.

Waters C D, Operations Management, Financial Times Prentice Hall 2002. Shelf Mark: 658.5/Wat.

Gattorna J, Handbook of Supply Chain Management, Gower Press 2003. Shelf Mark: 658.788/Gow

Background

None.

Module Specification

Return to Module List

Module Summary Information

1	**Module Title**	Advanced Materials
2	**Module Credits**	20
3	**Module Level**	6
4	**Module Code**	ENG6072
5	**Semester Taught**	1

6	**Module Overview**

This module provides an opportunity for you to investigate the world of new materials and their industrial application through a combination of taught content and both practical and theoretical research project work. It is anticipated that guest lectures will provide industrial focus to this wide-ranging subject.
It is proposed that a mini-conference will be held at the end of the module, offering opportunities for you to present your findings to academics, your peers, and industrial contacts.

7	**Indicative Content**

Material selection; New and emerging: Metals / Polymers / Ceramics / Composites; What's new in concrete?; Smart materials; Nano-Technology; Coatings.

8	**Module Learning Outcomes** **On successful completion of the module, students will be able to:**	
	1	Evaluate and appraise new and emerging materials and their applications.
	2	Analyse processing of new materials using appropriate methods.
	3	Critically appraise the case for the use of new techniques with particular reference to sustainability.

9	**Module Assessment**		
Learning Outcome			
	Coursework	**Exam**	**In-Person**
1-3	**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)

None.

Recommended

Callister,W, 2014. Materials Science and Engineering. 9th Edition. Wiley

Howes, P, Laughlin Z, 2012, Material Matters New Materials in Design. London. Black Dog Publishing.

Journal: Materials World, Iom3 Institute of Materials, Minerals and Mining.

IT Resources:

CES Software with the additional new, emerging and unusual materials database.

Background

None.

Module Specification

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Module Summary Information

1	**Module Title**	Dynamics and Control
2	**Module Credits**	20
3	**Module Level**	6
4	**Module Code**	ENG6074
5	**Semester Taught**	1

5	**Module Overview**
The module introduces you to the mathematical tools underpinning the analysis, modelling and design of complex vibrating systems and mechanisms, and the software tools within an appropriate simulation environment used for their solution. Industry standard software will also be utilised for the design of dynamical control systems using both time and frequency domain techniques.	

6	**Indicative Content**
Block Diagrams and Feedback DC Motors Kinematics Space diagram Transient Specifications D'Alembert's Principle Free and Forced Vibration Steady State-Type 0 and 1 Systems Suspension systems Routh Stability Two degrees of freedom Frequency Response Beam vibrations Root Locus	

7	**Module Learning Outcomes** **On successful completion of the module, you will be able to:**	
	1	Solve kinematics problems using the space diagram technique.
	2	Model and solve 1D and 2D forced vibration and control problems, including mitigation of security risks and design of quality management systems.
	3	Regulate steady-state performance of a system using proportional and integral controllers.
	4	Stabilise system oscillations using frequency response and pole placement techniques.

8	Module Assessment		
Learning Outcome			
	Coursework	**Exam**	**In-Person**
1-4	**40%**	**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 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)

Hannah, J and Stephens, R C, (1993) Mechanics of Machines, Advanced Theory and Examples, Edward Arnold, ISBN 0-7131-3254-X.
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**	Computer Aided Engineering
2	**Module Credits**	20
3	**Module Level**	6
4	**Module Code**	ENG6075
5	**Semester Taught**	1

6	**Module Overview**

In the development cycle of new and existing components, processes and systems the use of computer analysis has a strong role to play. Reduced lead times can mean faster arrival at the market than competitors and therefore gaining an advantage. Engineers are at the centre of the development process and therefore require a good understanding of the key aspects of computer aided engineering (CAE).

This module will expose you to key aspects of computer aided engineering with regards to the fundamental principles behind the screen, the selection of appropriate boundary conditions and methods for a solution, as well as raising awareness of the limitations of CAE.

