CBCS SCHEME

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18PHY12/22

First/Second Semester B.E. Degree Examination, July/August 2021
Engineering Physics

Time: 3 hrs. Max. Marks: 100

Note : 1. ***Answer any FIVE full questions.***
2. ***Physical constants :*** $C = 3 \times 10^8 m/s$; $h = 6.63 \times 10^{-34}$ JS ; $g = 9.8\ m/s^2$; $\in_O = 8.856 \times 10^{-12}$ F/m ; $M = 9.11 \times 10^{-31}$ kg ; $e = 1.6 \times 10^{-19} C$; $N_A = 6.02 \times 10^{26}$/K mole ; $K = 1.38 \times 10^{-23}$J/K

1 a. Define Simple Harmonic motion. Derive the equation of motion for Simple Harmonic motion. Explain how complex notation is used in Simple Harmonic motion. **(10 Marks)**
b. Define Shock waves. Mention its applications. **(06 Marks)**
c. A mass 0.5kg causes an extension 0.03m in a spring and the system is set for oscillations. Find force constant of the spring, angular frequency and period of resulting oscillations. **(04 Marks)**

2 a. What are Damped Oscillations? Give the theory of damped oscillations and discuss the case of over damping. **(10 Marks)**
b. Describe Hand Operated Reddy Shock tube with the help of diagram. **(06 Marks)**
c. A free particle is executing Simple Harmonic motion in straight line. The maximum velocity it attains during any oscillation is 62.8m/s. Find the frequency of oscillation if its amplitude is 0.5m. **(04 Marks)**

3 a. Define Young's modulus, Rigidity modulus and Poisson's ratio. Derive the relation between them. **(10 Marks)**
b. Describe Strain softening and Strain hardening. **(06 Marks)**
c. Calculate the force required to produce an extension of 1mm in steel wire of length 2m and diameter 1mm. If given $Y = 2 \times 10^{11}\ N/m^2$. **(04 Marks)**

4 a. State Hook's law. Derive an expression for Couple required to produce unit twist in a uniform cylindrical rod fixed at one end and the Couple being applied at the other end. **(08 Marks)**
b. What is Torsional Pendulum? Give the expression for period of oscillation and write its applications. **(06 Marks)**
c. A solid lead sphere of radius 10.3m is subjected to normal pressure of $10N/m^2$ acting all over the surface. Determine the change in its volume. Given Bulk modulus of lead is $4.58 \times 10^{10}\ N/m^2$. **(06 Marks)**

5 a. State and prove Gauss Divergence theorem. **(06 Marks)**
b. Describe three types of optical fibres with one application for each type. **(09 Marks)**
c. Calculate the curl of $\vec{A}$. Given $\vec{A} = (1 + yz^2)\ \hat{a}_x + xy^2 + x^2y\ \hat{a}_z$. **(05 Marks)**

6 a. Discuss Continuity equation and list the four Maxwell's equations. **(10 Marks)**
b. What is Numerical Aperture? Derive and expression for numerical aperture interms of refractive indices of core and cladding. **(06 Marks)**
c. Find the attenuation in an optical fiber of length 500m. When a light signal of power 100mw. Emerges out of the fiber with a power 90mw. **(04 Marks)**

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

7 a. State Heisenberg's uncertainity principle. Show that electron does not exist inside the nucleus by this principle. **(06 Marks)**

b. Explain the terms Spontaneous emission and stimulated emission. Derive the expression for energy density of radiation under equilibrium condition interms of Einstein's coefficients. **(10 Marks)**

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

8 a. Using time independent wave equation, find Energy Eigen values and Eigen functions for a particle in one dimensional potential well of infinite height. **(09 Marks)**

b. Describe the Construction and working of CO_2 Laser with energy level diagram. **(07 Marks)**

c. The average output Power of Laser source emitting a laser beam of wavelength 6328A° is 5mw. Find the number of Photons emitted per second by the laser source. **(04 Marks)**

9 a. Define Fermi energy and Fermi factor. Derive an expression for Fermi energy at Zero Kelvin. **(09 Marks)**

b. Obtain the expression for electrical conductivity of Semi Conductor. **(07 Marks)**

c. If a NaCℓ crystal is subjected to an electric field of 1000V/m and the resulting Polarization is 4.3×10^{-8} C/m^2. Calculate the dielectric constant of NaCℓ. **(04 Marks)**

10 a. Discuss any two success of Quantum Free Electron theory. **(06 Marks)**

b. State Hall effect. Obtain an expression for Hall Coefficient. **(08 Marks)**

c. Derive Calusius – Mossotti equation. **(06 Marks)**

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