

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURAJADA VIZIANAGARAM****I B. Tech II Semester Supplementary Examinations Dec -2025 / Jan 2026****Engineering Physics**

(Common to CE, EEE, AME, MECH &amp; ECE)

Time: 3 hours

Max. Marks: 70

***Question paper consists of Part A & Part B.******Part A is compulsory, Answer all questions.******In Part B, Answer any one question from each unit.***

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**PART-A****(20 Marks)**

- 1 a) State and explain superposition theorem. [2]
- b) Define plane of polarization and vibration. [2]
- c) What are Miller indices, and how are they used? [2]
- d) Explain the role of diffraction in identifying crystal structures. [2]
- e) Write down the temperature dependance of orientation polarization. [2]
- f) What do you mean by Neel temperature? [2]
- g) Write down the merits of classical free electron theory. [2]
- h) What happens to the Fermi-Dirac distribution at absolute zero temperature? [2]
- i) Define energy bands in solids. [2]
- j) Why fermi level lies in the middle of the forbidden gap in the case of intrinsic semiconductors. Explain. [2]

**PART-B****(50 Marks)****Unit-1**

- 2 a) With ray diagram discuss the theory of thin films and the conditions for constructive and destructive interference in the case of reflected system. [5]
- b) What is a wave plate? Explain about quarter and half wave plate. [5]

(OR)

- 3 a) Differentiate between interference and diffraction intensity patterns. [5]
- b) Explain the theory of Fraunhofer diffraction due to 'N' slits. [5]

**Unit-2**

- 4 a) Deduce the relation between the interplanar distance 'd' and the Miller indices (hkl) of the planes for a cubic system. [5]
- b) Discuss the Simple, Body-centered and Face centered cubic crystal structures. [5]

(OR)

- 5 a) Describe the seven crystal systems with diagrams. [5]
- b) With neat sketch explain the powder method for the measurement of lattice parameters. [5]

### Unit-3

- 6 a) What are the dielectric materials? Explain the behavior of polar and non-polar dielectrics under static electric fields. [5]  
b) Obtain an expression for ionic polarizability. The relative permittivity of Sulphur is 4. Calculate its atomic polarizability. Given that Sulphur is in cubic form and has a density of  $2.08 \times 10^3 \text{ kg/m}^3$  and atomic weight of 32. [5]

(OR)

- 7 a) Discuss the properties and effect external field on the dia, para, and ferromagnetic materials. [5]  
b) Explain hysteresis property of ferromagnetic materials with neat B-H plot by marking retentivity and coercive fields. [5]

### Unit-4

- 8 a) State de-Broglie hypothesis. Derive an expression for de-Broglie wavelength and using it show that an electron accelerated by a potential difference  $V$  volt is  $1.26\text{\AA}$ . [5]  
b) Obtain an expression for Schrodinger's time dependent wave equation. [5]

(OR)

- 9 a) Discuss merits and drawbacks of classical free electron theory. [5]  
b) Write an expression for the Fermi energy distribution function  $F(E)$  and discuss its behaviour with change in temperature. Plot  $F(E)$  versus  $E$  for  $T=0\text{K}$  and  $T>0\text{K}$ . [5]

### Unit-5

- 10 a) Discuss the dependence of Fermi energy level on carrier concentration in the case of extrinsic and intrinsic semiconductors with neat plots. [5]  
b) Obtain the expression for carrier concentration P- type semiconductor. [5]

(OR)

- 11 a) Distinguish between intrinsic and extrinsic semiconductors. Explain their structural difference with suitable diagrams. [5]  
b) Write short notes on drift and diffusion currents of a semiconductor. [5]

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