

CBCS SCHEME

18PHY12/22

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First/Second Semester B.E. Degree Examination, June/July 2023 Engineering Physics

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- Define Simple Harmonic Motion. Derive differential equation for SHM using Hooke's law. (06 Marks)
 - What are damped oscillations? Give the theory of damped oscillations and find the condition for critical damping. (10 Marks)
 - Calculate Mach number for a body when it is moving in air with a speed of 2000km/hr and 380km/hr. Classify these speeds as subsonic or supersonic or hypersonic. (04 Marks)

OR

- What is Mach number? Describe the working of hand operated Reddy shock tube with the help of neat diagram. (06 Marks)
 - Obtain an expression for steady state amplitude phase angle in case of forced oscillations. (10 Marks)
 - A mass of 0.5kg causes an extension of 0.03m in a spring and the system is set for oscillations. Calculate spring constant and its angular frequency. (04 Marks)

Module-2

- Explain the nature of elasticity with the help of stress-strain diagram. (06 Marks)
 - Define Young's modulus? Derive the relation between Y , K and σ , where Y is Young's modulus, K is bulk modulus and σ is Poisson's ratio. (10 Marks)
 - One end of wire of diameter 8mm and 1m in length is twisted through 60° . Calculate the angle of shear on its surface. (04 Marks)

OR

- Explain the term 'Bending Moment'. Obtain an expression for bending moment of a thin uniform bar of rectangular cross section. (10 Marks)
 - Show that for an elastic-body, shear strain is equal to sum of longitudinal strain and compressional strain. (06 Marks)
 - Calculate the elongation produced in a wire of length 1m and radius 0.01×10^{-2} m due to a force of 10N applied along its length. Given Young's modulus = 2.1×10^{11} N/m². (04 Marks)

Module-3

- State Gauss law in electrostatics and magneto-statics. Write Maxwell's equations for time varying conditions and explain the terms. (08 Marks)
 - Define displacement current and obtain its expression. (08 Marks)
 - Calculate the refractive index of the cladding of an optical fiber, if the refractive index of the core is 1.533 and fractional index change is 0.00515. (04 Marks)

OR

- 6 a. Derive the wave equation for electromagnetic waves using Maxwell's equations. (10 Marks)
 b. What is attenuation in optical fiber? Discuss point-to-point communication system using optical fiber with the help of block diagram. (06 Marks)
 c. A coil of mean radius 8cm and having 100 turns carries a current of 10A. Calculate the magnetic field produced at the centre of the coil and at a point on the axis at a distance of 4cm from the center. (04 Marks)

Module-4

- 7 a. State and explain Heisenberg uncertainty principle. Show that electron does not exist inside the nucleus. (06 Marks)
 b. Derive one dimensional time independent Schrodinger wave equation and reduce the same equation for a free particle. (10 Marks)
 c. A pulse laser emits pulses of 10ns duration with average power pulse being 0.16MW. If the wavelength of laser sources is 694.3nm, calculate the number of photons in each pulse. (04 Marks)

OR

- 8 a. Explain induced absorption, spontaneous emission and stimulated emission with their rate equations. (06 Marks)
 b. Describe construction and working of CO₂ laser and mention any two of its applications. (10 Marks)
 c. Find the energy spacing between first and third excited states of an electron confined to a potential well of infinite height and finite width 1 Å. (04 Marks)

Module-5

- 9 a. Mention any four assumptions of quantum free electron theory. Explain any two failures of classical free electron theory. (06 Marks)
 b. Define Fermi energy. Derive an expression for Fermi energy at absolute zero temperature. (10 Marks)
 c. The atomic weight and density of a material are 32 and $2.08 \times 10^3 \text{ kg/m}^3$ respectively. The electronic polarizability of the atom is $3.28 \times 10^{-40} \text{ Fm}^2$. If the given material has cubic structure, calculate its dielectric constant. (04 Marks)

OR

- 10 a. What is Hall effect? Obtain expression for Hall coefficient. (08 Marks)
 b. Describe different polarization mechanisms with the required diagrams. (08 Marks)
 c. Calculate the probability of an electron occupying an energy level 0.02eV below the Fermi level at 200K. (04 Marks)
