



First/Second Semester B.E. Degree Examination, June/July 2023
Engineering Physics

Max. Marks: 100

- Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.*
 2. Draw neat sketches wherever necessary.
 3. Constants: Speed of light “C” = 3×10^8 m/s, Boltzmann constant “K” = 1.38×10^{-23} J/K, Planck’s constant “h” = 6.625×10^{-34} JS. Acceleration due to gravity “g” = 9.8 m/s², permittivity of free space. “ ϵ_0 ” = 8.854×10^{-12} F/m.

Module-1

- 1 a. Obtain the expressions for force constant for series and parallel combination of springs also mention expressions for period of oscillation for series and parallel combination. (08 Marks)
- b. What are damped oscillations? Establish equation of motion for damped vibrations and obtain its general solution. (08 Marks)
- c. A car has a spring system that supports the in-built mass 1000kg. When a person with a weight 980N sits at the centre of gravity, the spring system sinks by 2.8cm. When the car hits a bump, it starts oscillating vertically. Find the period and frequency of oscillation. (04 Marks)

OR

- 2 a. Give the theory of forced vibration and obtain expression for amplitude and phase. (08 Marks)
- b. Illustrate the generation of shock waves using the Reddy shock tube and give any four applications of shock waves. (08 Marks)
- c. The distance between the two pressure sensors in shock tube is 100mm. The time taken by a shock wave to travel this distance is 100 microsecond. 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. State Heisenberg uncertainty principle and give its physical significance. Show that electron does not exist inside the nucleus by this principle. (08 Marks)
- b. Starting from Planck’s quantum theory of radiation arrive at Wien’s law and Rayleigh Jean’s law. (08 Marks)
- c. Compute the de Broglie wavelength for a neutron moving with one tenth part of the velocity of light, given, mass of neutron = 1.674×10^{-27} kg. (04 Marks)

OR

- 4 a. Set up one-dimensional time-independent Schrodinger’s equation. (08 Marks)
- b. Discuss the eigenfunction, eigenvalues and probability density for a particle in a potential well of infinite height. (08 Marks)
- c. An electron has a speed of 100m/s. The inherent uncertainty in its measurement is 0.005%. Calculate corresponding uncertainty that arises in the measurement of its position. (04 Marks)

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-3

- 5 a. Derive the expression for energy density in terms of Einstein's coefficients. (06 Marks)
 b. Derive the expression for numerical aperture of an optical fiber and discuss the block diagram of point-to-point communication. (10 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)

OR

- 6 a. Explain construction and working of CO₂ laser with necessary diagrams. (08 Marks)
 b. What is attenuation? Explain different types of optical fibers. (08 Marks)
 c. The attenuation of light in an optical-fiber is estimated at 2.2dB/km. What fractional initial intensity remains after 2km and 6km. (04 Marks)

Module-4

- 7 a. What is Hall effect? Obtain the expression for the Hall coefficient. (08 Marks)
 b. Define polarization, dipole and dipole moment derive Clausius-Mossotti equation. (08 Marks)
 c. The resistivity of intrinsic germanium at 27°C is equal to 0.47 ohm-meter. Assuming electron and hole mobilities as 0.38 and 0.18m²/vs respectively, calculate the intrinsic carrier density. (04 Marks)

OR

- 8 a. Define Fermi energy and Fermi factor. Discuss the dependence of Fermi factor on temperature and energy. (08 Marks)
 b. Discuss merits of quantum free electron theory give expressions for holes and electrons concentration in semiconductors. (08 Marks)
 c. Find the probability that an energy level at 0.2ev below Fermi level being occupied at temperatures 300K and 1000K. (04 Marks)

Module-5

- 9 a. With neat diagram, explain the principle, construction and working of X-ray photoelectron spectroscope. (08 Marks)
 b. With necessary diagram, explain the principle construction and working of Atomic force microscope. (08 Marks)
 c. X-ray of wavelength 0.12nm are found to undergo second order reflection at a Bragg angle of 28° from crystal. What is the interplanar spacing of the reflecting planes of the crystal? (04 Marks)

OR

- 10 a. With the help of neat diagram describe the principle construction and working of scanning electron microscope. (08 Marks)
 b. Define nano material, mention classification of nano materials explain in brief how crystal size is determined by Scherrer's equation. (08 Marks)
 c. The spacing between principal planes of the crystals is 2.82 Å. It is found that first order Bragg reflection occurs at an angle of 10°, what is the wavelength of X-rays? (04 Marks)

* * * * *