SEMESTER: S7

COMPOSITE MATERIALS

Course Code	PEPOT744	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:0:0-0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

1. Impart the basic concepts of composite materials.
2. Develop knowledge on Composite behaviour and application.

SYLLABUS

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Module No.	Syllabus Description	Contact Hours
1	General characteristics of composites, advantages and disadvantages, advantages of using composites in high performance structures application trends. Composite applications in aircraft, space, transportation, energy electronics, sports and medical industries. Characteristics of fibres, matrices, interface bonding, adhesives microstructure of composites, the function of the fibre and matrix in a composite. Thermoplastic and thermoset matrix composites. Composite products and their unique properties. The strengthening mechanism that makes composites stronger. Environmental effects to design of composite structures.	9
2	Traditional and novel approaches process fundamentals. Fundamental physics in composite manufacturing, manufacturing processes for polymeric composites. Typical defects introduced in manufacturing and the methods utilized to minimize these defects. Common terminology in composites manufacturing. Special tooling considerations required for composite manufacturing Basic concepts, stiffness, strength, thermal and moisture	9

	expansion. Anisotropic and isotropic materials, tailored specific strengths. The cause of discontinuous stresses in composites and how it differs from metals	
3	Laminate theory; micromechanical behaviour of a ply, out-of-plane effects. Hooke's Law to unidirectional composites. The stress-strain relations of a unidirectional composite subjected to mechanical, thermal and moisture loads. Stress/strain/curvature of a laminate under constant axial forces and bending moments. The unusual behaviours which may occur in laminates such as bending/stretching coupling and stretching-shear coupling. The use of a specific layup orientation based on the loading conditions and CLT. The role of lamina and their arrangement in laminate Failure criteria, Laminate Strength, Stress Concentrations.	**9**
4	The service life (fatigue) and environmental (damage/corrosion) effects on metallic vs. composite structures. Key damage mode for composites and composite damage tolerance capabilities How do actual composites for aerospace, automotive, sporting goods, high temperature applications behave? Problem areas, long-term performance, influence of structural geometries the Advantages and disadvantages of composites with respect to Product Lifecycle Management. General considerations and process involved in composite structural design. Typical in-service damage types for composites. Non-destructive inspection techniques for detecting damage in composites. Basic types of composite repair and their benefits	**9**

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Course Assessment Method

(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Define the fundamentals of composite technology	**K1**
CO2	Explain the significance of composite manufacturing	**K2**
CO3	Analyze the anisotropic and isotropic materials	**K4**
CO4	Explain the role of lamina and their arrangements in laminate	**K5**
CO5	Develop the general considerations and process involved in composite structural design	**K3, K6**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**											
CO2	**3**											
CO3	**3**											
CO4	**3**											
CO5	**3**											

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3Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	*Rapid prototyping: Principles and applications*	ChuaC. K., LeongK .F .,and LimC.S	World Scientific	3rdEdn, 2010
2	*Rapid prototyping*	Gebhardt A	Hanser Gardener	2003
3	*Mechanics and Analysis of Composite Materials*	V. V. Vasiliev and E. V. Morozov	Elsevier Science	2001
4	*Polymer Engineering Composites*	M. O. W. Richardson	Applied Science Publishers	1977

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	*Advances in composite materials*	G. Piatti	Applied Science Publishers	1977
2	*An Introduction to Composite Materials*	D. Hull	Cambridge University Press	1996
3	*Handbook of composites*	Globin	Van Nostrand	1982
4	*Composite Materials*	K. K. Chawla	Springer-Verlag	1987

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Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://youtu.be/mp5lwolO-wM
2	https://youtu.be/WFDMGn5pVws
3	https://youtu.be/CMhwNTMe_mo
4	https://youtu.be/Rx3nJicpDxs

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