Model Question Paper-1 with effect from 2018-19
(CBCS Scheme)

USN | | | | | | | | | | **18PHY12/22**

First/Second Semester B.E.Degree Examination
Engineering Physics
(Common to all Branches)

Time : 3 hrs Max. Marks: 100

Note: 1. Answer FIVE full questions, choosing one full question from each module.
2. Physical constants: Velocity of light $c = 3 \times 10^{8}$ 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 **(6 marks)**

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

c. A spring undergoes an extension of 5 cm for a load of 50 g. Find its force constant, angular frequency and frequency of oscillation, if it is set for vertical oscillations with a load of 200 g attached to its bottom. Ignore the mass of the spring. **(4 marks)**

OR

2 a. Define simple harmonic motion. Derive the equation for simple harmonic motion using Hooke's law. **(6 marks)**

b. Discuss the theory of forced vibrations and hence obtain the expression for amplitude. **(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. Calculate the displacement at the end of 10 seconds, and also the amplitude of oscillation. **(4 marks)**

Module-2

3. a. Explain in brief the factors affecting elastic property of a body. **(4 marks)**

b. Derive the relation between Y, η and σ where the symbols have their usual meaning **(7 marks)**

c. What are torsional oscillations? Give the expression for time period of torsional oscillations. Mention the applications of torsional oscillations **(5 marks)**

d. A rod of cross sectional area $1cm^2$ is rigidly planted into the earth vertically. A string which can withstand a maximum tension of 2kg is tied to the upper end of the rod and pulled horizontally. If the length of the rod from the ground level is 2m calculate the distance through which its upper end is displaced just before the string snaps **(4 marks)**

OR

4. a. State and explain Hookes' law. Define elastic and plastic limit. **(6 marks)**

b. Define Poisson's ratio. Mention its limiting values. Obtain the relation between shear strain, elongation strain and compression strain. **(10 marks)**

c. Calculate the twisting couple on a solid cylindrical rod of length 1.5m and radius 80mm when it is twisted through an angle 0.6^0. Rigidity modulus of the material of rod is $93x10^9 Nm^{-2}$. **(4 marks)**

Module-3

5. a. Explain the terms gradient of a scalar, divergence and curl of a vector. Derive Gauss divergence theorem **(7 marks)**
   b. What is displacement current? Obtain the expression for displacement current **(6marks)**
   c. Mention the conditions for three types of polarization of electric vector **(3marks)**
   d. Consider a slab waveguide made of AlGaAs having RI for core and clad 3.6 and 3.55 respectively. Find how many modes can propagate in this waveguide if d = 5λ **(4marks)**

OR

6. a. Give the four Maxwell's equations in differential form in vacuum and hence derive the EM wave equation in terms of electric field using Maxwell's equations **(8marks)**
   b. Name the three types of attenuation in optical fiber. Obtain the expression for attenuation coefficient **(8marks)**
   c. A plane EM wave propagating along the x-direction has a wavelength 5mm. The magnitude of the electric field in y-direction is 38V/m. Find the magnitude of the magnetic field. Also write the time varying equations for both the fields **(4marks)**

Module – 4

7. a. Setup 1-dimensional time independent Schrodinger wave equation. Explain Born's approximation **(8 marks)**
   b. Mention the three different vibrational modes of CO_2 molecule. With a neat energy level diagram explain the construction and working of CO_2 laser **(8 marks)**
   c. An electron is trapped in a 1-D potential well of infinite height and of width of 0.1 nm. Calculate the energy required to excite it from its ground state to fifth excited state **(4 marks)**

OR

8. a. With a proper energy level diagram explain the working of Semiconductor laser. Explain the working of laser range finder **(10 marks)**
   b. State and explain Heisenberg Uncertainty principle. Show that the electron emitted during β-decay does not pre-exist inside the nucleus using uncertainty principle **(6 marks)**
   c. Calculate the wavelength of laser emitted from an extrinsic semiconductor laser if the band gap is 0.02eV. To which region of EM spectrum does it belong? **(4 marks)**

Module – 5

9. a. Explain the failures of classical free electron theory. **(4 marks)**
   b. What is Hall Effect? Obtain the expression for Hall voltage in terms of Hall co-efficient **(6 marks)**.
   c. Define Fermi factor. Explain the variation of Fermi factor with temperature. **(6 marks)**
   d. The charge carrier density of intrinsic germanium is 2.372 x $10^{-19}/m^3$. Assuming electron and hole mobilities as 3.38 $m^2V^{-1}s^{-1}$ and 0.18 $m^2V^{-1}s^{-1}$ respectively, calculate the resistivity of intrinsic germanium at 27^o C. **(4 marks)**

OR

10. a. Give the assumptions of quantum free electron theory and hence obtain the expression for Fermi energy at 0 K **(8marks)**
    b. Define internal field in case of solid dielectrics. Derive Clausius-Mossotti equation **(8marks)**
    c. Calculate the Fermi energy and Fermi velocity of a metal at 0 K whose density is 10500kg/m^3, atomic weight is 107.9 and has one free electron per atom **(4 marks)**

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