



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 :

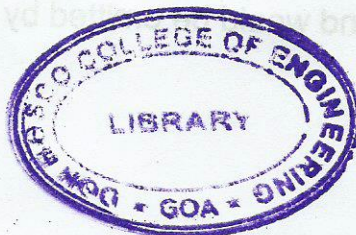
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|-------------------------|-------------------------------|
| 1. Planck's constant | = 6.626×10^{-34} J-s |
| 2. Electron charge | = 1.6×10^{-19} C |
| 3. Boltzmann's constant | = 1.38×10^{-23} J/K |
| 4. Electron mass | = 9.1×10^{-31} kg |
| 5. Rydberg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

PART – A

Answer **any two** questions :

- Show that the diameters of dark circular Newton's rings for reflected light are proportional to the square root of natural numbers. 5
 - Describe acoustic diffraction method to find velocity of ultrasonic waves in liquid. 5
 - Write a short note on Magnetostatic focusing. 5
 - 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
- Draw block diagram of CRO and explain its various sections. 5
 - Derive an expression for conductivity of a semiconductor in terms of carrier concentration and carrier mobility. 5
 - What are soft and hard ferromagnetic materials ? Write their properties and applications. 5
 - In a Newton's Rings experiment, the diameter of the 15th ring was found to be 0.59 cm and that of the 5th 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 $6.3 \times 10^4 \Omega\text{m}$ at 300 K. Given – mobility of electron = $0.14 \text{ m}^2/\text{v-s}$ and hole mobility = $0.05 \text{ m}^2/\text{v-s}$. 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 $\lambda = 6328 \text{ \AA}$. 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

