Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint David

MODULE DIRECTORY

LEVEL 6

ACADEMIC DISCIPLINE OF ENGINEERING

WALES INSTITUTE OF SCIENCE AND ART

2023-2024

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INTRODUCTION

This Module Directory includes all the modules for Level 6 within the Engineering in the academic year 2023-2024.

This directory accompanies the Programme of Study Handbook, which will provide you with details of which modules you will be studying for your programme this year in the 'Programme of Study' section. This directory may include modules that are running on other programmes of study within your Academic Discipline/Institute. If you require assistance in identifying the modules for your programme of study, please contact the Programme Manager (whose name and contact details are provided in the accompanying Programme of Study Handbook), or the relevant Institute Office.

The University has made every effort to make the information as full and as accurate as possible, but you should note that minor changes in the organisation of modules between the planning stage and the actual teaching are inevitable. We shall try to keep any such changes to a minimum, and you will receive plenty of advance warning in the event of any alteration. We would also be grateful if you would let us know about any changes that you think might be helpful if introduced into future handbooks.

MODULES

Module Code	ACHA6003
Title	Ride, Handling & NVH
Date	17/09/2020
Level	6
Credits	20
Pre-Requisites	None

AIM(S)

- The module aims to provide the student with the knowledge and understanding to evaluate vehicle ride, handling and NVH (Noise Vibration & Harshness)

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- demonstrate knowledge and understanding of vehicle suspension response under applied road inputs

- To evaluate the effects asymmetric traction forces and the effect on vehicle yaw response / control

- Critique sources of vehicle NVH, their transfer and effect upon human physiology and psychology.

INDICATIVE CONTENT

- Spring Mass Damper Systems
  - Suspension damping and damper construction
  - One, two and four degree of freedom suspension models and vehicle response

- Asymmetric drive forces
  - Vehicle mass distribution effects
  - Differentials
  - Vehicle yaw control

- NVH
  - NVH effect on humans and sound quality perception.
  - NVH generation. Wind, tyre, powertrain and driveline.
  - Transfer functions of vibrations and sound
  - Acoustics
  - Damping and suppression techniques

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	48	24%
Independent learning	152	76%
Placement learning	0	0
TOTAL	**200**	**100%**

ASSESSMENT

Assessment Component 1

☐ **Written exam** ☒ **Coursework** ☐ **Practical**

Mode of assessment	Volume	Weighting
Written technical report	3000 words	50%

Assessment Component 2

☒ **Written exam** ☐ **Coursework** ☐ **Practical**

Mode of assessment	Volume	Weighting
Exam	2 hours	50%

Assessment Summary

Activity type	Percentage
Written exam	50%
Coursework	50%
Practical	0%
TOTAL	**100%**

AHEP3 Version 3 outcomes to be met:
SM1b, SM2b, EA2, EA3b, EA4b, D1, D3b, P1, P3, P4, P8, G1

INDICATIVE READING LIST

Module Code	**ACHA6003**	
Module Title	**Ride, Handling & NVH**	
Classification	**Reading List entry**	**Electronic***
Essential	Gillespie, T. D. *Fundamentals of Vehicle Dynamics*. Warrendale, Pa.: Society of Automotive Engineers, 1992. Print.	☐
Essential	Guiggiani, M., The Science of Vehicle Dynamics 2nd Edition (Springer 2018)	☐
Essential	Pang, J., Noise and Vibration Control in Automotive Bodies (Wiley-Blackwell 2018)	☐
Essential	Brandt, A., Noise and Vibration Analysis (John Wiley and sons 2011)	☐
Further	Bastow D., Howard, G. and Whitehead. J., Car Suspension and Handling - 4th Edition (Society of Automotive Engineering, 2004)	☐
Further	Dixon, J., Tires, Suspension and Handling - 2nd Edition (Society of Automotive Engineering, 1996)	☐
Further	Schüetz, Thomas. Aerodynamics of Road Vehicles. Fifth ed. 2016. Print.	☐

Further	Blundell, M. and Harty, D., The Multibody Systems Approach to Vehicle Dynamics (Elsevier Butterworth-Heinemann, 2014)	☐
Further	Jacobson, Bengt. Vehicle Dynamics Compendium. 2017. Web. http://publications.lib.chalmers.se/records/fulltext/225751/local_225751.pdf	☒
Further	Day, A., Braking of Road Vehicles (Butterworth Heinemann 2014)	☐
Further	Thompson, J. K., Brake NVH: Testing and Measurements (SAE International 2011)	☒
Further	The Engineering Integrity Society http://e-i-s.org.uk/	☐
Further	Fuchs, A., Automotive NVH Technology (Springer 2015).	☐
Further	Singiresu S.Rao. Mechanical Vibrations in SI units (Person 6th edition Nov2014) ISBN 978- 1292178608	☐
Further	Sinha J.K. Vibration Analysis, Instruments and Signal Processing. (CRC Press Nov 14) ISBN 978-1482231441	☐
Further	Tuma J. Vehicle Gearbox Noise and Vibration (Wiley Feb 2014) ISBN 978-1118359419	☐

Module Code	**ACHA6006**
Title	**Contemporary Powertrain Design**
Date	**17/09/2020**
Level	**6**
Credits	**20**
Pre-Requisites	**None**

AIM(S)

- To introduce the student to dynamics and resulting stresses within a modern high-performance engine and to understand the combustion mechanisms, fuel chemistry and modelling for spark ignition (SI) and compression ignition (CI) engines

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- Demonstrate cognitive skills in how to improve performance and weight characteristics of next-generation engines with emphasis on powertrain sustainability; with the analysis of combustion and emissions mechanisms for conventional and biofuels used in SI and CI automotive applications

- Critically analyse the development opportunities in ICE and its integration to Electric and Hybrid Powertrain to meet future fuel efficiency, CO2 and emissions requirements for automotive, motorcycle and motorsport applications

INDICATIVE CONTENT

- Fuel chemistry, stoichiometry, rich and lean fuel balance equations for various fuels.

- Enthalpy of formation and calculations of heat release.

- Combustion properties and emissions mechanisms.

- Basic NOx formation model using Zeldovich mechanisms.

- Alternative IC concepts – including SI, CI, GDI, CAI, HCCI.

- Alternative power cycles – Atkinson, Rankine and Miller

- Crankshaft, piston and connecting rod kinematics and stress analysis

- Engine component balancing

- Friction analysis and techniques to reduce friction at high rpm

- Material properties and design requirements for major moving and stressed components specifically for low friction, high efficiency applications

- Emissions Regulations, commercial, legal & environmental considerations

- Engine control strategies and emissions modelling.

- Simulation of alternative power provider's drive-cycle emissions
- Alternative powertrain strategies and optimisation

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	48	24%
Independent learning	152	76%
Placement learning	0	0
TOTAL	**200**	**100%**

ASSESSMENT

Assessment Component 1

☐ **Written exam** ☒ **Coursework** ☐ **Practical**

Mode of assessment	Volume	Weighting
Written Report	3000 words	50%

Assessment Component 2

☐ **Written exam** ☒ **Coursework** ☐ **Practical**

Mode of assessment	Volume	Weighting
Written Report	3000 words	50%

Assessment Summary

Activity type	Percentage
Written exam	0%
Coursework	100%
Practical	0%
TOTAL	**100%**

AHEP3 Version 3 outcomes to be met:
SM1b, SM3b, EA1b, EA2, D1, D2, D4, EL2, EL4, P1, P2, P4, P5, P8, G1, G4

INDICATIVE READING LIST

Module Code	**ACHA6006**	
Module Title	**Contemporary Powertrain Design**	
Classification	**Reading List entry**	**Electronic***
Essential	Heywood, J., Internal Combustion Engine Fundamentals 2ED, McGraw-Hill Education; 2 edition (31 May 2018)	☒
Essential	Simulating Combustion: Simulation of combustion and pollutant formation for engine-development, Springer Berlin Heidelberg; 2006 edition (10 Oct. 2008)	☐
Further	Modern electric, hybrid electric, and fuel cell vehicles: fundamentals, theory, and design. (CRC Press 2018)	☐
Further	Thermodynamics: Concepts and Applications, Cambridge University Press; Har/Cdr edition (6 Mar. 2006)	☐
Further	http://www.electricmotorsport.com/	☒
Further	http://www.avt.uk.com/	☒
Further	http://www.fiaformulae.com/	☒
Further	http://www.dft.gov.uk/vca/	☒

Module Code	**ACHA6007**
Title	**Motorcycle Design & Innovation**
Date	**17/09/2020**
Level	**6**
Credits	**20**
Pre-Requisites	**None**

AIM(S)

- To explore with the student, the more complex aspects of the dynamics of the motorcycle, the influence of the rider and other 'hard to quantify' factors and the technical limitations experienced at the performance limits of the vehicle

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- Demonstrate knowledge and critical understanding of the processes governing the dynamic behaviour of a motorcycle, its suspension, steering, tyres and rider interaction while in motion.

- Display comprehensive skills in the use of advanced data acquisition interpretation techniques to interpret dynamic data with which to validate complex motorcycle simulation models

INDICATIVE CONTENT

- Frame Design Requirements and Torsional Stiffness's

- Motorcycle Design, Aesthetics and Commercial Drivers

- Modelling of Tyres

- One, two and four degree of freedom suspension modelling

- Detailed analysis, processing and interpretation of real dynamics data

- Analysis of the Rider as a part of the Machine.

- Rider Psychology and Cognitive Aptitude in Motorsport

- The Requirements of the Modern MotoGP/Competition Motorcycle.

