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## P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Fifth Semester, B.E. - Industrial Production and Engineering

Semester End Examination; Dec. - 2019

### Composite Materials

Time: 3 hrs

Max. Marks: 100

**Note:** Answer **FIVE** full questions, selecting **ONE** full question from each unit.

#### UNIT - I

- 1 a. What is a composite? How composites are classified? 10
- b. Write a note on;
- i) Fiber reinforced composites 10
- ii) Particle reinforced composites
- 2 a. What are the advantages and limitations of composites over other class of materials? 10
- b. Discuss the following:
- i) Laminated Composites 10
- ii) Polymer Nano composites

#### UNIT - II

- 3 a. Explain briefly the need for developing Metal Matrix Composites. 7
- b. List the various types of reinforcements used in Metal Matrix Composites. 5
- c. What are the advantages and limitations of Metal Matrix Composites? 8
4. Write a note on applications of composite materials in following sectors: 20
- i) Marine sector                      ii) Sports sector
- iii) Automobile sector              iv) Future potential of composites

#### UNIT - III

- 5 a. Explain the relationship between engineering constants reduced stiffness and compliances. 10
- b. Derive the expressions for Hooke's Law for a Two-dimensional angle Lamina. 10
- 6 a. Write a generalized Hooke's law in matrix form. Develop the stiffness matrix and compliance matrix for an orthotropic material. 10
- b. Estimate the compliance and stiffness matrix for a graphite/epoxy lamina using the following properties:
- $E_1 = 181 \text{ GPa}$ ,                       $E_2 = 10.3 \text{ GPa}$ ,                       $E_3 = 10.3 \text{ GPa}$  10
- $\nu_{12} = 0.28$ ,                       $\nu_{23} = 0.60$ ,                       $\nu_{13} = 0.27$
- $G_{12} = 7.17 \text{ GPa}$ ,                       $G_{23} = 3.0 \text{ GPa}$ ,                       $G_{31} = 7.0 \text{ GPa}$

#### UNIT - IV

7. Develop an expression for the three stiffness matrices [A], [B] and [D] for 2D Laminate composite. 20

- 8 a. Compute the three stiffness matrices [A], [B] and [D] for a three-ply [0/30/-45] graphite /epoxy laminate. Assume that each lamina has a thickness of 5mm. 15
- $E_1 = 181 \text{ GPa}$ ,       $E_2 = 10.3 \text{ GPa}$ ,       $\nu_{12} = 0.28$ ,       $G_{12} = 7.17 \text{ GPa}$
- b. Summarize the laminate codes with sketches. 5

**UNIT - V**

- 9 a. Explain the following process:
- i) Pultrusion 12
  - ii) Filament winding
- b. List the NDT methods. Explain Radiology with a neat sketch. 8
- 10 a. Identify the purpose of NDT. Outline the principle of ultrasonic inspection. 8
- b. Illustrate the following process:
- i) Hand lay-up technique 12
  - ii) Vacuum bag molding

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