SEM 1 – 2 (RC 16-17)

F.E. Semester – I/II (RC 2016-17) Examination, Nov./Dec. 2018
APPLIED SCIENCE – I (Physics)

Duration : 3 Hours   Total 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 :

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

PART – A

Answer **any two** questions :

1. a) Show that the diameters of dark circular Newton's rings for reflected light are proportional to the square root of natural numbers. 5
   b) Describe acoustic diffraction method to find velocity of ultrasonic waves in liquid. 5
   c) Write a short note on Magnetostatic focusing. 5
   d) A piezoelectric crystal of thickness 2.8 mm produces USW of frequency 410 KHz. Calculate the thickness of this crystal to produce ultrasonic waves of frequency 550 KHz. 5

2. a) Draw block diagram of CRO and explain its various sections. 5
   b) Derive an expression for conductivity of a semiconductor in terms of carrier concentration and carrier mobility. 5
   c) What are soft and hard ferromagnetic materials ? Write their properties and applications. 5
   d) In a Newton's Rings experiment, the diameter of the 15^{th} ring was found to be 0.59 cm and that of the 5^{th} ring was 0.336 cm. If the radius of the Plano-convex lens is 100 cm, calculate the wavelength of light used. What happens to ring diameter if air film is replaced with liquid to refractive index 1.5 ? 5

P.T.O.

3. a) Explain the term Magnetostriction. With the help of circuit diagram, explain the working of Magnetostriction oscillator. 5

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

c) Distinguish between diamagnetic, paramagnetic and ferromagnetic materials with two examples of each. 5

d) Calculate intrinsic carrier density of a silicon sample with resistivity $6.3 \times 1\ 0^4\ \Omega m$ at 300 K. Given – mobility of electron = 0.14 $m^2/v\text{-}s$ and hole mobility = 0.05 $m^2/v\text{-}s$. 5

PART – B

Answer **any two** questions :

4. a) Discuss Einstein's theory of stimulated emission. 5

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

c) Derive the expression for numerical aperture of a step index fibre. 5

d) Photon of initial energy 90 KeV undergoes Compton scattering at an angle 60°. Find. 5

i) The energy of the scattered photon and

ii) The recoil energy of the electron.

5. a) State and explain Moseley's law. Give its significance. 5

b) What are SI and GRIN optical fibres ? Draw their R.I. profile. 5

c) Describe construction and working of Ruby laser with necessary diagrams. 5

d) A SI fibre has a core R.I. of 1.44 and the cladding R.I. of 1.41. Find (i) the numerical aperture, (ii) the relative index difference and (iii) the acceptance angle. 5

6. a) Briefly explain Type-I and Type-II superconductors. 5

b) Write three advantages of optical fibres over conventional cables. Explain the use of fibre optics in scientific field. 5

c) What is Compton effect ? Derive an expression for Compton Shift. 5

d) A typical He-Ne laser emits radiation of $\lambda = 6328A°$. How many photons per second would be emitted by a 1 m W He-Ne laser ? 5

PART – C

Answer **any one** question :

7. a) Derive an expression for fringe width of interference fringes formed in a wedge shaped thin film. **5**

   b) Briefly explain three characteristics properties and two scientific applications of laser. **5**

   c) Describe an ~~expression~~ experiment to demonstrate the wave nature of electron. **5**

   d) A magnetic material with susceptibility of -0.28×10^{-5} is subjected to magnetic field of strength 1100 A/m. Calculate magnetization of the material. Also evaluate the magnetic flux density of the field inside the material. **5**

8. a) Describe how x-rays are produced in Coolidge tube. Explain how intensity and quality of x-rays are controlled in it. **5**

   b) Explain hysteresis loop. What is coercivity and retentivity. **5**

   c) Give an account of physical origin of Hall effect. Explain the application of Hall effect in determining mobility of charge carriers. **5**

   d) The ratio of population of two energy levels out of which upper one corresponds to a metastable state is 1.059×10^{-30}. Determine the wavelength of light emitted at 330 K. **5**