- Motorcycle Powertrain, Launch and Traction Control Strategies

- Active Safety Systems including collision avoidance

- Motorcycle Manoeuvrability and Directional Stability

- Roll motion, Steering Torque and Steer Angles

- Motorcycle Emissions Regulations and Implementation

- The modern motorcycle and its future sustainability

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	48	24%
Independent learning	152	76%
Placement learning	0	0
TOTAL	**200**	**100%**

ASSESSMENT

Assessment Component 1

☐ **Written exam** ☐ **Coursework** ☒ **Practical**

Mode of assessment	Volume	Weighting
Practical / Time Limited	Journal Paper – 3000 words	50%

Assessment Component 2

☐ **Written exam** ☒ **Coursework** ☐ **Practical**

Mode of assessment	Volume	Weighting
Assessment of Practical Work Report	3000 words	50%

Assessment Summary

Activity type	Percentage
Written exam	0%
Coursework	50%
Practical	50%
TOTAL	**100%**

AHEP3 Version 3 outcomes to be met:
SM1b, SM2b, EA2, EA3b, D1, D3b, P1, P3, P4, P6, P8, G1

INDICATIVE READING LIST

Module Code	**ACHA6007**	
Module Title	**Motorcycle Design & Innovation**	
Classification	**Reading List entry**	**Electronic***
Essential	Cossalter, V., Motorcycle Dynamics (Lulu, 2006)	☐
Essential	Spalding, N., MotoGP Technology (J H Haynes & Co Ltd, 2006)	☐
Further	Foale, T., Motorcycle Handling and Chassis Design (Tony Foale, 2002)	☐
Further	Bradley, J., The Racing Motorcycle: A Technical Guide for Constructors (Volumes 1 and 2) (Broadband Leisure Publications, 2003	☐
Further	Journals as appropriate	☒

Module Code	**ACHA6010**
Title	**Structural Design & Fluid Analysis**
Date	**17/09/2020**
Level	**6**
Credits	**20**
Pre-Requisites	**None**

AIM(S)

- To provide the student with the necessary skills required to investigate structural design and fluid engineering problems.

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- Critically analyse and evaluate techniques for structural and fluid problems and CAE results

- Demonstrate competence in the application of suitable software packages to investigate engineering structural and fluid problems and cognitive skills in the formulation and analytical solution of a problem within the chosen engineering specialism

INDICATIVE CONTENT

- Structural Design
  - The role of FEA in the lifecycle
  - Analysis types
  - Overview of FEA and creating an FE model
  - Mesh quality checks
  - 1D v 2D v 3D elements
  - Thermal effects on structures
  - Common design issues
  - DFMEA
  - Application of commercial software

- Fluid Mechanics
  - Bernoulli's Equation
  - Reynolds Number
  - Boundary layer development
  - Separation
  - Turbulence
  - Euler Equation Derivation
  - Navier-Stokes Equations
  - CFD Process & Approach
  - Application of commercial software

- Application of commercial software to investigate structural and fluid problems
  - Solidworks : Builds on Modelling and FEA skills introduced in Level 5 and allows students to explore more complex simulation situations such as vibrational or thermal analysis applied to engineering problems

- Fluent/HelyxOpenFoam: Allows the simulation and validation of 2D and 3D Computational fluid dynamics problems. CFD theory and practice, parallelisation of solvers, Higher order meshing including meshing theory

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	48	24%
Independent learning	152	76%
Placement learning	0	0
TOTAL	**200**	**100%**

ASSESSMENT

Assessment Component 1

☐ **Written exam** ☒ **Coursework** ☐ **Practical**

Mode of assessment	Volume	Weighting
Written Report	3000 words	50%

Assessment Component 2

☐ **Written exam** ☒ **Coursework** ☐ **Practical**

Mode of assessment	Volume	Weighting
Written Report	3000 words	50%

Assessment Summary

Activity type	Percentage
Written exam	0
Coursework	100%
Practical	0
TOTAL	**100%**

AHEP3 Version 3 outcomes to be met:
SM1b, EA1b, EA2, EA3b, D3b, D5, P2, P3, P4, P6, P7, P8

INDICATIVE READING LIST

Module Code	**ACHA6010**	
Module Title	**Structural Design & Fluid Analysis**	
Classification	**Reading List entry**	**Electronic***
Essential	Versteeg, Malalasekera, and Malalasekera, W. An Introduction to Computational Fluid Dynamics: The Finite Volume Method. 2nd ed. Harlow: Pearson Prentice Hall, 2007. Print.	☐
Essential	Hearn, E.J. *Mechanics of Materials, vols.1 & 2*, Butterworth-Heinemann, 1997	☐
Essential	Ferziger, J. H. and Perić, M., Computational Methods for Fluid Dynamics (Springer, 2002)	☐
Essential	Mac Donald, Bryan J. Practical Stress Analysis with Finite Elements. 2nd ed. Dublin: Glasnevin, 2011. Print.	☐
Further	McBeath, S., Competition Car Aerodynamics (Haynes, 2011)	☐
Further	Katz, J., Race Car Aerodynamics: Designing for Speed (Robert Bentley, 1995)	☐
Further	Barnard, R. H., Road Vehicle Aerodynamic Design: An Introduction (Mechaero, 2001)	☐
Further	Sifakis, Eftychios. and Jernej. Barbic. Finite Element Method Simulation of 3D Deformable Solids. 2016. Synthesis Digital Library of Engineering and Computer Science. Web.	☐
Further	Vanderplaats, G. N., Multidiscipline Design Optimisations (VR&D, 2007)	☐
Further	Bernoulli Aerodynamics International, Racecar Graphic (2006)	☐

Module Code	**ACHA6011**
Title	**Advanced Motorsport Dynamics**
Date	**17/09/2020**
Level	**6**
Credits	**20**
Pre-Requisites	**None**

AIM(S)

- To build on previous vehicle dynamics module to include combined accelerations and damping in transient vehicle performance

- To analyse the effect of asymmetric traction forces and the effect on vehicle yaw response / control

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- demonstrate knowledge and understanding of transient vehicle suspension response under applied road inputs and accelerations

- Investigate vehicle handling performance through simulation

- evaluate the effects asymmetric traction forces and the effect on vehicle yaw response / control

INDICATIVE CONTENT

- Transient Vehicle Behaviour and Simulation
  - Load transfer under transient acceleration
  - Modelling of Tyres
  - Driver in the loop simulation

- Spring Mass Damper Systems
  - Suspension damping and damper construction
  - One, two and four degree of freedom suspension models and vehicle response

- Asymmetric drive forces
  - Vehicle mass distribution effects
  - Differentials
  - Vehicle yaw control

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	48	24%
Independent learning	152	76%
Placement learning	0	0
TOTAL	**200**	**100%**

ASSESSMENT

Assessment Component 1

☒ **Written exam** ☐ **Coursework** ☐ **Practical**

Mode of assessment	Volume	Weighting
Exam	2 hours	50%

Assessment Component 2

☐ **Written exam** ☒ **Coursework** ☐ **Practical**

Mode of assessment	Volume	Weighting
Written Report	3000 words	50%

Assessment Summary

Activity type	Percentage
Written exam	50%
Coursework	50%
Practical	
TOTAL	**100%**

AHEP3 Version 3 outcomes to be met:
SM1b, SM2b, EA2, EA3b EA4b, D3b, P1, P3, P4, P8, G1

INDICATIVE READING LIST

Module Code	**ACHA6011**	
Module Title	**Advanced Motorsport Dynamics**	
Classification	**Reading List entry**	**Electronic***
Essential	Miliken, W. and Miliken D., Race Car Vehicle Dynamics (SAE,1995)	☒
Essential	Schüetz, Thomas. Aerodynamics of Road Vehicles. Fifth ed. 2016. Print.	☐
Essential	Rowley, W., An Introduction to Race Car Engineering - 3rd Edition (Rowley Race Dynamics, 2005)	☐
Essential	Segers, Jörge. Analysis Techniques for Racecar Data Acquisition. Second ed. 2014. Print.	☐
Essential	Gillespie, T. D. *Fundamentals of Vehicle Dynamics*. Warrendale, Pa.: Society of Automotive Engineers, 1992. Print.	☐
Essential	Guiggiani, M., The Science of Vehicle Dynamics 2nd Edition (Springer 2018)	☐
Further	Bastow D., Howard, G. and Whitehead. J., Car Suspension and Handling - 4th Edition (Society of Automotive Engineering, 2004)	☐
Further	Dixon, J., Tires, Suspension and Handling - 2nd Edition (Society of Automotive Engineering, 1996)	☐
Further	Pacejka, Hans. *Tire and Vehicle Dynamics*. 2nd ed. Elsevier Science, 2005. Web.	☒
Further	Blundell, M. and Harty, D., The Multibody Systems Approach to Vehicle Dynamics (Elsevier Butterworth-Heinemann, 2014)	☐
Further	Jacobson, Bengt. Vehicle Dynamics Compendium. 2017. Web. http://publications.lib.chalmers.se/records/fulltext/225751/local_225751.pdf	☒
Further	McBeath, S., Competition Car Aerodynamics, Haynes (2006)	☐
Further	Proceedings of the Institution of Mechanical Engineers, part D - Journal of Automobile Engineering	☒
Further	Science Direct (Website)	☒

Module Code	ACHA6012
Title	Automotive Materials & Sustainability
Date	17/09/2020
Level	6
Credits	20
Pre-Requisites	None

AIM(S)

- To enable the student to gain a critical understanding of the principles and potential applications of a range of advanced engineering processes and materials

- To examine the contemporary environmental issues raised by the automotive and motorsport industry.

- To investigate the technical and legislative response available to the governing bodies, teams and manufacturers.

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- Critically analyse the structure-property relationships and behaviour of a range of advanced engineering materials and manufacturing processes

- Critically appraise the potential for application of a range of advanced materials and processes in typical engineering applications, gaining an understanding of the development of new sustainable materials for specific applications

- Critically evaluate the impact of current and possible future legislation and public opinion on the operation of motorsport events and the new technologies being proposed and developed by the automotive engineering industry specifically related to sustainability and environmental impact.

- Critically analyse the operation and effectiveness of alternative fuels, electric and hybrid propulsion and energy recovery systems to reduce the environmental impact.

