CBCS SCHEME

USN

18PHY12/22

First/Second Semester B.E. Degree Examination, Dec.2019/Jan.2020
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 × 10⁸ m/s; Planck's constant h = 6.63 × 10⁻³⁴ J-S : Mass of an electron m = 9.11 × 10⁻³¹ kg Beltzmann constant K = 1.38 × 10⁻²³ J/K; Avagadro number N_A = 6.02 × 10²⁶/K mole.

Module-1

1 a. Give the theory of forced vibrations and obtain the expression for amplitude. **(08 Marks)**
b. With a neat diagram, explain the construction and working of Reddy tube. Mention four applications of shock waves. **(08 Marks)**
c. Calculate the resonant frequency for a simple pendulum of length 1m. **(04 Marks)**

OR

2 a. Define force constant and mention its physical significance. Derive the expression for force constant for springs in series and parallel combination. **(08 Marks)**
b. Define simple harmonic motion. Derive the differential equation of motion for it using Hook's law. Mention the characteristics and examples of simple harmonic motion. **(08 Marks)**
c. The distance between the two pressure sensors in a shock tube is 150mm. The time taken by a shock wave to travel this distance is 0.3ms. If the velocity of sound under the same condition is 340m/s, find the Mach number of the shock wave. **(04 Marks)**

Module-2

3 a. Explain longitudinal stress, longitudinal strain, volume stress and volume strain. Discuss the effect of stress, temperature, annealing and impurities on elasticity. **(08 Marks)**
b. Derive the relation between bulk modulus(k), Young's modulus (Y) and Poisson's ratio (σ), what are the limiting values of Poisson's ratio? **(08 Marks)**
c. Calculate the extension produced in a wire of length 2m and radius 0.013×10^{-2}m due to a force of 14.7 Newton applied along its length. Given, Young's modulus of the material of the wire $Y = 2.1 \times 10^{11} N/m^2$. **(04 Marks)**

OR

4 a. Describe a single cantilever and derive the expression for Young's modulus of the material of rectangular beam. **(08 Marks)**
b. Derive an expression for couple per unit twist for a solid cylinder with a diagram. **(08 Marks)**
c. Calculate the angular twist of a wire of length 0.3m and radius 0.2×10^{-3}m when a torque of 5×10^{-4} Nm is applied. (Rigidity modulus of the martial is $8 \times 10^{10} N/m^2$). **(04 Marks)**

Module-3

5 a. Explain Divergence and curl. Derive Gauss Divergence theorem. **(08 Marks)**
b. Define V-number and fractional index change. With a neat diagrams, explain different types of optical fibers. **(08 Marks)**
c. Find the divergence of the vector field $\vec{A}$ given by $\vec{A} = 6x^2\hat{a}_x + 3xy^2\hat{a}_y + xyz^3\hat{a}_z$ at a point P(1, 3, 6). **(04 Marks)**

OR

6 a. Derive the expression for displacement current. Mention 4 Maxwell's equations in differential form for time varying fields. **(08 Marks)**
b. Derive an expression for numerical aperture in an optical fiber and stain the condition for propagation. **(08 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)**

Module-4

7 a. State and explain Heisenberg's Uncertainty Principle. Show that the electron cannot exist inside the nucleus. **(08 Marks)**
b. Define spontaneous emission and stimulated emission. Explain the construction and working semiconductor Laser. **(08 Marks)**
c. A partied of mass $0.5 mev/C^2$ has kinetic energy 100eV. Find its de Broglie wavelength, where C is the velocity of light. **(04 Marks)**

OR

8 a. Assuming the time independent Schrödinger wave equation, discuss the solution for a particle in one dimensional potential well of infinite height. Hence obtain the normalized wave function. **(08 Marks)**
b. Derive the expression for energy density interms Eienstein's co-efficient. **(08 Marks)**
c. The ratio of population of two energy levels is 1.059×10^{-30}. Find the wavelength of light emitted by spontaneous emissions at 330K. **(04 Marks)**

Module-5

9 a. Give the assumptions of quantum free electron theory. Discuss two success of quantum free electron theory. **(08 Marks)**
b. What are polar and non-polar dielectrics? Explain types of polarization. **(08 Marks)**
c. Calculate the probability of an electron occupying an energy level 0.02ev above the Fermi level at 200K and 400K in a material. **(04 Marks)**

OR

10 a. Define internal field. Mention the expressions for internal field, for one dimension, for three dimensional, and Lorentz field for dialectics. Derive Clausius – Morsotti equation. **(08 Marks)**
b. Describe Fermi level in an intrinsic semi conductor and hence obtain the expression for Fermi energy in terms of energy gap of intrinsic semiconductor. **(08 Marks)**
c. An elemental solid dielectric material has polarizability $7 \times 10^{-40} Fm^2$. Assuming the internal field to be Lorentz field, calculate the dielectric constant for the material if the material has 3×10^{28} atoms/m³. **(04 Marks)**

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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 = 1.38×10^{-23} JK^{-1}
Avagadro number = 6.02×10^{23}/mol.

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.

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 (π/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 A, 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)**

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