Roll No.												

PRESIDENCY UNIVERSITY
BENGALURU

School of Engineering

Mid-Term Examinations - November 2024

Semester: 5th | **Date**: 04.11.2024

Course Code: PET2031 | **Time**: 09:30am – 11:00am

Course Name: Overview of Material Science | **Max Marks**: 50

Program: B. Tech | **Weightage**: 25%

Instructions:

(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2 marks. **5Q x2M=10M**

1	Define the term "Material".	**2 Marks**	**L1**	**CO1**
2	List two points on the importance of material science in the petroleum refinery industry.	**2 Marks**	**L1**	**CO1**
3	List four characteristics of a polymeric material.	**2 Marks**	**L1**	**CO1**
4	Reproduce the coordination number of a unit cell with a suitable schematic diagram.	**2 Marks**	**L1**	**CO2**
5	Define Schottky defects with a suitable image.	**2 Marks**	**L1**	**CO2**

Part B

Answer ALL Questions. Each question carries 10 marks. **4QX10M=40M**

6	**6a**	Define composite material with a suitable example.	**2 Marks**	**L1**	**CO1**
	6b	Explain the difference between metal and ceramic material.	**3 Marks**	**L2**	**CO1**
	6c	Suppose you are a leader or expert in "Material Science" division in a reputed industry. Being a leader, explain elaborately any **five** important parameters for selecting a right material from the thousands available.	**5 Marks**	**L3**	**CO1**

or

7	**7a**	Define opaque body with an example.	**2 Marks**	**L1**	**CO1**
	7b	**All ceramic materials are not crystalline**- explain this with proper mechanism and example.	**3 Marks**	**L2**	**CO1**
	7c	Imagine you are tasked with designing a material for a smartphone screen that needs to be transparent, mechanical strength, and high thermal resistance. Choose the best-fitted or suitable material type from the followings: crystalline, semi-crystalline, or amorphous material. Also explain the reasons behind for not selecting the other types material very clearly.	**5 Marks**	**L2**	**CO1**
8	**8a**	Discuss face-centered cubic (FCC) crystal structure with suitable diagram.	**2 Marks**	**L2**	**CO1**
	8b	Discuss the number of atoms (N) per unit cell of an FCC crystal.	**3 Marks**	**L2**	**CO1**
	8c	Demonstrate the unit cell volume and atomic packing factor (APF) of an FCC crystal. Also solve for the percent of void space present in that particular type of crystal structure. (Consider all spherical atoms are having same radius, which is "R")	**5 Marks**	**L3**	**CO1**

or

9	**9a**	Discuss simple cubic (SC) crystal structure with suitable diagram.	**2 Marks**	**L2**	**CO1**
	9b	Discuss the number of atoms (N) per unit cell of an SC crystal.	**3 Marks**	**L2**	**CO1**
	9c	Demonstrate the unit cell volume and atomic packing factor (APF) of an SC crystal. Also solve for the percent of void space present in that particular type of crystal structure. (Consider all spherical atoms are having same radius, which is "R")	**5 Marks**	**L3**	**CO1**
10	**10a**	Discuss Hock's Law with a suitable diagram.	**2 Marks**	**L2**	**CO2**
	10b	Compare between ductile and brittle material, **three** points only.	**3 Marks**	**L2**	**CO2**
	10c	Explain how stress and strain influence the failure of a metal under tensile loading.	**5 Marks**	**L2**	**CO2**

or

11	**11a**	Define fatigue failure.	**2 Marks**	**L1**	**CO2**
	11b	Discuss Brinell hardness and Rockwell hardness, and their applications.	**3 Marks**	**L2**	**CO2**
	11c	An automotive engine (consider a car) was tested at a fixed working conditions as follows: Load: 30 N/m^2; Temperature: Ambient (25°C); Car Speed: 80 km/hr. Suddenly, the working load of the engine is increased to 55 N/m^2 and the car is suddenly stroked with the wall**.** After that it is seen that the metal body of the car and engine was gone down permanently. Discuss your own design aspect in terms of selection of a material, safety of car so that the car can get a minimum loss after a striking with the same speed, i.e., 80 km/hr.	**5 Marks**	**L3**	**CO2**
12	**12a**	Discuss cup and cone type fracture of a solid material with proper diagram.	**2 Marks**	**L2**	**CO2**
	12b	Discuss clearly the effect of temperature and thermal shock on the fracture of a material taking a suitable example.	**3 Marks**	**L2**	**CO2**
	12c	Illustrate clearly the stress-strain curve for the following type of polymeric materials. From the graph select the material that has more sustainability at high temperature. (a) Elastomer (b) Strain-softening (quasi brittle material) (c) Ductile (d) Brittle	**5 Marks**	**L3**	**CO2**

or

13	**13a**	Define the term "Ultimate Safety Factor (USF)".	**2 Marks**	**L1**	**CO2**
	13b	In the manufacturing of critical components for a bridge, the material chosen must exhibit consistent mechanical properties across all parts. However, due to inherent property variability in materials, different batches may exhibit slight differences in strength, ductility, or toughness. Explain property variability impact the reliability and safety of the structure.	**8 Marks**	**L2**	**CO2**