INDICATIVE CONTENT

- Automotive Material Applications
  - Designing for failure (Failure Modes)
  - Phase diagrams and phase transformations
  - Fatigue
  - Characteristics, Applications and Processing of Metal Alloys
  - Characteristics, Applications, and Processing of Polymers
  - Characteristics, Applications, and Processing of Composite Materials
  - Sustainable material alternatives and environmental/social issues

- Life Cycle Analysis
  - Material Extraction and Production
  - Component Manufacture
  - Use Phase
  - End of Life Directive and Vehicle Recycling

- Political and legislative pressures on the industry including Euro emissions legislations and the European drive cycle.
- Emissions legislation within motorsport and the influence of the automotive industry.
- Alternative Fuels for IC engines – bio ethanol, bio butanol, bio diesel, lpg, hydrogen.
- Alternative and Hybrid powertrains and their potential as a sustainable solution.
- Power Generation and infrastructure
- CO2 emission levels and climate change.
- Carbon off setting and mechanisms.
- Noise pollution
- Autonomous & Connected Vehicle Technology

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	48	24%
Independent learning	152	76%
Placement learning	0	0
TOTAL	**200**	**100%**

ASSESSMENT

Assessment Component 1

☐ **Written exam** ☒ **Coursework** ☐ **Practical**

Mode of assessment	Volume	Weighting
Written Report	3000 words	50%

Assessment Component 2

☒ **Written exam** ☐ **Coursework** ☐ **Practical**

Mode of assessment	Volume	Weighting
Exam	2 hours	50%

Assessment Summary

Activity type	**Percentage**
Written exam	50%
Coursework	50%
Practical	
TOTAL	**100%**

AHEP 3 Version 3 Outcomes to be met:

SM1b, SM3b, EA1b, D1, D2, EL2, EL4, EL6, P1, P2, P4, P5.

INDICATIVE READING LIST

Module Code	ACHA6012	
Module Title	Automotive Materials & Sustainability	
Classification	Reading List entry	Electronic*
Essential	James D et al - *Automotive Fuel and Emissions Control Systems,* (Prentice Hall, 2008)	☐
Essential	Fuhs A - Hybrid Vehicles, (CRC Press, 2008)	☐
Essential	Singal S P - Noise Pollution and Control, (Narosa Publishing House, 2001)	☐
Essential	Callister, W. D.; Rethwisch, D. G., Materials Science and Engineering - 9th Edition (Wiley, 2014)	☒
Essential	I. Gibson (Ian),D. W Rosen (David W.), B Stucker (Brent) Additive manufacturing technologies: 3D printing, rapid prototyping and direct digital manufacturing Second edition. New York ; London : Springer 2015	☒
Further	Kalpakjian, S. and Schmid, S., Manufacturing, Engineering and Technology (Pearson, 2013)	☐
Further	Groover's Principles of Modern Manufacturing – 18 Nov 2016 by Mikell P. Groover	☐
Further	International Journal of Advanced Manufacturing Technology Proceedings of the IMEchE	☐
Further	Westbrook M - The Electric Car: Development and Future of Battery, Hybrid and Fuel-cell Cars, (IEE, Power & Energy, 2001)	☐
Further	Heck R M et al - Catalytic Air Pollution Control: Commercial Technology, (Wiley, 2009)	☐
Further	Gordon D & Sperling D - Two Billion Cars: Driving Toward Sustainability (Oxford University Press, 2009)	☐
Further	Race Car Engineering	☒
Further	Race Engine Technology	☒
Further	International Journal of Life Cycle Assessment	☒
Further	http://eemsonline.co.uk (Website for Energy Efficient Motorsport)	☒
Further	http://www.evuk.co.uk (Website For Electric Vehicles UK)	☒
Further	http://www.the-mia.com (Website for the Motorsport Industry Association)	☒

Module Code	**ACHA6013**
Title	**Independent Project**
Date	**25/06/2020**
Level	**6**
Credits	**40**
Pre-Requisites	**None**

AIM(S)

- To develop the ability of students to engage critically and innovatively with theory and/or practice relevant to their studied subject areas in order to produce a discipline specific in-depth project.

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- Demonstrate intellectual skills in the identification of an appropriate topic, problem or challenge for investigation pertinent to their field of study and formulate a suitable plan for further research utilising relevant investigative methods in order to produce a response.

- Evidence in-depth knowledge and critical understanding of principles necessary to underpin their education within their chosen field of study and problem solving techniques applicable to this.

- Evidence independence of thought and critical evaluation in the production of an independent piece of work, demonstrating transferable skills through exercising initiative and personal responsibility in planning own learning and self-management.

- Organise their knowledge and learning through use of a range of media, and present their work appropriately in a manner that can be understood by specialist and non-specialist audiences.

INDICATIVE CONTENT

- Research paradigms, methods, and techniques of research and enquiry.

- Conducting and writing literature reviews.

- Ethical concerns and the research process.

- Resource, project, and skills management processes and techniques.

- Presenting and illustrating data and information.

- Communication of general, specialist, technical ideas and results.

- Problem solving, creative, entrepreneurial thinking and approaches.

- Collaboration, adaptability and reflection.

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	36	9%
Independent learning	364	91%
Placement learning		
TOTAL	**400**	**100%**

ASSESSMENT

Assessment Component 1

☐ **Written exam** ☒ **Coursework** ☐ **Practical**

Mode of assessment	Volume	Weighting
Portfolio	Minimum of 3 elements (equivalent to 10,000 words)	100%

Assessment Summary

Activity type	Percentage
Written exam	
Coursework	100%
Practical	
TOTAL	**100%**

INDICATIVE READING LIST
This will be guided by the student's individual project.

Module Code	**ACHA6013**	
Module Title	**Independent Project**	
Classification	**Reading List entry**	**Electronic***
Essential	Cottrell S, (2015) *Skills for Success Personal Development and Employability, 3rd edition*, Palgrave. London.	☒
Essential	ASET, 2013 *Good Practice Guide for Workbased Learning and Placement Learning in Higher Education*	☒
Essential	Gray, D.E. (2018) *Doing Real World Research,* London: SAGE.	☐
Further	Gallagher K, (2016) *Essential Study and Employment Skills For Business and Management Students*, Oxford	☐
Further	Gottschall, Jonathan (2013), *The Storytelling Animal: How Stories Make Us Human,* Houghton Mifflin	☐
Further	Storr, Will (2020), *The Science of Storytelling,* William Collins	☐
Further	Cohen, L. Manion, L. and Morrison, K. (2017) *Research Methods in Education, 8th edition* London: Routledge.	☒
Further	Flick, U. (2014) *An Introduction to Qualitative Research*, London: SAGE.	☐

Further	Aubrey, K. & Riley, A. (2017) *Understanding and Using Challenging Education Theories*, London: SAGE.	☒
Further	Brinkmann, S. and Kvale, S. (2018) *Doing Interviews (Qualitative Research Kit)*. Sage	☐
Further	Gibbs, G. (2018) *Analysing Qualitative Data (Qualitative Research Kit).* Sage	☒
Further	Creswell, J. W. (2012*). Qualitative inquiry and research design: Choosing among five approaches*. Sage	☐
Further	Obschonka, M., Hakkarainen, K., Lonka, K. *et al.* Entrepreneurship as a twenty-first century skill: entrepreneurial alertness and intention in the transition to adulthood. *Small Bus Econ* **48,** 487–501 (2017). https://doi.org/10.1007/s11187-016-9798-6	☒
Further	https://ec.europa.eu/jrc/en/entrecomp	☒

Module Code	ACMA6000
Title	Advanced Processes and Materials
Date	01/02/2021
Level	6
Credits	20
Pre-Requisites	None

Engineering Council AHEP3 Learning Outcomes Assessed in this Module	
*SM3b	Ability to apply and integrate knowledge and understanding of other engineering disciplines to support study of their own engineering discipline
D4	Apply advanced problem-solving skills, technical knowledge and understanding, to establish rigorous and creative solutions that are fit for purpose for all aspects of the problem including production, operation, maintenance and disposal
EL4	Understanding of the requirement for engineering activities to promote sustainable development and ability to apply quantitative techniques where appropriate
P2	Knowledge of characteristics of particular materials, equipment, processes or products

*Only applies to Mechanical Engineering programme

AIM(S)

- To enable the student to gain a critical understanding of the principles and potential applications of a range of advanced engineering processes and materials

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- Critically analyse the structure-property relationships and behaviour of a range of advanced engineering materials and manufacturing processes
- Critically appraise the potential for application of a range of advanced materials and processes in typical engineering applications, gaining an understanding of the development of new sustainable materials for specific applications

INDICATIVE CONTENT

- Additive Manufacturing
- Non-traditional machining and thermal cutting processes. (Ultrasonic machining, Electro-chemical machining, electric discharge machining and chemical machining)
- Applications of lasers; laser cutting, laser welding, marking, drilling, laser surface treatment and laser bending. Including Health & Safety principles in the use of lasers
- Modern abrasive processes, ultrasonic machining, abrasive water jet cutting, magnetic abrasive machining
- Non-traditional methods of welding and defect repair: Pulsed laser deposition, Friction stir welding, Laser cladding Thermal spray, Plasma coating, Plasma arc welding
- Semiconductors
- Biomaterials
- Magnetostrictive materials
- SMA
- Nano-engineered Materials

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	48	24%
Independent learning	152	76%
Placement learning	0	0
TOTAL	**200**	**100%**

ASSESSMENT

Assessment Component 1

☒ **Written exam** ☐ **Coursework** ☐ **Practical**

Mode of assessment	Volume	Weighting
Exam	2 hours	50%

Assessment Component 2

☐ **Written exam** ☒ **Coursework** ☐ **Practical**

Mode of assessment	Volume	Weighting
Essay/Presentation	3,000 words	50%

Assessment Summary

Activity type	Percentage
Written exam	50%
Coursework	50%
Practical	
TOTAL	**100%**

