



CBCS SCHEME

15PHY12/22

First/Second Semester B.E. Degree Examination, Aug./Sept. 2020 Engineering Physics

Time: 3 hrs.

Max. Marks: 80

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.

2. Physical Constants: $h = 6.63 \times 10^{-34} \text{ JS}$; $C = 3 \times 10^8 \text{ m/s}$,
 $m_e = 9.1 \times 10^{-31} \text{ Kg}$; $m_n = 1.67 \times 10^{-27} \text{ Kg}$
 $lev = 1.6 \times 10^{-19} \text{ J}$; $e = 1.6 \times 10^{-19} \text{ C}$
 $K = 1.38 \times 10^{-23} \text{ J/K}$; $N_A = 6.025 \times 10^{26} \text{ Kmole}$.

Module-1

- 1 a. State Planck's radiation law and how it reduces to Wien's law and Rayleigh-Jean's law. (06 Marks)
- b. Derive the energy values for a particle in a potential well of infinite height using Schrodinger's wave equation (06 Marks)
- c. Calculate the potential required to accelerate a proton to have the deBroglie wavelength 10 \AA , given mass proton = $1.67 \times 10^{-27} \text{ Kg}$. (04 Marks)

OR

- 2 a. Obtain time independent Schrodinger's wave equation. (06 Marks)
- b. State Heisenberg's uncertainty principle and using this, show that e^- does not exist inside the nucleus. (06 Marks)
- c. The deBroglie wavelength of a fast moving Neutron is $2 \times 10^{-12} \text{ m}$. Find its group velocity and phase velocity of neutron. Given $m_n = 1.675 \times 10^{-27} \text{ Kg}$. (04 Marks)

Module-2

- 3 a. Explain the failure of classical free electron theory. (06 Marks)
- b. Explain type – I and type – II super conductors with necessary graph. (06 Marks)
- c. The intrinsic carrier density of Ge at Room temperature is $2.37 \times 10^{19} / \text{m}^3$. If the electron and hole mobilities are 0.38 and $0.18 \text{ m}^2 \text{ V}^{-1} \text{ S}^{-1}$ respectively, calculate the Resistivity. (04 Marks)

OR

- 4 a. Explain BCS theory of superconductivity. (06 Marks)
- b. Obtain the expression for electrical conductivity of a semiconductor in terms of mobility of electrons and holes. (06 Marks)
- c. Find the relaxation time of conduction electrons in a metal of resistivity $1.54 \times 10^{-8} \Omega \text{ m}$, if the metal has 5.8×10^{28} conduction electron/ m^3 . (04 Marks)

Module-3

- 5 a. Explain the construction and working of carbon dioxide LASER. (06 Marks)
- b. Obtain an expression for the numerical aperture of an optical fiber and hence give the condition for light propagation in an optical fiber. (06 Marks)
- c. Calculate the number of photons emitted/sec from a LASER source having the wavelength of 630 nm , operating at the power of 10 mW . (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.

OR

- 6 a. With necessary diagrams, explain the types of optical fibers. (06 Marks)
 b. Obtain an expression for energy density in terms of Einstein's coefficients. (06 Marks)
 c. The optical signal entering the optical fiber has the power of 5mW and emerges out with a power of 4mW. If the fiber is 800m long, calculate the attenuation coefficient. (04 Marks)

Module-4

- 7 a. With a neat diagram, explain Bragg's X-ray spectrometer and how it can be used to find interplanar spacing in a crystal. (06 Marks)
 b. What is co-ordination number? Show that atomic packing factor for bcc and fcc structure is 0.68 and 0.74. (06 Marks)
 c. Find the miller indices of a set of parallel planes which make intercepts in the ratio 3a:4b on X and Y axes and are parallel to Z-axis, where a and b the primitive vectors. (04 Marks)

OR

- 8 a. With a neat sketch, explain the Crystal structure of Diamond. (06 Marks)
 b. What are Miller indices? Obtain an expression for interplanar spacing in terms of Miller indices. (06 Marks)
 c. Copper has fcc structure of atomic radius 0.13mm. Calculate interplanar spacing for (3 2 1) plane. (04 Marks)

Module-5

- 9 a. Explain the construction and working of Reddy shock tube. (06 Marks)
 b. Explain the principle and working of scanning electron microscope. (06 Marks)
 c. Briefly explain Ball milling method of synthesis of nano particles. (04 Marks)

OR

- 10 a. What are Carbon nano tubes? Explain its synthesis using Arc discharge method. (06 Marks)
 b. Define Mach number and Mach angle and explain acoustic, Ultrasonic, supersonic and subsonic waves. (06 Marks)
 c. Mention any four applications of shock waves. (04 Marks)
