Automotive Engineering

PgDip Automotive Engineering: 8664

Compulsory Modules				
Module Code	CRN	Module Title	Credits	Semester
MECH5822M	13601	Technical Engineering Project	30	1-3

Candidates will be required to study 90 credits from the following optional modules. It may be possible to take modules not shown in this list with the prior approval of the Programme Manager.

Option Modules				
Module Code	CRN	Module Title	Credits	Semester
MECH5165M	13546	Vehicle Design and Performance	15	1
MECH5185M	13536	Automotive Chassis Engineering	15	1
MECH5200M	13541	Combustion and Pollution Chemistry	15	1
MECH5510M	13571	Computational and Experimental Methods	15	1
MECH5570M	19371	Introduction to Tribology	15	1
MECH5140M	13597	Racecar Chassis Engineering	30	1&2
MECH5100M	13668	Mechatronics Applications	15	2
MECH5155M	13544	Finite Element Analysis: Advanced Techniques & Applications	15	2
MECH5195M	13552	Automotive Driveline Engineering	15	2
MECH5215M	13553	Aerodynamics	15	2
MECH5245M	13573	Engine Tribology	15	2
MECH5265M	13579	Combustion in Engines	15	2
MECH5530M	19105	Dynamic Simulation	15	2
MECH5720M	16418	Propulsion	15	2
MECH5940M	13539	Manufacturing Management and Simulation	15	2

MSc Automotive Engineering: 8665

Compulsory Modules				
Module Code	CRN	Module Title	Credits	Semester
MECH5821M	13608	Professional Project	60	1-3

Candidates will be required to study 120 credits from the following optional modules. It may be possible to take modules not shown in this list with the prior approval of the Programme Manager.

Option Modules				
Module Code	CRN	Module Title	Credits	Semester
MECH5165M	13546	Vehicle Design and Performance	15	1
MECH5185M	13536	Automotive Chassis Engineering	15	1
MECH5200M	13541	Combustion and Pollution Chemistry	15	1
MECH5510M	13571	Computational and Experimental Methods	15	1
MECH5570M	19371	Introduction to Tribology	15	1
MECH5140M	13597	Racecar Chassis Engineering	30	1&2
MECH5100M	13668	Mechatronics Applications	15	2
MECH5155M	13544	Finite Element Analysis: Advanced Techniques & Applications	15	2
MECH5195M	13552	Automotive Driveline Engineering	15	2
MECH5215M	13553	Aerodynamics	15	2
MECH5245M	13573	Engine Tribology	15	2
MECH5265M	13579	Combustion in Engines	15	2
MECH5530m	19105	Dynamic Simulation	15	2
MECH5720M	16418	Propulsion	15	2
MECH5940M	13539	Manufacturing Management and Simulation	15	2

Module Details

MECH5100M: Mechatronics Applications

Module Leader: Professor GS Virk

Other teaching staff:

Semester: 2 Credits: 15 Level: 5 CRN: 13668

Pre-requisites: Mech 2170 and 3135

Assessment: Assessment by Coursework

Examination 0 % 0 hours

Coursework Coursework is worth 100% Assignments 4 x 25%

Teaching Methods: Lectures = 22 x 1 hour(s); Seminars = 4 x 1 hour(s); Tutorials = 4 x 1 hour(s); Practicals = 0 hour(s); Examples Classes = 3 x 1 hour(s); Other teaching methods = 0.

Syllabus:

1.0 Introduction
- Control system analysis methods
- Analysis methods and tools
- Classical and modern control methods
- Human factors in controller design
- Computer aided design tools (Matlab and Simulink)

2.0 Controller design methods
- SISO and MIMO systems
- Classical design methods (Bode, root locus, PID)
- Modern design methods (state space)
- Advanced design methods (adaptive, non-linear, intelligent)
- Problem formulationand solution design
- Case study on "Advanced Chassis Control Systems"

3.0 Controller Analysis and Validation
- PC based simulation controls
- problem formulation and solution design via CACSD
- Case study on "Aerospace application sector"

4.0 Control System Implementation
- Modular decomposition of mechanics systems
- Modular design
- Components in design (sensors, actuators, power supplies etc)
- Case study on "Climbing Robot application sector"

5.0 The Human-Controller Interface
- Human Controller interactions
- Haptic feedback devices
- Visual feedback devices
- Safety critical design issues
- Case study on "Medical application sector"

Module booklist:

Title	Author(s)	Edition	Publishers	Year	ISBN
Digital Control of Dynamic Systems Addison-Wesley	Franklin G, Powell J & Workman	3rd	Addison-Wesley	1998	0201820544
Control Systems Engineering	Nise NS	4th	Wiley	2004	0471445770
Using Matlab, Simulink and control Systems Toolbox	The Math Works Inc		Available on line inpdf form	1996	