INDICATIVE READING LIST

Module Code	ACMA6000	
Module Title	Advanced Processes and Materials	
Classification	Reading List entry	Electronic*
Essential	Groover, M. P., Principles of Modern Manufacturing - 4th Edition (John Wiley & Sons, 2011)	☒
Essential	Gibson, I. D., Rosen, D. W., Stucker, B., Additive manufacturing technologies: 3D Printing, Rapid Prototyping and Direct Digital Manufacturing Second edition. New York ; London : Springer 2015	☒
Essential	Callister, W. D.; Rethwisch, D. G., Materials Science and Engineering - 9th Edition (Wiley, 2014)	☒
Further	Understanding additive manufacturing: rapid prototyping : rapid tooling : rapid manufacturing Andreas. Gebhardt Cincinnati, Ohio : Hanser Publications 2011	☐
Further	Kalpakjian, S. and Schmid, S., Manufacturing, Engineering and Technology (Pearson, 2013)	☐
Further	Additive Manufacturing 3D Printing for Prototyping and Manufacturing Andreas Gebhardt Jan-Steffen Hötter Hanser Publishers Munich 2016 ISBN: 978-1-56990-582-1 E-Book ISBN: 978-1-56990-583-8	☐
Further	Manufacturing Process Selection Handbook K. G. Swift Department of Engineering, University of Hull J. D. Booker Department of Mechanical Engineering, University of Bristol Butterworth-Heinemann (Elsevier) Oxford 2013 ISBN: 978-0-08-099360-7	
Further	Karr, S. and Gill, A., Exploring Advanced Manufacturing Technologies (Industrial Press, 2003)	☐
Further	Ion, J., Laser Processing of Engineering Material: Principles, Procedure and Industrial Application (Elsevier Butterworth-Heinemann, 2006)	☐
Further	Steen, W. M. and Watkins, K., Laser Materials Processing (Springer-Verlag, 2003)	☐
Further	Groover's Principles of Modern Manufacturing – 18 Nov 2016 by Mikell P. Groover	☐
Further	Journal of Manufacturing Processes - The Society of Manufacturing Engineers (SME)	☐
Further	International Journal of Manufacturing Research	☐
Further	International Journal of Advanced Manufacturing Technology Proceedings of the IMEchE	☐

Module Code	**ACMA6001**
Title	**Control Technology**
Date	**01/02/2021**
Level	**6**
Credits	**20**
Pre-Requisites	**ACMA5001 Control and Automation**

Engineering Council AHEP3 Learning Outcomes Assessed in this Module	
EA1b	Understanding of engineering principles and the ability to apply them to analyse key engineering processes
EA2	Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques
P2	Knowledge of characteristics of particular materials, equipment, processes or products
P3	Ability to apply relevant practical and laboratory skills

AIM(S)

- To enable students to develop analytical skills in predicting the behaviour of feedback control systems and to apply that ability in the design and implementation of industrial control systems.

- To enable students to acquire and develop an understanding of the principles and practices of fluid power systems in the operation and control of mechanical and manufacturing systems and devices.

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- Analyse and characterise feedback systems in both the time and frequency domains and design PLC systems to satisfy a control specification.

- Critically evaluate fluid power (pneumatics and hydraulics) as a medium for the actuation and control of mechanical systems. Analyse and calculate the operational parameters.

INDICATIVE CONTENT

- Block diagrams, signal flow diagrams and transfer functions.

- Analysis in the time domain (root locus, Routh stability, transient performance).

- Analysis in the frequency domain (Nyquist diagrams, Nichol's chart, Bode diagrams) and frequency testing.

- PLC ladder diagrams.

- Robotics and kinematics.

- Fluid power components: hydraulic pumps, motors, actuators and valve systems; air

- Compressors and pneumatic equipment. Fluid conditioning considerations.

- Circuit diagrams - CETOP symbolic representation.

- Pump motor hydraulic drives; DCV controlled cylinders and motors; proportional control valves; metered and pressure compensated flow; power, energy and efficiency considerations.

- Energy storage: pneumatic and hydraulic reservoir/ accumulator systems, continuous and intermittent operating systems; safe working practices.

- Calculate flow rates, pressures, loads, motions, characteristics - associated with fluid power circuits/systems, and correspondingly select components and design appropriate circuits.

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	48	24%
Independent learning	152	76%
Placement learning	0	0
TOTAL	**200**	**100%**

ASSESSMENT

Assessment Component 1

☐ **Written exam** ☒ **Coursework** ☐ **Practical**

Mode of assessment	Volume	Weighting
Written assignment	3,000 words	50%

Assessment Component 2

☐ **Written exam** ☒ **Coursework** ☐ **Practical**

Mode of assessment	Volume	Weighting
Written assignment	3,000 words	50%

Assessment Summary

Activity type	Percentage
Written exam	0%
Coursework	100%
Practical	0
TOTAL	**100%**

INDICATIVE READING LIST

Module Code	**ACMA6001**	
Module Title	**Control Technology**	
Classification	**Reading List entry**	**Electronic***
Essential	Nise, N.S., Control Systems Engineering - 7th Edition (John Wiley & Sons, 2013)	☐
Essential	Parr, A., Hydraulic and Pneumatics: A Technician's and Engineer's Guide, 3rd Edition (Butterworth-Heinemann, 2011)	☒
Further	Khaled, N., Patel, B., Practical Design and Application of Model Predictive Control: MPC for Matlab and Simulink Users (Butterworth-Heinemann, 2018)	☐
Further	Skinner, S., Cuthbert, M., An Introduction to Practical Hydraulic System Maintenance: A Fluid Power Technician's Guide (Webtec Products Ltd, 2018)	☐
Further	Bolton, W., Programmable Logic Controllers, 6th Edition (Newnes, 2015)	☒
Further	Janardan, P.J. & Vishnu, P., Instrumentation and Process Control (New Delhi: I.K. International Publishing, 2010)	☐

Module Code	**ACMA6002**
Title	**Manufacturing Systems and Simulation**
Date	**01/02/2021**
Level	**6**
Credits	**20**
Pre-Requisites	**None**

Engineering Council AHEP3 Learning Outcomes Assessed in this Module	
EA2	Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques
EA3b	Ability to apply quantitative and computational methods in order to solve engineering problems and to implement appropriate action
D3b	Work with information that may be incomplete or uncertain and quantify the effect of this on the design
D6	Communicate their work to technical and non-technical audiences
P2	Knowledge of characteristics of particular materials, equipment, processes or products
P7	Awareness of quality issues and their application to continuous improvement
P8	Ability to work with technical uncertainty

AIM(S)

- To enable the student to evaluate key factors in the design and operation of manufacturing facilities

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- Interpret and evaluate the material and information flows in the manufacturing process using simulation and analytical techniques
- Evaluate a range of strategies for the improvement and management of production operations

INDICATIVE CONTENT

- Design of manufacturing systems- design methodologies and simulation of manufacturing systems as a tool for design/process improvement
- Lean manufacturing- value stream mapping techniques, 5S, waste reduction, lean tools and techniques
- Materials handling and storage techniques. Analytical analysis of these functions.
- Inventory management- types of inventory, methods for inventory management, ordering considerations
- JIT and MRP systems
- Maintenance management and overall equipment effectiveness
- Environmental issues such as reuse, recycling, managing particular waste streams and principles of pollution control

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	48	24%
Independent learning	152	76%
Placement learning	0	0
TOTAL	**200**	**100%**

ASSESSMENT

Assessment Component 1

☐ **Written exam** ☒ **Coursework** ☐ **Practical**

Mode of assessment	Volume	Weighting
Analytical Report	3,000 words	50%

Assessment Component 2

☒ **Written exam** ☐ **Coursework** ☐ **Practical**

Mode of assessment	Volume	Weighting
Examination	2 hours	50%

Assessment Summary

Activity type	Percentage
Written exam	50
Coursework	50
Practical	0
TOTAL	**100%**

INDICATIVE READING LIST

Module Code	**ACMA6002**	
Module Title	**Manufacturing Systems and Simulation**	
Classification	**Reading List entry**	**Electronic***
Essential	Muller, M (2019) Essentials of Inventory Management, 3rd, Edition, Harper Collins	☐
Essential	Reid, D and Sanders, N (2012) Operations Management: An Integrated Approach.5th Edition, John Wiley and Son	☐
Essential	Slack, N and Brandon-Jones, A (2018) Operations and Process Management: Principles and Practice for Strategic Input, 5th Edition, Pearson	☐
Further	Womack, JP and Jones, D (2003) Lean Thinking, Free Press	☐
Further	Cudney, E and Kestle, R (2011) Implementing Lean Six Sigma Throughout the Supply Chain, CRC Press	☐
Further	Bucheno, J and Holweg, M (2008) The Lean Toolbox, 5th Edition, Picisie Books	☐
Further	Hines, P Found, P Griffiths, G and Harrison, R (2011) Staying Lean: Thriving, Not Just Surviving, 2nd Edition, Productivity Press	☐
Further	Quality World	☐
Further	Quality Progress	☐
Further	International Journal of Production Economics	☒
Further	International Journal of Quality and Reliability Management	☒
Further	International Journal of Quality Science	☒
Further	Total Quality Management	☒
Further	Journal of Operations Management	☒
Further	Process Engineer	☒
Further	www.thecqi.org	☒
Further	www.asq.org	☒
Further	www.emeraldinsight.com	☒
Further	www.isspro.co.uk	☒

Module Code	**ACMA6004**
Title	**Metallurgy of Non-Ferrous Alloys**
Date	**01/02/2021**
Level	**6**
Credits	**20**
Pre-Requisites	**None**

Engineering Council AHEP3 Learning Outcomes Assessed in this Module	
SM1b	Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies
EA1b	Understanding of engineering principles and the ability to apply them to analyse key engineering processes
EA2	Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques
P1	Understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, application and development of technology, etc)
P2	Knowledge of characteristics of particular materials, equipment, processes or products

AIM(S)

- To provide the student with an in-depth understanding of the physical metallurgy of non-ferrous metals, their applications and processing technology.

