CBCS SCHEME

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21PHY12/22

First/Second Semester B.E. Degree Examination, Jan./Feb. 2023
Engineering Physics

Time: 3 hrs. Max. Marks: 100

Note: *1. Answer any FIVE full questions, choosing ONE full question from each module.*
2. Constants : Speed of light "C" = $3 \times 10^8 ms^{-1}$, Boltzmann constant "K" = $1.38 \times 10^{-23} JK^{-1}$, Planck's constant "h" = $6.625 \times 10^{-34} JS$, Acceleration due to gravity "g" = $9.8MS^{-2}$ permittivity of free space. "ε_0" = $8.854 \times 10^{-12} FM^{-1}$.

Module-1

1 a. What are damped oscillations? Discuss the theory of damped oscillations and derive general solution of damped oscillations. **(10 Marks)**

b. Discuss the classification of waves based on Mach number. **(06 Marks)**

c. For a particle executing SHM, the acceleration is found to be $15cm/s^2$ when it is at 3cm from its mean position. Calculate the period of oscillation. **(04 Marks)**

OR

2 a. Describe the construction and working of Reddy's shock tube. Explain any four applications of shockwaves. **(10 Marks)**

b. Define simple harmonic motion and derive differential equation of SHM. **(06 Marks)**

c. The time taken to travel between two sensors of the shock tube is 195 μs. If the distance between the sensors is 0.1m, find the Mach number of shockwaves produced. **(04 Marks)**

Module-2

3 a. Deduce Wein's equation and Rayleigh Jeans equation from Planck's equation and show that Planck's theory explains complete black body spectrum. **(08 Marks)**

b. State and explain Heisenberg's uncertainty principle and apply it to prove that free electron cannot exist inside the nucleus of atom. **(08 Marks)**

c. Calculate the de-Broglie wavelength associated with an electron accelerated to a potential 2KV. Also calculate the velocity of electron. Assume $m = 9.1 \times 10^{-31}kg$. **(04 Marks)**

OR

4 a. Apply Schrodinger equation for particle in one dimensional potential well of infinite height and derive expression for energy eigen value and eigen function. **(10 Marks)**

b. Discuss spectral distribution of energy in black body radiation spectrum and hence explain Wein's displacement law. **(06 Marks)**

c. An electron is bound in a one dimensional potential well of width 1Å but infinite height. Find its energy eigen values in the ground state and first two excited states. **(04 Marks)**

Module-3

5 a. Explain induced absorption, spontaneous and stimulated emission. Obtain an expression for density of states using Einstein's coefficients. **(08 Marks)**

b. Define numerical aperture and derive an expression for numerical aperture. **(08 Marks)**

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

OR

6 a. What is attenuation in an optical fiber? Describe the different types of attenuation. **(09 Marks)**

b. Describe the construction and working of semiconductor Laser with suitable figures. **(07 Marks)**

c. In an optical fiber of core diameter 50μm the refractive indices of core and cladding are respectively 1.45 and 1.40. If the wavelength of the light passing through the fiber is 820nm find the numerical aperture, V-number and number of modes of propagation. **(04 Marks)**

Module-4

7 a. Mention the assumptions and failures of classical free electron theory. **(09 Marks)**

b. Derive Clausius – Mosotti equation. **(07 Marks)**

c. Find the temperature at which there is 1% probability of occupation of an energy level 0.5eV above Fermi energy. **(04 Marks)**

OR

8 a. What is Hall effect? Obtain an expression for Hall coefficient. **(09 Marks)**

b. Discuss the variation of Fermi factor with temperature with graph. **(07 Marks)**

c. A dielectric material of dielectric constant 6 is subjected to an electric field 500/mm. Calculate the polarization produced. **(04 Marks)**

Module-5

9 a. Write the properties and applications of nano composites. **(08 Marks)**

b. Describe the principle, construction and working of scanning electron microscope. **(08 Marks)**

c. Determine the crystallite size for a cubic crystal (K = 0.94) if the wave length of X-rays used is 10nm, the peak width is 0.50 for a peak positioned at 25°. **(04 Marks)**

OR

10 a. With a neat sketch explain the construction and working principle of Atomic Force Microscope. **(08 Marks)**

b. Describe the construction and mechanism of X-ray photoelectron spectroscopy. **(08 Marks)**

c. X-rays are diffracted at 30° from a crystal of interplanar spacing 0.187nm. If it is a second order diffraction, calculate the wavelength of X-rays. **(04 Marks)**

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