MECH5140M: Racecar Chassis Engineering

Module Leader: Dr HM Thompson

Other teaching staff:	AJ Deakin, External Lecturer; PC Brooks; DC Barton
Semester:	1&2
Credits:	30
Level:	5
CRN:	13597
Pre-requisites:	Equiv of BEng(Hons) in engineering or related subj
Assessment:	Assessment by Examination and Coursework
Examination	% 2 hours
Coursework	Coursework is worth 60% 10% case study 50% assignments
Teaching Methods:	Lectures = 18 + 9 hour(s); Seminars = 3 hour(s); Tutorials = 1 hour(s); Practicals = hour(s); Examples Classes = 9 hour(s); Other teaching methods = 27 assignment supervision.

Syllabus:

Overall design principles for racing cars :
- design specification, cost / weight / stiffness trade-offs
- maximising acceleration
- braking and cornering performance
- chassis balance to extract maximum tyre capability

Chassis Structural Design
- single seater racing cars, special considerations
- principles, monocoque vs spaceframe
- materials, properties, weight reduction, structural efficiency
- loading, torsional/bending stiffness, load input points, static/dynamic loads
- crashworthiness, rollover protection, driver protection

Suspension Design
- racing car requirements
- effect on ride and handling dynamics
- kinematic analysis
- compliances, non-linear effects
- effect of springs/dampers on steady state and transient handling
- forces in members
- materials, suspension component design

Aerodynamic Design
- principles, airfoils, wings, racing requirements
- wind tunnel testing, scaling, measuring techniques
- wing design, front/rear balance, ground effects
- cooling air management
- flow around rotating wheels

For each of these subject areas, a computer-aided engineering package will be introduced and used as part of the assignments. The 3 packages will be linked to:

Finite Element Analysis (FEA)
Multibody System Dynamics (MBS)
Computational Fluid Dynamics (CFD)

Module booklist:

Title	Author(s)	Edition	Publishers	Year	ISBN
Racecar Vehicle Dynamics	Milliken WF and Milliken DF		SAE	1995	
Race and Rally Car Source Book	Staniforth A	3rd	Haynes	1992	
Aerodynamics of road vehicles	Hucho H			1986	0-408-01422-9.
Chassis Engineering	Adams H		HP Books	1993	
Performance Handling	Alexander D		Motorbooks International	1990	
How to Make Your Car Handle	Puhn F		HP Books	1981	
Competition Car Suspension	A Staniforth		Haynes	1994	
Road vehicle aerodynamic design	Barnard RH			1996	0-582-24522-3

Race Car Aerodynamics	Milliken WF and Milliken DF		SAE	1995	

MECH5155M: Finite Element Analysis: Advanced Techniques & Applications

Module Leader: Dr PC Brooks

Other teaching staff: DC Barton; OM Querin

Semester: 2 Credits: 15 Level: 5 CRN: 13544

Pre-requisites: MECH 2115 or equivalent

Assessment: Assessment by Examination and Coursework

Examination % 2 hours

Coursework: Coursework is worth 50% 2 assignments 20% & 30%

Teaching Methods: Lectures = 29 x 1 hour(s); Seminars = 1 x 1 hour(s); Tutorials = 0 hour(s); Practicals = 0 hour(s); Examples Classes = 0 hour(s); Other teaching methods = 3 x 1 hr supervision toward assignments.

Syllabus:

The process of finite element analysis:
- The creation of a mathematical idealisation of the real structure
- The development of the finite element model, assumptions, choice of element type, constraints and convergence of mesh

Finite element systems:
- Role of finite element analysis in engineering
- Integration of design and analysis
- Quality assurance and commercial codes

Model verification:
- The need for verification
- Alternative theoretical approaches
- Experimental

Advanced analysis applications:
- Analysis of dynamic problems, differences between static analysis and dynamic, the free vibration problem, transient problems
- Contact analysis, types of contact, methods of analysis
- Structural optimisation, review of optimisation methods and their application to example problems
- Material models, elastic models, elastic-plastic behaviour, models used assist in the analysis of impact

Module booklist:

Title	Author(s)	Edition	Publishers	Year	ISBN
Finite element analysis theory and practice	Fagan MJ		Longman	1996	
Using finite elements in mechanical design	Mottram & Shaw		McGraw Hill	1996	
The finite element method: Principles and applications.	Lewis and Ward		Longman	1992	

MECH5165M: Vehicle Design and Performance

Module Leader: Dr PC Brooks

Other teaching staff: B Hall and J Fieldhouse, Huddersfield University

Semester: 1 Credits: 15 Level: 5 CRN: 13546

Pre-requisites: Equiv of BEng(Hons) in engrg or related subject

Assessment: Assessment by Examination and Coursework

Examination 70 % 2 hours

Coursework: Coursework is worth 30% 2 assignments each worth 12.5%

Teaching Methods: Lectures = 26 x 1 hour(s); Seminars = 0 hour(s); Tutorials = 7 x 1 hour(s); Practicals = 0 hour(s); Examples Classes = 0 hour(s); Other teaching methods = 0.