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- appraise the behaviour of a range of non-ferrous metals, their strengthening mechanisms; evaluate in terms of microstructure and make predictions about behaviour based on microstructural information
- interpret and evaluate the formulation and modelling of real engineering problems for a range of non-ferrous metals related processes and in relation to the microstructure of the metal or alloy

INDICATIVE CONTENT

- overview of non-ferrous alloys and review of strengthening mechanisms
- aluminium and its alloys – binary and ternary alloy systems
- magnesium and its alloys
- titanium and its alloys
- copper and its alloys
- zinc and its alloys
- nickel and its alloys – nickel base super-alloys, shape memory alloys
- other significant metals – refractory metals
- applications – aerospace, medical, automotive
- emerging non-ferrous metals technology – such as laser processing, metal matric composites, powder processing of titanium, aluminium alloys for high performance forming operations

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	48	24%
Independent learning	152	76%
Placement learning	0	0
TOTAL	**200**	**100%**

ASSESSMENT

Assessment Component 1

☐ **Written exam** ☒ **Coursework** ☐ **Practical**

Mode of assessment	Volume	Weighting
Report	1,800 words	30%

Assessment Component 2

☒ **Written exam** ☐ **Coursework** ☐ **Practical**

Mode of assessment	Volume	Weighting
Exam	2 hours	70%

Assessment Summary

Activity type	Percentage
Written exam	70%
Coursework	30%
Practical	
TOTAL	**100%**

AHEP3 Version 3 outcomes to be met:
SM1b, P2

INDICATIVE READING LIST

Module Code	**ACMA6004**	
Module Title	**Metallurgy of Non-Ferrous Alloys**	
Classification	**Reading List entry**	**Electronic***
Essential	Campbell, F. C., Elements of Metallurgy and Engineering Alloys (ASM International, 2008)	☐
Further	Raghavan, V., Physical Metallurgy: Principles and Practice, 3rd Edition (PHI Learning, 2015)	☐
Further	Hosford, W. F., Physical Metallurgy (CRC, 2010)	☐
Further	Lumley R., Fundamentals of Aluminium Metallurgy: Production, Processing and Applications (CRC, 2010)	☐
Further	Porter, D. A., Easterling, K. E. and Sherif, M., Phase Transformations in Metals and Alloys (Taylor & Francis, 2009)	☐
Further	Polmear, I. J., Light Alloys: From Traditional Alloys to Nanocrystals (Butterworth-Heinemann, 2005)	☐
Further	Reed, R. C., The Superalloys: Fundamentals and Applications (Cambridge University Press, 2008)	☐
Further	Sanchez, P. N., Titanium Alloys: Preparation, Properties and Applications (Nova Science Publishers, 2010)	☐

Module Code	**ACMA6005**
Title	**Metallurgy of Steel**
Date	**01/02/2021**
Level	**6**
Credits	**20**
Pre-Requisites	**None**

Engineering Council AHEP3 Learning Outcomes Assessed in this Module	
SM1b	Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies
EA1b	Understanding of engineering principles and the ability to apply them to analyse key engineering processes
EA2	Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques
P1	Understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, application and development of technology, etc)
P2	Knowledge of characteristics of particular materials, equipment, processes or products

AIM(S)

- To provide the student with an in-depth understanding of the physical metallurgy of steel and steel processing technology

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- appraise the behaviour of a range steels, their strengthening mechanisms; evaluate in terms of microstructure and make predictions about behaviour based on microstructural information
- interpret and evaluate the formulation and modelling of real engineering problems for a range of steel related processes and in relation to the microstructure of the metal or alloy

INDICATIVE CONTENT

- Phase Transformations: The Iron-carbon phase diagram, Steels and Cast Irons, TTT and CCT diagrams;
- Study of equilibrium and non-equilibrium ferrous transformations: Pearlitic, Bainitic and Martensitic Transformations;
- Effect of alloy additions on steel properties: Martensitic quench, Hardenability issues;
- High Strength Low Alloy Steels, Interstitial Free Steels, Tool Steels, Creep resistant steels, High temperature oxidation resistant steels;
- Stainless Steels: Metallurgy, Fabrication, Properties, Applications (Automotive, Aerospace, Power generation) ;
- Surface treatment and coating technology for steel products;
- Microstructural characterisation techniques for steel products;
- Surface Analysis Techniques for steel products;
- Applications of Steels – automotive, marine, structural
- Coated products – tinplate, galvanised steel, polymer coatings, Cr/CrO2 coatings
- Emerging steel technology e.g., laser processing, steel nanostructures

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	48	24%
Independent learning	152	76%
Placement learning	0	0
TOTAL	**200**	**100%**

ASSESSMENT

Assessment Component 1

☐ **Written exam** ☒ **Coursework** ☐ **Practical**

Mode of assessment	Volume	Weighting
Report	1,800 words	30%

Assessment Component 2

☒ **Written exam** ☐ **Coursework** ☐ **Practical**

Mode of assessment	Volume	Weighting
Exam	2 hours	70%

Assessment Summary

Activity type	Percentage
Written exam	70%
Coursework	30%
Practical	
TOTAL	**100%**

INDICATIVE READING LIST

Module Code	ACMA6005	
Module Title	Metallurgy of Steel	
Classification	Reading List entry	Electronic*
Essential	Bhadeshia, H. and Honeycombe, R., Steels: Microstructure and Properties, 4th Edition (Butterworth-Heinemann, 2017)	☐
Essential	Mandal, S.K., Steel Metallurgy: Properties, Specifications and Applications (McGraw Hill, 2014)	☐
Essential	Llewellyn, D. T., Steels: Metallurgy and Applications (Butterworth-Heinemann, 2013)	☐
Further	Porter, D. A., Easterling, K. E. and Sherif, M., Phase Transformations in Metals and Alloys, 3rd Edition (Routledge, 2009)	☐
Further	Hosford, W. F., Physical Metallurgy (CRC, 2010)	☐
Further	Verhoeven, J. D., Steel Metallurgy for the Non-Metallurgist(ASM International, 2007)	☐
Further	Brandt, D Metallurgy Fundamentals: Ferrous and Non-Ferrous, 5th Edition Goodheart-Wilcox Publisher	☐
Further	Journal of Manufacturing Processes	☒
Further	Journal of Materials Processing Technology	☒
Further	Surface and Coatings Technology	☒
Further	Additive Technology	☒
Further	Engineering Failure Analysis	☒
Further	Materials Today	☒
Further	Materials Science and Engineering	☒
Further	www.theweldinginstitute.com	☒
Further	www.bindit.org	☒
Further	www.iiwelding.org	☒
Further	www.iso.org	☒
Further	www.iom3.org	☒
Further	www.imeche.org	☒

Module Code	**ACMA6006**
Title	**Environmental Pollution Control**
Date	**01/02/2021**
Level	**6**
Credits	**20**
Pre-Requisites	**None**

Engineering Council AHEP3 Learning Outcomes Assessed in this Module	
EA1b	Understanding of engineering principles and the ability to apply them to analyse key engineering processes
D2	Investigate and define the problem, identifying any constraints including environmental and sustainability limitations; ethical, health, safety, security and risk issues; intellectual property; codes of practice and standards
EL2	Knowledge and understanding of the commercial, economic and social context of engineering processes
EL4	Understanding of the requirement for engineering activities to promote sustainable development and ability to apply quantitative techniques where appropriate
P2	Knowledge of characteristics of particular materials, equipment, processes or products
P5	Knowledge of relevant legal and contractual issues
P6	Understanding of appropriate codes of practice and industry standards

AIM(S)

- To enable students to understand and explain the principles of environmental pollution control and be able to apply engineering solutions and technologies to control or eliminate pollution

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- in-depth knowledge and understanding of environmental pollution control in relation to noise, air water and land pollution
- critical evaluation of a range of technologies from an engineering perspective that are available to control pollution and financial, operational and economic considerations when selecting suitable pollution control options

INDICATIVE CONTENT

- Control of emissions to air and the range of technologies utilised to manage the impacts of air pollution gaseous emission control
- To perform noise assessments, calculate noise exposure and consider the options available to control the effects of noise pollution
- Water treatment principles and emerging methods of water treatment. Wastewater and sewage treatment processes and pollution control measures
- Economics of pollution control
- Legislation relating to air, noise and water pollution
- Recycling of materials

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	48	24%
Independent learning	152	76%
Placement learning	0	0
TOTAL	**200**	**100%**

ASSESSMENT

Assessment Component 1

☐ **Written exam** ☒ **Coursework** ☐ **Practical**

Mode of assessment	Volume	Weighting
Report	3,000 words	50%

Assessment Component 2

☒ **Written exam** ☐ **Coursework** ☐ **Practical**

Mode of assessment	Volume	Weighting
Exam	2 hours	50%

Assessment Summary

Activity type	Percentage
Written exam	50%
Coursework	50%
Practical	0
TOTAL	**100%**

INDICATIVE READING LIST

Module Code	ACMA6006	
Module Title	Environmental Pollution Control	
Classification	Reading List entry	Electronic*
Essential	Hill, M., Understanding Environmental Pollution – 4th Edition (Cambridge University Press, 2020)	☐
Essential	Mihelic, J. and Zimmermann, J. B., Environmental Engineering: Fundamentals, Sustainability, Design – 3rd Edition (Wiley, 2021)	☐
Further	Davis, M. and Cornwell, D., Introduction to Environmental Engineering - 5th Edition (McGraw Hill, 2012)	☐
Further	Jacobson, M., Air Pollution and Global Warming: History, Science and Solutions - 2nd Edition (Cambridge University Press, 2012)	☐
Further	Tchobanoglous, G., Burton, F. and Stensel, D., Wastewater Engineering: Treatment and Reuse - 5th Edition (McGraw Hill, 2013)	☐
Further	Bies, D. A. and Hansen, C. H., Engineering Noise Control: Theory and Practice - 4th Edition (CRC Press, 2009)	☐
Further	Crawford, R. and Crawford, D., Bioremediation: Principles and Applications (Biotechnology Research) (Cambridge University Press, 2005)	☐
Further	Davis, M., Water and Wastewater Engineering (McGraw Hill, 2010)	☐
Further	Fender, J. and Tjell, C. J., Air Pollution from a Local to a Global Perspective (RSC Publishing, 2009)	☐
Further	Hess-Kosa, K., Indoor Air Quality: The Latest Sampling and Analytical Methods - 2nd Edition (CRC Press, 2011)	☐
Further	Peters, R., Smith, B. and Hollins, M., Acoustics and Noise Control - 3rd Edition (Routledge, 2011)	☐
Further	Phalen, R. F. and Phalen, R. N., Introduction to Air Pollution Science (Jones and Barlett, 2011)	☐
Further	Riffat, R., Fundamentals of Wastewater Treatment and Engineering (CRC Press, 2012)	☐
Further	Vallero, D., Fundamentals of Air Pollution - 5th Edition (Academic Press Inc, 2014)	☐
Further	Journal of Environmental Engineering	☐
Further	Journal of Cleaner Production	☐
Further	Resources Conservation and Recycling	☐
Further	Applied Acoustics	☐
Further	Journal of Sound and Vibration	☐
Further	Environmental Impact Assessment Review	☐

