

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)**

**CLASS: BTECH
BRANCH: MECHANICAL**

**SEMESTER : V
SESSION : MO/2022**

SUBJECT: ME333 COMPOSITE MATERIALS

TIME: 3:00 Hours

FULL MARKS: 50

INSTRUCTIONS:

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
 2. Attempt all questions.
 3. The missing data, if any, may be assumed suitably.
 4. Before attempting the question paper, be sure that you have got the correct question paper.
 5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
-

- Q.1(a) Define Composite and differentiate it from Alloys and Compounds. (CO-1, BT-L) [2]
Q.1(b) Explain the terms CMC, MMC and PMC with suitable examples (CO-1, BT-M) [3]
Q.1(c) Discuss the various characteristics of reinforcement with suitable example. (CO-1, BT-L) [5]
- Q.2(a) Discuss the failure mechanism of composite materials in the Following conditions; brittle fibre in ductile matrix and ductile fibre in brittle matrix. (CO-2, BT-M) [2]
Q.2(b) Evaluate the material properties along arbitrary directions in a fibre reinforced composite using the properties along principal material directions. (CO-2, BT-M) [3]
Q.2(c) For a Glass / Epoxy composite $E_f = 85\text{GPA}$, $E_m = 3.4$, Poisson's ratio $\nu_m = 0.3$ and $\nu_f = 0.25$, determine the minor Poisson's ratio ν_{f12} and G_{12} for a fibre fraction of 60%. The symbols are as usually defined (CO-2, BT-M) [5]
- Q.3(a) Define ablative composites. Discuss the properties and applications with suitable example (CO-3, BT-L) [5]
Q.3(b) Explain Carbon - Carbon Composites elaborating the manufacturing considerations and applications. (CO-3, BT-M) [5]
- Q.4(a) Discuss and briefly classify functionally graded composite materials with the aid of a flowchart. (CO-4, BT-L) [5]
Q.4(b) Describe the different methods of sandwich construction of polymeric matrix composites. Also enumerate their relative advantages and disadvantages. (CO-4, BT-L) [5]
- Q.5(a) Discuss the yield criteria used for the failure analysis of composite materials. (CO-5, BT-M) [2]
Q.5(b) With a neat sketch, explain the process parameters and mechanism of infection moulding of thermoset composites. (CO-5, BT-M) [3]
Q.5(c) You are required to make a rectangular tray measuring 45 X 30 cm, with a depth of 12 cm in ABS composite (Density 2 g/cc). An acceptable tray can be produced by thermoforming 3 mm extruded sheet, which is available as 200 X 120 cm sheets at Rs.2 Lakhs per ton. It would be necessary to use blanks measuring 55 X 40 cm, which would be trimmed to 47 X 32 cm after forming. For thermoforming, the mould would cost Rs. 4 Lakhs, cycle time would be 90 seconds, and total factory costs would be Rs.1200 per hour. A somewhat better tray, weighing 495 grams, could be made by injection moulding. The mould cost is Rs. 16 Lakhs, cycle time is 30 seconds, and factory costs are Rs.2500 per hour. A scrap rate of 5% can be assumed. Moulding composite granules cost Rs.16 Lakhs per ton. Scrap from either process can be sold at Rs.50000 per ton. Calculate the minimum number of trays you would have to make to justify injection moulding. (CO-5, BT-H) [5]

:::28/11/2022:::M