Syllabus:

Vehicle Mechanics:
- Modelling philosophy
- Co-ordinate systems
- Axle loads of vehicle and vehicle/trailer combinations
  ~ static and dynamic conditions
  ~ rear wheel, front wheel and 4 wheel drive
- Forces

Road loads:
- Generation of aerodynamic loads on vehicles
- Road loads due to aerodynamic forces
- Aerodynamic design of vehicles
- Load transfer due to cornering
- Roll over stability

Acceleration behaviour:
- Tractive resistance and tyre properties
- Engine characteristics
- Transmission characteristics
- Clutch, gearbox, driveline, differential and transfer box
- Traction and power limited calculations
- Fuel economy calculations

Deceleration behaviour:
- Overview of the brake system
- Kinematic analysis of a braking vehicle
- Driver-vehicle braking model
- Brake proportioning
- Efficiency and adhesion utilisation
- Standards and legislation

Module booklist:

Title	Author(s)	Edition	Publishers	Year	ISBN
Fundamental of vehicle dynamics	Gillsepie TD		SAE	1992	
Road vehicle performance	Lucas GG		Gordon and Breach Science Publishers Inc	1986	
Brake design and safety	Limpert R		Society of Automotive Engineers	1992	1-56091-261-8

MECH5185M: Automotive Chassis Engineering

Module Leader: Professor DC Barton

Other teaching staff: B Hall and J Fieldhouse, Huddersfield University

Semester: 1 Credits: 15 Level: 5 CRN: 13536

Pre-requisites: Equiv of BEng(Hons) in engrg or related subject

Assessment: Assessment by Examination and Coursework

Examination [ ] % [2] hours

Coursework: Coursework is worth 25% 2 assignments each work 12.5%

Teaching Methods: Lectures = 27 x 1 hour(s); Seminars = 0 hour(s); Tutorials = 6 x 1 hour(s); Practicals = 0 hour(s); Examples Classes = 0 hour(s); Other teaching methods = 0.

Syllabus:

Suspension systems and components:
- Introduction to vehicle suspensions
- Suspension types
- Suspension components and their characteristics, design and selection
  ~ springs
  ~ anti roll bars
  ~ dampers

~ bushes
- Kinematic and force analysis
- Antisquat and antidive geometries

Steering systems:
- Review of designs
- Handling requirements and regulations
- System geometry and kinematics
- Bump, roll and compliance steer
- Forces - stationary and moving vehicles
- Four wheel steer

Noise and vibration harshness (NVH):
- Fundamentals of acoustics
- Subjective response to noise
- Automotive vibration - sources, modelling and control
- Automotive noise - sources, criteria and control

Chassis structure:
- Review of vehicle structures
- Analysis of car body structures
- Safety under impact

Module booklist:

Title	Author(s)	Edition	Publishers	Year	ISBN
Handbook of Vehicle Design Analysis	Fenton J		MEP	1996	0-8529-8963-6.
The Motor Vehicle	Newton K, Steeds W & Garret TK	11th	Butterworth	1989	
Automotive Handbook	Bosch R	3rd		1993	1-56091-372-X

MECH5195M: Automotive Driveline Engineering

Module Leader: Dr PC Brooks

Other teaching staff: THC Childs; DC Barton

Semester: 2 Credits: 15 Level: 5 CRN: 13552

Pre-requisites: mech 3165 for level 4, MECH5165 for Msc Students

Assessment: Assessment by Examination and Coursework

Examination % 2 hours

Coursework Coursework is worth 25% 2 assignments worth 12.5% each

Teaching Methods: Lectures = 30 x 1 hour(s); Seminars = 1 hour(s); Tutorials = 0 hour(s); Practicals = 0 hour(s); Examples Classes = 2 hour(s); Other teaching methods = 0.

Syllabus:

Introduction: Overview of components and systems

Design of power transmission elements: shafts, couplings, clutches, gear pairs, transmission, final drive.

Driveline NVH: Modelling strategies and methods, performance and refinement issues.

