

# CBCS SCHEME

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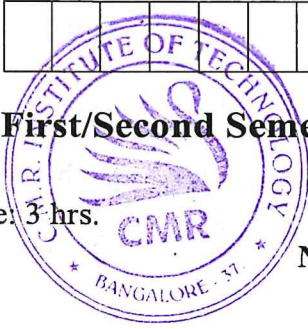
15PHY12/22

First/Second Semester B.E. Degree Examination, July/August 2021

## Engineering Physics

Time: 3 hrs.

Max. Marks: 80



Note: 1. Answer any FIVE full questions.

2. Physical Constants: Velocity of light,  $C = 3 \times 10^8$  m/S,

Plank's constant  $h = 6.625 \times 10^{-34}$  J-S;

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

Avogadro's number,  $N_A = 6.023 \times 10^{26}$  /Kmole

Boltzmann constant  $K = 1.38 \times 10^{-23}$  J/K,

Charge of an electron  $e = 1.602 \times 10^{-19}$  C

- 1 a. What is black body? Explain the spectral distribution of energy radiation emitted by the black body. (06 Marks)  
b. What are Matter waves? Mention its characteristics properties? (06 Marks)  
c. The uncertainty in the location of a particle is  $1 \text{ \AA}$ . Find the uncertainty in its momentum. (04 Marks)
- 2 a. Using Heisenberg's uncertainty principle. Prove that electron does not exist in the nucleus. (05 Marks)  
b. Set up time independent Schrodinger wave equation for a particle in one – dimension using complex variables. (06 Marks)  
c. Compare the energy of photon with that of a neutron when both are associated with a wavelength of  $1 \text{ \AA}$  (given that the mass of the neutron is  $1.678 \times 10^{-27}$  kg). (05 Marks)
- 3 a. Explain the terms :  
i) Mean free path  
ii) Relaxation time  
iii) Drift velocity. (06 Marks)  
b. Explain the success of Quantum free electron theory. (06 Marks)  
c. For GaAS, the electrical conductivity at room temperature is  $10^{-6}$  s/m. The electron and hole mobility are  $0.85 \text{ m}^2/\text{V.S}$  and  $0.04 \text{ m}^2/\text{V.S}$  respectively. Calculate the intrinsic carrier concentration. (04 Marks)
- 4 a. What is Meissner effect? Explain Type – I and Type – II superconductors. (07 Marks)  
b. Explain the BCS theory of superconductivity. (05 Marks)  
c. Calculate the probability of finding an electron at an energy level 0.02 eV above the Fermi level of ambient temperature of 300K. (04 Marks)
- 5 a. Mention the condition and requisites for lasing action. (06 Marks)  
b. Explain the construction and working principle of  $\text{CO}_2$  gas laser. (06 Marks)  
c. The refractive indices of the core and cladding of a step index optical fiber are 1.45 and 1.40 respectively and its core diameter is  $50 \mu\text{m}$ . Calculate the number of modes for the light of wavelength 670nm. (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.

- 6 a. Derive an expression for numerical aperture of an optical fiber placed in a Air medium. (05 Marks)
- b. Describe the method of recording and reconstruction of an image in a holography with the help of suitable diagrams. (06 Marks)
- c. What is Attenuation? Explain any two factors affecting the power loss. (05 Marks)
- 7 a. Define the terms :  
 i) Space lattice  
 ii) Poly morphism  
 iii) Allotropy  
 iv) Unit cell. (06 Marks)
- b. What is Atomic Packing Factor (APF)? Calculate the atomic packing factor for simple cubic, Face centered cubic and BCC. (06 Marks)
- c. Sketch the following planes in cubic unit cell i) (110) ii) ( $\bar{1}$ 10) iii) (213) and ( $\bar{2}$ 13). (04 Marks)
- 8 a. What is Primitive cell? Derive an expression for interplaner spacing in terms of Miller indices. (06 Marks)
- b. Describe the Bragg's X-ray diffractometer used to determine the crystal system. (06 Marks)
- c. A monochromatic x-ray beam of wavelength 700nm undergoes 2<sup>nd</sup> order Bragg's reflection from a plan (302) of a cubic crystal at a glancing angle of 35°. Calculate the lattice constant. (04 Marks)
- 9 a. What are the shock waves? Mention its properties and applications. (07 Marks)
- b. Give the graphical representation of density of states for 0D, 1D, 2D and 3D structures as a function of energy. (04 Marks)
- c. Write a note on Carbon Nanotube (CNT). (05 Marks)
- 10 a. Define Machnumber and give distinctions between acoustics, ultrasonic, subsonic and supersonic waves. (06 Marks)
- b. Describe the process of recording the image of sample using scanning electron microscope. (06 Marks)
- c. The distance between the two pressures sensors in a shock wave tube 100mm the time taken by a shock wave to travel this distance is 0.2ns. Find the Mach number of the shock wave travelling at 330m/s. (04 Marks)

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