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F.E. (Semester – II) (RC 2019-20)
EXAMINATION JULY 2022
PHYSICS

[Duration : Three 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:

Physical Contents:

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

PART A

- | | | |
|-----|--|---|
| Q.1 | (a) What are soft and hard ferromagnetic materials? Write their properties and applications. | 5 |
| | (b) Obtain the condition of bright and dark interference due to transmitted light from a parallel sided thin film. | 5 |
| | (c) What is Hall Effect? Derive an expression for Hall Voltage. | 5 |
| | (d) A quartz crystal of thickness 0.15cm is vibrating at resonance. Calculate its fundamental frequency if Young modulus of quartz = $7.9 \times 10^{10} \text{N/m}^2$ and the density is 2650kg/m^3 . | 5 |
| Q.2 | (a) With neat circuit diagram, explain working of magnetostriction oscillator for production of ultrasonic waves. | 5 |
| | (b) Give five points of difference between diamagnetic and paramagnetic substances. | 5 |
| | (c) Show that the diameters of bright circular Newton's rings for reflected light are proportional to the square root of odd natural numbers. | 5 |
| | (d) Find the relative permeability of the ferromagnetic material if a magnetic field of strength 220A/m produces magnetization of 3300A/m in it. | 5 |
| Q.3 | (a) Derive an expression for fringe width of interference fringes formed in a wedge-shaped thin film. | 5 |
| | (b) Draw the block diagram of a CRO and briefly explain its application to measure amplitude of de voltages. | 5 |
| | (c) Describe acoustic diffraction method to find velocity of ultrasonic waves in liquid. | 5 |
| | (d) A specimen of semiconductor has a hall coefficient of $3.66 \times 10^{-4} \text{m}^3/\text{C}$ and resistivity of $8.93 \times 10^{-3} \Omega\text{m}$. In a hall effect experiment a magnetic flux density of 0.5wb/m^2 is used. Find the mobility and density of charge carrier by assuming single charge carrier concentration. | 5 |

PART B

- Q.4 (a) Describe construction and working of a Ruby laser with necessary diagrams. 5
 (b) State and explain Moseley's law. Give its significance. 5
 (c) Give the block diagram of fibre optic communication system explaining the functions of the different blocks. 5
 (d) Find the de Broglie wavelength of an electron accelerated through a potential difference of 182 volts. 5
- Q.5 (a) What is Compton effect? Derive an expression for Compton Shift. 5
 (b) Draw and explain the structure of an optical fibre cable. 5
 (c) Write any five properties of X-rays. 5
 (d) The relative population of two energy states in a Laser that emits wavelength 6200\AA is 2.359×10^{-34} , Find the temperature at which the laser emits light. 5
- Q.6 (a) Derive the expression for numerical aperture of an optical fibre in terms of fractional R.I. differences. 5
 (b) Explain the origin of continuous spectrum. 5
 (c) Write down any three characteristics properties and any two application of laser. 5
 (d) Calculate the numerical aperture and critical angle of an optical fibre from the following data. $n_1 = 1.55$ and $n_2 = 1.50$. 5

PART C

- Q.7 (a) What are SI and GRIN optical fibres? Draw their R.I. profile. 5
 (b) Describe an expression to demonstrate the wave nature of electron. 5
 (c) Derive an expression for conductivity of a semiconductor in terms of carrier concentration and carrier mobility. 5
 (d) A parallel beam of light $\lambda = 5870 \times 10^{-8}\text{cm}$ is incident on a thin glass plate $\mu = 1.5$ such that the angle of refraction into the plate is 60° . Calculate the smallest thickness of the glass plate which will appear dark by reflection. 5
- Q.8 (a) What are ultrasonics? Write down three properties of ultrasonic waves. 5
 (b) What is X-rays diffraction? Derive Bragg's law of x-ray diffraction. 5
 (c) Give construction and working of He-Ne Laser. Draw energy level diagram. 5
 (d) Newton's rings are obtained with reflected light of wavelength 5000\AA . If the diameter of 10^{th} dark ring is 0.5cm , calculate the radius of curvature of the lens and hence find out the radius of 50^{th} dark ring. 5

12.27 p.m.