Module booklist:

Title	Author(s)	Edition	Publishers	Year	ISBN
See module leader for book list	n/a	n/a	n/a	n/a	n/a
Automotive Transmissions and Drivelines	N Vaughan	n/a	Butterworth	2002	0750651393
Automotive Transmissions: fundamentals, selection, design and application	G Lechner, H Naunheimer	n/a	Springer Verlag	1999	354065903
An Introduction to Modern Vehicle Design	Julian Happian-Smith	n/a	Butterworth	2001	075065443
Gears and their Vibration	JD Smith	n/a	Marcel Dekker	1983	0824717597

MECH5200M: Combustion and Pollution Chemistry

Module Leader: Professor CGW Sheppard

Other teaching staff: AA Burluka; M Lawes; J Griffiths (Chemistry)

Semester: 1 Credits: 15 Level: 5 CRN: 13541

Pre-requisites: None

Assessment: Assessment by Examination and Coursework

Examination 50 % 2 hours

Coursework Coursework is worth 50% 2 assignments 25% each

Teaching Methods: Lectures = 24 x 1 (incl 6 examples classes) hour(s); Seminars = 2 x 1 hour(s); Tutorials = 0 hour(s); Practicals = 0 hour(s); Examples Classes = 0 hour(s); Other teaching methods = 0.

Syllabus:

Weeks 1- 4
1. Stoichiometry and equivalence ration
2. Properties of combustion gases. Enthalpy, enthalpy of formation and adiabatic flame temperature; Internal energy; Entropy; Enthalpy of combustion and calorific value combustion efficiency
3. Mechanism and rate of chemical reactions. Detailed mechanisms; rates of chemical reaction, forward and reverse rates; Rate laws and activation energy; equilibrium constant
4. Thermochemical equilibrium. Equilibrium composition, multi-component chemical equilibrium and atom balances; Temperature of combustion products for open and closed systems.
5. Combustion generated pollutants. Basics of unburned hydrocarbons, carbon monoxide, nitrogen oxide and soot chemistry.
Week 5: Examples/project
Weeks 6 - 10
6. Kinetic mechanisms and molecular structure of fuels
7. High temperature and flame chemistry (T>1000K). Methane combustion as a model system; Relevance of hydrogen oxidation related chemistry and that of carbon monoxide in flames; Combustion of higher hydrocarbons; role of degradation processes; combustion of aromatics; Relationship between elementary reaction rates and the attainment of chemical equilibrium.
8. Premixed and diffusion flames. The ideal, adiabatic, one-dimensional, laminar premixed flame; Modifying effects in real flames; Light emission, chemiluminescence and icons in flames; Equilibrium chemistry, species dissociation and relationship to flame temperatures; Diffusion flames.
9. Flame propagation and hazards. Measurement of burning velocities, and the relationship of burning velocity to stoichiometry; Flammability limits, flash point, ignition energies; Fire retardants and extinguishing agents.
10. Low temperature chemistry (T<1000K). Simplified representation of alkane oxidation; Importance of R + O2/RO2 equilibrium; Effect of temperature and pressure change and spontaneous ignition; Chain braching and chain-thermal interactions; Gasoline reactivity; engine knock, octane rating, octane boosers and other additives; Diesel fuel reactivity and additives.
11. Heterogeneous combustion (catalytic surfaces, solid fuels)
12. Emissions. Soot and polycyclic aromatic hydrocarbon (PAH) formation; Spark ignition engines; pollutant emissions (nitrogen and carbon oxides, unburned hydrocarbons), catalytic converters.
Week 11: Examples/project

Module booklist:

Title	Author(s)	Edition	Publishers	Year	ISBN
Flame and Combustion	Griffiths JF and Barnard JA	3rd	Blackie	1995	0751401994
An Introduction to Combustion	Turns SR		McGraw Hill	1996	0-07-911812-7

MECH5215M: Aerodynamics

Module Leader: Dr JL Summers

Other teaching staff:

Semester: 2 Credits: 15 Level: 5 CRN: 13553

Pre-requisites: MECH2270

Assessment: Assessment by Examination and Coursework

Examination [ ] % [2] hours

Coursework: Coursework is worth 25% 2 Assignments (25%)

Teaching Methods: Lectures = 24 x 1 hour(s); Seminars = 0 hour(s); Tutorials = 0 hour(s); Practicals = 2 x 15 hour(s); Examples Classes = 0 hour(s); Other teaching methods = 0.

Syllabus:

Background/Fundamentals:

- Inviscid 2-D flow equations, definition of stream function, vorticity and irrotational flow.
- Standard irrotational flows: source, sinks and point vortex.
- The complex potential, circulation and the Kutta-Joukowski theorem.
- Effects of viscosity: boundary layers and separated flow.