Further	Journal of Environmental Sciences	☐
Further	Water Research	☐
Further	Monitoring Water Quality	☐
Further	Marine Pollution Bulleting	☐
Further	Science of The Total Environment	☐
Further	Journal of Hazardous Materials	☐
Further	Environmental Pollution	☐
Further	Atmospheric Environment	☐
Further	www.carbontrust.com	☒
Further	www.defra.gov.uk	☒
Further	www.environment-agency.gov.uk	☒
Further	www.ciwm.co.uk	☒
Further	www.ciwem.org	☒
Further	www.water-pollution.org.uk	☒
Further	www.epa.gov	☒
Further	www.springer.com	☒

Module Code	**ACMA6007**
Title	**Plant and Asset Engineering**
Date	**01/02/2021**
Level	**6**
Credits	**20**
Pre-Requisites	**None**

Engineering Council AHEP3 Learning Outcomes Assessed in this Module	
SM1b	Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies
EA1b	Understanding of engineering principles and the ability to apply them to analyse key engineering processes
EA4b	Understanding of, and the ability to apply, an integrated or systems approach to solving engineering problems
D4	Apply advanced problem-solving skills, technical knowledge and understanding, to establish rigorous and creative solutions that are fit for purpose for all aspects of the problem including production, operation, maintenance and disposal
EL4	Understanding of the requirement for engineering activities to promote sustainable development and ability to apply quantitative techniques where appropriate
P1	Understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, application and development of technology, etc)
P2	Knowledge of characteristics of particular materials, equipment, processes or products

AIM(S)

- To enable students to critically analyse a range of engineering requirements in order to ensure plant equipment runs efficiently and assets are well maintained

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- Evaluate the energy efficiency of equipment and processes; make informed decisions on how energy consumption can be reduced and understand the importance of asset management.

- Interpret and evaluate equipment maintenance requirements from an engineering and process perspective, in order to ensure it operates efficiently and reduces waste in processes.

INDICATIVE CONTENT

- Compressors- operational requirements, treatment of air, distribution, maintenance requirements, compressed air audit

- Energy efficiency in processes, operations and equipment selection, energy auditing and performance monitoring

- Combined heat and power (CHP) operations

- Asset management maintenance planning, scheduled and breakdown maintenance, TPM, RCM and condition-based monitoring

- Motors and drivers- motor efficiency/rating, variable speed drives, maintenance considerations, rotor balancing, fans and blowers

- Reliability analysis in relation to failure (MTBF MTTR MTTF), systems analysis, redundancy and reliability testing
- Efficiency of burners, flame parameters, calculation of fuel ratios and combustion parameters
- Particulate emissions control

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	48	26
Independent learning	152	76
Placement learning	0	0
TOTAL	200	100%

ASSESSMENT

Assessment Component 1

☐ Written exam ☒ Coursework ☐ Practical

Mode of assessment	Volume	Weighting
Report	3,000 words	50%

Assessment Component 2

☒ Written exam ☐ Coursework ☐ Practical

Mode of assessment	Volume	Weighting
Examination	2 hours	50%

Assessment Summary

Activity type	Percentage
Written exam	50%
Coursework	50%
Practical	0
TOTAL	**100%**

INDICATIVE READING LIST

Module Code	ACMA6007	
Module Title	**Plant and Asset Engineering**	
Classification	**Reading List entry**	**Electronic***
Essential	Mobley, K (2014) Maintenance Engineering Handbook 8th Edition, McGraw Hill	☐
Essential	Tooley, N (2009) Plant and Processes Engineering, Elsevier	☐
Essential	Beggs, C (2010) Energy Management, Supply and Construction, 2nd Edition, Routledge	☐
Further	Borris, S (2006) Total Productive Maintenance: Proven Strategies and Techniques to Keep Equipment Running, McGraw Hill	☐
Further	Brown (2005) Compressors: Selection and Sizing, 3rd Edition, Gulf Professional Publishing	☐
Further	Turns, S (2020) An Introduction to Combustion: Concepts and Applications, 4rd Edition, McGraw Hill	☐
Further	Campbell, J Jardine, A and McGlynn, J (2011) Asset Management Excellence: Optimising Equipment Life Cycle Decisions, 2nd Edition, CRC Press	☐
Further	Hughes, A and Drury, B (2019) Electric Motors and Drives, 5th Edition, Newnes	☐
Further	Mowbray, J (1999) Reliability Centred Maintenance, 2nd Edition, Elsevier	☐
Further	Smith (2017) Reliability, Maintainability and Risk: Practical Methods for Engineers, 9th Edition, Butterworth-Heinemann Ltd	☐
Further	Volk, M (2013) Pump Characteristics and Applications, 3rd Edition. CRC Press	☐
Further	Energy and Buildings	☒
Further	Energy Conservation and Management	☒
Further	Renewable and Sustainable Energy	☒
Further	Chemical Engineering Journal	☒
Further	Energy Policy	☒
Further	Fuel Processing Technology	☒
Further	International Journal of Production Economics	☒
Further	Reliability Engineering & System Safety	☒
Further	Control Engineering Practice	☒
Further	www.carbontrust.com	☒
Further	www.defra.gov.uk	☒
Further	www.imeche.org	☒
Further	www.combustioninstitute.org	☒
Further	www.chpa.co.uk	☒
Further	www.babcockwanson.co.uk	☒
Further	www.wrap.org.uk	☒
Further	www.energyinst.org	☒
Further	www.breeam.org	☒

Module Code	ACMA6008
Title	Procurement and Negotiation
Date	01/02/2021
Level	6
Credits	20
Pre-Requisites	None

AIM(S)

- To provide engineers and operations specialists with a range of skills needed to negotiate requirements and procure goods effectively.

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- Appraise and evaluate the importance of the procurement process and the need to manage suppliers effectively
- Plan for negotiations, evaluate a range of negotiation tactics and the importance of negotiation in operations

INDICATIVE CONTENT

- Key approaches to negotiation and the importance of planning for negotiations
- Factors that influence the effectiveness of negotiations – balance of power, relationships and communication
- The procurement process, supplier selection and sourcing, use of a purchasing models and supplier perspective
- Different types of procurement, and conflict management
- Financial considerations in procurement – life cycle costing, total acquisition costing, hiring\leasing and straight buys

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	48	24%
Independent learning	152	76%
Placement learning	0	0
TOTAL	**200**	**100%**

ASSESSMENT

Assessment Component 1

☐ **Written exam** ☒ **Coursework** ☐ **Practical**

Mode of assessment	Volume	Weighting
Report	3,000 words	50%

Assessment Component 2

☐ **Written exam** ☒ **Coursework** ☐ **Practical**

Mode of assessment	Volume	Weighting
Practical Exercise	3,000 words	50%

Assessment Summary

Activity type	Percentage
Written exam	0
Coursework	100%
Practical	0
TOTAL	**100%**

INDICATIVE READING LIST

Module Code	**ACMA6008**	
Module Title	**Procurement and Negotiation**	
Classification	**Reading List entry**	**Electronic***
Essential	Van Weele, A (2018) Purchasing and Supply Chain Management, 7th Edition, Cengage	☐
Essential	Lysons, K and Farrington, B (2016) Procurement and Supply Chain Management, 9th Edition, Pearson	☐
Essential	Bailey, P Farmer, D Crocker, B Jessop, D and Jones, D (2015) Procurement, Principles and Management, 11th Edition, Pearson	☐
Further	Booth, C (2010) Strategic Procurement: Organising Suppliers and Supply Chain for Competitive Advantage, Kogan Page	☐
Further	Burt, D Dobler, S and Starling, S (2003) World Class Supply Management, 7th Edition McGraw Hill	☐
Further	Fells, R (2016) Effective Negotiation: From Research to Results, 3rd Edition, Cambridge University Press	☐
Further	Lewick, R Barry, B and Saunders, D (2015) Essentials of Negotiation, 6th Edition, McGraw Hill	☐
Further	European Journal of Purchasing and Supply Management	☒
Further	International Journal of Production Economics	☒
Further	Journal of Business Ethics	☒
Further	Journal of Operations Management	☒
Further	Journal of Production and Operations Management	☒
Further	Journal of Supply Chain Management	☒
Further	www.supplymanagement.com	☒
Further	www.ipscmi.org	☒
Further	www.ism.ws	☒
Further	www.cips.org	☒
Further	www.cilt.org.uk	☒
Further	www.ipsera.org	☒

Module Code	**ACMA6009**
Title	**Welding Engineering**
Date	**01/02/2021**
Level	**6**
Credits	**20**
Pre-Requisites	**ACMA4000 Materials and Introduction to Processing**

Engineering Council AHEP3 Learning Outcomes Assessed in this Module	
SM1b	Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies
EA1b	Understanding of engineering principles and the ability to apply them to analyse key engineering processes
P1	Understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, application and development of technology, etc)
P2	Knowledge of characteristics of particular materials, equipment, processes or products

AIM(S)

- To provide the student with a critical understanding of a range of welding processes, the microstructures of welded joints in ferrous and non-ferrous alloys and the factors which lead to weld defects.

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- Apply physical metallurgy principles to explain the response of ferrous and non-ferrous metals to welding, analyse and interpret the microstructures of welds and evaluate the causes of defects in welds
- Demonstrate an in-depth understanding of a range of processes for welding ferrous and non-ferrous metals and an ability to critically analyse key process parameters

INDICATIVE CONTENT

- Conventional welding technologies – principles of and equipment for arc welding, plasma arc welding and cutting. Metal transfer in consumable electrode processes. Process / [principles, operation and application of manual metal arc welding. Submerged arc welding. Electroslag welding. Gas metal arc welding. Pressure welding, ultrasonic welding, explosive welding, diffusion bounding. Stud welding / mechanical fasteners. Resistance welding. Oxy-fuel gas welding. Thermal cutting and other edge preparation process. Brazing. Soldering. Preheating.
- Advanced welding processes – laser welding, friction stir welding.
- Design of welded joints.
- Response of materials to welding – structural change, stresses and distortion in welding, weldability of ferrous and non-ferrous alloys. Weld metal and heat affected zones. The effect of the heat input on the thermal profile, and its subsequent effect on the microstructure of both the weld metal and heat affected zones.
- Weld defects.
- Weld cracking – hydrogen, solidification, reheat cracking and lamellar tearing – causes and remedies.
- Corrosion of welds.

