

MODULE SPECIFICATION FORM*

Module Title: Advanced Materials	Level: 6	Credit Value: 10
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Module code: ENG677 (if known)	Cost Centre: GAME	JACS2 code: H410
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Semester(s) in which to be offered: 1	With effect from: July 2015
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Office use only: To be completed by AQSU:	Date approved: July 2015
	Date revised:
	Version No: 1

Existing/New: Existing	Title of module being replaced (if any):
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Originating Academic area: Engineering and Applied Physics	Module Leader: R Bolam
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Module duration (total hours) 100	Status: core/option/elective (identify programme where appropriate):	Free-standing 10-credit component comprising half of ENG621 (Modern Aircraft Materials and Technologies).
Scheduled learning and teaching hours 36		
Independent study hours 64		
Placement hours 0		

Percentage taught by Subjects other than originating Subject (please name other Subjects):	0%
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Programme(s) in which to be offered: Engineering European Programme (Non Award Bearing)	Pre-requisites per programme (between levels):	None
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Module Aims: <ul style="list-style-type: none"> To extend previous knowledge of materials and components by analysing the latest developments in aerospace industry. To apply comprehensive analytical methods to materials and technology, including eco-auditing, from industrial perspective.

Expected Learning Outcomes Knowledge and Understanding: At the completion of this module, the student should be able to: <ol style="list-style-type: none"> Review and critically evaluate present and emerging processes for producing composites and new materials, including "smart" materials; Apply a range of analytical and characterisation methods and select the most appropriate one on the basis of application data and type of composite material; Evaluate and select aeronautical materials from eco-auditing and apply this to industrial scenarios and critically appraise the results; (KS 7) 		
Key skills for employability <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"> 1. Written, oral and media communication skills, 2. Leadership, team working and networking skills 3. Opportunity, creativity and problem solving skills 4. Information technology skills and digital literacy 5. Information management skills 6. Research skills </td> <td style="width: 50%; border: none;"> 7. Intercultural and sustainability skills 8. Career management skills 9. Learning to learn (managing personal and professional development, self management) 10. Numeracy </td> </tr> </table>	1. Written, oral and media communication skills, 2. Leadership, team working and networking skills 3. Opportunity, creativity and problem solving skills 4. Information technology skills and digital literacy 5. Information management skills 6. Research skills	7. Intercultural and sustainability skills 8. Career management skills 9. Learning to learn (managing personal and professional development, self management) 10. Numeracy
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Assessment: Please indicate the type(s) of assessment (eg examination, oral, coursework, project) and the weighting of each (%).

Assessment is by means of an examination covering all outcomes. It is an unseen time-constrained exam. (This corresponds to Assessment 1 of ENG621.)

Assessment number (use as appropriate)	Learning Outcomes met	Type of assessment	Weighting	Duration (if exam)	Word count (if coursework)
Assessment One:	1, 2, 3	Examination	100%	2 hr	

Learning and Teaching Strategies:

The module will be presented to students through a series of lectures, tutorials, interactive web-based analytical software and case studies utilising laboratory equipment where appropriate. Problem based learning (PBL) approach will be employed and students will be presenting their detailed analysis as a part of their portfolio.

Syllabus outline:

Materials, manufacturing and properties: Strengthening in composite materials. Manufacturing techniques. Fibre reinforced polymers. Anisotropy in composites. Metal matrix (MMC) and ceramic matrix (CMC) composites. Cellular materials. High performance super alloys. Introduction to novel and smart materials for aeronautical applications. Degradation of materials and anti-degradation measures.

Analysis of Materials: Introduction to the major theories of composites (e.g. failure envelopes, Tsai-Hill criteria etc.) relating to stiffness and strain in continuous and short fibres. Analysis of 3D stress. Strengthening mechanism and failure mechanisms.

Eco-informed materials: Materials selection process (including economic aspects), Life cycle analysis (including end of life analysis), eco-audits, material efficiency, recycling of aeronautical materials, materials from renewable sources.

Bibliography:

Essential reading:

Ashby, M.F. et al. (2010) *Materials; engineering, science, processing and design*, 2nd Edn., London: Elsevier.
Strong, B. (2008) *Fundamentals of Composites Manufacturing: Materials, Methods and Applications*, 2nd Edn., Dearborn, Michigan: Society of Manufacturing Engineers.

Recommended reading:

Ashby, M.F. (2012) *Materials and the environment*, London: Elsevier.
Sholte, J. (2005) *Nanotechnology industry trends and applications*, Oxford: John Wiley and Sons.
Callister, W.F. (2005) *Fundamentals of materials science and engineering*, 4th Edn., Oxford: John Wiley and Sons.