Aircraft Aerodynamics:

- 2-D flow over aerofoils: lift, drag and strategies for avoiding separation.
- Panel methods for irrotational flow past bodies.

Vehicle Aerodynamics:

- Historical development and similarities/differences with aircraft aerodynamics.
- Forces and moments acting on a vehicle.
- Design factors influencing aerodynamic drag and top speeds.
- Importance of lift and design features for its minimisation.
- Negative lift devices.
- Aerodynamic stability: simple rules for good stability.
- Applications and current limitations of CFD in automotive design.

Module booklist:

Title	Author(s)	Edition	Publishers	Year	ISBN
The elements of aerofoil and airscrew theory	Glauert H		CUP	1959	
Aerodynamics of road vehicles	Hucho H			1986	0-408-01422-9.
Fundamentals of aerodynamics	Anderson JD		McGraw-Hill	1984	0-07-001656-9
Aerodynamics for engineering students	Houghton EL, Carruthers			1982	0-7131-3433-X.
Road vehicle aerodynamic design	Barnard RH			1996	0-582-24522-3

MECH5245M: Engine Tribology

Module Leader: Dr M Priest

Other teaching staff:

Semester: 2 Credits: 15 Level: 5 CRN: 13573

Pre-requisites: MECH3280 for UG Masters, MECH5570M for PG Masters

Assessment: Assessment by Examination and Coursework

Examination [60] % [2] hours

Coursework: Coursework is worth 40% 2 x MCQ tests; one for Work Unit 1 and 2 and a second for Work Units 3 and 4; equally weighted (10%)
1 x case study assignment (30%)

Teaching Methods: Lectures = 0 hour(s); Seminars = 0 hour(s); Tutorials = 0 hour(s); Practicals = 0 hour(s); Examples Classes = 0 hour(s); Other teaching methods = All private study time (see below). Student-centred distance learning material delivered by the Internet and CD materials. Tutor and peer support via Internet student portal and email..

Syllabus:

Work Unit 1 : Tribology of Engine Systems
Introduction, lubrication regimes, regimes of fluid film lubrication, hydrodynamic lubrication and the Reynolds equation, application of Reynolds equation and the tribology of an automobile engine.

Work Unit 2 : Engine Bearings

Introduction, Reynolds equation for dynamically loaded journal bearings, short journal bearing mobility analysis, further aspects of engine bearing lubrication, journal bearing materials and failure.

Work Unit 3 : Valve Trains
Design and lubrication, cam and follower kinematics and the Reynolds equation, elastohydrodynamic lubrication, application of valve train lubrication analysis, valve train materials and factors leading to cam/follower failure, wear prediction and advanced design and system features.

Work Unit 4 : Piston Assemblies
Design and lubrication, single piston ring dynamics and lubrication analysis, ring pack considerations, oil-control rings, piston skirt dynamics and lubrication, materials and advanced features of piston assembly analysis.

Module booklist:

Title	Author(s)	Edition	Publishers	Year	ISBN
Engine Tribology	Elsevier Tribology Series	26th	C M Taylor	1993	

MECH5265M: Combustion in Engines

Module Leader: Dr M Lawes

Other teaching staff: CGW Sheppard

Semester: 2 Credits: 15 Level: 5 CRN: 13579

Pre-requisites:

Assessment: Assessment by Examination and Coursework

Examination 60 % 3 hours

Coursework Coursework is worth 40% 25% assignment
15% laboratory report

Teaching Methods: Lectures = 30 x 1 hour(s); Seminars = 0 hour(s); Tutorials = 0 hour(s); Practicals = 2 x 3 hour(s); Examples Classes = 6 x 1 hour(s); Other teaching methods = 0.

Syllabus:

The course is designed to give an understanding of the basic principles of combustion processes relating to reciprocating engines. These principles are established and applied to spark ignition and diesel engines commonly used in vehicles as well as for land-based power generation. Extensive reference is made to the wide range of related combustion research projects under way in the School of Mechanical Engineering and elsewhere within the University. Introduction: Discussion of differing nature of combustion in various engine types, applications, environmental issues and performance considerations, advanced concepts.

Fundamentals of combustion: Thermochemistry: fuels, stoichiometry, calorific values, equilibrium chemistry and flame temperature, reaction rate. Turbulence. Burning rates: laminar and turbulent burning rates, premixed, diffusion and droplet flames. Ignition: spark and auto-ignition.