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	48	24%
Independent learning	152	76%
Placement learning	0	0
TOTAL	**200**	**100%**

ASSESSMENT

Assessment Component 1

☐ **Written exam** ☒ **Coursework** ☐ **Practical**

Mode of assessment	Volume	Weighting
Report	1800 words	30%

Assessment Component 2

☒ **Written exam** ☐ **Coursework** ☐ **Practical**

Mode of assessment	Volume	Weighting
Exam	2 hours	70%

Assessment Summary

Activity type	Percentage
Written exam	70%
Coursework	30%
Practical	
TOTAL	**100%**

INDICATIVE READING LIST

Module Code	ACMA6009	
Module Title	Welding Engineering	
Classification	Reading List entry	Electronic*
Essential	Lippold, J.C., Welding Metallurgy and Weldability (Wiley-Blackwell, 2015)	☐
Essential	Lancaster, J.F., Metallurgy of Welding (Woodhead Publishing, 1999)	☐
Further	Blondeau, R., Metallurgy and Mechanics of Welding (Wiley-Blackwell, 2008)	☐
Further	Timings, R., Fabrication and Welding Engineering (Routledge, 2008)	☐
Further	Kou, S., Welding Metallurgy, 2nd Edition (John Wiley & Sons, 2002)	☐
Further	Vora, J and Badheka Advances in Welding Technologies for Process Development (CRC Press, 2019)	☒
Further	Schwartz, M Innovations in Materials Manufacturing Fabrication and Environmental Safety, (CRC Press, 2010)	☐
Further	Phillips, D Welding Engineering: An Introduction, (John Wiley & Sons, 2015)	☐
Further	Black, J and Kohser, S DeGarmo's Materials and Processes in Manufacturing, SI Version, 12th Edition, (Wiley, 2018)	☐
Further	Engineering Failure Analysis	☒
Further	Materials Science and Engineering	☒
Further	Engineering Fracture Mechanics	☒
Further	Journal of Materials Processing Technology	☒
Further	Journal of Manufacturing Systems	☒
Further	Journal of Computational Design and Engineering	☒
Further	Materials Today	☒
Further	Materials & Design	☒
Further	Journal of Manufacturing Processes	☒
Further	www.theweldinginstitute.com	☒
Further	www.bindit.org	☒
Further	www.iiwelding.org	☒
Further	www.asq.org	☒
Further	www.iom3.org	☒
Further	www.imeche.org	☒

Module Code	**ACMA6010**
Title	**Structural and Fluid Analysis**
Date	**01/02/2021**
Level	**6**
Credits	**20**
Pre-Requisites	**None**

Engineering Council AHEP3 Learning Outcomes Assessed in this Module	
SM1	Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies
EA1b	Understanding of engineering principles and the ability to apply them to analyse key engineering processes
EA2	Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques
EA3b	Ability to apply quantitative and computational methods in order to solve engineering problems and to implement appropriate action
D3b	Work with information that may be incomplete or uncertain and quantify the effect of this on the design
D5	Plan and manage the design process, including cost drivers, and evaluate outcomes
P2	Knowledge of characteristics of particular materials, equipment, processes or products
P3	Ability to apply relevant practical and laboratory skills
P4	Understanding of the use of technical literature and other information sources
P6	Understanding of appropriate codes of practice and industry standards
P8	Ability to work with technical uncertainty

AIM(S)

- To provide the student with the necessary skills required to investigate structural and fluid engineering problems.

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- Critically analyse and evaluate techniques for structural and fluid problems and CAE results
- Demonstrate competence in the application of suitable software packages to investigate engineering structural and fluid problems and cognitive skills in the formulation and analytical solution of a problem within the chosen engineering specialism

INDICATIVE CONTENT

- Finite Element Method
  - The role of FEA in the lifecycle
  - Analysis types
  - Overview of FEA and creating an FE model
  - Mesh quality checks
  - 1D v 2D v 3D elements
  - Common issues
- Structural analysis techniques using analytical approaches
  - Theories of elastic failure/yield criteria
  - Elastic instability of axially loaded components – Euler theory. Rankine-Gordon theory.

    - Failure of materials – Fatigue, creep and stress concentrations
    - Measurement of stress – photoelasticity, strain gauges
- Fluid Mechanics
    - Bernoulli's Equation
    - Reynolds Number
    - Boundary layer development
    - Separation
    - Turbulence
    - Euler Equation Derivation
    - Navier-Stokes Equations
    - CFD Process & Approach
- Optimisation techniques
    - Optimisation in the design process
    - What is optimisation?
    - Topology, Topography, Size, Shape and composite optimisation
- Application of commercial software to investigate structural and fluid problems
    - Solidworks : Builds on Modelling and FEA skills introduced in Level 5 and allows students to explore more complex simulation situations such as vibrational or thermal analysis applied to engineering problems
    - Genesis : Allows an FEM optimisation methodology to be applied to specific engineering problems. Optimisation techniques, topology, topography, topometry, sizing optimisation, fibre orientation and lay-up optimisation in composite materials
    - Fluent/HelyxOpenFoam: Allows the simulation and validation of 2D and 3D Computational fluid dynamics problems. CFD theory and practice, parallelisation of solvers, Higher order meshing including meshing theory

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	48	24%
Independent learning	152	76%
Placement learning	0	0
TOTAL	**200**	**100%**

ASSESSMENT

Assessment Component 1

☐ **Written exam** ☒ **Coursework** ☐ **Practical**

Mode of assessment	Volume	Weighting
Written assignment	3,000 words	50%

Assessment Component 2

☐ **Written exam** ☒ **Coursework** ☐ **Practical**

Mode of assessment	Volume	Weighting
Written assignment	3,000 words	50%

Assessment Summary

Activity type	Percentage
Written exam	0
Coursework	100%
Practical	0
TOTAL	**100%**

INDICATIVE READING LIST

Module Code	**ACMA6010**	
Module Title	**Structural and Fluid Analysis**	
Classification	**Reading List entry**	**Electronic***
Essential	Versteeg, Malalasekera, and Malalasekera, W. An Introduction to Computational Fluid Dynamics: The Finite Volume Method. 2nd ed. Harlow: Pearson Prentice Hall, 2007. Print.	☐
Essential	Hearn, E.J. *Mechanics of Materials, vols.1 & 2*, Butterworth-Heinemann, 1997	☐
Essential	Ferziger, J. H. and Perić, M., Computational Methods for Fluid Dynamics, 4th Edition (Springer, 2019)	☐
Essential	Mac Donald, Bryan J. Practical Stress Analysis with Finite Elements. 3rd Edition (Machdohnil Limited, 2020)	☐
Further	McBeath, S., Competition Car Aerodynamics, 3rd Edition (Veloce Publishing Ltd, 2017)	☐
Further	Katz, J., Race Car Aerodynamics: Designing for Speed (Robert Bentley, 1995)	☐
Further	Barnard, R. H., Road Vehicle Aerodynamic Design: An Introduction, 3rd Edition (Mechaero, 2010)	☐
Further	Sifakis, Eftychios. and Jernej. Barbic. Finite Element Method Simulation of 3D Deformable Solids. 2016. Synthesis Digital Library of Engineering and Computer Science. Web.	☐
Further	Vanderplaats, G. N., Multidiscipline Design Optimisations (VR&D, 2007)	☐
Further	Bernoulli Aerodynamics International, Racecar Graphic (2006)	☐

Module Code	ACMA6011
Title	Advanced Thermofluid Mechanics
Date	01/02/2021
Level	6
Credits	20
Pre-Requisites	ACMA5011 Thermofluid Mechanics

Engineering Council AHEP3 Learning Outcomes Assessed in this Module	
SM1b	Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies
EA1b	Understanding of engineering principles and the ability to apply them to analyse key engineering processes

AIM(S)

- To enable the student to apply principles of heat transfer and fluid flow to the design and critical analysis of heat exchangers and the application of extended surfaces for enhancing heat transfer
- To extend the student's understanding of heat transfer by employing numerical techniques to evaluate the thermodynamic performance of heat exchangers

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- Demonstrate an ability to critically appraise various industrial heat exchanger configurations and critically evaluate heat exchanger design methodologies
- Analyse key concepts to evaluate optimum extended surface configurations for improved heat transfer performance and apply computational tools to a design solution of a heat exchanger and optimise the performance

INDICATIVE CONTENT

- Consolidation of fundamental principles of fluid flow and heat transfer
- Basics of heat exchanger design – configuration and types
- Heat exchanger design methodologies – overall heat transfer coefficient, Log Mean Temperature Difference, effectiveness-NTU methods
- Limitations of design methods
- Fouling factor – effects on thermal resistance
- Extended surfaces – types and efficiency measures, contact resistance
- Numerical design and optimisation of heat exchanger

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	48	24%
Independent learning	152	76%
Placement learning	0	0
TOTAL	**200**	**100%**

ASSESSMENT

Assessment Component 1

☐ **Written exam** ☒ **Coursework** ☐ **Practical**

Mode of assessment	Volume	Weighting
Report	2,500 words	40%

Assessment Component 2

☒ **Written exam** ☐ **Coursework** ☐ **Practical**

Mode of assessment	Volume	Weighting
Exam	2 hours	60%

Assessment Summary

Activity type	Percentage
Written exam	60%
Coursework	40%
Practical	
TOTAL	**100%**

INDICATIVE READING LIST

Module Code	**ACMA6011**	
Module Title	**Advanced Thermofluid Mechanics**	
Classification	**Reading List entry**	**Electronic***
Essential	Holman, J.P., Heat Transfer (SI Units), 10th Ed. – International Edition (Mc Graw-Hill, 2011)	☐
Essential	Rogers, G. and Mayhew, Y.R., Engineering Thermodynamics: work and heat transfer, 4th Ed. (Harlow: Pearson Prentice Hall, 1992)	☐
Essential	Webb, R.L. and Kim, N-H., Principles of Enhanced Heat Transfer, 2nd Edition (CRC Press, 2005)	☒
Further	Bolton, W., Engineering Science, 7th Ed. (Routledge, 2020)	☐
Further	Moran, M.J. and Shapiro, H.N., Fundamentals of Engineering Thermodynamics, 8th Edition (Wiley, 2014)	☐
Further	Bergman, T.L., Lavine, A.S., Incropera, F.P. and DeWitt, D.P., Fundamentals of Heat and Mass Transfer, 8th Edition (Wiley, 2017)	☐
Further	Science Direct: www.sciencedirect.com	☒

