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BAS-022

B.Tech. AEROSPACE ENGINEERING (BTAE)

Term-End Examination

December, 2015

BAS-022 : COMPOSITE MATERIALS

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any* ***seven*** *questions. All questions carry equal marks. Use of scientific calculator is permitted.*

1. (a) Differentiate between Ceramics and Glass with the help of suitable examples. What is the Glass Transition Temperature ? *5*

(b) Explain the reasons for the rising popularity of pure oxide ceramics over traditional refractories. *5*

2. (a) Name one natural fiber-reinforced composite and one human-made aggregate composite material. What is the large-scale use of the human-made aggregate composite material which acts as the matrix in such aggregate composite ? *5*

(b) Define monomer and polymer. Write typical polymeric repeat unit structure for both addition and condensation polymerization. Which of the methods is expected to result in branched structure ? 5

3. (a) What processing steps are carried out, if a very-high-strength type of carbon fiber is desired ? If a very-high-modulus type of carbon fiber is desired, what processing steps are carried out ? 5

(b) What is an aramid fiber ? What are the two types of commercially available aramid fibers ? 5

4. (a) How does the amount and arrangement of the glass fibers in fiberglass-reinforced plastic affect its strength ? 5

(b) What are the main property contributions of the carbon fibers in carbon-fiber-reinforced plastics ? 5

5. (a) How will you control the crystallinity of polymers by polymerization method ? 5

(b) Why is a certain amount of amorphous material provided in crystalline polymers ? 5

6. (a) How are glass fibers produced ? What is a glass-fiber roving ? 5

(b) What is meant by the term compounding of plastic ? What are the functions of ingredients used in compounding of plastics ? 5

7. (a) Describe in brief the Metal-Matrix Composites (MMCs) materials. 5

(b) State the characteristics of long chain polymers. Describe briefly the deformation behaviour of plastics. 5

8. (a) A piece of wood contains 42 percent moisture. What must its final weight be after oven drying, if it weighed 175 gm before drying ? 5

(b) An MMC is made with an Al 2024 alloy with 30 volume percent SiC whiskers. If the density of the composite is 2·98 gm/cm^3 and that of the SiC fiber is 3·12 gm/cm^3, what will the density of the Al 2024 alloy be ? 5

9. (a) What are the techniques for non-destructive testing employed in ultrasonic testing ? What are its advantages as compared to other methods of non-destructive testing ? 5

(b) What are the advantages of X-ray technique as a non-destructive testing method ? Explain X-ray technique as NDT in brief. 5

10. Calculate *10*

(a) the modulus of elasticity,

(b) the tensile strength, and

(c) the fraction of the load carried

by the fiber for the following composite material stressed under isostrain conditions. The composite consists of a continuous glass-fiber-reinforced-epoxy resin produced by using 68 percent by volume of E-glass fiber having a modulus of elasticity of E_f = 72 GPa and a tensile strength of 2400 MPa and a hardened epoxy resin with a modulus of E_m = 3 GPa and a tensile strength of 62 MPa.