Seat No.

[5151]-104

F.E. (I Semester) EXAMINATION, 2017
ENGINEERING PHYSICS
(2015 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)　Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(iv)　Assume suitable data, if necessary.

Constants :— (1)　Mass of electron = 9.1×10^{-31} kg.

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

(3)　Mass of proton, $M_p = 1.673 \times 10^{-27}$ kg

(4)　Mass of Neutron, $M_n = 1.675 \times 10^{-27}$ kg

(5)　Planck's constant, $h = 6.63 \times 10^{-34}$ J.s

(6)　Velocity of light in vacuum, $c = 3 \times 10^8$ m/s.

1.　(a)　A thin film of uniform thickness is illuminated by a monochromatic light. Derive an expression for path difference for the reflected rays system. Hence obtain the conditions for constructive and destructive interference. [6]

(b)　What is reverberation time ? Explain any *two* measures to control reverberation time in an auditorium. [3]

(c)　Calculate the reverberation time for an empty hall of volume 1200 m^3 that has total sound absorption of 450 m^2 sabine. When the hall is completely occupied, total sound absorption is further increased by 450 m^2 sabine. Hence calculate the reverberation time. [3]

2. (*a*) What is piezoelectric effect ? Draw neat and labelled diagram for piezoelectric oscillator and hence explain its construction and working. [6]

(*b*) What is diffraction of light ? Differentiate between Fresnel and Fraunhoffer diffraction (*two* points). [3]

(*c*) A monochromatic light of wavelength 5500 Å incident normally on a slit of width 2×10^{-4} cm. Calculate the angular position of first and second minimum. [3]

3. (*a*) Why is the combination of Helium and Neon gases chosen in He-Ne laser system ? Explain construction and working of He-Ne laser system with the help of energy level diagram. [6]

(*b*) Define Fermi level for a semiconductor. Draw a neat and labelled diagram showing position of Fermi level in intrinsic semiconductor and in N-type semiconductor. [3]

(*c*) A sample of intrinsic germanimum at room temperature has a carrier concentration 4.41×10^{22} cm^3. Donor impurity is added in the ratio 1 donor atom per 10^8 atoms/cm^3 of germanium. Determine the resistivity of the material thus formed. (Given : μ_e 3800 cm^2/V.s) [3]

Or

4. (*a*) What is Hall effect ? Derive the expression for Hall voltage and Hall coefficient. State applications of Hall effect. [6]

(b) What is double refraction ? Draw neat and labelled diagram (either for positive or negative crystal) showing propagation of light within a doubly refracting crystal when optic axis is : [3]

(i) parallel to crystal surface

(ii) perpendicular to crystal surface.

(c) Sugar solution is kept in a 20 cm long tube.When plane polarized light is passed through this solution, its plane of polarization is rotated by 10°. If the concentration of sugar solution is 0.07575, calculate the specific rotation of sugar. [3]

5. (a) Deduce Schrodinger's time independent wave equation. [6]

(b) What is de-Broglie hypothesis. Derive an expression for de-Broglie wavelength for an electron when it is accelerated by potential diffrerence 'V'. [4]

(c) Calculate the energy (in eV) with which a proton has to acquire de-Broglie wavelength of 0.1Å. [3]

Or

6. (a) State and explain Heisenberg's uncertainty principle. Illustrate the principle by electron diffraction at a single slit. [6]

(b) Explain physical significance of wave function ψ and $(\psi)^2$. State the mathematical conditions that wave function ψ should satisfy. [4]

(c) A neutron is trapped in an infinite potential well of width 1 Å. Calculate the values of energy and momentum in its ground state. [3]

7. (*a*) Explain critical magnetic field or superconductor. Differentiate between type-I and type-II superconductors (*four* points). [6]

(*b*) With necessary diagram, explain physical method for synthesis of nanoparticles. [4]

(*c*) State applications of nano-particles. Explain any *one* application. [3]

Or

8. (*a*) What is nanotechnology ? Explain optical and electrical properties of nano-particles. [6]

(*b*) Explain Meissner effect and show that supercondcutors exhibit perfect diamagnetism. [4]

(*c*) State applications of superconductors. Explain any *one* application. [3]