Combustion in Spark Ignition Engines: Thermochemical equilibrium otto cycle, instantaneous and empirical burn rate, CO and NO kinetics, heat transfer; Turbulent flame propagation, cycle modelling using ut data, parametric study of effects of turbulence, mixture strength, ignition timing, throttling etc, on economy, emissions and performance; Gasoline components, reformulated fuels, autoignition chemistry, octane rating, autoignition prediction, end gas inhomegeneity, CFD modelling of modes of autoignition and pressure wave interaction, knock intensity; Lean burn, high EGR combustion, charge stratification, exhaust reactors and catalytic converters. Advanced engine concepts including HCCI and GDI.

Compression Ignition Engine Combustion: Basic combustion process; physical and chemical ignition delay period; effects of air motion and turbulence; direct and indirect fuel injection; fuel injection systems, spray combustion, composition of diesel fuels, cetane rating, ignition improvers; influence of operating parameters on performance and emissions behaviour; polycyclic aromatic hydrocarbons and soot formation, modelling of CI engine combustion.

Module booklist:

Title	Author(s)	Edition	Publishers	Year	ISBN
Internal Combustion Engine & Fundamentals	JB Heywood	1st	McGraw Hill	1988	007028637X
Gas Turbine Combustion	A. Lefebvre	1st	Hemisphere	1983	089116896-6
Introduction to Internal Combustion Engines	Stone R	3rd	MacMillan	1999	0-333-74013-0

MECH5510M: Computational and Experimental Methods

Module Leader: Dr M Lawes

Other teaching staff: HM Thompson; R Woolley

Semester: 1 Credits: 15 Level: 5 CRN: 13571

Pre-requisites: None

Assessment: Assessment by Examination and Coursework

Examination % 0 hours

Coursework: Coursework is worth 100% Computing assignment 50%
Experimental methods assignment - 50%.
These will take place on or before week 10.

Teaching Methods: Lectures = 32 x 1 hour(s); Seminars = 0 hour(s); Tutorials = 0 hour(s); Practicals = 6 x 1.5 hour(s); Examples Classes = 0 hour(s); Other teaching methods = 0.

Syllabus:

Unit 1: Computational Methods (16 Lectures, 6 x 1 1/2 hour practical classes)

1-2 The role of approximations in Engineering computation, Introduction to Matlab and programming in Matlab M code.
3-4 Data types, assignments, constants, logical expressions, decisions and loops.
5-6 Numerical solution of Ordinary Differential Equations using Matlab functions and via programming of numerical methods.
7-8 Classification of Partial Differential Equations into parabolic, elliptic and hyperbolic types.
9-10 Numerical methods for solving engineering examples of parabolic, elliptic and hyperbolic equations.
11-12 Signal processing using Matlab.

Unit 2: Experimental Methods (8 lectures)

13 Pressure transducers.
14 Temperature - thermocouples, compensation, optical pyrometry.
15 Hot wire anemometry.
16 Shadow and Schlieren photography.
17 Introduction to lasers. Laser Doppler Velocimetry..
18-20 Advanced laser diagnostics.
21-22 Automotive applications.

Unit 3: Data acquisition and Signal Processing (8 lectures)

25-26 Computer-based data acquisition: Analogue interfacing basics, PC data acquisition boards, analogue to digital and digital to analogue conversion, digital i/o and counters/timers.
27-29 Frequency analysis: frequency content of signals, Fourier series, Fourier transform and frequency spectrum, discrete Fourier transform, sample rate and aliasing.
30-32 Digital filtering: transform function, first and second order, Bode plots, digital filters, difference equation, discretising continuous-time filters.

Module booklist:

Title	Author(s)	Edition	Publishers	Year	ISBN
Experimental methods for engineers	Holman JP		McGraw Hill		

MECH5530M: Dynamic Simulation

Module Leader: Dr MC Levesley

Other teaching staff:

Semester: 2 Credits: 15 Level: 5 CRN: 19105

Pre-requisites: First degree in engineering or related area (some experience in dynamics /vibration or control e.g. MECH2170 and MECH3135 will be assumed)

Assessment: Assessment by Examination and Coursework

Examination 40 % 2 hours

Coursework: Coursework is worth 60% 2 tests (20%)
2 Assignments (40%)

Teaching Methods: Lectures = 0 hour(s); Seminars = 0 hour(s); Tutorials = 0 hour(s); Practicals = 0 hour(s); Examples Classes = 0 hour(s); Other teaching methods = This module is taught using a series of student centred work units and interactive web based material.

Syllabus:

An introduction to simulation of dynamics systems using computational means will be covered in this module. System models will be developed in two-standard forms a) Input-Output equations and b) State-Variable equations. Examples and case studies from a variety of fields will be considered including a variety of engineering fields. The use of transfer functions and the importance of system poles in determining its likely response will be covered. Matlab/Simulink will be used throughout as the simulation environment. The effects of common non-linearities will be introduced and studied through the use of appropriate system models and simulation methods.

