SEM 1 – 2 (RC 16-17)

F.E. Semester – I/II (Revised in 2016-2017) Examination, May/June 2017
APPLIED SCIENCE (PHYSICS)

Duration : 3 Hours | Max. Marks :100

Instructions : *1) Answer* ***any two*** *questions from Part – **A** and Part – **B** **each** and* ***any one*** *question from Part – **C**.*
2) ***Assume*** *additional data, if required.*
3) ***Draw*** *diagrams* ***wherever*** *required.*

Physical constants :

Planck's constant	=	6.626×10^{-34} J-S
Electron charge	=	1.6×10^{-19} C
Boltzmann's constant	=	1.38×10^{-23} J/K
Electron mass	=	9.1×10^{-31} kg
Rydberg constant	=	1.097×10^{7}/m
Velocity of light	=	3×10^{8} m/s.

PART – A

Answer **any two** questions :

1. a) Briefly explain generation and recombination of charge carriers in a semiconductor. Derive the expression for recombination of minority carriers within a semiconductor. **5**

   b) Obtain the condition of bright and dark interference due to reflected light from a parallel sided thin film. **5**

   c) Explain the method of measuring voltage and frequency of ac signal on CRO. **5**

   d) A magnetic material has a magnetization M = 2800 A/m, flux density $B = 28\ \pi \times 10^{-4}$ wb/m^2, calculate magnetising force H and relative permeability (μ_r) of the material. **5**

P.T.O.

2. a) Describe magnetostriction method to produce ultrasonic waves. Draw necessary diagram. 5

   b) Write down features of diamagnetic material. Also give an account of the origin of diamagnetism. 5

   c) Explain Newton's rings experiment to determine refractive index of liquid. 5

   d) Calculate the density of donor atoms to produce n-type material with resistivity 0.2 Ω -m and electron mobility 0.35 m^2/V.S. What will be the diffusion constant of the above material at 300 K. 5

3. a) What are ultrasonics ? Write down four properties of ultrasonic waves. 5

   b) Distinguish between dia-, para- and ferromagnetic materials. 5

   c) Derive an expression for fringe width in a wedge shaped film. 5

   d) The Hall coefficient of a doped silicon sample is found to be 3.57×10^{-4} m^3/c. The resistivity of the sample is 8.80×10^{-3} Ω m. Determine the mobility and density of charge carriers. 5

PART – B

Answer **any two** questions :

4. a) What are the advantages of optical fiber communication over conventional ones ? Briefly explain scientific applications of optical fibers. 5

   b) Distinguish between type – I and type – II superconductors. 5

   c) What are matter waves ? Using the concept of matter waves, obtain Bohr's condition for quantization of angular momentum. 5

   d) A laser system emits photons of wavelength 6925 A° and 6941 A° due to transition at ground state from the upper and lower energy states. Calculate ratio of populations of these energy levels. 5

5. a) What are characteristics x-rays ? Explain its origin. 5

   b) Derive expression for NA of optical fiber in terms of refractive indices of core and cladding materials. 5

c) Discuss various properties of laser beam and its advantage over conventional light source. 5

d) Calculate the smallest glancing angle at which K_α line of 1.549 A° will be reflected from the crystal having interplanar spacing 3.873 A°. What is the highest order of reflection that can be observed with this radiation. 5

6. a) Describe Davisson-Germer experiment to prove wave like character of a beam of electron. 5

b) Describe construction and working of Ruby Laser with necessary diagrams. 5

c) What is superconductivity ? Explain critical temperature and critical magnetic field in a superconductor. 5

d) SI fiber is made with a core of R.I. 1.52, diameter of 29 μ m and fractional index difference of 0.0007. The fiber is operated at wavelength 1.3 μ m. Calculate : 5

i) V-number and

ii) Number of modes the fiber will support.

PART – C

Answer **any one** question :

7. a) Explain the terms : 5

i) Stimulated emission

ii) Population inversion

iii) Resonating cavity.

b) A current of 5 mA flows in an X-ray tube operating under a potential of 10 KV. Calculate the rate at which the electrons are bombarding the target and the maximum speed they could attain. 5

c) Explain briefly the role of ultrasonic waves in : 5

i) Flow detection in metals and

ii) Echo sounding in marine application.

d) How are colours exhibited by thin films when illuminated by an extended source ? Show that the interference pattern of reflected and transmitted sources of light in a thin parallel film are complementary. 5

8. a) Explain the terms – geometrical path and optical path. How are they related ? Give an account of role of interference in optical flatness of a surface. 5

b) Explain the basic principle of following : 5

i) Magnetic lens

ii) Cavitation.

c) A photon of 2 A° strikes an electron at rest and is scattered at an angle of 120° to the original direction. Find the speed and wavelength of the photon after collision. 5

d) How does a metastable state help in the production of laser light ? Briefly explain the pumping methods used in lasers. 5
