Subject Description Form

Subject Code	ME43001
Subject Title	Advanced Materials for Design and Technology
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME33001 Mechanics of Materials Exclusion: ME45006 Aircraft Structure and Engineering Composite
Objectives	To provide advanced knowledge on the design, development, processing, applications and structural evaluations of advanced materials and structures, including smart materials and aircraft and aerospace structures.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Apply the mechanics of composites and smart materials in the product design process. b. Design innovative products/structures by applying knowledge in advanced materials and technology including smart materials and intelligent technology. c. Identify the limitations and constraints by using advanced materials at different environments. d. Consider environmental factors during the product design process.
Subject Synopsis/ Indicative Syllabus	***Advanced Composite Materials*** **-** Design and mechanical performance; Lamination theory; The rule of mixtures; Design for aircraft and aerospace structures; Environmentally-friendly composites; Composite manufacturing process; Recycling advanced composites; Environmental impact. ***Smart Materials and Structures and Integrated Systems*** **-** Shape memory alloy (SMA) sensors and actuators; Hysteresis loop; Constitutive models; Active piezo-electric actuators; PVDF; Magnetostrictive materials; Dynamic control of smart structures; Bio-compatibility; Embedded sensor technology. ***Nano-structural Materials*** **-** Carbon nanotubes and their composite structures; Nanoclay/polymer composites; Superhard particles for wear resistance; Micro-electro-mechanical (MEMs) and Nano-electro-mechanical (NEMs) devices.

Teaching/Learning Methodology

Lectures are used to deliver the fundamental knowledge in relation to advanced materials. (Outcomes a, b and c)

Tutorials are used to illustrate the application of fundamental knowledge to practical situations. (Outcomes a, b and c)

Project or case study is used to allow students to deepen their knowledge on a specific topic through search of information, analysis of data and report writing. (Outcomes a to d)

Experiments are used to relate the concepts to practical applications and students are exposed to hand-on experience, proper use of equipment and application of analytical skills on interpreting experimental results. (Outcomes a and c)

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lecture	√	√	√	
Tutorial	√	√	√	
Project/case study	√	√	√	√
Experiment	√		√	

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)			
		a	b	c	d
1. Examination	50%	√	√	√	√
2. Assignment	25%	√	√	√	√
3. Project / case study / Presentation	20%	√	√	√	√
4. Laboratory report	5%	√		√	
Total	100%				

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:

$0.50 \times$ End of Subject Examination + $0.50 \times$ Continuous Assessment

Examination is adopted to assess students on the overall understanding and the ability of applying the concepts. It is supplemented by the assignments and laboratory reports which provide timely feedbacks to both lecturers and students on various topics of the syllabus. Written report and oral presentation on a specific project or case study are used to assess the students' knowledge on smart materials.

Student Study Effort Expected	Class contact:	
	▪ Lecture	33 Hrs.
	▪ Tutorial/Laboratory	6 Hrs.
	Other student study effort:	
	▪ Assignment	21 Hrs.
	▪ Self-study	40 Hrs.
	Total student study effort	100 Hrs.
Reading List and References	1. Nano-scale materials: from science to technology, S.N. Sahu, R.K. Choudhury, and P. Jena, editors, New York, Nova Science Publishers, latest edition. 2. Smart Materials, edited by Mel Schwartz, CRC Press/Taylor & Francis, latest edition. 3. Progress in Smart Materials and Structures, Peter L. Reece, editor, New York, Nova Science Publishers, latest edition. 4. Smart Structures -Analysis and Design, A. V. Srinivasan and D. M. McFarland, Cambridge University Press, latest edition. 5. Shape Memory Materials, K. Otsuka & C. M. Wayman, Cambridge University Press, latest edition. 6. Zafer Gurdal, Raphael T. Haftka and Prabhat Hajela, Design and Optimization of Laminated Composite Materials, John Wiley & Sons, latest edition. 7. Sergey Edward Lyshevski, MEMS and NEMS: Systems, Devices, and Structures, Boca Raton, Fla.: CRC Press, latest edition. 8. Facing up to the Recycling Challenge, Reinforced Plastics, Elsevier, Monthly Periodocal, latest edition. 9. Principles of Composite Material Mechanics, Ronald F. Gibson, CRC Press, Taylor & Francis Group, latest edition. 10. Materials Science and Engineering an Introduction, William D. Callister, David G. Rethwisch, John Wiley & Sons, latest edition.	

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