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17AE52

Fifth Semester B.E. Degree Examination, Jan./Feb. 2021
Introduction to Composite Materials

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1   a. Define Composite Materials? How they are classified? **(08 Marks)**
    b. Differentiate thermoplastics and thermoset polymers. **(06 Marks)**
    c. List the advantages and drawbacks of composites. **(06 Marks)**

OR

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 Al, Mg and Ti based MMC's. **(06 Marks)**

Module-2

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 of filament winding with neat diagram. Also mention the advantages, drawbacks and applications. **(10 Marks)**

OR

4   a. Explain with neat diagram the blow moulding process. Mention the applications. **(10 Marks)**
    b. Explain the post processing of cutting in composites. Mention the advantages and disadvantages. **(10 Marks)**
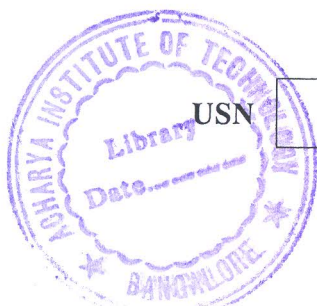
Module-3

5   a. Define the following with equations:
      i)   Volume fraction
      ii) Mass fraction
      iii) Density of a composite
      iv) Void content. **(12 Marks)**
    b. Determine the transverse Young's modulus by strength of material approach. **(08 Marks)**

OR

6   a. Determine the global and local stresses in an angle lamina. **(10 Marks)**
    b. For a graphite/epoxy unidirectional lamina, find the following:
      i)   Compliance matrix
      ii) Minor Poisson's ratio
      iii) Strain in the 1-2 coordinate system, if the applied stresses are:
      $\sigma_1 = 2MPa$, $\sigma_2 = -3MPa$, $\tau_{12} = 4MPa$
      [Use $E_1 = 181GPa$, $E_2 = 10.3GPa$, $\gamma_{12} = 0.28$, $G_{12} = 7.17GPa$]. **(10 Marks)**

Module-4

7. Explain the following failure theories with equations:
   i) Tsai-Hill failure theory
   ii) Tsai-Wu failure theory. (20 Marks)

OR

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

Module-5

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

OR

10. Give the applications of composite materials in the following:
    a. Aircrafts
    b. Missiles
    c. Automobile
    d. Sports equipment
    e. Marine. (20 Marks)

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