

**B.TECH. IN AEROSPACE ENGINEERING  
(BTAE)**

**Term-End Examination**

**June, 2012**

**BAS-022 : COMPOSITE MATERIALS**

*Time : 3 hours*

*Maximum Marks : 70*

*Note : Answer any seven questions. All questions carry equal marks.*

1. (a) Define a composite material with respect to a material system. Give some suitable examples. 5+5  
(b) What are the three main types of synthetic fibers used to produce fiber-reinforced-plastic composite materials ? Describe in brief each of them.
2. (a) How are glass fibers produced ? What is a glass-fiber roving ? 5+5  
(b) What properties make carbon fibers important for reinforced plastics ?
3. (a) What are the processing steps for the production of carbon fibers from polycrylonitrile ? What reaction takes place at each step ? 5+5

- (b) Describe the spray - up process for producing a fiber glass-reinforced part. What are some advantages and disadvantages of this method ?
4. A unidirectional carbon-fiber-epoxy-resin composite contains 68 percent by volume of carbon fiber and 32 percent epoxy resin. The density of the carbon fiber is  $1.79 \text{ gm/cm}^3$  and that of the epoxy resin is  $1.20 \text{ gm/cm}^3$ . 10
- (a) What are the weight percentages of carbon fibers and epoxy resin in the composite ?
- (b) What is the average density of the composite ?
5. Calculate the tensile modulus of elasticity of a unidirectional kevlar 49 - fiber-epoxy composite material that contains 63 percent by volume of kevlar 49 fiber and is stressed under isostrain conditions. The kevlar 49 fibers have a tensile modulus of elasticity of 1895 GPa and the epoxy matrix a tensile modulus of elasticity of 3.8 GPa. 10
6. (a) What are the advantages of a composite material over a single component material ? 5+5
- (b) Distinguish between addition and condensation polymerization, and state which of those are applied for processing polyethylene and polycarbonates.

7. (a) What do you understand by polymerization ? What is the difference between additional polymerization and condensation polymerization ? 5+5
- (b) What is sandwich structures of composite materials ? Describe in brief any one sandwich structure with the help of neat diagram.
8. (a) Describe in brief the Metal-Matrix Composites (MMCs) materials. 5+5
- (b) State the characteristics of long chain polymers. Describe briefly the deformation behaviour of plastics.
9. (a) A piece of wood contains 45 percent moisture. What must its final weight be after oven drying if it weighted 165 gm before drying ? 5+5
- (b) An MMC is made with an Al 2024 alloy with 20 volume percent Sic whiskers. If the density of the composite is  $2.90 \text{ gm/cm}^3$  and that of the Sic fibers is  $3.10 \text{ gm/cm}^3$ , what must the density of the Al 2024 alloy be ?
10. (a) It is generally true that fibers are stronger (in the length direction) than the bulk material from which they are made. Can you explain why ? 5+5
- (b) Define Non - destructive testing (NDT). What are the benefits of NDT ? Describe in brief ultrasonic NDT.