USN ☐☐☐☐☐☐☐☐☐☐   **18AE54**

Fifth Semester B.E. Degree Examination, July/August 2021
Introduction to Composite Materials

Time: 3 hrs.   Max. Marks: 100

Note: *Answer any FIVE full questions.*

1 a. Define composite materials? How they are classified?   **(08 Marks)**
   b. Differentiate thermo plastic and thermoset polymers.   **(06 Marks)**
   c. List the advantages and drawbacks of composites.   **(06 Marks)**

2 a. Explain the solid state processing of MMC's? Also mention the advantages and applications.
                                                                             (08 Marks)
   b. Explain the process of liquid forging with neat sketch.   **(06 Marks)**
   c. List the applications of Aluminum, magnesium and Titanium based MMC's. **(06 Marks)**

3 a. With a neat sketch, explain the thermoset polymer processing of Hand-layup process with advantages and disadvantages.   **(10 Marks)**
   b. Explain the process filament winding, with neat diagram. Also mention the advantages, drawbacks and applications.   **(10 Marks)**

4 a. Explain with neat diagram the blow moulding process. Mention the application.   **(10 Marks)**
   b. Explain the post processing of cutting in composites. Mention the advantages and disadvantages.   **(10 Marks)**

5 Based on the strength of material approach, determine the four elastic moduli of a unidirectional lamina.
   i)   Longitudinal Young's modulus E_1
   ii) Transverse Young's modulus E_2
   iii) Major Poisson's ratio V_{12}
   iv) In-plane shear modulus G_{12} **(20 Marks)**

6 a. Number of independent elastic constants for three dimensional anisotropic, monoclinic, orthotropic, transversely isotropic and isotropic materials.   **(05 Marks)**
   b. Derive the stress transformation matrix from local fiber coordinate system (x-y) to global co-ordinate system (1-2) in two dimensional.   **(15 Marks)**

7 Explain the following failure theories with equations
   a)   Tsai – Hill failure theory
   b)   Tsai – Wu failure theory   **(20 Marks)**

8 Determine the terms [A], [B] and [D], matrices for a [0/90º] laminate with the following properties of lamina.
$E_1 = 140$GPa, $E_2 = 10$GPa, $G_{12} = 5$GPa, $\mu_{12} = 0.3$ and thickness of ply is 0.125mm. **(20 Marks)**

9 a. Define NDT testing. Explain any one NDT testing with neat diagram. **(10 Marks)**
  b. Explain about tensile and ultrasonic testing. **(10 Marks)**

10 Give the applications of composite materials in the following
  i) Aircraft
  ii) Missiles
  iii) Automobile
  iv) Sports equipment
  v) Marine. **(20 Marks)**

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