CBCS SCHEME

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21PHY12/22

First/Second Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Engineering Physics

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Draw neat sketches wherever necessary.
3. Constants: Mass of the c^- (Rest) = 9.1×10^{-31} kg
Electronic charge = C = 1.6×10^{-19} C
Permittivity of free space = $\varepsilon_o = 8.854 \times 10^{-12}$ Fm^{-1}
Planck's constant = h = 6.625×10^{-23} JS
Speed of light = C = 3×10^8 ms^{-1}.

Module-1

1 a. Define mach number with formula and enumerate different mach regimes. **(06 Marks)**

b. Set up differential equation for damped oscillations and assuming the solution discuss the types of damping. **(09 Marks)**

c. Estimate the number of oscillations the spring would complete in 1 minute given the spring constant 10 Nm^{-1} if it is set to oscillations using a load 100 gram. Assume no external force is acting on the system. **(05 Marks)**

OR

2 a. Define shock tube. Explain the construction and working of Reddy shock tube and its advantage over conventional shock tubes. **(08 Marks)**

b. Describe mechanical simple harmonic oscillator and hence set up differential equation for free oscillations. **(07 Marks)**

c. Calculate the amplitude of oscillations at resonance, if the mass attached to the spring-mass system is 0.1 kg, given the damping constant of the medium, 0.1 kg s^{-1} and a periodic force of 2 N and time period 2 S is applied. **(05 Marks)**

Module-2

3 a. Prove that Planck's law explains the distribution of energy completely in black body radiation spectrum. **(06 Marks)**

b. Discuss the motion of a particle in one dimensional potential well of infinite height and sketch the wave forms. **(10 Marks)**

c. An electron is accelerated by a potential differences of 150 V. Calculate the de Broglie wave length of the electron. **(04 Marks)**

OR

4 a. State and explain Heisenberg's uncertainty principle with physical significance and hence prove that electron does not exist inside the nucleus. **(08 Marks)**

b. Derive Schrodinger time independent wave equation for matter waves. **(08 Marks)**

c. Given ground sate energy of an electron in an one dimensional potential well of width 'a' as 60 cV. Calculate the ground state energy of the c^- in an one dimensional potential well of width '2a'. **(04 Marks)**

Module-3

5 a. State the types of interaction of radiation with matter and hence arrive at the expression for energy density using Einstein's A and B coefficients. **(09 Marks)**

b. Describe the various types of fiber losses. **(06 Marks)**

c. The RI of core and cladding of an optical fiber placed in air are 1.5 and 1.45 respectively. Calculate the number modes supported by the fiber given the core diameter 100 micrometer for a radiation of wavelength 1 micro meter. **(05 Marks)**

OR

6 a. Enumerate the three vibrational levels of CO_2 molecule and describe the construction and working of CO_2 LASER with a neat sketch and energy level diagram. **(10 Marks)**

b. Derive an expression for numerical aperture of an optical fiber. **(06 Marks)**

c. The energy difference between two energy levels of a LASER system in 2×10^{-19} J. Calculate the number of photons emitted per second if the power output of LASER is 4×10^{-3} W. **(04 Marks)**

Module-4

7 a. Define Lorentz field. Derive Clausius-Mossotti relation and mention its application. **(07 Marks)**

b. Explain fermifactor and discuss the variation of fermifactor with energy and temperature and also draw a graph representing the variations at different temperatures. **(08 Marks)**

c. The mobilities of electrons and holes in silicon are 0.15 $m^2 v^{-1} s^{-1}$ and 0.05 $m^2 v^{-1} s^{-1}$ respectively. Calculate the resistivity of silicon given the intrinsic carrier concentration 1.5×10^{16} electrons / m^3. **(05 Marks)**

OR

8 a. Using the concept of Fermi surface obtain an expression for electrical conductivity. **(08 Marks)**

b. Explain hall effect and derive an expression for hall voltage. **(07 Marks)**

c. The dielectric constant of an elemental solid dielectric is 12.33. Calculate the electronic polarizability of the material if there are 3×10^{28} atoms/m^3. Assume internal field to be Lorentz field. **(05 Marks)**

Module-5

9 a. Define nanomaterial and classify nano materials interms of nano dimensions. **(05 Marks)**

b. Illustrate the construction and working of transmission electron microscope. **(10 Marks)**

c. Given the glancing angle for the first order Bragg reflection $\theta_1 = 5°$. Calculate the glancing angle for third order Bragg reflection. **(05 Marks)**

OR

10 a. Explain the principle of X Ray photoelectron spectroscope and mention any three applications. **(05 Marks)**

b. Describe the principle, construction and working of atomic force microscope with the help of a neat sketch. **(10 Marks)**

c. Elucidate the determination of crystallite size using Schrerrer's equation. **(05 Marks)**

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