CBCS SCHEME

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18PHY12/22

First/Second Semester B.E. Degree Examination, Jan./Feb. 2021
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 $h = 6.63 \times 10^{-34}$ *JS ;* $C = 3 \times 10^{8} ms^{-1}$ *;* $\epsilon_O = 8.854 \times 10^{-12}$ $F\,m^{-1}$. $K = 1.38 \times 10^{-23}$ *J/K ;* $N_A = 6.02 \times 10^{26}$*/K mole ;* $m_e = 9.1 \times 10^{-31}$ *kg ;* $e = 1.6 \times 10^{-19}$*C;* $g = 9.81$ *m/s ;* $\mu_O = 4\pi \times 10^{-7}$ *H/m.*

Module-1

1 a. Derive an expression for equivalent force constant for two springs in series. What is the expression for period of its oscillation? **(08 Marks)**

b. Distinguish between ultrasonic, subsonic, supersonic and hypersonic waves. Define Mach number and Mach Angle. **(08 Marks)**

c. Evaluate the natural frequency of a spring of force constant 1974 N/m, carrying a mass of 2kg. **(04 Marks)**

OR

2 a. What are damped oscillations? Give the theory of damped vibrations and find the condition for critical damping. **(10 Marks)**

b. Describe the construction and working of Reddy's shock tube with the help of a neat sketch. **(06 Marks)**

c. A vibrating system of natural frequency 500Hz is forced to vibrate with a periodic force per unit mass of amplitude 100×10^{-5} N/kg in the pressure of a damping/unit mass of 0.01×10^{-3} rad/s. Calculate the maximum amplitude of vibration of the system. **(04 Marks)**

Module-2

3 a. Define different moduli of elasticity. Derive an expression for couple per unit twist of a solid cylinder fixed at one end and the couple being applied at the other end. **(10 Marks)**

b. Show that for an elastic body, shear strain is equal to the sum of longitudinal strain and compressional strain. **(06 Marks)**

c. In a stretching experiment, the extension produced in a wire for a load of 1.5kg is 0.2×10^{-2}m. The length of the wire is 2m and its radius is 0.013×10^{-2}m . Find the Young's modulus of the material of the wire. **(04 Marks)**

OR

4 a. Derive an expression for the Young's modulus of the material of a single cantilever in terms of depression at the free end. **(08 Marks)**

b. Show the relationship between Bulk modulus (K), Young's modulus (Y) and Poisson's Ratio (σ). **(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 material is 8×10^{10} N/m^2. **(04 Marks)**

Module-3

5 a. Describe the vector operator ∇ and explain the concepts of divergence and curl with physical significance. **(08 Marks)**

b. Explain the attenuation in an optical fibre? Discuss any three factors contributing to the fibre loss. **(08 Marks)**

c. Calculate the number of modes that can propagate inside an optical fibre with the data given below :

Refractive index of core	=	1.53
Refractive index cladding	=	1.50
Core radius	=	50 μm
Wavelength of light propagating through the optical fiber	=	1 μm

(04 Marks)

OR

6 a. With the help of a block diagram, explain the basics of point – to – point communication system using optical fibre. Mention any two advantages of optical communication system. **(08 Marks)**

b. State and obtain Faraday's law of electromagnetic induction in differential form. **(08 Marks)**

c. Find the divergence of the vector field $\vec{A}$ given by $\vec{A} = 3x^2\,\hat{a}_x + \frac{1}{2}y^2z\,\hat{a}_y + 3xy\,\hat{a}_z$. **(04 Marks)**

Module-4

7 a. Set up Schrödinger's Time independent wave equation in one dimension. **(08 Marks)**

b. Explain the construction and working of semiconductor laser with the help of necessary neat diagram. **(08 Marks)**

c. The inherent uncertainity in the measurement of time spent by a nuclei in the excited state is 1.4×10^{-10}s. Calculate the uncertainity that results in its energy in the excited state. **(04 Marks)**

OR

8 a. Show that electron cannot exist inside the nucleus of an atom. **(08 Marks)**

b. Derive an expression for energy density at thermal equilibrium in terms of 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 emission at 330K. **(04 Marks)**

Module-5

9 a. Derive an expression for electrical conductivity of an intrinsic semiconductor. **(08 Marks)**

b. Define internal field and obtain the Clausius – Mossotti equation and different polarization mechanisms. **(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 Fermi energy and Fermi factor. Explain the dependence of Fermi factor on temperature and energy. **(08 Marks)**

b. Derive an expression for Hall coefficient and Hall voltage. **(08 Marks)**

c. Find the polarization produced in a dielectric medium of relative permittivity 15 in presence of an electric field of strength 500V/m. **(04 Marks)**

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