Total No. of Questions—**6**] [Total No. of Printed Pages—**3**

Seat No.	

[4856]-23

F.E. (Second Semester) EXAMINATION, 2015

APPLIED SCIENCE

Paper II

(Physics)

(2008 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. **:—** (*i*) Neat diagrams must be drawn wherever necessary.

(*ii*) Figures to the right indicate full marks.

(*iii*) Assume suitable data, if necessary.

(*iv*) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

Constants :

Charge on electron $e = 1.6 \times 10^{-19}$ C

Mass of electron $m = 9.1 \times 10^{-31}$ kg

Planck's const. $h = 6.63 \times 10^{-34}$ J.s.

1. (*a*) State Heisenberg's Uncertainty principle. Illustrate it with electron diffraction due to single slit. [6]

(*b*) Derive Schrödinger's time independent wave equation. Also write the Schrödinger's time dependent wave equation. [7]

(*c*) An electron is trapped in a rigid box of width 2Å. Find its lowest three permissible energies in eV. [4]

P.T.O.

Or

2. (*a*) State de Broglie's hypothesis. Derive the equation for de Broglie wavelength in terms of energy and potential difference 'V'. [6]

(*b*) Derive the expression for energy and wavefunction of a particle trapped in an infinite potential well. Give the graphical representation for ψ and $|\psi|^2$. [7]

(*c*) An electron is accelerated through a potential difference of 10 kV. Calculate the de Broglie wavelength and momentum of the electron. [4]

3. (*a*) Explain the construction and working of Ruby laser with neat and labelled diagrams. [7]

(*b*) Distinguish between Type I and Type II superconductors. [6]

(*c*) Define : [4]

(1) Spontaneous emission

(2) Stimulated emission

(3) Population inversion

(4) Pumping.

Or

4. (*a*) Explain the construction and working of He-Ne laser with neat and labelled diagrams. [7]

(*b*) Explain the terms : [6]

(1) Meissner effect

(2) Critical magnetic field.

(*c*) What do you mean by Holography ? Explain the process of construction of Hologram with neat and labelled diagram. [4]

5. (*a*) Using the Fermi-Dirac probability distribution function, show that the Fermi-level in the intrinsic semiconductor lies at the centre of the band gap. [6]

(*b*) Explain the optical and electrical properties of nanoparticles. [6]

(*c*) Calculate the number of acceptors to be added to germanium sample to obtain the resistivity of 10 Ω-cm.

Given : $\mu = 1700$ cm^2/Volt-sec. [4]

Or

6. (*a*) Explain the working of P-N junction diode on the basis of energy band diagrams for : [6]

(1) Forward bias

(2) Reverse bias.

(*b*) Explain the construction and working of solar cell. Also draw the I-V characteristics of solar cell. [6]

(*c*) Explain the synthesis of metal nano-particles by colloidal route. [4]