Module booklist:

Title	Author(s)	Edition	Publishers	Year	ISBN
See module leader					

MECH5570M: Introduction to Tribology

Module Leader: Dr M Priest

Other teaching staff:

Semester: 1 Credits: 15 Level: 5 CRN: 19371

Pre-requisites: First degree in engineering or related subject

Assessment: Assessment by Examination and Coursework

Examination 60 % 2 hours

Coursework: Coursework is worth 40% 3 x MCQ tests; one per Work Unit; equally weighted (15%)
1 x essay assignment (25%)

Teaching Methods: Lectures = 0 hour(s); Seminars = 0 hour(s); Tutorials = 0 hour(s); Practicals = 0 hour(s); Examples Classes = 0 hour(s); Other teaching methods = All private study time (see below). Student-centred distance learning material delivered by the Internet and CD materials. Tutor and peer support via Internet student portal and email..

Syllabus:

Work Unit 1 : Introduction to Tribology and Real Surfaces
Fundamental concepts, major factors that affect tribological performance, Hertzian analysis of the contact of smooth surfaces, the complex nature of real rough surfaces, measurement and characterisation of rough surfaces, contact between rough surfaces.

Work Unit 2 : Friction and Wear of Surfaces
Laws of friction, theories of friction, frictional properties of engineering materials, static and dynamic friction, stick-slip, wear mechanisms, laws of wear, analysis of wear, wear properties of engineering materials, oxides and surface films, experimental methods.

Work Unit 3 : Lubricants and Lubrication
Types of lubricants (solid, liquid and gas), lubrication regimes, Stribeck curve, boundary lubrication, fluid film lubrication, the Reynolds equation, mixed lubrication, elastohydrodynamic lubrication, simple applications.

Module booklist:

Title	Author(s)	Edition	Publishers	Year	ISBN
The History of Tribology	Dowson D	2nd	MEP	1998	
Principles of Tribology	Ed. J. Halling		Macmillan	1978	
Friction and Wear of Materials	Rabinowicz E	2nd	Wiley	1995	
Tribology: Friction and Wear of Engineering Materials	Hutchings IM		Edward Arnold Ltd	1992	
Basic Lubrication Theory	Cameron A		Longman	1983	

Chemistry and Technology of Lubricants	Ed Mortier RM and Orszulik ST	2nd	Blackie Academic and Professional	1997	
Engineering Tribology	Williams, JA	-	Oxford Science Publications	1994	-

MECH5720M: Propulsion

Module Leader: Dr AA Burluka

Other teaching staff: Not applicable

Semester: 2 Credits: 15 Level: 5 CRN: 16418

Pre-requisites: MECH2260, MECH3270

Assessment: Assessment by Various

Examination 60 % 2 hours

Coursework Coursework is worth 40% 2 laboratory reports - 10%
1 team design assignment - 30%
2 hour closed book examination - 60%

Teaching Methods: Lectures = 27 x 1 hour(s); Seminars = 0 hour(s); Tutorials = 0 hour(s); Practicals = 2 x 2 hour(s); Examples Classes = 2 x 1 hour(s); Other teaching methods = 0.

Syllabus:

1. Classification of propulsion engines: turboprops, turbojets, ramjets, rocket engines, hybrids and future concepts.
2. Main components of an aircraft propulsion engine: intakes, compressors, burners, turbines, nozzles.
3. Thrust, specific impulse, propulsive efficiency, propeller and rotary wing theory.
4. Intakes and nozzles: compressible high-speed flow theory. Isentropic flows, total and static properties, Mach number. Normal and oblique shocks, pressure recovery. Prandtl-Meyer angle (rarefaction waves), supersonic flow around winglets. Laval nozzle. Flows with heat exchange and friction.
5. Axial compressors: Turbomachinery fundamentals, velocity triangles, Euler equation, dimensionless criteria, flow and work coefficients, specific diameter and speed. Slip phenomena and losses. Flow diffusion, stall and surge phenomena.
6. Burners: Combustion fundamentals, stoichiometry, energy release, chemical kinetics, thermodynamic and chemical equilibria, pollutant emissions and legislation. Combustion regimes, turbulence characterisation. Fuel injection systems, droplet and spray combustion. Ignition process and combustion stability.
7. Axial turbines: Degree of reaction, impulse and reaction turbines. Staging. Blade cooling schemes. Isentropic efficiency.
8. Ancillary equipment, air-cycle air conditioning systems.

