2023
TP-153

Course Specification
(Bachelor)

Course Title:	Composite Materials
Course Code:	391E-MEC-2
Program:	Bachelor of Science in Engineering
Department:	Mechanical Engineering
College:	College of Engineering
Institution:	Najran University
Version:	1.0
Last Revision Date:	27 February 2024

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (2)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☐Required		☒ Elective		
3. Level/year at which this course is offered: (Fourth Year \ Level 8)					
4. Course general Description:					
Analysis, design and applications of laminated and chopped fiber reinforced composites. Micro- and macro-mechanical analysis of elastic constants, failure and environmental degradation. Fabrication and processing of metal matrix (MM) polymer matrix (PM) and ceramic matrix (CM) composites and their characterization. Secondary processing and joining of various composite materials for structural applications and their fracture behavior Design of composites for quality and safety.					
5. Pre-requirements for this course (if any)**:**					
213-MEC-3 (Mechanics of Material) 341-MEC-3 (Mechanical Engineering Design (1))					
6. Co-requisites for this course (if any)**:**					
NIL					
7. Course Main Objective(s):					
1. An ability to identify the properties of fiber and matrix materials used in commercial composites, as well as some common manufacturing techniques. 2. An ability to predict the elastic properties of both long and short fiber composites based on the constituent properties. 3.An ability to rotate stress, strain and stiffness tensors using ideas from matrix algebra. 4. A basic understanding of linear elasticity with emphasis on the difference between isotropic and anisotropic material behavior. 5. An ability to analyze a laminated plate in bending, including finding laminate properties from lamina properties and find residual stresses from curing and moisture.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	15
5.	**Others (specify)**	
Total		45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	An ability to compute the properties of a composite laminate with any stacking sequence.	1	TS:1-Interactive lectures using PowerPoint slides with more examples in the class TS:2-Recall the topics discussed in the last lecture by asking questions to the students. TS: 3 – Associating the topics in each chapter with the CLO.	Class participation Quizzes Midterm exams. Final Exams at the end of the semester.

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
			TS:4 – Conducting oral quizzes by the end of each chapter TS:5 – Giving more example programs in the lecture TS: 6 – Discussion with the students in the class hours	
1.2	A knowledge of issues in fracture of composites and environmental degradation of composites	7	TS:1-Interactive lectures using PowerPoint slides with more examples in the class TS:2-Recall the topics discussed in the last lecture by asking questions to the students. TS: 3 – Associating the topics in each chapter with the CLO. TS:4 – Conducting oral quizzes by the end of each chapter TS:5 – Giving more example programs in the lecture TS: 6 – Discussion with the students in the class hours	Class participation Quizzes Midterm exams. Final Exams at the end of the semester.
2.0	**Skills**			
2.1	Easily understand about the dimensionality associated with the materials.	2	TS:1-Interactive lectures using PowerPoint slides with more examples in the class TS:2-Recall the topics discussed in the last lecture by asking questions to the students. TS: 3 – Associating the topics in each chapter with the CLO. TS:4 – Conducting oral quizzes by the end of each chapter	Class participation Quizzes Midterm exams. Final Exams at the end of the semester.

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
			TS:5 – Giving more example programs in the lecture TS: 6 – Discussion with the students in the class hours	
2.2	An ability to predict the failure strength of a laminated composite plate.	6	TS:1-Interactive lectures using PowerPoint slides with more examples in the class TS:2-Recall the topics discussed in the last lecture by asking questions to the students. TS: 3 – Associating the topics in each chapter with the CLO. TS:4 – Conducting oral quizzes by the end of each chapter TS:5 – Giving more example programs in the lecture TS: 6 – Discussion with the students in the class hours	Class participation Quizzes Midterm exams. Final Exams at the end of the semester.
3.0	**Values, autonomy, and responsibility**			
3.1	An ability to predict composite properties from fiber and matrix properties and volume fractions for both long and short fiber composites.	4	TS:1-Interactive lectures using PowerPoint slides with more examples in the class TS:2-Recall the topics discussed in the last lecture by asking questions to the students. TS: 3 – Associating the topics in each chapter with the CLO.	Class participation Quizzes Midterm exams. Final Exams at the end of the semester.

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
			TS:4 – Conducting oral quizzes by the end of each chapter TS:5 – Giving more example programs in the lecture TS: 6 – Discussion with the students in the class hours	
3.2	An understanding of how anisotropic elasticity differs from isotropic elasticity.	5	TS:1-Interactive lectures using PowerPoint slides with more examples in the class TS:2-Recall the topics discussed in the last lecture by asking questions to the students. TS: 3 – Associating the topics in each chapter with the CLO. TS:4 – Conducting oral quizzes by the end of each chapter TS:5 – Giving more example programs in the lecture TS: 6 – Discussion with the students in the class hours	Class participation Quizzes Midterm exams. Final Exams at the end of the semester.

C. Course Content

No	List of Topics	Contact Hours
1.	Analysis, design and applications of laminated and chopped fiber reinforced composites.	10
2.	Micro- and macro-mechanical analysis of elastic constants, failure and environmental degradation.	10
3.	Fabrication and processing of metal matrix (MM) polymer matrix (PM) and ceramic matrix (CM) composites and their characterization.	10
4.	Secondary processing and joining of various composite materials for structural applications and their fracture behaviour	7
5.	Design of composites for quality and safety.	8
Total		**45**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignments	1-12	10%
2.	Quizzes	1-12	10%
3.	Mid-term	8	30%
4.	labs	-	-
5.	Lab final exam	-	-
6.	Final exam	15	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	***Engineering Mechanics of Composite Materials,*** Daniel and Ishai, 2nd edition, Oxford University Press, 2005.
Supportive References	1. Composite materials, K. K. Chawala, 2 nd ed., (1987) Springer-Verlag, New York 2. Advances in composite materials, G Piatti, (1978) Applied Science Publishers Ltd. London.
Electronic Materials	Online custom books
Other Learning Materials	N/A

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms
Technology equipment (projector, smart board, software)	Projector
Other equipment (depending on the nature of the specialty)	--

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Program Leaders and Peer Reviewer	Direct, Indirect
Effectiveness of Students assessment	Students & Faculty	Direct and Indirect
Quality of learning resources	Students & Faculty	Direct and Indirect
The extent to which CLOs have been achieved	Students & Faculty	Direct and Indirect
Other		

Assessors (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	**DEPARTMENT OF MECHANICAL ENGINEERING**
REFERENCE NO.	
DATE	**27/02/2024**