Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 11114

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2014.

Fifth/Seventh Semester

Mechanical Engineering

080120028/080190042 — COMPOSITE MATERIALS

(Common to Automobile Engineering)

(Regulation 2008)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. List any four composite components used in a bus.

2. Can we join composites by welding? Justify the answer.

3. List out some composite materials used for high temperature applications.

4. What is the major advantage of carbon fibers over glass fibers?

5. Can we use filament wound PMC cylinders to replace steel cylinders for natural gas transportation?

6. What are the three types of metal matrix composites?

7. What is the specific modulus of a polymer fiber with a density of 1.20g/cc and an elastic modulus of 600 Mpa?

8. What is the use of Halpin-Tsai equation in the micromechanics of composites?

9. What is thermal fatigue of a composite? Give two examples of composite materials subjected to thermal fatigue.

10. What is whisker reinforced composite?

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) Explain in detail different types of composites by giving their properties and applications. (8)

(ii) Give a detailed account of different matrix materials used in the manufacture of composite material. (8)

Or

(b) (i) Explain the effect of surface roughness and wettability of fibre on the properties of composite material. (8)

(ii) Explain in detail interfacial bonding of composites. (8)

12. (a) (i) Give a detailed account of manufacture of glass fibers by giving their properties and applications. (8)

(ii) Discuss in detail manufacture of Kevlar fibers. (8)

Or

(b) (i) Discuss in detail manufacture of non oxide fibers by giving their properties, applications and limitations. (8)

(ii) Explain in detail manufacture of carbon fibers. (8)

13. (a) (i) Discuss with a neat sketch filament winding process for manufacture of composites. (8)

(ii) Give a detailed account of hand lay up method with a neat sketch. (8)

Or

(b) (i) Discuss in detail autoclave method with a neat sketch. (8)

(ii) Explain in detail reaction injection moulding process and give its limitations and advantages. (8)

14. (a) (i) Derive an expression for the stress-strain relationship for an anisotropic composite material. (8)

(ii) Give a detailed account of failure criteria of orthotropic lamina. (8)

Or

(b) (i) The modulus and tensile strength of a SMC composites are reported as 15 GPa and 230 Mpa, respectively. Assuming that the density of the SMC is 1.85 g/cm^3. Calculate the strength weight for the composite. (8)

(ii) An aligned fiber composites has Vol of 30%. Carbon fibers in a polycarbonate matrix. The fibers have a diameter of 9μm and length of 3 mm. If the tensile strength and interface shear strength of the interface are 4.5Gpa and 14.5Mpa respectively.

(1) Calculate the critical fiber length and (4)

(2) Estimate the longitudinal tensile strength of the composite. Assume the failure stress of the fibers as 35 MPa. (4)

15. (a) (i) Compare the fatigue behavior of ceramic matrix composites and steel with S-N curves. (8)

(ii) Give a detailed account thermal fatigue behavior of composites. (8)

Or

(b) Give a detailed account of bonded, bolted, bolted and bonded joints used to manufacture composites. (16)
