Printed Page:- 04 **Subject Code:- AMTME0202**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

M.Tech

SEM: II - THEORY EXAMINATION (2023 - 2024)

Subject: Composite Materials

Time: 3 Hours **Max. Marks: 70**

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

1. *This Question paper comprises of* **three Sections -A, B, & C.** *It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.*

2. *Maximum marks for each question are indicated on right -hand side of each question.*

3. *Illustrate your answers with neat sketches wherever necessary.*

4. *Assume suitable data if necessary.*

5. *Preferably, write the answers in sequential order.*

6. *No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.*

SECTION A **15**

1. Attempt all parts:-

1-a. Size range of dispersoids used in dispersion strengthened composites. (CO1) 1

(a) 0.01-0.1 μm

(b) 0.01-0.1 nm

(c) 0.01-0.1 mm

(d) None

1-b. which of the fiber material would be highly strong (CO2) 1

(a) whisker

(b) fiber

(c) wires

(d) none of above

1-c. Which of the following materials can be used to make the thermoplastic prepreg tapes for the Thermoplastic Tape Winding? (CO3) 1

(a) Carbon

(b) Polypropylene

(c) Polyamide

(d) All of these

1-d. Which of the following is/are the disadvantage(s) of Carbon-Carbon Composites? (CO4) 1

(a) Low coefficient of thermal expansion

(b) High thermal conductivity

(c) Low oxidation resistance

(d) All of these

1-e. A laminate is called quasi-isotropic when its ..... is similar to that of an isotropic material. (CO5) 1

(a) bending stiffness matrix

(b) extensional stiffness matrix

(c) coupling stiffness matrix

(d) extensional and coupling stiffness matrix

2. Attempt all parts:-

2.a. How to identify the potential application of the Al-MMCs material? (CO1) 2

2.b. Which material properties that can be improved by forming a composite material? (CO2) 2

2.c. What is a material with very similar properties to carbon fiber but is much cheaper? (CO3) 2

2.d. What is the failure criteria for composite materials? (CO4) 2

2.e. Is the parallel axis theorem concept valid with the laminate plate theory? (CO5) 2

SECTION B **20**

3. Answer any <u>five</u> of the following:-

3-a. What is the difference between a composite and an alloy? (CO1) 4

3-b. What is the role reinforcement in composite materials? (CO1) 4

3-c. Describe the major differences in the processing of composites having a thermoset matrix and those having a thermoplastic matrix. (CO2) 4

3-d. Aluminum and magnesium are two common metal matrix materials. What is the viscosity of molten aluminum and magnesium? (CO2) 4

3.e. Explain briefly any two methods used for producing laminar composites. Give examples and applications for laminar composites. (CO3) 4

3.f. Why do we need standards in composites testing? List down the common 4

standards available for testing in composites. (CO4)

3.g. Write the number of independent elastic constants for three-dimensional anisotropic, monoclinic, orthotropic, transversely isotropic, and isotropic materials. (CO5) 4

SECTION C **35**

4. Answer any <u>one</u> of the following:-

4-a. Describe the use of composite materials in the Voyager airplane that circled the globe for the first time without refueling in flight. (CO1) 7

4-b. Discuss the use of composite materials in civilian aircraft, with special attention to Boeing 787 and Airbus A380 aircraft. (CO1) 7

5. Answer any <u>one</u> of the following:-

5-a. What are the different physical forms that reinforcements are available in? Discuss and make a comparative note of these forms in glass, carbon fibers, and aramid fibers. (CO2) 7

5-b. What are prepregs and molding compounds? Write a brief note giving the similarities and differences between the two ready-to-use material forms. (CO2) 7

6. Answer any <u>one</u> of the following:-

6-a. Write a brief note on the need for machining of composites. What are the different types of machining involved in PMCs? (CO3) 7

6-b. Consider a cylindrical mandrel with hemispherical end domes. Consider a geodesic helical fiber path. Show that the mandrel rotation corresponding to the fiber path in one end dome is 90°, irrespective of the diameters at the cylinder and pole openings. (CO3) 7

7. Answer any <u>one</u> of the following:-

7-a. Compare the tensile strength, tensile modulus of elasticity, elongation, and density properties of glass, carbon, and aramid fibers. (CO4) 7

7-b. What are the main property contributions of the carbon fibers in carbon-fiber-reinforced plastics? What are the main property contributions of the matrix plastic? (CO4) 7

8. Answer any <u>one</u> of the following:-

8-a. A unidirectional composite is subjected to the following stresses: σL = 3.0 MPa, σT = 0.5 MPa, and τLT = 3.5 MPa, Find the normal and shear strains. Engineering constants are EL= 14.0 GPa, ET= 3.5 GPa, GLT = 4.2 GPa, νLT = 0.4 and νTL = 0.1 (CO5) 7

8-b. Explain why a high-modulus unidirectional graphite-fiber-reinforced epoxy 7

beam fractured in impact breaks cleanly into two halves without delamination and with little fiber pullout, whereas an equivalent glass fiber composite exhibits considerable delamination on failure. (CO5)