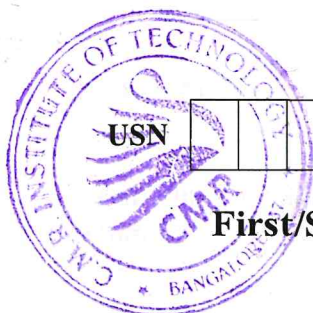


# CBCS SCHEME



17PHY12/22

## 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: Velocity of light,  $C = 3 \times 10^8$  m/s*

*Planck's constant,  $h = 6.63 \times 10^{-34}$  JS*

*Mass of electron,  $m_e = 9.1 \times 10^{-31}$  kg*

*Charge on electron,  $e = 1.6 \times 10^{-19}$  C*

*Boltzmann constant =  $1.38 \times 10^{-23}$  JK<sup>-1</sup>*

*Avagadro number =  $6.02 \times 10^{26}$ /kmol*

### Module-1

- 1 a. What is ultra violet catastrophe? Deduce Planck's law of radiation to Wien's law and Rayleigh Jeans law. (06 Marks)
- b. State Heisenberg's uncertainty principle. Prove that electron cannot exist inside the nucleus. (06 Marks)
- c. Explain the physical significance of wave function. (04 Marks)
- d. Calculate the momentum of an electron and the de Broglie wavelength associated with it if its kinetic energy is 1.5 KeV. (04 Marks)

OR

- 2 a. Derive the expression for time independent one dimensional Schrodinger wave equation. (06 Marks)
- b. Define group velocity and phase velocity. Arrive at the relation between group velocity and phase velocity. (06 Marks)
- c. Explain Compton effect and its physical significance. (04 Marks)
- d. An electron is confined in a one dimensional infinite potential well of width  $2 \text{ \AA}$ . Calculate its energy in ground and first excited state. (04 Marks)

### Module-2

- 3 a. State law of mass action. Obtain an expression for electrical conductivity of intrinsic semiconductors. (06 Marks)
- b. What is Fermi Energy? Explain the variation of Fermi factor with temperature and energy. (07 Marks)
- c. What is critical field? Discuss temperature dependence of critical field in superconductors. (03 Marks)
- d. Calculate the relaxation time of conduction electrons in a metal of resistivity  $1.54 \times 10^{-8} \Omega\text{-m}$  if the metal has  $5.8 \times 10^{28}$  conduction electrons per  $\text{m}^3$ . (04 Marks)

OR

- 4 a. What are superconductors? Explain the BCS theory of Superconductivity. (06 Marks)
- b. Discuss the failures of classical free electron theory. (06 Marks)
- c. Explain MAGLE V vehicles. (04 Marks)
- d. The electron concentration in an n-type semiconductor is  $5 \times 10^{17}/\text{m}^3$ . Calculate the conductivity of the material if the drift velocity of electron is 350 m/s in an electric field of 1000 V/m. (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. Describe the construction of semiconductor diode laser and explain its working. (06 Marks)  
 b. Discuss point to point communication with neat block diagram. (04 Marks)  
 c. Explain three different types of losses in optical fiber. (06 Marks)  
 d. A laser operating at 632.8 nm emits  $3.182 \times 10^{16}$  photons per second. Calculate the output power of the laser. If the input power is 100 Watt, calculate the percentage power converted into coherent light energy. (04 Marks)

**OR**

- 6 a. Obtain an expression for numerical aperture of an optical fibre and arrive at the condition for propagation of a signal in an optical fibre. (06 Marks)  
 b. What is Holography? Explain the recording and reconstruction of hologram with suitable ray diagram. (07 Marks)  
 c. Explain LIDAR used in the measurement of pollutants in the atmosphere. (03 Marks)  
 d. Calculate the attenuation in an Optical fibre of length 500 m, when a light of signal of power 100 mW emerges out of the fiber with a power 90 mW. (04 Marks)

**Module-4**

- 7 a. What are Miller indices? Derive an expression for interplanar distance in terms of Miller indices. (05 Marks)  
 b. Explain in brief the seven crystal systems with lattice parameters and necessary figures. (07 Marks)  
 c. Define primitive and non-primitive cell. Mention types of unit cell. (04 Marks)  
 d. Calculate the density of diamond, given that the cube edge of its unit cell is 3.57 Å and the atomic weight of carbon is 12.01. (04 Marks)

**OR**

- 8 a. Describe the construction and working of Bragg's X-ray spectrometer. (06 Marks)  
 b. Explain the crystal structure of diamond with neat diagram and calculate its atomic packing factor. (06 Marks)  
 c. Explain Allotropy and polymorphism with examples. (04 Marks)  
 d. Draw the following planes in cubic unit cell: (1 1 1) (2 0 2) (1 2 T) and (0 T 1) (04 Marks)

**Module-5**

- 9 a. Discuss the variation of density of energy states for 3D, 2D, 1D and 0D structures. (06 Marks)  
 b. Describe the construction and working of Reddy shock tube. (06 Marks)  
 c. Explain ball milling method to produce nanoparticles. (04 Marks)  
 d. What are shock waves? Mention any three applications of shock waves. (04 Marks)

**OR**

- 10 a. Describe the principle, construction and working of scanning electron microscope. (07 Marks)  
 b. Explain pyrolysis method of obtaining carbon nanotubes. (05 Marks)  
 c. Distinguish between subsonic and supersonic waves. (04 Marks)  
 d. Mention Rankine-Hugoniot equations for shock waves. (04 Marks)

\* \* \* \* \*

