CBCS SCHEME

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 : $C = 3 \times 10^8 m/s$; $h = 6.63 \times 10^{-34} JS$;*
$g = 9.8\ m/s^2$; $\epsilon_O = 8.856 \times 10^{-12}\ F/m$; $M = 9.11 \times 10^{-31}\ kg$;
$e = 1.6 \times 10^{-19}C$; $N_A = 6.02 \times 10^{26}/K\ mole$; $K = 1.38 \times 10^{-23}J/K$

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)**

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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