Total No. of Printed Pages:2

F.E. Semester-I (Revised Course 2019-20)
EXAMINATION AUGUST 2021
Physics

[Duration: Two Hours] **[Total Marks: 60]**

Instruction :
1) Answer THREE FULL QUESTIONS with ONE QUESTION FROM EACH PART.
2) Assume additional data, if required.
3) Draw diagrams **wherever** required.

Part A

Q.1
(a) Briefly explain acoustic diffraction method to determine the velocity of ultrasonic waves. (5)
(b) Derive the expression for conductivity of an intrinsic semiconductor in term of currier concentration and carrier mobility. (5)
(c) Explain interference in wedge shaped film and hence derive expression for fringe width. Draw necessary diagrams. (5)
(d) Determine the magnetization and flux density of the diamagnetic material if its magnetic susceptibility is -0.4×10^{-5} and the magnetic field in it is 10^4 Am^{-1}. (5)

Q.2
(a) What are soft and hard ferromagnetic materials? Write their properties and applications. (5)
(b) Draw block diagram of CRO and explain its various sections. (5)
(c) Show that the diameters of dark circular Newton's rings for reflected light are proportional to the square root of natural numbers. (5)
(d) Find the electric required to establish current density of $1 A/m^2$ of copper plate whose conductivity is 5.8×10^5 mho/cm. (5)

Q.3
(a) What is Hall Effect? Derive an expression for hall voltage. (5)
(b) Give five points of difference between diamagnetic and paramagnetic substances. (5)
(c) With neat circuit diagram, explain working of magnetostriction oscillator for production of ultrasonic waves. (5)
(d) A wedge air film is enclosed between two glass plates touching at one edge and separated by a wire of 0.006×10^{-3} m diameter at a distance of 0.15m from the edge. Calculate the fringe width. The light of wavelength 6.0×10^{-7} m from the board source is allowed to fall normally on the film. (5)

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Part B

Q.4 (a) What is X-ray diffraction? Derive Bragg's law of X-ray diffraction. (5)
(b) With neat energy diagram explain 3- level pumping scheme. (5)
(c) What is Compton Effect? Derive an expression for Compton shift. (5)
(d) X-ray with initial wavelength 0.5×10^{-10} m undergo Compton scattering for what scattering angle is the wavelength of the scattered X-ray greater than that of the incident X-ray by one percent. (5)

Q.5 (a) Write down any three characteristics properties and any two application of laser. (5)
(b) Explain production of X-ray by using Coolidge tube. (5)
(c) Derive the expression for numerical aperture of optical fibre in term of fractional R.I. differences. (5)
(d) A light rays enters from air to a fibre the refractive index of air is 1.0 . than fibre has refractive index of core is equal to 1.5 and that of cladding is .1.48. find the critical angle, the fractional index, the acceptance angle and numerical aperture. (5)

Q6 (a) What are the types of optical fibre? Discuss each of them separately. Draw the necessary diagrams. (5)
(b) State and explain Moseley's law. Give its significance. (5)
(c) Describe an expression to demonstrate the wave nature of electron. (5)
(d) A typical He-Ne laser emits radiation of $\lambda = 6328A^0$. How many photons per second would be emitted by a one mill-watt He-Ne laser? (5)

Part C

Q.7 (a) Obtain the condition of bright and bright and dark interference due to transmitted light from a parallel sided thin film. (5)
(b) Write any five properties of X-rays. (5)
(c) Give the block diagram of fibre optic communication system explaining the functions of the different blocks. (5)
(d) Find the frequency to which a piezoelectric oscillator circuit should be turned so that a piezoelectric crystal of 0.1 cm thickness vibrates in its fundamental mode to generate ultrasonic waves. Young's modulus and density of material of the crystals are 8×10^{10} Nm^{-2} and 2.654×10^3 kg m^{-3} respectively. (5)

Q.8 (a) Explain hysteresis loop? What is coercivity and retentivity? (5)
(b) Draw and explain the structure of an optical fibre cable. (5)
(c) i) Flaw detection in metals. (5)
ii) Echo sounding in marine application.
(d) X-rays with $\lambda = 1A^0$ are scattered from a carbon block. The scattered radiation is viewed at 90^0 to the incident beam. (5)
i) What is Compton shift?
ii) What kinetic energy is imparted to the recoil electron?

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