The focus will be on combining theoretical concepts and user experience design with practical “hands-on” approaches widely used within the engineering industry and considering specific cases to build a bridge between theory and practise.

7	**Indicative Content**

Introduction to multi-body dynamic system simulation
Analysis of single degree of freedom system, analytical verification of results,

Introduction to Finite Element Analysis
Theoretical background, elements types and limitations, application of boundary conditions, selection of stress and strain components, model convergence

Validation of results
Benchmark of tests, correlation between results between analytical, practical and numerical methods, assessment of quality of results

8	Module Learning Outcomes On successful completion of the module, students will be able to:	
	1	Apply the principles of computational technology to practical engineering problems.
	2	Evaluate and employ an appropriate approach for the modelling of a given engineering problem.
	3	Determine and analyse the loads, deformations and stresses in engineering components and systems using industry-standard software.
	4	Analyse and evaluate results obtained from computational simulations and cross-reference with learned knowledge from other modules.

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**	*2 x 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

Chen, Xiaolin; Liu, Yijun (2015) Finite element Modeling and simulation with ANSYS Workbench. Boca Raton: CRC Press.

Background

None.

Module Specification

Return to Module List

Module Summary Information

1	**Module Title**	Powertrain and Hybrid Vehicles
2	**Module Credits**	20
3	**Module Level**	6
4	**Module Code**	ENG6078
5	**Semester Taught**	*2*

5	**Module Overview**

In times of consumer - and legislation-driven demand for increased fuel efficiency and reduced emissions of vehicles, the complexity in the development of future powertrains increases. A good understanding of powertrain sub-system behaviour is required to solve such complex systems.
The module therefore aims to allow you to gain understanding of current technologies, but also an inside in emerging and future technologies to address the problems of future transportation. Formal lectures, tutorials, hands-on experience in labs and solving of problem based scenarios will enhance the learning process.

6	**Indicative Content**

Combustion Engine Technology
Mechanical Design, Thermodynamic Processes, Engine Fuelling, Gas Exchange Process, Combustion in SI and CI Engines, Emissions Formation and Reduction

Performance Analysis
Engine Testing, Performance Simulation, Data Calibration and Verification

Vehicle Transmission
Design of Transmission, Clutches and Torque Converters, Gearbox Ratio Analysis

Hybridisation
Electric Motor Performance and Behaviour, Batteries, Capacitors, Converter Technologies

7	**Module Learning Outcomes** **On successful completion of the module, students will be able to:**	
	1	Critically appraise the operating principles of different powertrains and their sub-systems as used in modern vehicles.
	2	Critically review vehicle manufacturer data.
	3	Synthesise methods and plans to perform powertrain tests and evaluate data with respect to performance and environmental considerations.
	4	Communicate findings and results from analysis and complex ideas in a professional way.

8	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**	*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)

- Van Basshuysen, R., Schäfer, F. (2004) Internal combustion engine handbook: basics, components, systems, and perspectives, SAE International.
- Heywood, J. B. (1989) Internal combustion engine fundamentals, McGraw-Hill Higher Education.
- Naunheimer, H., Bertsche, B., Ryborz, J., Novak, W., Fietkau, P., Kuchle, A. (2010) Automotive Transmissions: Fundamentals, Selection, Design and Application, Springer, 2nd ed. Edition. (2007)
- Institution of Mechanical Engineers (Great Britain). Combustion Engines & Fuels Group. (2013). Internal combustion engines: Performance, fuel economy and emissions. Cambridge: Woodhead Publishing.

Recommended

- Automotive handbook (2011). (8th, rev. and expand ed.). Plochingen: Robert Bosch.

- Manning, J. (2012). Internal combustion engine design. Shoreham-by-Sea, West Sussex: Ricardo.

Background

- https://saemobilus.sae.org/
- http://www.atzonline.com/
- https://www.theengineer.co.uk/
- http://www.enginetechnologyinternational.com/