Code No: **R164103D** **R16** **Set No. 1**

IV B.Tech I Semester Regular Examinations, October/November - 2019

ADVANCED MATERIALS

(Mechanical Engineering)

Time: 3 hours **Max. Marks: 70**

Question paper consists of Part-A and Part-B
Answer ALL sub questions from Part-A
Answer any FOUR questions from Part-B
*****

PART–A*(14 Marks)*

1. a) Mention any two live applications of carbon–carbon composites in the field of electronics? [2]
   b) Mention the applications of Thermosetting plastics. [2]
   c) Explain the importance of fiber orientation in fiber reinforced composites. [3]
   d) What is a lamina and laminate? [2]
   e) Mention the properties of shape memory alloys. [3]
   f) What is the significance of specific surface area of nanomaterials? [2]

PART–B*(4x14 = 56 Marks)*

2. a) Explain the mechanism of strengthening in fiber reinforced composites with neat diagrams. [7]
   b) A polymer composite has 60% glass fiber in epoxy matrix. If the elastic moduli of glass is 85 GPa and that of epoxy is 3.4 GPa. Compare:
   (i) Modulus of elasticity of the composite in fiber direction
   (ii) Modulus of elasticity in transvers direction
   (iii) Load carried by the fiber [7]

3. a) Describe the powder metallurgy technique with flow chart, for fabrication of CCC. [7]
   b) Define a polymer composite. Explain the classification of polymer composites. Mention the advantageous and limitation of polymer composites. [7]

4. a) Describe the RTM process with neat diagram. [7]
   b) What are the different molding methods used for manufacturing of composites. Describe injection molding process with neat diagram. [7]

5. a) Derive generalized Hooke's law for a lamina. [7]
   b) What are the assumptions made in the classical lamination theory? Explain. [7]

6. a) Describe the phenomenology of phase transformation in shape memory alloys. [7]
   b) Describe the Fraction gradient, Shape gradient and Naturally occurred FGMs. [7]

7. a) Describe the properties of nano-materials. [7]
   b) Write a note on applications of nano-material for structural applications. [7]

Code No: **R164103D** **R16** **Set No. 2**

IV B.Tech I Semester Regular Examinations, October/November - 2019

ADVANCED MATERIALS

(Mechanical Engineering)

Time: 3 hours **Max. Marks: 70**

Question paper consists of Part-A and Part-B
Answer ALL sub questions from Part-A
Answer any FOUR questions from Part-B
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PART–A *(14 Marks)*

1. a) Mention any two applications of ceramic matrix compositesin the field of aerospace. [2]
   b) Mention the applications of CCC in Aircraft Industry. [2]
   c) Discuss the effect of interface bonding on properties of composite. [3]
   d) Calculate V_f and ρ_C for a composite laminate containing 30% weight of E-glass fibres in a polyster resign. Assume ρ_C=2.54 g/ml and ρ_C=1.1 g/ml. [3]
   e) Mention the applications of shape memory alloys. [2]
   f) How resistivity varies for nano materials? [2]

PART–B *(4x14 = 56 Marks)*

2. a) Explain the mechanism of strengthening in metal matrix composites with neat diagrams. [7]
   b) What are the characteristic of fiber that are to be used in reinforcement? Explain. [7]

3. a) How the metal matrix composites are different from polymer matrix composites? Explain. [7]
   b) What are the properties of thermosetting and thermoplast products. [7]

4. a) Describe the filament winding process with neat diagram. [7]
   b) Describe the hand layup process with neat diagram. [7]

5. a) What is lamination theory? Describe with sketch of laminate stacking sequence code. [7]
   b) Deduce the stiffness matrix for a lamina from generalized Hooke's law. [7]

6. a) How the functionally graded materials are classified? Mention at least one applications of each. [7]
   b) Mention the properties of shape memory alloys. In what way these are different? Explain. [7]

