Reg No.: _____ Name : _____

**Jyothi Engineering College(Autonomous)**

B. Tech Degree S2 (S) Examination, June 2026 (2025 Scheme)

**25PHT101 - PHYSICS FOR INFORMATION SCIENCE**

**Total Mark: 60** **Total Time: 2hrs 30 min**

CO MARK

## PART A

**(Answer All Questions. Each question carries 3 marks)**

1. Prove the susceptibility of superconductor is -1 on the basis of Meissner effect. CO1 (3)
2. What is meant by Fermi energy? Why is it important in the study of metals? CO1 (3)
3. What is meant by quantum mechanical tunnelling? Name two devices based on this phenomenon. CO2 (3)
4. What are the conditions to be satisfied by a wave function? CO2 (3)
5. Why are pure semiconductors called intrinsic semiconductors? How are charge carriers generated in them? CO3 (3)
6. A silicon diode is forward biased with a voltage of **0.5 V** at **298 K**. The reverse saturation current is found to be **10 nA**. Find the diode current. Given $V_T$=0.026 V CO3 (3)
7. Draw and explain the V-I characteristics of a Zener diode. CO4 (3)
8. The applied input ac power to a half wave rectifier is **200 watts**. The DC output power obtained is **80 watts**. What is the rectifier efficiency? CO4 (3)

## PART B

**(Answer any one full question from each module, each question carries 9 marks)**

### Module - 1

9. Explain the Fermi–Dirac distribution function. Discuss the variation of the Fermi function with temperature for the cases (i) T = 0 K, (ii) T > 0 K and (iii) T >> 0 K. CO1 (9)

**OR**

10. a) Explain the concept of energy bands in solids using band theory. CO1 (5)

    b) The density of Cu is $8.92 \times 10^3 \mathrm{kg/m^3}$ and its atomic weight is **63.5**. Determine the current density if the current of **5.0 A** is maintained in Cu wire of radius **0.7 mm**. Assuming that only one electron of an atom takes part in conduction. Also calculate the drift velocity of electrons. CO1 (4)

### Module - 2

11. Explain Heisenberg's uncertainty principle and write its mathematical expressions for the pairs (i) position and momentum, (ii) energy and time, and (iii) angular position and angular momentum. Using this principle, show that an electron cannot exist inside an atomic nucleus of radius $1 \times 10^{-15}\mathrm{m}$. CO2 (9)

**OR**

12. a) Explain how the finite lifetime of an excited atom leads to the natural broadening of spectral lines using Heisenberg's uncertainty principle. Calculate the uncertainty in the frequency of light emitted by an atom whose excited state has a lifetime of $10^{-8}$s. CO2 (5)

b) Calculate the energies of the ground state and first excited state, in electron volts (eV), for an electron confined in a one-dimensional box of width **10 nm**. CO2 (4)

**Module - 3**

13. a) Explain the behavior of a p–n junction diode in forward and reverse bias using the diode equation. CO3 (5)

b) At what temperature, the probability of a state to be occupied by an electron is **2 %.** Given that the energy of the state is **0.1eV** above the fermi level. CO3 (4)

**OR**

14. Derive an expression for density of holes in the valence band of an intrinsic semiconductor. CO3 (9)

**Module - 4**

15. a) Explain the construction and working of a PIN photodiode. CO4 (5)

b) Explain any four advantages of semiconductor laser. CO4 (4)

**OR**

16. a) Derive the expression for efficiency of a full wave rectifier. CO4 (5)

b) The Light Emitting Diode emits light of wavelength **720 nm**. Calculate the band gap energy of the semiconductor material in eV. Also state the type of region of the electromagnetic spectrum in which this radiation lies. CO4 (4)

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