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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

M.Tech.

SEM: II - THEORY EXAMINATION (2021 - 2022)

Subject: Composite Materials

Time: 3 Hours Max. Marks: 70

General Instructions:

1. The question paper comprises three sections, A, B, and C. You are expected to answer them as directed.
2. Section A - Question No- 1 is 1 marker & Question No- 2 carries 2 marks each.
3. Section B - Question No-3 is based on external choice carrying 4 marks each.
4. Section C - Questions No. 4-8 are within unit choice questions carrying 7 marks each.
5. 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. In sandwich composites, which of the following material can be used for filling purpose? (CO1) 1

(a) Wood

(b) Cement

(c) Polymer

(d) All of the mentioned

1-b. When fibers are used as a dispersed phase for the reinforcement of matrices, the resultant composites are known as _____ (CO2) 1

(a) Glass-fiber reinforced

(b) Carbon-fiber reinforced

(c) Wood-fiber reinforced

(d) Unidirectional-fiber reinforced

1-c. How can we minimize the variations of the parts in a product? (CO3) 1

(a) By making the new design parts

(b) By making the parts with different materials

(c) By standardizing the parts

(d) None of these

1-d. Which of the following products can be made from the Metal Matrix Composite? (CO4) 1

(a) Brake Disks

(b) Drive Shafts

(c) Brake Drums

(d) All of these

1-e. Calculate the ultimate strength of the composite for the following given values. 1

Ultimate strength of the fiber = 12 Mpa

Volume fraction of fiber = 0.80

Matrix stress at the fiber fracture strain = 10 MPa (CO5)

(a) 12.4 MPa

(b) 11.1 MPa

(c) 11.6 MPa

(d) 12.5 MPa

2. Attempt all parts:-

2.a. What is the need for composite material? (CO1) 2

2.b. How Aluminium oxide can be formed as continuous matrix to make Ceramic matrix composite? (CO2) 2

2.c. What is resin-transplant method? Give some examples of products made by resin-transplant method. (CO3) 2

2.d. Why does Stress Intensity Factor decrease while increasing plate thickness? (CO4) 2

2.e. What are the failure criteria used for the analysis of wooden structure? (CO5) 2

SECTION B 20

3. Answer any five of the following:-

3-a. Differentiate orthotropic materials from isotropic materials. (CO1) 4

3-b. Explain the function of a matrix and reinforcement in a composite material. (CO1) 4

3-c. How are composites classified? Briefly explain each type of composites with their merits and demerits. (CO2) 4

3-d. What is the relationship between surface area of fibres and water absorbed in case of bamboo reinforced polymer composite? (CO2) 4

3.e. Enumerate six primary material selection parameters that are used in evaluating the use of a particular material. (CO3) 4

3.f.	How do properties like elasticity, ductility, and tensile strength of materials like metals, ceramics, polymers and composites compare with each other? (CO4)	4
3.g.	Briefly explain the yield criteria used for the failure analysis of composite materials. (CO5)	4

SECTION C 35

4. Answer any one of the following:-

4-a.	Many ceramic-based composite materials are used in the electronics industry. Describe some of these electroceramic composites. (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 one of the following:-

5-a.	Write a short note about different types of matrix material and reinforced material used to make polymer matrix composites. (CO2)	7
5-b.	How fibres effect in concrete? Explain the necessity of fibre reinforced concrete. What are the different types of fibre reinforced concrete? (CO2)	7

6. Answer any one of the following:-

6-a.	With illustration and giving all the details explain filament winding process used to manufacture polymer matrix composites. (CO3)	7
6-b.	With the help of sketch/flow chart explain the stages involved in hand lay-up method for the production of polymer-based composites. (CO3)	7

7. Answer any one of the following:-

7-a.	Ductility, the ability to deform plastically in response to stresses, is more of a characteristic of metals than it is of ceramics or polymers. Why? (CO4)	7
7-b.	Ceramic materials generally have some residual porosity. How does the presence of porosity affect the elastic constants of ceramic materials? How does it affect the fracture energy of ceramics? (CO4)	7

8. Answer any one of the following:-

8-a.	Derive the expressions for resultant in plane forces and bending moments for laminate (CO5)	7
8-b.	Obtain an expression for E1 , E2, and G12 in terms of material properties with respect to principal material directions using mechanics of material approach. (CO5)	7