



PRESIDENCY UNIVERSITY

BENGALURU

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| Roll No. | | | | | | | | | | | | | | | | | | | |
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Mid - Term Examinations - March 2026

Date: 13-03-2026

Time: 09.30am to 11.00am

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| School: SOE | Program: B.Tech | | |
| Course Code : PHY2503 | Course Name: Fundamentals of Material Physics | | |
| Semester: II | Max Marks: 50 | Weightage:25% | |

| CO - Levels | CO1 | CO2 | CO3 | CO4 | CO5 |
|-------------|-----|-----|-----|-----|-----|
| Marks | 4 | 22 | 24 | 0 | 0 |

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.

5Q x 2M=10M

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|---|---|---------|----|-----|
| 1 | Draw the crystallographic direction [010] in a cubic unit cell and label the axes clearly. | 2 Marks | L2 | CO1 |
| 2 | Define Atomic Packing Factor with reference to a unit cell. | 2 Marks | L1 | CO1 |
| 3 | Mention the type of doping needed for making p-type semiconductor. Name the majority carrier in p-type semiconductor. | 2 Marks | L1 | CO3 |
| 4 | Define Fermi energy. | 2 Marks | L1 | CO3 |
| 5 | State the reduced (condensed) phase rule. | 2 Marks | L1 | CO2 |

Part B

Answer the Questions.

Total Marks 40M

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|----|----|---|----------|----|-----|
| 6. | a. | Define phase, component, and degree of freedom. State and explain the Gibbs Phase Rule. Using Gibbs Phase Rule, calculate the degree of freedom for the following systems and comment on their nature. (i) Ice + water | 10 Marks | L2 | CO2 |
|----|----|---|----------|----|-----|

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|-----------|-----------|---|-----------------|-----------|------------|
| | | (ii) Ice + water + vapour (iii) Binary alloy consisting of liquid and solid phases | | | |
| | b. | Explain the unary system of water with a neat labelled phase diagram. Using Gibbs phase rule, calculate the degree of freedom at: (i) Any point on the fusion curve (ii) Triple point (iii) Critical point | 10 Marks | L3 | CO2 |
| Or | | | | | |
| 7. | a. | Describe the essential features of a binary phase diagram. Draw and explain an isomorphous binary phase diagram. At a given temperature, an alloy lies in the liquid + solid region. Explain what phases are present and how their compositions are determined. | 10 Marks | L3 | CO2 |
| | b. | Draw and explain the cooling curve of a binary alloy. Explain Eutectic temperature and write practical applications of cooling curve. | 10 Marks | L2 | CO2 |

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| 8. | a. | Discuss Hall effect with the help of a neat diagram. Mention the formula for Hall voltage and Hall coefficient explaining the terms. The Hall coefficient of certain silicon specimen was found to be $-7.35 \times 10^{-5} \text{ m}^3 \text{ C}^{-1}$ at 400 K. Calculate the number of charge carriers and determine the nature of the semiconductor. | 10 Marks | L3 | CO3 |
| | b. | Explain the Seebeck effect with a neat diagram. Define thermoelectric power and explain its dependence on temperature. A thermocouple develops an emf of 6 mV for a temperature difference of 150 K. Calculate the Seebeck coefficient of the thermocouple. | 10 Marks | L2 | CO3 |
| Or | | | | | |
| 9. | a. | Define dielectric material and explain polarization in dielectrics. Derive the relation between polarization (P), electric field (E), and electric susceptibility (χ_e). If the susceptibility of a dielectric is 0.6, calculate the polarization when the applied electric field is $3 \times 10^5 \text{ V m}^{-1}$. (Take $\epsilon_0 = 8.854 \times 10^{-12} \text{ F m}^{-1}$) | 10 Marks | L3 | CO |
| | b. | Explain the principle, construction, and working of a solar cell with a neat diagram. | 10 Marks | L2 | CO |