Code No: 182AJ **R22**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech I Year II Semester Examinations, January/February - 2024
ENGINEERING MATERIALS
(Common to ME, AE)

Time: 3 Hours **Max. Marks: 60**

Note: This question paper contains two parts A and B.
i) **Part- A** for 10 marks, ii) **Part - B** for 50 marks.

- Part-A is a compulsory question which consists of ten sub-questions from all units carrying equal marks.
- Part-B consists of **ten questions** (numbered from 2 to 11) **carrying 10 marks each**. From each unit, there are two questions and the student should answer one of them. Hence, the student should answer five questions from Part-B.

PART- A

(10 Marks)

1.a)	Define area of reduction in area.	[1]
b)	Define stress and strain and their relationship in the context of materials.	[1]
c)	Define the term metal and metal alloys.	[1]
d)	State the properties of Aluminium alloy.	[1]
e)	Why are reinforcement made in thin fibre form?	[1]
f)	What are the assumptions used in classical lamination theory?	[1]
g)	What are ceramics? Can you name two everyday examples of ceramic materials?	[1]
h)	Define polymer.	[1]
i)	List the properties of metal nanoparticles.	[1]
j)	Provide an example of a bio material used in nanotechnology.	[1]

PART - B

(50 Marks)

2. Describe the Ashby chart and its significance in material selection. Choose a specific engineering application (e.g., automotive components) and use the Ashby chart to justify the selection of material. [10]

OR

3. Imagine you are designing a bicycle frame. Discuss the materials you would consider, emphasizing their mechanical properties. Explain how the stress–strain behaviour of the chosen materials influences the design decisions. [10]

4.a) How do alloys combine the best characteristics of multiple materials while maintaining the original properties of the pure metals?
b) How are they used in various industrial applications? [7+3]

OR

5.a) Imagine stretching a rubber band. What happens to it? Relate this to stress and strain.
b) How does understanding stress and strain help engineers design things like bridges or cars? [5+5]

6. Find the stiffness matrices [A] and [B] for a three ply [0/30/-45] graphite epoxy laminate. Assume each lamina has a thickness of 5mm. The properties of graphite/epoxy are E_1 = 181GPa, E_2 = 10.3 GPa, v_{12} = 0.28 and G_{12} = 7.17GPa. [10]

OR

7.a) Write the number of independent elastic constants for three-dimensional anisotropic, monoclinic, orthotropic, transversely isotropic and isotropic materials.

b) Reduce the monoclinic stress-strain relationships to those of an orthotropic material. [7+3]

8.a) Compare the crystal structures of diamond and graphite. How do these structures give rise to the distinct properties of each form of carbon?

b) Discuss two applications for both diamond and graphite, highlighting their unique properties that make them suitable for these applications. [5+5]

OR

9.a) Explain the processing techniques used for polymers, such as extrusion or injection moulding. How do these processes affect the properties of the final product?

b) List the characteristics of polymers that make them suitable for various applications and provide examples. [6+4]

10. Explain the concept of integrating different types of nanomaterials for multifunctional applications. Provide an example where the combination of semiconductor, metal, and ceramic nanomaterials enhance performance. [10]

OR

11.a) Define ceramic nanomaterials and discuss their unique characteristics. Choose one specific ceramic nanomaterial and describe its applications in nanotechnology.

b) How do ceramic nanomaterials contribute to advancements in materials science and technology? [5+5]

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