CBCS SCHEME

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18PHY12/22

First/Second Semester B.E. Degree Examination, June/July 2019
Engineering Physics

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Define SHM and mention any two examples. Derive the differential equation for SHM using Hooke's law. **(07 Marks)**

b. With a neat diagram, explain the construction and working of Reddy's tube. Mention any three applications of shock waves. **(09 Marks)**

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

OR

2 a. Explain the basics of conservation of mass, momentum and energy. **(06 Marks)**

b. What are forced oscillations? Derive the expressions for steady state amplitude and phase angle in case of forced oscillations. **(10 Marks)**

c. A 20g oscillator with natural angular frequency 10 $rads^{-1}$ is vibrating in damping medium. The damping force is proportional to the velocity of the vibrator. Calculate the value of damping required for the oscillations to be critically damped. (Given damping coefficient is 0.17). **(04 Marks)**

Module-2

3 a. State and explain Hooke's law. Explain the nature of elasticity with the help of stress-strain diagram. **(08 Marks)**

b. Define bending moment. Derive the expression for bending moment interms of moment of inertia. **(08 Marks)**

c. Calculate the torque required to twist a wire of length 1.5m, radius 0.0425×10^{-2}m, through an angle $\left(\frac{\pi}{45}\right)$ radian, if the value of rigidity modulus of its material is 8.3×10^{10} N/m^2. **(04 Marks)**

OR

4 a. Define Poisson's ratio. Obtain the relation between y, n and σ where the symbols have their usual meaning. **(08 Marks)**

b. What are Torsional Oscillations? Mention any two applications of Torsional Pendulum. Derive the expression for couple per unit twist of a solid cylinder. **(08 Marks)**

c. Calculate the force required to produce an extension of 1mm in steel wire of length 2m and diameter 1mm (Young's modulus for steel $Y = 2 \times 10^{11}$ N/m^2). **(04 Marks)**

Module-3

5 a. State and prove Gauss Divergence Theorem. **(08 Marks)**

b. Define fractional Index change (Δ). Derive the expression for Numerical aperature and acceptance angle of an optical fiber. **(08 Marks)**

c. A circular coil of radius 10cm having 50 turns carries a current of 5A. Determine the magnetic field produced by the coil at a distance of 3cm from the centre. Also determine magnetic field produced by the coil at its centre. **(04 Marks)**

OR

6 a. Derive wave equation in terms of electric field using Maxwell's equations for free space. **(08 Marks)**

b. Describe different types of optical fibers with neat diagrams. Mention any two mechanisms involved in fiber loss. **(08 Marks)**

c. Calculate the V-number for a fiber of core-diameter 40μm and with refractive indices of 1.55 and 1.5 respectively for core and cladding. When the wavelength of the propagating wave is 1400nm. Also calculate the number of modes that the fiber can support for propagation. Assume that the fiber is in air. **(04 Marks)**

Module-4

7 a. Starting from Schrodinger's time independent wave equation, derive the expression for energy eigen value and eigen function for an electron in one dimensional potential well of infinite height. **(10 Marks)**

b. Explain the construction and working of CO_2 LASER with the help of energy level diagram. **(06 Marks)**

c. The average output power of laser source emitting a laser beam of wavelength 632.8nm. Find the number of photons emitted per second by the laser source. **(04 Marks)**

OR

8 a. Define the terms population inversion and meta-stable state. Derive the expression for energy density of radiation at equilibrium interms of Einstein's coefficients. **(10 Marks)**

b. Using Heisenberg's uncertainty principle, show that electrons do not reside inside the nucleus. **(06 Marks)**

c. An electron is bound in an 1-D potential well of infinite height and of width 1 Å. Calculate its energy values in the ground state and also in the first two excited states. **(04 Marks)**

Module-5

9 a. Define Fermi energy. Explain the variation of Fermi factor with temperature. **(08 Marks)**

b. What is Hall effect? Obtain the expression for Hall coefficient, and express Hall voltage interms of Hall coefficient. **(08 Marks)**

c. The dielectric constant of sulphur is 3.4. Assuming a cubic lattice for its structure, calculate the electronic polarizability of sulphur (given, density of sulphur = 2.07 g/cc and atomic weight = 32.07). **(04 Marks)**

OR

10 a. Mention the assumptions of Quantum free electron theory. Discuss two success of quantum free electron theory. **(08 Marks)**

b. Define the term internal field in case of solid dielectrics with one-dimensional equation. Explain polar and non-polar dielectrics with examples. **(08 Marks)**

c. The intrinsic charge carrier concentration of germanium is $2.4 \times 10^{19}/m^3$, calculate its resistivity if mobility of electrons and holes respectively are $0.39 m^2/vs$ and $0.19 m^2/vs$. **(04 Marks)**

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