

HKUST
MAE3400 Introduction to Composites
Fall 2023-24

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Required textbook: *Engineering Mechanics of Composite Materials*, IM Daniel & O Ishai, 2nd, 2006

Prerequisites: Mechanics of materials, Matrix algebra or equivalent

Class schedule: Tuesday (16:30 to 17:50) and Thursday (16:30 to 17:50)

Tutorial schedule: Monday (18:00 to 18:50)

Exams and weightage:

30% Homework

20% Midterm exam

40% Final Project (Presentation + report)

10% Lab

Objectives:

- Be familiar with the definition, classification, application and mechanical properties of modern composite materials
- Learn the rule of mixture and different mechanical models to analyse micromechanics of lamina from constituent materials (fiber + matrix)
- Analyse macroscale averaged mechanics of lamina, based on anisotropic properties.
- Understand the failure of lamina and learn how to calculate composite strength.
- Learn Non-destructive evaluation techniques to inspect composite materials, detect/characterise defects, and how to repair damages.

Learning outcomes:

- Students can predict the elastic constants of a unidirectional lamina, given constituent properties and loading conditions.
- Students can perform mechanical analysis from anisotropic parameters of unidirectional lamina
- Students can analyse strength and failure of a typical unidirectional lamina.
- Students can apply the knowledge for designing lamina
- Students know the basic NDE methods to detect/characterise defects and repair damages.

Topics:

- Introduction to composite (Definition, types, manufacturing, applications and constituents)
- Lamina micromechanics (Micromechanics, rule of mixture, parallel/series model, Halpin-Tsai model)
- Lamina macromechanics (General elasticity, stiffness/compliance matrix, rotation matrix, orthotropic, transverse isotropic)
- Lamina strength (Strength under different loading, failure theories and modes)
- Nondestructive evaluation/structural health monitoring of composites (Ultrasonic detection and characterisation of damages in composites)

Class policies

<http://ugadmin.ust.hk/ug-guide/index.html>