CBCS SCHEME

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18PHY12/22

First/Second Semester B.E. Degree Examination, Aug./Sept.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 : $h = 6.62 \times 10^{-34}$ JS ; $C = 3 \times 10^{8}$ m/s ; $K = 1.38 \times 10^{-23}$ 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 ; $g = 9.8$ m/s ; $\mu_O = 4\pi \times 10^{-7}$ H/m ; $\epsilon_O = 8.852 \times 10^{-12}$ F/m.***

Module-1

1 a. Discuss the theory of forced oscillations and obtain an expression for Amplitude resonance. **(10 Marks)**

b. Define shock waves and mention the applications of shock waves. **(06 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 second is 340m/s under the same condition, find the Mach number of the shock wave. **(04 Marks)**

OR

2 a. What is Mach Number? Classify shock waves on the basis of Mach number and mention examples for each. **(06 Marks)**

b. Derive the expression for equivalent force constant for two springs in series and parallel. What is the period of its oscillations? **(10 Marks)**

c. A 20g oscillator with natural frequency 10 rad/s is vibrating in damping medium. The damping force is proportional to the velocity of the vibrator. If the damping coefficient is 0.17, how does the oscillations decays. **(04 Marks)**

Module-2

3 a. Explain stress and strain diagram. **(06 Marks)**

b. Derive an expression for couple per unit twist of a solid cylinder. **(10 Marks)**

c. A load of 2kg produces an extension of 1mm in a wire of 3m in length and 1mm in diameter. Calculate the Young's modulus of the wire. **(04 Marks)**

OR

4 a. Show that shear strain (θ) is equivalent to half of compression strain ($\theta/2$) and half of extension strain ($\theta/2$) in two mutually perpendicular directions. **(06 Marks)**

b. Derive an expression for Young's modulus (Y) using Single Cantilever method. **(10 Marks)**

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

Module-3

5 a. By using Maxwells equations develop wave equation for electric and magnetic fields in free space. **(10 Marks)**

b. Explain with neat diagram the different types of optical fibre. **(06 Marks)**

c. An optical fibre has core RI 1.5 and RI of cladding is 1.455. Calculate numerical aperture and angle of acceptance. **(04 Marks)**

OR

6 a. Obtain the expression for Numerical Aperture and angle of acceptance and hence show the condition for propagation. **(08 Marks)**

b. State and prove Gauss divergence theorem. **(08 Marks)**

c. Find attenuation in an optical fibre of length 500m when a length of power 100mw emerges out of the fiber with a power 90mw. **(04 Marks)**

Module-4

7 a. State Heisenberg's uncertainty principle. Show that electron do not exists inside the nucleus using it. **(08 Marks)**

b. With neat diagram, explain the construction and working of CO_2 laser. **(08 Marks)**

c. An electron is trapped in a one – dimensional potential well of infinite height and a width of 0.2nm. Calculate the energy required for ground state and its first two excited states. **(04 Marks)**

OR

8 a. Derive an expression for energy density in terms of Einsteins co-efficients. **(10 Marks)**

b. Obtain energy eigen values for a particle in a potential well of infinite height. **(06 Marks)**

c. The uncertainty in the measurement of time spent by Iridium – 199 nuclei in the excited state is found to be 1.4×10^{-10} sec. Estimate the uncertainty in energy in the excited state. **(04 Marks)**

Module-5

9 a. Explain Hall effect. Derive an expression for Hall voltage, Hall field and Hall co-efficient. **(10 Marks)**

b. Define Fermi factor. Explain the variation of Fermi factor with temperature. **(06 Marks)**

c. The intrinsic carrier concentration of Germanium is $2.4 \times 10^{19}/m^3$. Calculate its conductivity if the mobility of the electron and holes respectively are $0.39 m^2/VS$ and $0.19 m^2/V\text{-}S$. **(04 Marks)**

OR

10 a. Derive Clausius – Morsotti relation in a solid dielectric. **(08 Marks)**

b. Explain any two failures of classical free electron theory and any two merits of quantum free electron theory. **(08 Marks)**

c. Calculate the concentration at which donor atoms need to be added to a silicon semiconductor, so that it results in n-type semi conductivity of 2.2×10^{-4} S/m and the mobility of electron being $1.25 \times 10^{-3} m^2/VS$. **(04 Marks)**

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