CBCS SCHEME

USN | | | | | | | | | | |

18PHY12

First Semester B.E. Degree Examination, Dec.2018/Jan.2019

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, $c = 3 \times 10^8$ m/s

Planck's constant, $h = 6.63 \times 10^{-34}$ JS

Mass of electron, $m_e = 9.1 \times 10^{-31}$ kg

Charge of electron, $e = 1.6 \times 10^{-19}$ C

Boltzmann constant $= 1.38 \times 10^{-23}$ JK^{-1}

Avagadro number $= 6.02 \times 10^{23}$/mol.

Module-1

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

b. What are damped oscillations? Give the theory of damped oscillations and hence discuss the case of critical damping. **(10 Marks)**

c. A free particle is executing simple harmonic motion in a straight line with a period of 25 seconds; 5 seconds 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 seconds and also amplitude of oscillations. **(04 Marks)**

OR

2 a. Define SHM. Mention the characteristics of SHM. Give one example of SHM. **(06 Marks)**

b. With a neat diagram, explain the construction and working of Reddy's shock tube. Mention conservation of mass energy and momentum expressions. **(10 Marks)**

c. A mass of 0.5kg causes on extension of 0.03m in a spring and the system is set for oscillations. Find i) The force constant for the spring ii) Angular frequency and iii) Time period of the resulting oscillation. **(04 Marks)**

Module-2

3 a. State and explain Hooke's law. Define elastic and plastic limits. **(06 Marks)**

b. Define Young's modulus of materials. Derive an expression for the Young's modulus of a beam using single cantilever method. **(10 Marks)**

c. Calculate the torque required to twist a wire of length 1.5m, radius 0.0425×10^{-2}m through an angle of $(\pi/45)$ radians, if the value of rigidity modulus of the material is 8.3×10^{10}N/m^2. **(04 Marks)**

OR

4 a. What is Bending moment? Mention various types of beams and their engineering applications (any four). **(06 Marks)**

b. What are the types of Elastic moduli? Derive a relation between Y, K and σ. **(10 Marks)**

c. Calculate the Force required to produce an extension of 1mm in steel wire of length 2m and diameter 1mm. ($Y = 2 \times 10^{11}$ N/m^2) **(04 Marks)**

Module-3

5 a. What is Numerical Aperture? Derive an expression for the same. **(06 Marks)**

b. State and explain Maxwell's equation for electromagnetic field. Starting from Maxwell's equations, deduce the wave equation for a plane wave in free space. **(10 Marks)**

c. Determine constant C, such that $\vec{A} = (x + ay)\hat{a}_x + (y + bz)\hat{a}_y + (x + cz)\hat{a}_z$ is solenoidal. **(04 Marks)**

OR

6 a. Explain the types of fiber losses. **(06 Marks)**

b. State and explain Gauss Divergence theorem. Mention the Stoke's theorem. **(10 Marks)**

c. The refractive indices of core and clad are 1.50 and 1.48 respectively in an optical fiber. Find the numerical aperture and angle of acceptance. **(04 Marks)**

Module-4

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

b. Mention the three modes of vibration in CO_2 molecule. With neat diagrams explain the construction and working of CO_2 laser. **(10 Marks)**

c. A pulsed laser emits photons of wavelength 780nm with 20mW average power/pulse. Calculate the number of photons contained in each pulse if the pulse duration is 10ns. **(04 Marks)**

OR

8 a. Prove that electron cannot exist inside the Nucleus of an atom. **(06 Marks)**

b. Derive an expression for energy density in terms of Einstein's coefficients. **(10 Marks)**

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

Module-5

9 a. What are the assumptions of Quantum Free Electron Theory (QFET)? Explain the merits of QFET. **(06 Marks)**

b. What is Hall Effect? Derive an expression for Hall voltage interms of Hall coefficient. **(10 Marks)**

c. Find the temperature of which there is 1% probability that a state with an energy 0.5eV above the Fermi energy is occupied. **(04 Marks)**

OR

10 a. What is polarization? Explain various types of polarizations mechanisms. **(06 Marks)**

b. What is Fermi Energy? Derive an expression for Fermi Energy at zero Kelvin for a metal. **(10 Marks)**

c. The resistivity of intrinsic germanium at 27°C is equal to 0.47 ohm-m. Assuming the electron and hole mobilities as 0.38 and 0.18 m^2/V-Sec respectively. Calculate the intrinsic carrier density. **(04 Marks)**

* * * * *