OR

4 a. State and explain Hooke's Law. Define rigidity and bulk modulus. **(06 Marks)**

b. Obtain an expression for bending moment of a bar with rectangular cross section. Use the above expression to arrive the equation for depression at the loaded end of a single cantilever. **(10 Marks)**

c. A wire of length 2m and radius 2mm is fixed to the center of a wheel. A torque of magnitude 0.0395 Nm is applied to twist the wire. Find the rigidity modulus of the wire if the angular twist is 0.038 rad. **(04 Marks)**

Module-3

5 a. Explain linear surface and volume integrations. **(06 Marks)**

b. Obtain an expression for displacement current. **(05 Marks)**

c. Explain briefly the Faraday's Law of electromagnetic induction. **(05 Marks)**

d. An optical fiber has the refractive index 1.5 and cladding refractive index 3% less than that of core. Calculate numerical aperture. **(04 Marks)**

OR

6 a. Give the 4 Maxwell's equations in differential form in vacuum and hence derive the T2M wave equation interm of electric field using Maxwell's equations. **(10 Marks)**

b. Obtain the expression for attenuation co-efficient of an optical fiber. **(06 Marks)**

c. Calculate the divergence of D at the point if
$\vec{D} = \frac{1}{z^2}\left[10xyz\,\hat{a}_x + 5x^2z\,\hat{a}_y + (2z^3 - 5x^2y)\,\hat{a}_z\right]$ at a point P[–2, 3, 5]. **(04 Marks)**

Module-4

7 a. Set up one dimensional time independent Schrödinger wave equation. **(06 Marks)**

b. With a neat energy level diagram, explain the construction and working of CO_2 laser. **(10 Marks)**

c. Estimate the potential difference through which a Porton is needed to be accelerated so that its de-broglie wavelength becomes equal to 1 Å, given its mass is 1.673×10^{-27} kg. **(04 Marks)**

CBCS SCHEME

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18PHY12/22

First/Second Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026

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 : Velocity of light $C = 3\times10^8$ m/s, Planck's constant $h = 6.625 \times 10^{-34}$ JS, Boltzmann constant $K = 1.38 \times 10^{-23}$ J/K, Avogadro number $N_A = 6.02\times10^{26}$/K mole, Mass of electron $m_e = 9.1 \times 10^{-31}$ kg, Charge of electron $e = 1.6\times10^{-19}$C.

Module-1

1 a. What are Shock Waves? List any 5 application of shock waves. **(06 Marks)**

b. Derive the expression for equivalent force constant for 2 springs connected in series and parallel and hence write the expression for period of its oscillations. **(10 Marks)**

c. A mass 0.5 kg causes an extension 0.03 m in a spring and the system is set for oscillations. Find : i) Force constant K of the spring ii) Angular frequency W. **(04 Marks)**

Module-2

3 a. Explain the stress-strain curve with a neat diagram. **(05 Marks)**

b. Derive the relation between y, x and σ where the symbols have their usual meaning. **(06 Marks)**

c. What is Torsional Oscillation? Give the expression for time period of torsional oscillation. Mention the applications of them. **(05 Marks)**

d. Calculate the extension produced in a wire of length 2m and radius 0.013×10^{-2} m due to a force of 14.7 N applied along the length. Given Young's modulus of the material of the wire, $Y = 2.1\times10^{11}$ N/m^2. **(04 Marks)**

c. A free particle is executing simple harmonic motion in a straight line. The minimum velocity it attains during any oscillation is 62.8 ms^{-1}. Find the frequency of oscillation if its amplitude is 0.5m. **(04 Marks)**

OR

2 a. Define Simple Harmonic Motion. Derive the differential equation for simple harmonic motion using Hooke's law. **(06 Marks)**

b. Describe the construction and working of Reddy's shock tube and also mention any three properties of shock waves. **(10 Marks)**

OR

8 a. With a proper energy level diagram, explain the working of semi conducer laser. Explain how data storage is achieved in a compact disc. **(10 Marks)**

b. Using uncertainty principle, show that a free electron cannot exist within the nucleus of an atom **(06 Marks)**

c. Find the ratio of population of the 2 states in a He - Ne laser that produces a light of wavelength 6328 Å at 27°C. **(04 Marks)**

Module-5

9 a. With any one specific case, explain how quantum free electron theory succeeds in overcoming the draw backs of classical free electron theory. **(04 Marks)**

b. Discuss the 3 polarization mechanism in dielectrics. **(06 Marks)**

c. Define Fermi Factor. Explain the variation of Fermi Factor with temperature. **(06 Marks)**

d. The resistivity of intrinsic silicon at 27°C is 3000rm. Assuming electron an hole mobilities of silicon as 0.17 $m^2 V^{-1}s^{-1}$ and 0.035 $m^2 V^{-1}s^{-1}$ respectively. Calculate the intrinsic carrier concentration at 27°C. **(04 Marks)**

OR

10 a. Give the assumptions of quantum free electron theory and hence obtain the expression for Fermi energy at 0 K. **(08 Marks)**

b. Define Internal field in case of solid dielectric. Derive Clausius – Morsotti equation. **(08 Marks)**

c. Find the electron density for metal with Fermi energy of 3eV. **(04 Marks)**

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