## MECH3400 – Introduction to Composite Materials

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<th>Course Code: MECH 3400</th>
<th>Course Title: Introduction to Composite Materials</th>
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<tr>
<td>Required Course Or Elective Course:</td>
<td>Terms Offered (Credits): Fall, 3 credits</td>
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<td>Required Course</td>
<td>Pre-Requisites: MECH2040 AND MECH2410</td>
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<td>Faculty In Charge: Fan Shi</td>
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### Course Structure:
Lecture: 2 days per week, 3 hours; tutorial 1 day per week, 1 hour

### Textbook/Required Material:

### Course Description:
This course introduces fundamentals of composite materials, which will cover basic concepts of composites, their classifications and characteristics, manufacturing, micro and macro mechanics, common applications in science and engineering, as well as maintenance and inspections. One important objective of the course is to understand the rule of mixture and anisotropic properties, by which the mechanical properties of composite materials can be analysed in the micro and macro scales, to achieve a proper design for engineering applications. In addition, failure/damage mechanisms and common methodologies to inspect and characterise these damages will be explained.

### Course Topics:
1. Definitions, basic concepts and examples
2. Classifications and characteristics of composite materials
3. Micromechanics of composites: rule of mixture
4. Macromechanics of composites: anisotropy
5. Failure mechanisms
6. Inspection of damages

### Course Objectives:
1. Underlie the concepts of rule of mixtures and anisotropy to analyze the structural and mechanical behaviors of composite materials (P-O1, P-O3, P-O5)
2. Introduce the basic failure modes and fatigue of composite materials (P-O1, P-O3, P-O5)
3. Select appropriate material constants for specific engineering applications (P-O2, P-O3, P-O4)
4. Introduce common inspection techniques for detecting and characterising damages in composite materials, from industrial examples (P-O1, P-O2, P-O3, P-O4)

### Course Outcomes:
A. Be able to distinguish different types of composite materials. Clearly understand the specific reinforcement mechanisms for various types of composite materials (POC1, POC3-6, POC10)
B. Understand the uses of different types of reinforcements under specific application environment (POC2, POC5, POC-7, POC10-12)
C. Be able to calculate and analyze the elastic modulus and strength of composite materials and undertake further independent
research in the relevant fields (POC1-6, POC11)

Assessment Tools:
(correlated course outcomes)

- Homework – 40% [4 assignments]
- Lab tutorial – 10%
- Final project – 50%

BEng in Aerospace Engineering (4-year program)

Program Objectives:
P-O1. Be able to communicate and perform as an effective engineering professional in both individual and team-based project environments,
P-O2. Have an international outlook with clear perspectives on the Pearl river Delta and Greater China,
P-O3. Be able to research, design, develop, test, evaluate and implement engineering solutions to problems that are of complexity encountered in professional practice and leadership,
P-O4. Clearly Consider the ethical implications and societal impacts of engineering solutions,
P-O5. Continuously improve through lifelong learning.

Program Outcomes:
POC1. Ability to identify and formulate problems in multidisciplinary environment with an understanding of engineering issues and constraints
POC2. Ability to design and conduct experiments as well as analyze and interpret data
POC3. Ability to apply knowledge of mathematics, science, and engineering for problem solving in aerospace engineering and related sectors or for further education in a research career
POC4. Ability to develop specification and to design system, component, or process to meet needs
POC5. Ability to understand the design, operation, and maintenance of aircraft components and systems
POC6. Ability to use modern engineering tools, techniques, and skills in engineering practice
POC7. Ability to communicate effectively
POC8. Ability to function in multi-disciplinary teams and provide leadership
POC9. Broadly educated with an understanding of the impact of engineering solutions on issues such as economics, business, politics, environment, health and safety, sustainability, and societal context
POC10. Clear understanding of professional and ethical responsibilities
POC11. Recognition of the need for life-long learning and continuing education
POC12. International outlook with knowledge of contemporary issues