7. a) Mention the advantages & disadvantages in comparison with bulk material. [7]
   b) What is meant by top-down approach in nano material synthesis? Explain. [7]

Code No: **R164103D** **R16** **Set No. 3**

IV B.Tech I Semester Regular Examinations, October/November - 2019

ADVANCED MATERIALS

(Mechanical Engineering)

Time: 3 hours **Max. Marks: 70**

Question paper consists of Part-A and Part-B
Answer ALL sub questions from Part-A
Answer any FOUR questions from Part-B
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PART–A *(14 Marks)*

1. a) Mention any two applications of ceramic matrix composites in the field of aerospace. [2]
   b) Mention the applications of PMC in Aircraft Industry. [2]
   c) Differentiate between a lamina and laminate. [3]
   d) What are the common modes of failure of a unidirectional composite subjected to longitudinal tensile load? [3]
   e) What is shape memory alloy? [2]
   f) Mention any two advantages of powders in nano scales. [2]

PART–B *(4x14 = 56 Marks)*

2. a) Explain the mechanism of strengthening in ceramic composites with neat diagrams. [7]
   b) Describe the classification of composites? Mention at least one application of each. [7]

3. a) Define a thermosetting material. Mention the applications, advantageous and limitation of thermosetting materials. [7]
   b) Explain the process of squeeze casting of MMC with neat diagram. [7]

4. a) Describe the pultration process with neat diagram. [7]
   b) Mention the applications, advantageous and limitations of autoclave process. [7]

5. a) What is an angle –ply lamina? Explain its specific features. [7]
   b) How the Hooks law is reduced from three dimensions to two dimensions? Explain. [7]

6. a) Mention the properties of functionally graded materials. In what way these are different? Explain. [7]
   b) How the shape memory alloys are classified? Explain their composition. [7]

7. a) Mention the applications in comparison with bulk materials. [7]
   b) Explain bottom-up synthesis of nano materials. [7]

Code No: **R164103D** **R16** **Set No. 4**

IV B.Tech I Semester Regular Examinations, October/November - 2019

ADVANCED MATERIALS

(Mechanical Engineering)

Time: 3 hours **Max. Marks: 70**

Question paper consists of Part-A and Part-B
Answer ALL sub questions from Part-A
Answer any FOUR questions from Part-B
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PART–A *(14 Marks)*

1. a) Mention any two live applications of metal matrix composites. [2]
   b) Mention the applications of MMC in automobile sector. [2]
   c) Define strength ratio. [2]
   d) Define rule of mixtures in the determination of elasticity modulus. [3]
   e) What is functionally graded material? [2]
   f) What is Sol-Gel method? [3]

PART–B *(4x14 = 56 Marks)*

2. a) Explain the mechanism of strengthening in carbon- carbon composites with neat diagrams. [7]
   b) Determine the bulk modulus of (i) fiber (ii) Matrix and the inplane shear modulus of glass epoxy composite containing 65% fiber volume fraction. Given that Eg=85 GPa and Em= 3.4GPa, Poissions ratio Vf=0.2 and Vm=0.3, Shear modulus Gf=35.42GPa and Gm=1.308GPa. [7]

3. a) Define a thermoplastic materials. Mention the applications, advantageous and limitation of thermoplastic materials. [7]
   b) Explain the process of solid state processing of MMC with neat diagram. [7]

4. a) Describe the autoclave process with neat diagram. [7]
   b) Mention the applications, advantageous and limitations of hand layup process. [7]

5. a) Describe the laminate- laminate code. [7]
   b) What is mid-plane symmetric laminates? Explain its specific features. [7]

6. a) How the functionally graded materials are prepared? Explain powder metallurgy technique with neat diagram. [7]
   b) What is shape memory alloy? Explain the shape memory effect. [7]

7. a) What are the possible applications of CNTs for pressure and gas sensor? Explain principle with neat diagram. [7]
   b) Explain Ball-milling for nano synthesis. [7]