CBCS SCHEME

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21PHY12/22

First/Second Semester B.E. Degree Examination, June/July 2024
Engineering Physics

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Physical constants speed of light $C = 3 \times 10^8$ m/s, Plancks constant $h = 6.625 \times 10^{-34}$ J/S, Boltzmann constant $K = 1.38 \times 10^{-23}$ J/K, Acceleration due to gravity $= 9.8 m/s^2$, Mass of electron $= 9.1 \times 10^{-31}$ kg, Charge on electron $= 1.6 \times 10^{-19}$ C, Permittivity of free space $= 8.854 \times 10^{-12}$ F/m.

Module-1

1 a. Define simple harmonic motion and give two examples applying Hookes law arrive at an equation for the effective spring constant of series and parallel combination of springs. **(09 Marks)**

b. Define Mach number and explain subsonic, supersonic, and transonic waves. **(07 Marks)**

c. The distance between the pressure sensors in a shock tube is 170mm. The time taken by the shock wave this distance is 0.5ms. If the velocity of the sound under same condition is 340m/s, find the mach number of the shock waves. **(04 Marks)**

OR

2 a. With neat diagram, explain construction and working of Reddys tube. Mention any two applications of shock waves. **(09 Marks)**

b. What are damped oscillations? Discuss the theory of damped oscillations. **(07 Marks)**

c. A mass of 0.5kg causes an extension 0.03m in a spring and the system is set for oscillations. Find the force constant of the spring. Also find the angular frequency and period of oscillations. **(04 Marks)**

Module-2

3 a. Discuss the spectral distribution of energy in the black body radiation spectrum and hence explain Wein's displacement law and Stefan's law of radiation. **(08 Marks)**

b. Show that electron is extra nuclear particle in an atom by applying Heisenbergs uncertainity principle. **(07 Marks)**

c. An electron is bound in an one dimensional potential box of 1 Å and infinite wall height. Find the energy of electron in the ground state and first three excited state. **(05 Marks)**

OR

4 a. Set up time independent Schrodingers wave equation in one dimension. **(08 Marks)**

b. State and explain de-Broglies hypothesis of matter waves. Explain the properties of wave function. **(07 Marks)**

c. The position and momentum of an electron with energy 0.5kev are determined. What is minimum percentage uncertainity in its momentum if the uncertainity in the measurement of its position is 0.5 Å ? **(05 Marks)**

Module-3

5 a. Obtain the expression for energy density of radiation in terms of Einsteins A and B coefficients. Mention the conditions for laser action. **(09 Marks)**

b. Define modes of propagation, with neat diagram explain the types of optical fiber. **(07 Marks)**

c. Compare the acceptance angle of an optical fiber placed in air and water. Given the R.I of core and cladding of optical fiber are 1.5 and 1.45 respectively. The R.I. of water is 1.33. **(04 Marks)**

OR

6 a. Derive an expression for numerical aperture of an optical fiber. **(08 Marks)**

b. With neat diagrams explain construction and working of CO_2 laser. **(08 Marks)**

c. The ratio of population of two energy levels is 1.059×10^{-30}. Find the wavelength of light emitted for the transition between these states at 330K. **(04 Marks)**

Module-4

7 a. What is Fermi function? Explain the variation of Fermi function with energy at OK and T > OK. **(08 Marks)**

b. Obtain an expression for electrical conductivity for an intrinsic semiconductor. **(07 Marks)**

c. Find the polarization produced in a crystal by an electric field of strength 500V/mm if it has dielectric constant of 6. **(05 Marks)**

OR

8 a. What is Hall effect? Obtain an expression for Hall coefficient. **(08 Marks)**

b. What is polarization? Derive Clausius-Mossotti equation. **(07 Marks)**

c. The resistivity of intrinsic Ge is 0.47Ωm. If mobilities of electron and hole are respectively $0.38 m^2/vs$ and $0.18 m^2/vs$, calculate intrinsic carrier density. **(05 Marks)**

Module-5

9 a. With neat diagrams explain principle, construction and working of atomic force microscopy. **(10 Marks)**

b. Define nano material and explain. What are nano composites? **(05 Marks)**

c. X-rays are diffracted in the first order from a crystal with inter planar spacing $2.8 \times 10^{-10} m$ at a glancing angle of 60°. Calculate the wavelength of X-ray. **(05 Marks)**

OR

10 a. With neat diagram describe the principle construction and working of scanning electron microscope. **(10 Marks)**

b. Explain the principle of X-ray photo electron spectroscopy. **(05 Marks)**

c. Determine the crystallite size if the wavelength of X-rays used is 10nm, the peak width is 0.5° and peak position is 25° for a cubic crystal (Given K = 0.94). **(05 Marks)**

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