

Module Code	ACMA5002
Title	Manufacturing Design and Technology
Date	24/04/2020
Level	5
Credits	20
Pre-Requisites	None

Engineering Council AHEP3 Learning Outcomes Assessed in this Module	
EA4b	Understanding of, and the ability to apply, an integrated or systems approach to solving engineering problems
D1	Understand and evaluate business, customer and user needs, including considerations such as the wider engineering context, public perception and aesthetics
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
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
D5	Plan and manage the design process, including cost drivers, and evaluate outcomes
EL6	Knowledge and understanding of risk issues, including health & safety, environmental and commercial risk, and of risk assessment and risk management techniques
P3	Ability to apply relevant practical and laboratory skills

AIM(S)

- To enable students to develop an understanding of a wide range of variables relating to both primary and secondary manufacturing processes including recognising typical process defects and to propose appropriate preventative and remedial methods of dealing with these defects.
- To enable the student to critically appraise a range of factors affecting the design process and to apply suitable techniques to arrive at design solutions and develop appropriate solutions to engineering problems, using new or existing design techniques.

LEARNING OUTCOMES

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

- use appropriate design methods in conjunction with advanced features of a 3D CAD system in engineering design.
- evaluate with a view to improving the selection and optimisation of existing manufacturing processes through the application of physical principles of these processes
- analyse computational methods for the manufacture and intellectual skills in the appraisal of mechanical components the limitations of manufacturing processes in respect to their effects on both operating conditions and material performance.

INDICATIVE CONTENT

- Design Algorithms including Design for Six Sigma and Total Design
- Overview of design tools including Quality Function Deployment, Axiomatic Design, TRIZ, Design for X, VA / VE, Failure Mode-Effect Analysis, Taguchi's orthogonal array, Tolerance design and Design Verification / Product Validation.

- Mechanical tolerance calculations and tolerance stack-up analysis including GD&T
- Moldflow analysis, Sheet metal design analysis and Motion Simulation and Animation.
- Primary processes. – casting (mould design, feeding mechanisms, metallurgical considerations, casting systems and defects: deformation processes-rolling theory, forging, extrusion and drawing (die-design, process parameters, and defects).
- Computer Aided Manufacturing Technologies and applications including Computer Numerical Control Principles.
- Polymeric and ceramic material processing (Mould design, process parameters and defects)
- Role of Additive Manufacturing in the product development process and future applications and development of the technology.
- Design for Additive Manufacturing, including part consolidation and redesign. Looking at the unique capabilities of shape, functional and material complexities.
- Materials and the environment: Recycling, corrosion, UV degradation, hygroscopy.
- Material failure: Fatigue, creep and fracture, crack criteria, stress concentration factors, residual stresses. Preventative measures and design implications.
- Cambridge Engineering Selector (CES) software database.

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
Design Project	5000 words	100%

Assessment Summary

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

INDICATIVE READING LIST

Module Code	ACMA5002	
Module Title	Manufacturing Design and Technology	
Classification	Reading List entry	Electronic*
Essential	Pugh, S., Total Design: Integrated Methods for Successful Product Engineering (Prentice Hall 1990)	☐
Essential	Groover, M. P., Principles of Modern Manufacturing, 4 th Edition (John Wiley & Sons, 2016)	☒
Essential	Xiaozhong, R., Fundamentals of Manufacturing Technology, (Alpha Science International Ltd., 2019)	☐
Further	Chanda, M. and Roy, S. K., Plastic Fundamentals, Properties and Testing (Boca Raton, 2009)	☐
Further	Milewski, J.O., Additive Manufacturing of Metals: From Fundamental Technology to Rocket Nozzles, Medical Implants, and Custom Jewelry (Springer, 2017)	☒
Further	Campbell, J., Complete Casting Handbook: Metal Casting Processes, Metallurgy, Techniques and Design, 2 nd Edition (Butterworth-Heinemann, 2015)	☒
Further	Gebhardt, A., Understanding Additive Manufacturing: Rapid Prototyping - Rapid Tooling - Rapid Manufacturing (Hanser Fachbuchverlag, 2011)	☐
Further	Bitonti, F., 3D Printing Design: Additive Manufacturing and the Materials Revolution. (Bloomsbury Visual Arts, 2019)	☒
Further	Locke, R. M and Wellhausen, R., Production in the Innovation Economy (MIT Press, 2014)	☐