Module booklist:

Title	Author(s)	Edition	Publishers	Year	ISBN
Gas Turbine Theory	H Cohen, GFC Rogers HIH Saravanamuttoo	4th	Addison Wesley Longman Ltd	1998	0-582-23632-0
Gas Turbine Combustion	A. Lefebvre	1st	Hemisphere	1983	089116896-6
See module leader					
Introduction to Turbomachinery	Japsike D & Baines, N		Conceots ETI and OUP	1997	0-933283-06-7

MECH5821M: Professional Project

Module Leader: Dr PC Brooks

Other teaching staff: Various

Semester: 1-3 Credits: 60 Level: 5 CRN: 13608

Pre-requisites: 2.2 Hons/equiv in physical/engrg sciences.

Assessment: Assessment by Coursework

Examination % 0 hours

Coursework Coursework is worth 100% Task1 - Intermediate Report submitted at end of Semester 2, 10% of total module mark
Task 2 - Project Presentation at end of Semester 2, 10% of total module mark

Task 3 - Dissertation and viva at end of Semester 3, 80% of total module mark

Teaching Methods: Lectures = 0 hour(s); Seminars = 0 hour(s); Tutorials = 0 hour(s); Practicals = 0 hour(s); Examples Classes = 0 hour(s); Other teaching methods = Meetings with supervisor 20 x 2 hours.

Syllabus:

The subject of the project will be drawn from the field of engineering implicit in the student's chosen programme of study. It will reflect an area of current interest. The project may be linked to industry and should be sufficiently broad to embrace more than one of the following: design, analysis, computation and experimentation. The principal deliverables are an oral presentation and full report on completion of the project.

Module booklist:

Title	Author(s)	Edition	Publishers	Year	ISBN
See module leader					

MECH5822M: Technical Engineering Project

Module Leader: Dr PC Brooks

Other teaching staff: Various

Semester: 1-3 Credits: 30 Level: 5 CRN: 13601

Pre-requisites: uk 3 Hons in physical/engrg sciences

Assessment: Assessment by Coursework

Examination % 0 hours

Coursework: Coursework is worth 100% Task 1 - Intermediate Report submitted at end of Semester 2, 10% of total module mark
Task 2 - Project Presentation at end of Semester 2, 10% of total module mark.
Task 3 - Dissertation and viva at end of Semester 3, 80% of total module mark.

Teaching Methods: Lectures = 0 hour(s); Seminars = 0 hour(s); Tutorials = 0 hour(s); Practicals = 0 hour(s); Examples Classes = 0 hour(s); Other teaching methods = Meetings with supervisor 20 x 1 hours.

Syllabus:

The subject of the project will be drawn from the field of engineering implicit in the student's chosen programme of study. It will reflect an area of current interest. The project may be linked to industry and should focus on at least one of the following: design, analysis, computation and experimentation. The principal deliverables are an oral presentation and full report on completion of the project.

Module booklist:

Title	Author(s)	Edition	Publishers	Year	ISBN
See module leader					

MECH5940M: Manufacturing Management and Simulation

Module Leader: Dr KW Dalgarno

Other teaching staff: CJ Barnes

Semester: 2 Credits: 15 Level: 5 CRN: 13539

Pre-requisites: None

Assessment: Assessment by Coursework

Examination % 0 hours

Coursework: Coursework is worth 100% 100% coursework
- Management assignment 40%
- Simulation assignment 45%
- Presentation 15%

Teaching Methods: Lectures = 28 x 1 hour(s); Seminars = 0 hour(s); Tutorials = 0 hour(s); Practicals = 3 x 2 hour(s); Examples Classes = 0 hour(s); Other teaching methods = 2 x 2 days.

Syllabus:

This module aims to introduce the students to the concepts involved in manufacturing management and some of the tools and techniques used to design, operate and control the system. The module will be delivered in a 2 x 2day format as shown in the table below.

Prior to the start of the module, students will be given some compulsory pre reading and an assignment that requires them to complete a presentation on a particular manufacturing management topic.

The first day of the module will contain several of the student's presentations and seminar sessions discussing the newly presented concepts. Towards the end of the day, the students will be given the first part of an assignment to complete that uses a case study to apply the theory taught in the module.

The students will be introduced to the basic principles and underlying theory of manufacturing systems simulation on the second day of the first session, and will be introduced to a commercial manufacturing systems simulation package. The second part of the assignment will be presented that requires the application of simulation to the same case study.

The second set of two days will start with the same format as day 1. Students will be asked to deliver their presentations on several new topics and seminar sessions will be used to explore the application of these new concepts.

The final day of the module will give the students opportunity to complete the simulation element of their coursework, with supervision. The hand-in date for this will be two weeks after session 2, day 2.

Module booklist:

Title	Author(s)	Edition	Publishers	Year	ISBN
Operations Management	Slack N, Chambers S and Johnson R	3rd	Pearson Education	2000	