

# 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 :  $C = 3 \times 10^8 \text{ m/s}$  ;  $h = 6.63 \times 10^{-34} \text{ JS}$  ;

$g = 9.8 \text{ m/s}^2$  ;  $\epsilon_0 = 8.856 \times 10^{-12} \text{ F/m}$  ;  $M = 9.11 \times 10^{-31} \text{ kg}$  ;

$e = 1.6 \times 10^{-19} \text{ C}$  ;  $N_A = 6.02 \times 10^{26} / \text{K mole}$  ;  $K = 1.38 \times 10^{-23} \text{ J/K}$

- 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  $Y = 2 \times 10^{11} \text{ N/m}^2$ . (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  $10 \text{ N/m}^2$  acting all over the surface. Determine the change in its volume. Given Bulk modulus of lead is  $4.58 \times 10^{10} \text{ N/m}^2$ . (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 uncertainty 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 in terms of Einstein's coefficients. (10 Marks)
- c. An electron is bound in an one dimensional potential well of width  $1\text{\AA}$ , 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  $\text{CO}_2$  Laser with energy level diagram. (07 Marks)
- c. The average output Power of Laser source emitting a laser beam of wavelength  $6328\text{\AA}$  is  $5\text{mw}$ . 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  $\text{NaCl}$  crystal is subjected to an electric field of  $1000\text{V/m}$  and the resulting Polarization is  $4.3 \times 10^{-8} \text{C/m}^2$ . Calculate the dielectric constant of  $\text{NaCl}$ . (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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