CBCS SCHEME

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21PHY12/22

First/Second Semester B.E. Degree Examination, Dec.2023/Jan.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 : Plank's constant= 6.625×10^{-34} J-S, Boltzmann's constant = 1.38×10^{-23} J/K, $e = 1.6 \times 10^{-19}$ C, $C = 3 \times 10^{8}$ m/s, $g = 9.8$ m/sec^2, $m_e = 9.1 \times 10^{-31}$ Kg

Module-1

1 a. What are damped oscillations? Deduce the differential equation for damped oscillations arrive at the solutions give graphical representations of all the three cases. **(08 Marks)**

b. What are shock waves? With a neat diagram, explain the construction and working of Reddy shock tube. **(08 Marks)**

c. A mass of 0.8Kg causes an extension of 0.06m in a spring and mass system which is set for oscillations. Calculate force constant of the spring and time period of oscillations. **(04 Marks)**

OR

2 a. Discuss the theory of forced vibrations and hence obtain the expression for amplitude by solving the differential equation of forced oscillation. **(08 Marks)**

b. What is spring constant? Mention its significance. Deduce the expression for equivalent spring constants, when two springs are connected in series and parallel. **(08 Marks)**

c. While using a Reddy shock tube, it is found that the time taken to travel between two pressure sensors is 15μs. If the distance between two sensors is 10mm, find the Mach number. Assume that the velocity of sound in the medium is 340m/sec. **(04 Marks)**

Module-2

3 a. State and explain Plank's law of radiation. Explain how it changes to Wein's law and Rayleigh-Jeans law. **(08 Marks)**

b. Mention the properties of wave function. Deduce Schrodinger's time independent wave equation. **(08 Marks)**

c. The inherent uncertainty in the measurement of the time spent by iridium – 191 nuclei in the excited state is found to be 2.5×10^{-10} sec. Calculate the uncertainty that results in its energy in the excited state. **(04 Marks)**

OR

4 a. Solve the Schrodinger wave equation for the case of a particle in an infinite potential well and discuss its solutions? **(08 Marks)**

b. Explain the spectrum of black body radiation. Prove that an electron does not exist inside the nucleus using Heisenberg's uncertainty principle. **(08 Marks)**

c. Compute momentum and de-Broglie wavelength associated with an electron moving with kinetic energy 2KeV. **(04 Marks)**

Module-3

5 a. Derive an expression for energy density of incident radiation interms of Einstein's coefficients. **(08 Marks)**

b. What is angle of acceptance and numerical aperture of an optical fiber? Deduce the expression for Numerical aperture of optic fiber and mention the condition for ray propagation. **(08 Marks)**

c. Find the attenuation in an optic fiber of length 600m when a light of power 150mW incident and emerges out with 140mW power. **(04 Marks)**

OR

6 a. Describe construction and working of CO_2 laser with a neat energy level diagram. **(08 Marks)**

b. Explain different modes of propagation in optic fiber. Explain the optic fiber as temperature sensor. **(08 Marks)**

c. Ratio of population of two energy levels is 1.06×10^{-30}. Find the wavelength of light emitted by spontaneous emission at 310K. **(04 Marks)**

Module-4

7 a. Explain Hall effect. Deduce the expression for Hall voltage and Hall coefficient. **(08 Marks)**

b. Explain different polarization mechanisms in dielectrics. Briefly explain internal fields in solid dielectrics. **(08 Marks)**

c. The resistivity of intrinsic germanium at 27°C is equal to 0.47Ωm. Assuming electron and hole mobilities as 0.36 and $0.17 m^2V^{-1}S^{-1}$ respectively, calculate intrinsic carrier density. **(04 Marks)**

OR

8 a. Derive the expression for electrical conductivity in metals using quantum free electron theory. Explain any two success of quantum free theory. **(08 Marks)**

b. State and explain Fremi energy? Deduce the expression for Fermi energy at zero Kelvin **(08 Marks)**

c. Find the temperature at which there is 1% probability that a state with an energy 0.5eV above Fermi energy is occupied. **(04 Marks)**

Module-5

9 a. With a neat diagram, explain the principle, construction and working of Atomic force microscope. **(08 Marks)**

b. Explain the principle, construction and working of transmission electron microscope using a neat labelled diagram. **(08 Marks)**

c. Write a note on nano-composites. Give two examples. **(04 Marks)**

OR

10 a. Give the principle instruction and working of X-ray diffraction meter. **(08 Marks)**

b. Explain the principle, construction and working of scanning electron microscope with a neat labelled diagram. **(08 Marks)**

c. Determine the crystal size ; given, the wavelength of X-rays 10nms, the peak width of 0.5° and peak position of 25° and K = 0.94 for a cubic crystal? **(04 Marks)**

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