Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – May / June 2026

Date: 25- 05- 2026 **Time:** 09:30am – 12:30pm

School: SOE	**Program:** B.Tech	
Course Code: PHY2503	**Course Name**: Fundamentals of Material Physics	
Semester: II	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	CO1	CO2	CO3	CO4	CO5	CO6
Marks	12	12	14	19	17	26

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 2marks. **10Q x 2M=20M**

1.	Explain Bravais lattices. State the total number of Bravais lattices.	**2 Marks**	**L2**	**CO1**
2.	Explain the term degree of freedom.	**2 Marks**	**L1**	**CO2**
3.	Define Fermi energy.	**2 Marks**	**L1**	**CO3**
4.	Explain the concept of solar cell efficiency with expression.	**2 Marks**	**L2**	**CO3**
5.	Define strain. Explain why is strain dimensionless.	**2 Marks**	**L2**	**CO4**
6.	Define Poisson's ratio.	**2 Marks**	**L1**	**CO4**
7.	Define shear stress in fluids.	**2 Marks**	**L1**	**CO5**
8.	Explain the limitations of ball milling.	**2 Marks**	**L2**	**CO6**
9.	Explain any two properties of CNTs.	**2 Marks**	**L2**	**CO6**
10.	Describe graphene and its basic characteristics.	**2 Marks**	**L2**	**CO6**

Part B

Answer the Questions. **Total Marks 80M**

11.	**a.**	Define Miller indices and explain the step-by-step method for finding Miller indices of a plane which makes intercepts a,2b and 3c with axes. Make a suitable sketch. Draw a neat diagram of the (100) and (200) planes in a cubic unit cell.	**10 Marks**	**L3**	**CO1**
	b.	Explain phase. Distinguish between phase and component. State Gibbs Phase Rule and explain each term briefly.	**5 Marks**	**L2**	**CO2**
	c.	Explain the construction of a binary phase diagram. Mention the significance of binary phase diagrams in materials engineering.	**5 Marks**	**L2**	**CO2**
		Or			
12.	**a.**	Explain line defects (dislocations) in crystals. Distinguish between edge dislocation and screw dislocation with suitable diagram. Distinguish between primitive unit cell and non-primitive unit cell.	**10 Marks**	**L2**	**CO1**
	b.	Describe an isomorphous binary system, clearly explaining: Liquidus line, Solidus line, Single-phase and two-phase regions.	**5 Marks**	**L2**	**CO2**
	c.	Define phase diagram. Explain the tie line and lever rule for a binary phase diagram.	**5 Marks**	**L2**	**CO2**

13.	**a.**	Explain how to determine modulus of rigidity using torsional pendulum. Two torsional pendulums have moments of inertia in ratio 1:4. Find ratio of time periods.	**10 Marks**	**L3**	**CO4**
	b.	Explain the influence of frequency and temperature on polarization mechanisms in dielectric materials.	**5 Marks**	**L2**	**CO3**
	c.	If the susceptibility of a dielectric is 0.6, calculate the polarization when the applied electric field is 3×10^5 V m^{-1}. ε_0= 8.854 X 10^{-12} F^{-1} m^{-1}	**5 Marks**	**L2**	**CO3**
		Or			
14.	**a.**	Explain the stress–strain curve with all important points. Discuss the elastic and plastic behavior of materials using stress–strain curve.	**10 Marks**	**L3**	**CO4**
	b.	Explain Peltier effect with diagram. Define Peltier coefficient.	**5 Marks**	**L2**	**CO3**
	c.	At a thermocouple junction, 180 J of heat is absorbed when a current of 5 A flows for 3 minutes. Calculate the Peltier coefficient (π) of the junction.	**5 Marks**	**L3**	**CO3**

15.	**a.**	Explain the continuum hypothesis and discuss its validity in engineering applications. Classify fluids based on viscosity and compressibility with suitable examples.	**10 Marks**	**L2**	**CO5**
	b.	Explain the no-slip condition. Discuss its importance in fluid flow problems with practical examples.	**5 Marks**	**L2**	**CO5**
	c.	Explain the assumptions made in the theory of simple bending.	**5 Marks**	**L2**	**CO4**
Or					
16.	**a.**	Mention Newton's law of viscosity and explain its physical significance. Explain Newtonian and non-Newtonian fluids with examples.	**10 Marks**	**L2**	**CO5**
	b.	A plate in a machine is lubricated by a film of SAEOW oil at 200C with thickness t=1.5 mm. The plate has a length L=30 mm and depth w= 130 mm (into the page). Calculate the shear force (F) required to slide the plate at a velocity v=2.1m/s. Dynamic viscosity of oil is 0.86 kg/m.s^2.	**5 Marks**	**L3**	**CO5**
	c.	Explain bending moment and shear force for a beam. Mention the relation between them.	**5 Marks**	**L2**	**CO4**

17.	**a.**	Explain the effect of nanoscale size on material properties such as mechanical, optical, electrical, and chemical properties with examples. Explain the significance of surface to volume ratio here.	**10 Marks**	**L2**	**CO6**
	b.	Differentiate between top-down and bottom-up approaches of nanomaterial synthesis.	**5 Marks**	**L2**	**CO6**
	c.	An XRD pattern shows broad peaks. Analyze the reason for peak broadening and explain how crystallite size is determined.	**5 Marks**	**L3**	**CO6**
Or					
18.	**a.**	Explain the principle and working of X-ray Diffraction (XRD). Discuss how it is used to determine crystal structure.	**10 Marks**	**L2**	**CO6**
	b.	For X-ray of wavelength 1.54 Å, find interplanar spacing if diffraction occurs at $\theta = 30°$.	**5 Marks**	**L3**	**CO6**
	c.	Given a requirement for high purity and controlled size nanomaterials, select a suitable synthesis method and justify your choice with reasoning.	**5 Marks**	**L3**	**CO6**