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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 and Production Engineering

Semester End Examination; Dec - 2017/Jan - 2018

Composite Materials

Time: 3 hrs *Max. Marks: 100*

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

UNIT - I

1 a. Define composite. Explain in detail how composites are classified? 10

b. List and explain the types of Matrix Materials used in composites. 10

2 a. Explain the importance of sandwich structures in composites. 7

b. List the advantages and limitations of composite. 5

c. Write a note on : 8

i) Carbon Nano-Fiber ii) Nano-clay.

UNIT - II

3 a. Explain the role of composites in the following fields : 20

i) Automobile sector ii) Recreational and Sports equipment's

iii) Marine sector iv) Electrical and Electronics sectors.

4 a. Define Metal Matrix Composites (MMC's). Explain how the reinforcements are selected in MMC's? 10

b. With a neat sketch, explain how graphite fibers are produced by PAN-based precursors? 10

UNIT - III

5 a. Derive an expression of Nine independent constants for orthotropic material. 10

b. For a graphite / epoxy unidirectional lamina the Young's modulus E_1 = 170 GPa, E_2 = 9.5 GPa. Major Poisson's ratio δ_{12} = 0.28, Shear modulus G_{12} = 6.8 GPa, then find the following : 10

i) Compliance Matrix

ii) Minor Poisson's Ratio

iii) Reduced stiffness matrix.

6 a. Derive an expression for Hooke's law for a 2-Dimensional angle lamina. 14

b. The stresses in the global axes of a 30° ply are given by σ_x = 4 MPa, σ_y = 2 MPa and τ_{xy} = -3 MPa. Calculate the stresses in the local axes. 6

UNIT - IV

7 a. Develop an expression for strain-displacement by considering Classical Lamination Theory (CLT). 8

Contd…2

b. Find the 3-stiffness matrices [A], [B] and [D]for a 3-ply [0 / 30 / -45] graphite epoxy laminates as shown in Fig 1. Assume that each lamina has a thickness of 5 mm, given E_1 = 38.6 GPa, E_2 = 8.27 GPa, δ_{12} = 0.26, and G_{12} = 4.14 GPa. 12

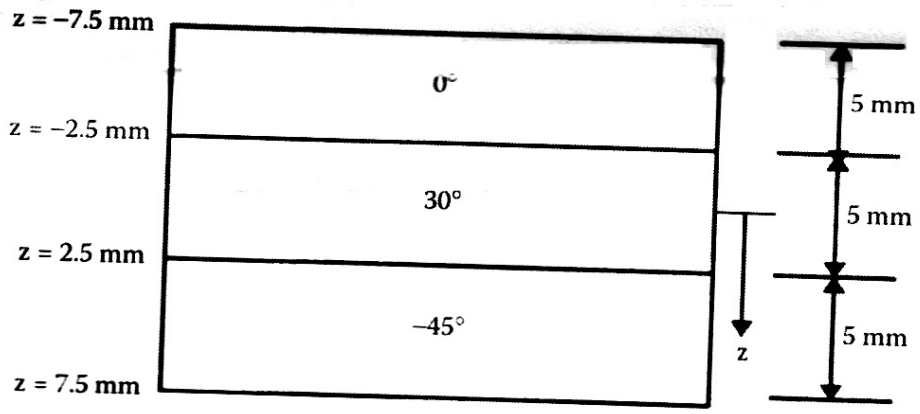

Fig. 1

8 a. Derive an expression for the stiffness matrices [A], [B] and [D] for an isotropic material in terms of its thickness (*t*), Young's modulus (E) and Poisson's Ratio δ. 15

b. Write a note on laminate code. 5

UNIT - V

9 a. Explain the injection moulding process with a neat sketch. 8

b. With a neat sketch, explain pressure Bag Moulding Process. 7

c. Write a note on ultrasonic inspection used in composites. 5

10 a. Explain filament winding process with a neat sketch. 8

b. List and explain the different types of defects in composites. 7

c. Explain how drilling operations are carried out in composites? 5

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