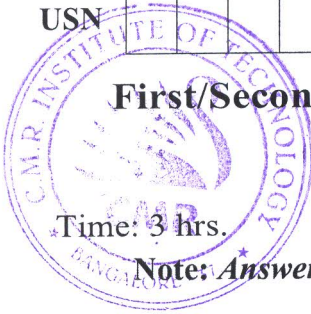


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First/Second Semester B.E. Degree Examination, Dec.2023/Jan.2024
Engineering Physics

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Define simple harmonic motion and mention its characteristics. Derive expression for effective spring constant for two springs in series and parallel. (09 Marks)
- b. Distinguish between subsonic supersonic, Transonic and hypersonic waves. (06 Marks)
- c. The distance between two pressure sensors in a shock tube is 100mm. The time take by the shock wave to travel this distance is 0.2ms. If the velocity of sound under the same condition is 330ms^{-1} find the mach number of shock waves. (05 Marks)

OR

- 2 a. What are damped and forced vibrations? Give examples write a note on sharpness of resonance. (08 Marks)
- b. What are shock waves? Describe construction and working of Reddy's shock tube. (08 Marks)
- c. A body having a mass 4gm executes simple harmonic motion. The force acting on the body, when the displacement is 8cm is 24gm.wt. Find the period if the maximum velocity is 5m/s, find the amplitude and maximum acceleration ($g = 9.8 \text{ ms}^{-2}$). (04 Marks)

Module-2

- 3 a. State and explain Hook's law, and different elastic module. (08 Marks)
- b. What is torsional pendulum? Derive an expression for couple per unit twist of a solid cylinder (08 Marks)
- c. Two solid cylinders of the save material having length l , $2l$ and r , $2r$ respectively are joined coaxially, under a coupled applied between the free ends, the shorter cylinder shows a twist of 30° . Calculate the twist of the laser cylinder. (04 Marks)

OR

- 4 a. Define neural surface of a beam. Obtain an expression for bending moment of a rectangular beam. (08 Marks)
- b. Derive the relation between Young's modulus, bulk modulus and Passions ratio. Discuss the limiting values of σ . (08 Marks)
- c. A steel wire of 1mm radius is bent to form a circle of 10cm radius. What is the bending moment and the maximum stress, if Young's modulus = $2 \times 10^{11} \text{ N-m}^{-2}$ (04 Marks)

Module-3

- 5 a. Define gradient, divergence and Carl. Derive Gauss's divergence theorem. (08 Marks)
- b. What is V-number? Explain three different types of optical fibre with neat diagram. (08 Marks)
- c. An optical fibre of 600m long has input power of 120mW which emerges out with power of 90mW. Find attenuation in the fiber. (04 Marks)

OR

- 6 a. Define attenuation angle acceptance. Derive the condition for propagation of light through an optical fiber. (08 Marks)
- b. List the four Maxwell's equations for time varying conditions. Explain the conditions for elliptical polarization of electromagnetic waves. (08 Marks)
- c. Find the divergence of the vector field \vec{A} given by
 $\vec{A} = 6x^2\hat{a}_x + 3xy^2\hat{a}_y + xyz^3\hat{a}_z$ at a point P(1, 3, 6). (04 Marks)

Module-4

- 7 a. State and explain Heisenberg's concentrating principle. Show that no electrons present inside the nucleus. (09 Marks)
- b. Define population inversion. Explain construction and working of carbon dioxide laser with neat diagrams. (07 Marks)
- c. An electron is bound in one dimensional potential well of width 0.12nm. Find the every values in the ground states and first excited states electron volt (eV). (04 Marks)

OR

- 8 a. Obtain an expression for energy density of radiation under equilibrium condition in terms of Einstein's coefficients. (08 Marks)
- b. Mention the properties of wave function. Set up one dimensional time independent wave equation. (08 Marks)
- c. Find the ratio of population of two energy levels in a laser if the transition between them produces light of wavelength 694.3nm. Assume the ambient temperature to be 27°C. (04 Marks)

Module-5

- 9 a. Explain success of quantum free electron theory and discuss the variation of Fermi factor with temperature. (08 Marks)
- b. What is internal field? Derive Clausius – Morsotti equation. (08 Marks)
- c. The resistivity of intrinsic Germanium at 25°C is equal to 0.47 ohm-meter. Assuming electron and hole mobilities as 0.38 and 0.18m² v⁻¹s⁻¹ respectively, calculate the intrinsic carrier density. (04 Marks)

OR

- 10 a. What is Hall effect? Explain an expression for electrical conductivity of a semiconductor. (08 Marks)
- b. Explain density of states, polar and non-polar dielectrics (08 Marks)
- c. The hall coefficient of a specimen is $-3.66 \times 10^{-4} \text{m}^3 \text{c}^{-1}$, its resistivity is 8.93×10^{-3} . Find mobility and density of charge carriers. (04 Marks)
