

Registration No.:

--	--	--	--	--	--	--	--	--	--

Total Number of Pages: 02

Course: B.Tech
Sub_Code: RME6D001

6th Semester Regular/Back Examination: 2024-25

SUBJECT: Smart and Composite Materials

BRANCH(S): MECH, MMEAM

Time: 3 Hours

Max Marks: 100

Q.Code: S180

Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.

The figures in the right hand margin indicate marks.

Part-I

Q1 Answer the following questions:

(2 x 10)

- How are composites classified?
- Give any four examples of naturally found composites.
- Name two each of synthetic organic and inorganic fibers.
- What is metal matrix composites?
- What is rheocasting?
- What is autoclave moulding?
- What is sol-gel processing of ceramic matrix composites?
- Name two practical uses of honey comb structure.
- The weight fraction of glass in a glass/epoxy composite is 0.8. If the specific gravity of glass and epoxy is 2.5 and 1.2 respectively, find the fiber and matrix volume fractions.
- State the reasons of using short fiber composites.

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)

(6 x 8)

- What are the factors that determine the properties of composite materials? Explain.
- Write the number of independent elastic constants for three-dimensional anisotropic, monoclinic, orthotropic, transversely isotropic, and isotropic materials.
- Discuss the melt stirring liquid state processing of metal matrix composites.
- Give the advantages and drawbacks of metal matrix composites over polymer matrix composites.
- Give names of various fibers used in advanced polymer composites. Give a description of the carbon fiber.
- With neat sketch, elaborate the sol-gel processing of ceramic matrix composite.
- Differentiate between cold pressing and sintering process of ceramic matrix composite.
- Briefly discuss the damping characteristics of polymer matrix composites.

- i) Polymers are classified as thermosets and thermoplastics. Briefly discuss about the difference between the two.
- j) A balanced orthotropic, or square symmetric lamina, is made up of 0° and 90° fibers woven into a fabric and bonded together. Describe the stress - strain relationships for such a lamina in terms of the appropriate engineering constants.
- k) Classify the following laminates:
1. $[-30/45/-45/-30]$
 2. $[-30/30/-30/30]$
 3. $[30/-30/30]$
 4. $[45/30/-30/-45]$
- l) A carbon/epoxy composite specimen has dimensions of $2.54 \text{ cm} \times 2.54 \text{ cm} \times 0.3 \text{ cm}$ and a weight of 2.98 gm . After "resin digestion" in an acid solution, the remaining carbon fibers weigh 1.863 gm . From independent tests, the densities of the carbon fibers and epoxy matrix materials are found to be 1.9 and 1.2 gm/cm^3 , respectively. Determine the volume fractions of fibers, epoxy matrix, and voids in the specimen.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

(16 x 2)

- Q3** Explain with neat sketches, liquid state processing of metal matrix composites. (16)
- Q4** Discuss the processing, properties and applications of SiC whisker reinforced ceramic matrix composites. (16)
- Q5** Name various manufacturing methods of polymer matrix composites. With neat sketch, elaborate the spray-up technique for manufacturing of polymer matrix composites. (16)
- Q6** Write short note on the followings: (4 x 4)
- a) Interfacial bonding
 - b) Chemical vapour deposition (CVD) technique
 - c) Liquid infiltration
 - d) Recycling of polymer matrix composites (PMCs)