The University of Jordan
School of Engineering

Department	Course Name	Course Number	Semester
Mechanical Engineering	Selected Topics in Mechanical Engineering: Composite Materials	0904730	

2024 Course Catalog Description

Background and Brief Overview of Fiber-Reinforced Composite Materials, Linear Elastic Stress-Strain Characteristics of Fiber-Reinforced Material, Prediction of Engineering Properties Using Micromechanics, Plane-Stress: Stress-Strain Relations for Plane Stress, Interpretation of Stress-Strain Relations Revisited, Plane-Stress Stress-Strain Relations and the Effects of Free Thermal and Free Moisture Strains. Plane-Stress Stress-Strain Relations in a Global Coordinate System. Classical Lamination Theory: The Kirchhoff Hypothesis, Laminate Stiffness Matrix. Failure Theories for Fiber-Reinforced Materials: Maximum Stress Criterion, the Tsai-Wu Criterion. Environmentally Induced Stresses in Laminates. Through-Thickness Laminate Strains. Introduction to Fiber-Reinforced Laminated Plates.

Instructors

Name	E-mail	Sec	Office Hours		Lecture Time	
Prof. Naser Al-Huniti						

Text Books

	Text book 1	Text book 2
Title		
Author(s)		
Publisher, Year, Edition		

References

Books	1. A. K. Kaw, Mechanics of composite materials, Taylor and Francis Group, 2006. 2. R. Jones, Mechanics of Composite Materials, McGraw-Hill, 1975. 3. J. Vinson and R. Sierakowski, The Behavior of Structures Composed of Composite Materials, Martinus Nijhoff, 1986. 4. C. Herakovich, Mechanics of Fibrous Composites, Wiley, 1998. 5. N. Cristescu, E. Craciun and E. Soós, Mechanics of Elastic Composites, CRC, 2000. 6. J. Reddy, Mechanics of Laminated Composite Plates and Shells, CRC, 2004.
Journals	
Internet links	

Prerequisites

Prerequisites by topic	1. Mechanics and properties of materials 2. Matrix algebra
Prerequisites by course	
Co-requisites by course	
Prerequisite for	

Topics Covered

Week	Topics	Chapter in Text	Sections
	• Basic Concepts: definitions and overview of composite material, classifications, advantages, disadvantages, manufacturing methods, applications	1	
	• Constitutive Equations: mathematical and tensor representations, material symmetry and classifications, plane stress and plane strain, transformation equations, stiffness and compliance matrices, engineering constants, hygro-thermo-elastic equations of a composite lamina.	2,3	

	• Micromechanics: representative unit cell, the fiber, matrix and interface, micromechanical models, equivalent mechanical properties based on the fiber volume fraction.	4	
	• Lamination Theory: classical plate theories, loads and deflections, composite laminate, fiber orientation and stacking sequences, laminate constitutive equations, symmetric, anti-symmetric and special laminates	5	
	• Strength and failure analysis: failure mechanism and modes, microscopic and macroscopic failure theories.	6	
	• Applications: bending, vibration and buckling of different composite structures (beams, plates, shells).	9	

Course Outcomes

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Evaluation

Assessment Tools	Expected Due Date	Weight
Assignments and Research Paper		20%
First Exam		20%
Second Exam		20%
Final Exam		40%

Contribution of Course to Meet the Professional Components

This course covers the main concepts, analysis, modeling and design of composite materials in general with applications to composite beams, plates and shells.

Relationship to Mechanical Engineering Program Objectives (MEPOs)

MEPO1	MEPO2	MEPO3	MEPO4

Updated by Graduate Studies Committee, 2024