CBCS SCHEME

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18PHY12/22

First/Second Semester B.E. Degree Examination, July/August 2022
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 : $c = 3 \times 10^8$ m/s, $h = 6.625 \times 10^{-34}$ JS, $K = 1.38 \times 10^{-23}$ J/K, $N_A = 6.02 \times 10^{26}$/kmole, $m_e = 9.1 \times 10^{-31}$ kg, $e = 1.6 \times 10^{-19}$ C.***

Module-1

1 a. What are shock waves? Mention the characteristics of shock waves. **(06 Marks)**

b. Discuss theory of forced vibrations and hence obtain the expression for amplitude. **(10 Marks)**

c. A free particle is executing S.H.M in a straight line with a period of 25 sec, 5 sec after it has crossed the equilibrium point, the velocity is found to be 0.7 m/s. Find the displacement at the end of 10 sec, and also the amplitude of oscillation. **(04 Marks)**

OR

2 a. Derive the expression for equivalent force constant for 2 springs in series. What is an expression for period of its oscillation? **(06 Marks)**

b. Explain the construction and working of Reddy tube with a neat diagram. Mention any four applications of shock waves. **(10 Marks)**

c. A 20 gm oscillator with natural angular frequency 10 rad/sec is vibrating in damping medium. The damping force is proportional to the velocity of the vibrator. If the damping coefficient is 0.17, how does the oscillation decay? **(04 Marks)**

Module-2

3 a. State and explain Hooke's law with the help of stress-strain diagram. Define elastic limit. **(06 Marks)**

b. Define bending moment. Derive an expression for Young's modulus of single cantilever beam. **(09 Marks)**

c. An increment in length by 1 mm was observed in a gold wire of diameter 0.3 mm, when it was subjected to a longitudinal force of 2 Newtons and a twist of 0.1 radian was observed in the same wire when its one end was subjected to a torque of 7.9×10^{-7} Nm, while its other end was fixed. Calculate the value of Poisson's ratio of gold. **(05 Marks)**

OR

4 a. Derive the relation between K, Y and σ where the symbols have their usual meaning. **(07 Marks)**

b. Derive the expression for couple per unit twist of a solid cylinder. **(10 Marks)**

c. Calculate the Poisson's ratio for silver given Young's modulus is 7.25×10^{10} N/m^2 and bulk modulus is 11×10^{10} N/m^2. **(03 Marks)**

Module-3

5 a. Describe the concept of divergence. What is the physical significance? Derive Gauss divergence theorem. **(09 Marks)**

b. With neat diagrams, explain different types of optical fibers. **(07 Marks)**

c. Find the divergence of the vector field $\vec{A}$ given $\vec{A} = 6x^2\hat{a}_x + 3xy^2\hat{a}_y + xyz^3\hat{a}_z$ at a point P(1, 3, 6) **(04 Marks)**

OR

6 a. What is displacement current? Derive an expression for displacement current. **(06 Marks)**

b. Explain the terms:
(i) Total internal reflection
(ii) Acceptance angle
(iii) Numerical aperture.
Obtain an expression for numerical aperture. **(09 Marks)**

c. The attenuation in an optical fiber is 3.6 dB/km. What fraction of its initial intensity remains after (i) 1 km (ii) 2 km (iii) 3 km? **(05 Marks)**

Module-4

7 a. Setup one dimensional time independent Schrodinger wave equation. **(08 Marks)**

b. Derive an expression for energy density using Eeinstein's coefficients. **(08 Marks)**

c. A spectral line of wavelength 5461 $\mathring{A}$ has a width of 10^{-4} $\mathring{A}$. Evaluate the minimum time spent by the electrons in the upper energy state. **(04 Marks)**

OR

8 a. With a proper energy level diagram, explain the construction and working of semiconductor laser. Write a short note on laser range finder. **(10 Marks)**

b. Explain the four properties of wave function. **(06 Marks)**

c. The ratio of population of two energy levels is 1.059×10^{-30}. Find the wavelength of light emitted by laser at 330 K. **(04 Marks)**

Module-5

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

b. What are dielectrics? Derive Clausius-Mossotti equation. **(06 Marks)**

c. The conductivity and Hall coefficient of an n-type semiconductor are 112/Ωm and 1.25×10^{-3} m^3/c respectively. Calculate the charge carrier concentration and electron mobility. **(04 Marks)**

OR

10 a. Describe Fermi level in intrinsic semiconductor and hence obtain an expression for Fermi energy interms of energy gap of intrinsic semiconductor. **(08 Marks)**

b. What is Hall effect? Obtain an expression for charge density and Hall voltage interms of Hall coefficient. **(08 Marks)**

c. An elemental solid dielectric material has polarizability 7×10^{-40} Fm^2. Assuming the internal field to be Lorentz field, calculate the dielectric constant for the material if the material has 3×10^{28} atoms/m^3. **(04 Marks)**

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