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GANDHI INSTITUTE OF ENGINEERING AND TECHNOLOGY UNIVERSITY, ODISHA, GUNUPUR

(GIET UNIVERSITY)

Ph.D. (First Semester-Winter) Examinations, June – 2025

23WPEME1011 – Composite Materials

(Mechanical Engineering)

Time: 3 hrs Maximum: 70 Marks

The figures in the right hand margin indicate marks.

Answer *ANY FIVE* Questions. (14 x 5 = 70 Marks) **Marks**

1.a.	Compare and contrast the properties of carbon fiber composites with those of traditional materials such as metals, ceramics, and polymers. Highlight the specific advantages and disadvantages that make carbon fibre composites suitable for certain applications.	8
b.	Investigate the manufacturing processes involved in producing carbon fiber composites. Discuss the key steps, technologies, and considerations in the fabrication of carbon fiber composites. How do these manufacturing processes influence the final properties and performance of the composites?	6
2.	Characterize composite systems like carbon fiber/epoxy and glass fiber/polyester, highlighting their specific properties, including mechanical, thermal, and chemical characteristics. Discuss how the choice of fibre and matrix influences the overall performance and applications of these composites in different industries.	14
3.a.	What role do continuous fibres play in enhancing the stiffness and strength of composite materials? Compare their contribution with discontinuous and short fiber systems, discussing the mechanisms involved	7
b.	Evaluate the testing methods used to determine the mechanical properties of composites. Discuss the advantages and limitations of tension, compression, flexure, and shear tests, and explore how the choice of testing method influences result interpretation.	7
4.	Provide an overview of different types of laminates, emphasizing their unique features and applications. Cover symmetric laminates, antisymmetric laminates, balanced laminates, quasi-isotropic laminates, cross-ply laminates, angle-ply laminates, and orthotropic laminates. Discuss the selection criteria for each type in various engineering applications.	14
5.a.	Compare and contrast mechanically fastened joints with adhesive joints, emphasizing their respective advantages and disadvantages. Explore specific applications where one joining method may be preferred over the other based on considerations such as material compatibility, load-carrying capacity, and environmental conditions.	7
b.	Discuss the advantages and disadvantages of adhesive joints in the context of joining methods. Highlight key factors that influence the performance of adhesive joints and explain typical bond strengths associated with different adhesive materials. Additionally, describe common test procedures used to evaluate the strength and reliability of adhesive joints.	7
6.a.	What role do continuous fibers play in enhancing the stiffness and strength of composite materials? Compare their contribution with discontinuous and short fiber systems, discussing the mechanisms involved.	7

b.	Discuss the properties and characteristics of orthotropic laminates, emphasizing their moduli and how they differ from other types of laminates. Explain how the orientation and arrangement of layers influence the overall behavior of orthotropic laminates.	7
7.	Provide a detailed analysis of test methods employed to assess the strength and durability of mechanically fastened joints. Discuss the importance of factors like preload, torque, and fastener material in determining the performance of mechanically fastened joints. Additionally, explore the impact of joint design on the load-carrying capacity of such joints.	14
8.a.	Explain the concept of hybrid composites and their advantages over traditional composite materials.	7
b.	Discuss the advancements in composite materials technology and their implications for future engineering applications.	7

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