Subject Description Form

Subject Code	AAE4105
Subject Title	Engineering Composites
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	**Pre-requisite:** AAE3002 Aircraft Structures and Materials
Objectives	1. To provide students with knowledge of mechanical behavior of composite materials used in aircraft; and 2. To provide students with understanding of the processing, fabrication and influence of fabrication and environment on properties of aircraft composites; and 3. To gain appreciation of the wide design flexibility that composites can afford.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Demonstrate a good understanding of types and properties of composites used in aircraft; b. Possess knowledge in processing and fabrication of structural composites; c. Understand mechanical behaviors of aircraft composite materials; d. Analyze composite laminates using classic laminate theory and apply failure criteria to assess composite structures subject to various types of loading.
Subject Synopsis/ Indicative Syllabus	***Introduction to Composites*** - Classification and characteristics of composite materials in aircraft. Mechanical behavior of composite materials. Reinforcements. Matrix materials. Green composites ***Composite Interfaces*** - Fibre-matrix interfaces. Interfacial properties. Stress transfer through composite interfaces. ***Lamina Stress-strain Relationships*** - Lamina and laminate theories. Transformation and prediction of elastic parameters. Load-deformation relationship. ***Analysis of Continuous Fibre-Reinforced Lamina and Laminates*** - Macromechanical behaviour of a lamina. Macromechanical behaviour of a laminate. ***Processing and Fabrication*** - Structural composites and their processing technology. Manufacture of laminated fibre-reinforced composite materials. Influence of fabrication and environment on properties.

Failures, Design, and Applications of Composites - Failure theories. Design optimization. Engineering applications of composites.

Non-Destructive Testing Techniques for Composites – Visual testing, ultrasonic testing, thermography, radiographic testing, electromagnetic testing, acoustic emission, new trends in structural health monitoring strategies.

Laboratory Experiments

Typical experiments:

1. Manufacturing of composites
2. Tensile test of composites
3. Inspection of composites
4. Repair of a composite structure

Teaching/Learning Methodology

Lectures are used to deliver the fundamental knowledge in relation to advanced composite materials (outcomes a to d).

Tutorials are used to illustrate the application of fundamental knowledge to practical situations (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 b).

Teaching/Learning Methodology	Intended subject learning outcomes to be covered			
	a	b	c	d
Lecture	✓	✓	✓	✓
Tutorial	✓	✓	✓	✓
Experiment	✓	✓		

Assessment Methods in Alignment with Intended Learning Outcomes

(Note 4)

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed			
		a	b	c	d
1. Examination	60%	✓	✓	✓	✓
2. Assignment	20%	✓	✓	✓	✓
3. Test	10%	✓		✓	✓
4. Laboratory report	10%	✓	✓		
Total	100 %				

	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: Overall Assessment: 0.6 × End of Subject Examination + 0.4 × Continuous Assessment Examination is adopted to assess students on the overall understanding and the ability of applying the concepts. It is supplemented by the tests, assignments and laboratory reports which provide timely feedbacks to both lecturers and students on various topics of the syllabus.	
Student Study Effort Expected	Class contact:	
	▪ Lecture	33 Hrs.
	▪ Tutorial/Laboratory	6 Hrs.
	Other student study effort:	
	▪ Self Study	45 Hrs.
	▪ Case study report preparation and presentation	21 Hrs.
	Total student study effort	**105 Hrs.**
Reading List and References	1. Ronald F. Gibson, Principles of Composite Material Mechanics, McGraw-Hill International Editions, latest edition. 2. C.T. Sun, Mechanics of Aircraft Structures, John Wiley & Sons, latest edition. 3. Celine A. Mahieux, Environmental Degradation in Industrial Composites, Elsevier, latest edition. 4. A. Brent Strong, Fundamentals of Composites Manufacturing-Materials, Methods and Applications, Society of Manufacturing Engineers, latest edition.	

December 2019