



CBCS SCHEME

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 : $h = 6.62 \times 10^{-34} \text{ JS}$; $C = 3 \times 10^8 \text{ m/s}$; $K = 1.38 \times 10^{-23} \text{ J/K}$;
 $N_A = 6.02 \times 10^{26} / \text{K mole}$; $M_e = 9.1 \times 10^{-31} \text{ kg}$; $e = 1.6 \times 10^{-19} \text{ C}$; $g = 9.8 \text{ m/s}$;
 $\mu_0 = 4\pi \times 10^{-7} \text{ H/m}$; $\epsilon_0 = 8.852 \times 10^{-12} \text{ F/m}$.

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 sound 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 decay. (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 ($\frac{\theta}{2}$) and half of extension strain ($\frac{\theta}{2}$) 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 $0.0425 \times 10^{-2} \text{ m}$ through an angle of ($\frac{\pi}{45}$) radians. If the rigidity modulus of the material is $8.3 \times 10^{10} \text{ N/m}^2$. (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 CO₂ 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 $0.39m^2/V\text{-S}$ and $0.19m^2/V\text{-S}$. (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 $1.25 \times 10^3 m^2/V\text{-S}$. (04 Marks)