Module Code	**ACMA6012**
Title	**Computational Methods**
Date	**01/02/2021**
Level	**6**
Credits	**20**
Pre-Requisites	**None**

Engineering Council AHEP3 Learning Outcomes Assessed in this Module	
SM1b	Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies
EA1b	Understanding of engineering principles and the ability to apply them to analyse key engineering processes
EA2	Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques
EA3b	Ability to apply quantitative and computational methods in order to solve engineering problems and to implement appropriate action
D3b	Work with information that may be incomplete or uncertain and quantify the effect of this on the design
P1	Understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, application and development of technology, etc)
P2	Knowledge of characteristics of particular materials, equipment, processes or products
P3	Ability to apply relevant practical and laboratory skills
P4	Understanding of the use of technical literature and other information sources
P8	Ability to work with technical uncertainty

AIM(S)

- To provide the student with the necessary skills required to apply computer systems and simulations to model engineering problems

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- evaluate the usage of suitable analysis packages for specific problems and competence in the application of the packages studied to specific engineering problems

- demonstrate subject specific skills and the ability to successfully validate and critically evaluate CAE results and cognitive skills in the formulation and numerical solution of a problem within the chosen engineering specialism

INDICATIVE CONTENT

- Programming methodology for computational methods

- Partial differential equations: finite difference methods

- Matlab / SciLAB : Allows use of numerical modelling for a variety of mathematical and engineering specific problems

- Solidworks / NX8.5 : Builds on Modelling and FEA skills introduced in Level 5 and allows students to explore more complex simulation situations such as vibrational or thermal analysis

- Genesis: Allows an FEM optimisation methodology to be applied to specific engineering problems. Optimisation techniques, topology, topography, topometry, sizing optimisation, fibre orientation and lay-up optimisation in composite materials

- Fluent: Allows the simulation and validation of 2D and 3D Computational fluid dynamics problems. HPC parallelisation of ANSYS solvers, CFD theory and practice, Higher order meshing including meshing theory and Multi-physics (Fluid-structure interaction) modelling will be introduced

- 2D Data Acquisition Analysis and Programming: Develops an advanced programming skill in the 2D software environment for the analysis and development of the competition motorcycle

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	48	24%
Independent learning	152	76%
Placement learning	0	0
TOTAL	**200**	**100%**

ASSESSMENT

Assessment Component 1

☐ **Written exam** ☒ **Coursework** ☐ **Practical**

Mode of assessment	Volume	Weighting
Written assignment	3,000 words	50%

Assessment Component 2

☐ **Written exam** ☒ **Coursework** ☐ **Practical**

Mode of assessment	Volume	Weighting
Written assignment	3,000 words	50%

Assessment Summary

Activity type	Percentage
Written exam	0
Coursework	100%
Practical	0
TOTAL	**100%**

INDICATIVE READING LIST

Module Code	**ACMA6012**	
Module Title	**Computational Methods**	
Classification	**Reading List entry**	**Electronic***
Essential	Langtangen H.P., Linge, S., Finite Difference Computing with PDEs: A Modern Software Approach (Springer, 2017)	☐
Essential	Mazumder, S., Numerical Methods for Partial Differential Equations: Finite Difference and Finite Volume Methods (Academic Press, 2015)	☐
Essential	Croft, D.R., Lilley, D.G., Heat Transfer Calculations Using Finite Difference Equations (Elsevier Science & Technology, 1977)	☐
Essential	Smith, G.D., Numerical Solution of Partial Differential Equations: Finite Difference Methods, 3rd Edition (Oxford University Press, 1986)	☐
Further	Hunt, B.R., Lipsman, R.L, Rosenberg, J., A Guide to Matlab: for beginners and experienced users, 3rd Edition (Cambridge University Press, 2014)	☒
Further	Evans, G., Numerical Methods for Partial Differential Equations (Springer, 1999)	☐
Further	Spiegel, M.R., Schaum's Outline of Calculus of Finite Differences and Difference Equations, 3rd Edition (McGraw-Hill, 1971)	☐
Further	Versteeg, H. K. and Malalasekera, W., An Introduction to Computational Fluid Dynamics: The Finite Volume Method (Longman Scientific & Technical, 1995)	☐
Further	Ferziger, J. H. and Perić, M., Computational Methods for Fluid Dynamics (Springer, 2002)	☐
Further	MacDonald, B. J., Practical Stress Analysis with Finite Elements, Glasnevin Publishing (2007)	☐
Further	McBeath, S., Competition Car Aerodynamics (Haynes, 2011)	☐
Further	Katz, J., Race Car Aerodynamics: Designing for Speed (Robert Bentley, 1995)	☐
Further	Barnard, R. H., Road Vehicle Aerodynamic Design: An Introduction (Mechaero, 2001)	☐
Further	Vanderplaats, G. N., Multidiscipline Design Optimisations (VR&D, 2007)	☐
Further	Bernoulli Aerodynamics International, Race car Graphic (2006)	☐

Module Code	**ACMA6013**
Title	**Independent Project**
Date	**24/04/2020**
Level	**6**
Credits	**40**
Pre-Requisites	**None**

Engineering Council AHEP3 Learning Outcomes Assessed in this Module	
D6	Communicate their work to technical and non-technical audiences
EL1	Understanding of the need for a high level of professional and ethical conduct in engineering and a knowledge of professional codes of conduct
EL2	Knowledge and understanding of the commercial, economic and social context of engineering processes
EL3b	Knowledge and understanding of management techniques, including project management, that may be used to achieve engineering objectives
P1	Understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, application and development of technology, etc)
P4	Understanding of the use of technical literature and other information sources
P5	Knowledge of relevant legal and contractual issues
P6	Understanding of appropriate codes of practice and industry standards
P8	Ability to work with technical uncertainty
G1	Apply their skills in problem solving, communication, information retrieval, working with others and the effective use of general IT facilities
G2	Plan self-learning and improve performance, as the foundation for lifelong learning/CPD
G3b	Plan and carry out a personal programme of work, adjusting where appropriate
G4	Exercise initiative and personal responsibility, which may be as a team member or leader

AIM(S)

- To develop the ability of students to engage critically and innovatively with theory and/or practice relevant to their studied subject areas in order to produce a discipline specific in-depth project.

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- Demonstrate intellectual skills in the identification of an appropriate topic, problem or challenge for investigation pertinent to their field of study and formulate a suitable plan for further research utilising relevant investigative methods in order to produce a response.
- Evidence in-depth knowledge and critical understanding of principles necessary to underpin their education within their chosen field of study and problem solving techniques applicable to this.
- Evidence independence of thought and critical evaluation in the production of an independent piece of work, demonstrating transferable skills through exercising initiative and personal responsibility in planning own learning and self-management.
- Organise their knowledge and learning through use of a range of media, and present their work appropriately in a manner that can be understood by specialist and non-specialist audiences.

INDICATIVE CONTENT

- Research paradigms, methods, and techniques of research and enquiry.
- Conducting and writing literature reviews.
- Ethical concerns and the research process.
- Resource, project, and skills management processes and techniques.
- Presenting and illustrating data and information.
- Communication of general, specialist, technical ideas and results.
- Problem solving, creative, entrepreneurial thinking and approaches.
- Collaboration, adaptability and reflection.

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	36	9%
Independent learning	364	91%
Placement learning		
TOTAL	**400**	**100%**

ASSESSMENT

Assessment Component 1

☐ **Written exam** ☒ **Coursework** ☐ **Practical**

Mode of assessment	Volume	Weighting
Portfolio	Minimum of 3 elements (equivalent to 10,000 words)	100%

Assessment Summary

Activity type	Percentage
Written exam	
Coursework	100%
Practical	
TOTAL	**100%**

INDICATIVE READING LIST
This will be guided by the student's individual project.

Module Code	**ACMA6013**	
Module Title	**Independent Project**	
Classification	**Reading List entry**	**Electronic***
Essential	Cottrell S, (2015) *Skills for Success Personal Development and Employability, 3rd edition*, Palgrave. London.	☒
Essential	ASET, 2013 *Good Practice Guide for Work based Learning and Placement Learning in Higher Education*	☒
Essential	Gray, D.E. (2018) *Doing Real World Research,* London: SAGE.	☐
Further	Gallagher K, (2016) *Essential Study and Employment Skills For Business and Management Students*, Oxford	☐
Further	Gottschall, Jonathan (2013), *The Storytelling Animal: How Stories Make Us Human,* Houghton Mifflin	☐
Further	Storr, Will (2020), *The Science of Storytelling,* William Collins	☐
Further	Cohen, L. Manion, L. and Morrison, K. (2017) *Research Methods in Education, 8th edition* London: Routledge.	☒
Further	Flick, U. (2014) *An Introduction to Qualitative Research*, London: SAGE.	☐
Further	Aubrey, K. & Riley, A. (2017) *Understanding and Using Challenging Education Theories*, London: SAGE.	☒
Further	Brinkmann, S. and Kvale, S. (2018) *Doing Interviews (Qualitative Research Kit)*. Sage	☐
Further	Gibbs, G. (2018) *Analysing Qualitative Data (Qualitative Research Kit)*. Sage	☒
Further	Creswell, J. W. (2012*). Qualitative inquiry and research design: Choosing among five approaches*. Sage	☐
Further	Obschonka, M., Hakkarainen, K., Lonka, K. *et al.* Entrepreneurship as a twenty-first century skill: entrepreneurial alertness and intention in the transition to adulthood. *Small Bus Econ* **48,** 487–501 (2017). https://doi.org/10.1007/s11187-016-9798-6	☒
Further	https://ec.europa.eu/jrc/en/entrecomp	☒