CBCS SCHEME

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18PHY12/22



# First/Second Semester B.E. Degree Examination, June/July 2025
## 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 : $h = 6.625 \times 10^{-34}$ JS, $e = 1.602 \times 10^{-19}$C, $K = 1.38 \times 10^{-23}$ J/K$^{-1}$, $m_e = 9.1 \times 10^{-31}$ kg, $c = 3 \times 10^{8}$ms$^{-1}$, $g = 9.8$ms$^{-2}$***



### Module-1

1 a. What is simple harmonic motion? Derive the differential equation of motion for SHM and mention its solution. **(06 Marks)**

b. Give the theory of demand vibrations and discuss the case of underdamping. **(10 Marks)**

c. The distance between two pressure sensors in a shock tube is 100 mm. The time taken by a shock wave to travel this distance is 200µs. If the velocity of sound under the same conditions is 340 m/s, find the Mach number of the shock wave. **(04 Marks)**

**OR**

2 a. Discuss the construction and working of Reddy shock tube, with the help of neat diagram. **(07 Marks)**

b. Discuss the theory of forced oscillations and obtain an expression for amplitude and phase of forced vibration. **(09 Marks)**

c. A mass 0.5 Kg causes an extension 0.03m in a spring and the system is set for oscillations. Find : i) Force constant 'K' of the spring
ii) angular frequency 'w' and
iii) period 'T' of resulting oscillation. **(04 Marks)**

### Module-2

3 a. Derive the relation between Young's modulus (Y), Bulk modulus (K) and Poisson's ratio ($\sigma$). **(08 Marks)**

b. Derive the expression for couple per unit twist of a solid cylinder. **(08 Marks)**

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

**OR**

4 a. Define Young's modulus, Bulk modulus and Rigidity modulus. And derive an expression for Young's modulus of rectangular bar of single cantilever. **(10 Marks)**

b. Obtain an expression for the bending moment of a bar with rectangular cross-section. **(06 Marks)**

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





### Module-3

5 a. State and derive Faraday's law of electromagnetic induction in differential form. **(08 Marks)**

b. Obtain an expression for numerical aperture and acceptance angle and arrive at the condition for propagation of a signal in an optical fiber. **(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)**

**OR**

6 a. Explain the attenuation in an optical fiber . Discuss any three factors contributing to the fiber loss. **(08 Marks)**

b. State and prove Gauss divergence theorem. **(08 Marks)**

c. The angle of acceptance of an optical fiber is 30° when kept in air, Find the angle of acceptance when it is in a medium of RI 1.33. **(04 Marks)**

### Module-4

7 a. Assume the time independent Schrodinger wave equation, discuss the solution for energy of a particle in one dimensional potential well of infinite height. **(10 Marks)**

b. Derive the expression for energy density of radiation in terms of Einstein's coefficient. **(06 Marks)**

c. Find the ratio of population of the two states in a He-Ne laser that produces light of wave length 6328 Å at 300 K. **(04 Marks)**

**OR**

8 a. With the neat diagram, explain construction and working of $CO_2$ laser. **(09 Marks)**

b. Derive expression for one dimensional time independent Schrodinger wave equation. **(07 Marks)**

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

### Module-5

9 a. Define Fermi Energy and Fermifactor. Discuss the dependence of Fermi factor on temperature and energy. **(08 Marks)**



b. Derive an expression for electrical conductivity of an intrinsic semiconductor. **(08 Marks)**

c. Find the polarization produced in a crystal by an electric field of strength 500V/mm if it has a dielectric constant of 6. **(04 Marks)**

**OR**

10 a. Derive an expression for Hall coefficient and Hall voltage. **(08 Marks)**

b. Define internal field and obtain the Clausius-Mossotti equation. **(08 Marks)**

c. Calculate the probabilities of an electron occupying an energy level 0.02 eV above the Fermi level and that in an energy level 0.02 eV below the Fermi level at 200 K. **(04 Marks)**

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