



MODULE SPECIFICATION

Faculty of Engineering

Last Updated (22 October 2018)

1. **Module Title**
Composite Structures

2. **Module Code**
EM5103

3. **Number of credits**
10

4. **Level**
5

5. **Semester**
2a

6. **Pre-requisites for admission to the module**
Normal entry requirements

7. **Module Coordinator**
Dr. Asad A. Khalid

8. **Aims**
This module provides the students with the means of evaluating and analysing the mechanical properties of laminate composite for laminate composite design theoretically and using Finite element Analysis tools.

9. **Summary of Contents**

This module covers the following topics:

- **The concepts of composite materials:** classify and characterize composite materials. Determine the macro-mechanical and micro-mechanical properties.
- **Composite Fabrication methods:** Types of fabrication methods, selection of fabrication method,
- **Mechanical properties of composites:** stress-strain relations and compliance matrix of composite materials,
- **Failure theories and selection of failure criteria:** Maximum stress theory, Maximum strain theory, Tsai-wu theory, Tsai-hill theory, Hoffman's criteria, Hashins criteria,
- **Laminate structures:** Forms of lamina to laminate, unidirectional laminates, cross-ply laminates, angle - ply laminates, symmetric laminates, antisymmetric, unsymmetric and quasi isotropic.
- **Lamination theories:** Assumptions, lamina strains, lamina forces and moments, element in stiffness matrix.
- **Finite element analysis on composite materials:** Build models of composite structures for different applications using FEA software. Applying different loading conditions and analyzing the results.

10. Module Intended Learning Outcomes (MILOs)

Upon successful completion of this module, students will be able to:

No.	MILOs	Weightage (%)
1	Determine the micromechanical and macro-mechanical properties of composite materials, with different fiber and matrix types and fiber orientation angles	20
2	Design Laminate structures made from different composites materials including applying corresponding failure theories.	20
3	Evaluate stiffness matrix elements for the laminate structures by applying the lamination theories on composite materials and structures	35
4	Construct and analyze Finite Element Analysis models of composite structures under different loading conditions	25

11. Teaching and Learning Activities (TLAs)

MILO No.	TLAs	Functions	Hours/Week
1-4	Lecture	To present and convey underlying concepts and theories on composite materials	2
1-3	Tutorial	Interactive problem-solving session used for transfer of knowledge by example through a set of instructions to complete a task	1
1-4	Laboratory session	To perform analysis using a suitable finite element software	Two 2hr sessions per semester

12. Assessment Tasks/Activities

MILO No.	Type of Assessment Tasks/Activities	Weightage (%)
1-4	University Exam	60
2-4	2 Laboratory Reports	20
1-2	Class test	10
1-4	2 Assignments	10

Assessment Criteria:

Assessment components of the module shall be University Examination and Course-works. To achieve a pass in the module students must obtain a minimum overall mark of 50% and a minimum of 40% in each assessment component.

Resit: Students eligible for resit shall be assessed according to the programme area Examination Board recommendation.

13. Attendance Requirements

Students are expected to attend all lectures, tutorials and lab sessions.

14. Contribution to Programme Intended Learning Outcomes

PILO		MILO No.			
		1	2	3	4
1	Science & Mathematics	✓	✓	✓	✓
2	Engineering Analysis		✓	✓	✓
3	Design		✓	✓	✓
4	Advanced Design				✓
5	Engineering Practice Knowledge		✓	✓	✓
6	Engineering Practice		✓	✓	✓
7	Ethical, Economic & Social				
8	Management, Legal & Environmental				
9	General Skills				

15. Grading of Student Achievement

Marks (%)	Grades	Grade Definition
85-100	A+	Excellent
75-84	A	
70-74	B+	Very Good
65-69	B	
60-64	C+	Good
55-59	C	
50-54	D	Satisfactory
0-49	F	Fail

16. Resources

Primary text

No	Name of Author(s)	Year of Publication	Title of Book	Edition	Publisher's Name	ISBN
1	Isaac M. D. and Ishai D.	2006	Engineering mechanics of composite Materials	2 nd	Oxford university press, New York	978-0195150971

Secondary texts

No	Name of Author(s)	Year of Publication	Title of Book	Edition	Publisher's Name	ISBN
1	Mathews F. L. and Rawlings R. D.	1996	Composite materials engineering and science	-	Woodhead Publishing	978-1855734739
2	Hyer, M. W.	1999	Stress- analysis of fiber reinforced materials	3 rd	McGraw Hill Book Co.	0-07-016700-1
3	Ochoa O.O. and Reddy J.N.	1992	Finite element analysis of composite laminates	-	Springer Netherlands	978-94-015-7995-7