**FE (Semester 1) Examination Model Paper 1**

**Applied Science (Physics)**

Duration : 3 Hours Total Marks : 100

**Instructions**

* Attempt **any two** questions from questions **1, 2 & 3.**
* Attempt **any two** questions from questions **4, 5 & 6.**
* Attempt **any one** question from questions **7 & 8**.

**Q1** a) Explain briefly generation and recombination of charge carriers in a semiconductor.

Derive the expression for recombination of minority carriers within a semiconductor. 5

b) Describe Newton’s rings method to determine refraction index of a liquid. Derive the necessary

expression for R.I. 5

c) write a short note on diamagnetic substance and its properties. 5

d) Derive Einstein’s relation between mobility µ and diffusion constant D. if diffusion constant of

electron is 9.36x10-3 m2s-1 at 300K, what is its mobility. Given k=1.38x10-23 J/K and e = 1.6x10-19 C. 5

**Q2** a) Describe how will you measure wavelength and frequency of ac signal on CRO. 5

b) Describe construction and working of electrostatic lens. 5

c) Explain piezoelectric method to produce ultrasonic waves. 5

d) Write down five properties of Ultrasonic waves. 5

**Q3** a) Describe acoustic diffraction method to find velocity of ultrasonic waves in liquid. 5

b) Explain the construction & working of a magnetic lens. 5

c) Explain how ultrasonic waves are produced by magnetostriction oscillator. 5

d) Draw the block diagram of a CRO. Briefly explain the use of CRO to determine frequency of ac

mains. 5

**Q4** a) What is Compton effect? Deduce the expression for Compton shift. Discuss different cases with

Regard of angle of scattering. 10

b) Explain characteristic x-ray spectra. State Mosley’s law. 5

c) Find the wavelength of x-ray photon which produces recoil electron of energy 5kev in Compton

effect. The direction of recoil electron is in the direction of incident photon while photon is

Scattered through an angle of 1800. 5

**Q5** a) Derive Braggs equation for x-ray diffraction. 5

b) Discuss type II superconductor. What is its advantage over type I superconductor? 5

c) Explain, persistent current, effect of temperature & effect of magnetic field in superconductors. 5

d) Describe Braggs x-ray spectrometer to verify Braggs law. 5

**Q6** a)Describe the application of optical fibre in

i) Fibre optics communication system &

ii) fiberscope. 10

b) Give industrial, scientific, medical & defenc applications of laser. 5

c) A step index fibre has N.A of 0.16, a core R.I of 1.450 a core diameter of 50µm calculate

i) The acceptance angle

ii) R.I of cladding

iii) No.of modes with a wavelength of 1.6 µm the fibre can carry

iv)No of modes if fibre is graded index type with same specifications. 5

**Q7** a) What is the basic principle of fibre optics? Explain the classification of optical fibre based on

modes of propagation. 5

b) Give four important characteristic properties of laser. Explain in brief. 5

c) Prove that in reflected light, radii of bright circular Newton’s rings are proportional to square

roots of odd natural numbers. 5

d) The population ratio of two energy states in a laser that emits wavelength 6328AU is 2x10-25 find

the temperature at which the laser emits light. 5

**Q8** a)Describe the production of x-rays by Coolidge tube. How are intensity and quality of x-rays

controlled in x-ray tube? 5

b) Using Braggs spectrometer, explain the experimental verification of Compton effect give

explanation for unmodified wavelength in Compton effect. 5

c) A crystal has its principle planes separated at 5.653AU first order Bragg reflection is located at

130.40 calculate

i) wavelength of x-rays

ii) the angle for the second order Bragg reflection. 5