

ANNA UNIVERSITY OF TECHNOLOGY, COIMBATORE  
B.E. / B.TECH. DEGREE EXAMINATIONS : NOV / DEC 2011  
REGULATIONS : 2008  
FIFTH SEMESTER : MECHANICAL ENGINEERING  
080120028 - COMPOSITE MATERIALS

Time : 3 Hours

Max. Marks : 100

PART - A

(10 x 2 = 20 MARKS)

ANSWER ALL QUESTIONS

1. What are the roles of matrix and reinforcement in a Composite material?
2. Mention any four advantages of Composite materials.
3. Differentiate thermoplastic and thermosetting matrices in composites giving one example for each.
4. Give any four applications of carbon fibers.
5. What do you mean by pre-pregs?
6. Mention any four advantages of Reaction Injection Moulding.
7. Define the Rule of Mixtures.
8. What do you mean by inter laminar stresses?
9. What are Hybrid composites? Give one example.
10. Name two composite structures subjected to (i) creep and (ii) fatigue loading.

PART - B

(5 x 16 = 80 MARKS)

ANSWER ALL QUESTIONS

11. a) Discuss in detail the types of reinforcements in composites.  
(OR)  
b) Define the term composite material. Discuss in details the need for composites. Compare the properties of composite materials over conventional materials.

12. a) Explain in detail the manufacturing, properties and applications of  
(i) Glass fibers and  
(ii) Carbon fibers

(OR)

- b) Explain the properties of the following matrices:  
(i) Polyester  
(ii) Epoxy  
(iii) Nylon  
(iv) PEEK

13. a) Explain the following composites manufacturing methods with neat sketches

- (i) Autoclave method  
(ii) Filament Winding Method

(OR)

- b) Explain the following composites manufacturing methods in detail with neat sketches

- (i) Compression moulding  
(ii) Reaction injection moulding

14. a) (i) Derive the Rule of Mixture? (8)

- (ii) A unidirectional Kevlar 49 fiber-epoxy composite contains 60% by volume of Kevlar 40% fibers and 40% epoxy resin. The density of the Kevlar 49 fibers is  $1.48 \text{ mg/m}^3$  and that of the epoxy resin is  $1.20 \text{ mg/m}^3$ . What are the weight percentages of Kevlar 49 and epoxy resin in the composite material and what is the average density of the composite? (8)

(OR)

- 14 b) (i) Explain the classical laminate theory. (8)
- (ii) A tensile load of 100 N is applied to an Aluminium – Boron composite of  $1 \text{ mm}^2$  cross sectional area. If the volume of parallel fibers is 30%, what is the stress in the fiber when the load axis is parallel to the fibers and when the load axis is perpendicular to the fibers. Take  $E_f = 440 \text{ GPa}$  and  $E_m = 71 \text{ GPa}$  (8)

- 15 a) Explain in detail about the fatigue behaviors of CMC.

(OR)

- b) Explain the optimization of laminates in detail.

\*\*\*\*\*THE END\*\*\*\*\*