Exam Date & Time: 06-May-2024 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

VI SEMESTER B.TECH END SEMESTER EXAMINATIONS, APR / MAY 2024

COMPOSITE MATERIALS [MME 4095]

Marks: 50 **Duration: 180 mins.**

A

Answer all the questions.

Instructions to Candidates: Answer ALL questions Missing data may be suitably assumed

1) Explain classification of composite materials based on matrix and reinforcement. (4)

A)

B) Describe different factors affecting the properties of composite materials. (3)

C) Explain with sketch production of glass fiber. (3)

2) Estimate longitudinal modulus, transverse modulus, poison's ratio and in-plane shear modulus of Glass-Epoxy composite consisting of 40% volume of Glass fibers. The material properties are as given in table below:

A)

Material	Young's modulus (GPa)	Poisson's ratio
Epoxy	3.5	0.35
Glass fiber	70	0.20

(4)

B) The material of a tension link is changed from an aluminum alloy to unidirectional graphite-epoxy composite. Calculate the volume fraction of graphite fibers required in the composite to match its longitudinal modulus with that of the aluminum alloy. What is the percentage of weight saving in this material replacement? (3)

Following are the constituent properties.

Material	Young's modulus (GPa)	Ultimate Strength (MPa)	Density (g/cc)
Epoxy	3.5	90	1.2
Graphite fiber	390	2100	1.9

C) Calculate the minimum volume fraction and critical volume fraction of a graphite fiber reinforced epoxy composite. The material properties are as given in table below:

Material	Young's modulus (GPa)	Ultimate Strength (MPa)	Density (g/cc)
Epoxy	3.5	90	1.2
Graphite fiber	390	2100	1.9

(3)

3) Explain with sketch Slurry infiltration process of production of ceramic matrix composites. (4)

A)

B) Explain with sketch stir casting process of production of metal matrix composites. (3)

C) Explain with sketch Resin Transfer Molding process of production of polymer matrix composites. (3)

4) i) Explain with sektch Abrasive Water Jet.machining of polymer composite materials.

ii) List different abrasive particles used in the process. (3+1). (4)

A)

B) Compare adhesive and mechanical joints used in the fabrication of composite products. (Mention at least three points). (3)

C) Answer the following questions.
i) List the functions of dielectric fluid in Electro Discharge Machining process.
ii) Which etchant is used for Nickel work piece in chemical milling?
iii) In case of Ultrasonic machining ther is static pressure is applied on the tool - workpiece interface. Why? (1+1+1) (3)

5) Explain with sketch, Ultrasonic inspection method of testing FRP composites. How location of defect is identified using this method. (3+1) (4)

A)

B) Explain the procedure of conducting a tensile test on a flat composite laminate as per ASTM standards. (3)

C) Explain with sketch two types of micro buckling failure mode observed in unidirectional composite lamina. (3)

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