Regd. No. | | | | | | | | | | |

VIGNAN'S
FOUNDATION FOR SCIENCE, TECHNOLOGY & RESEARCH
(Deemed to be University) - Estd. u/s 3 of UGC Act 1956

Regulation: R22C24 **Course Code: 24PY102-4**

I B. Tech II Semester Regular Examinations – June, 2025

ENGINEERING PHYSICS

(CSE(AI&ML)/CSE(CS)/CSE(DS))

Time: 150 Min **Max. Marks: 60M**

SECTION – A

Answer all Four questions **4×8M=32M**

1. a) Explain the significance of Heisenberg's uncertainty principle with one suitable example. [4M]
   b) Describe how Heisenberg's uncertainty principle helps to understand the non-existence of electrons inside the nucleus of an atom. [3M]
   c) An electron is confined in a box of length 10^{-9}m. Calculate the minimum uncertainty in its momentum. [1M]

2. a) Explain how the Schrödinger equation helps to understand the quantization of energy levels in a one-dimensional potential well. [4M]
   b) Apply the normalization condition to obtain the wave functions for a particle in one-dimensional potential well and plot them. [3M]
   c) An electron possesses a wavelength of 2Å in the ground state; calculate the length of the potential. [1M]

3. a) Explain what is photovoltaic effect. [1M]
   b) Elucidate the role of depletion region in P-N junction diode in conversion of light power into electrical power in the photovoltaic cell. [4M]
   c) Draw the I-V characteristics of a solar cell and write the expressions for Fill factor and efficiency. [3M]

4. a) Describe how the direct bandgap materials have superior performance than the indirect bandgap materials in LEDs and LASERs. [2M]
   b) What are the essential conditions for an ordinary light to be called a LASER? [2M]
   c) Briefly explain the lasing action in semiconductor LASER with the help of a suitable band diagram. [4M]

SECTION - B

Answer all Two questions **2×14M=28M**

5. a) How does the principles of Quantum free electron theory are applied to elucidate the electronic-specific heat of metals to overcome the failures of the classical free electron theory. [7M]
   b) What is the Fermi-Dirac distribution function? Explain its temperature variation at T=0K and T>0K. [4M]
   c) The Fermi level of silver is 5.5eV. Calculate the probability of finding the electron at the energy of 0.3eV above the Fermi level at 1000K. [3M]

6. a) Apply the law of mass-action to obtain an expression for the electrical conductivity of an intrinsic semiconductor from the electron and hole carrier concentrations. [5M]

   b) Why the carrier concentration of Ge is more than Si at all temperatures? [1M]

   c) Mobilities of electrons and holes in a sample of intrinsic Ge at 300K are $0.36 m^2/Vs$ and $0.17 m^2/Vs$ respectively. If the resistivity of the specimen is $2.12 \Omega m$, compute the forbidden energy gap for Ge, $m_e^* = 0.5 m_0$ and $m_h^* = 0.37 m_0$. [4M]

   d) The conductivity of Ge at 20°C is $2(\Omega m)^{-1}$. Calculate its conductivity at a temperature of 40°C. Given bandgap of Ge=0.7eV. [4M]