CBCS Scheme

USN | | | | | | | | | | |

15PHY12/22

First/Second Semester B.E. Degree Examination, June/July 2019
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: Velocity of light, $C = 3\times10^{8}$ m/S,
Plank's constant $h = 6.625\times10^{-34}$ JS;
Mass of electron $m = 9.1\times10^{-31}$ kg,
Boltzmann constant $K = 1.38\times10^{-23}$ J/K,
Avagadro number, $N_A = 6.02\times10^{26}$ /Kmole,
Charge of electron $e = 1.6\times10^{-19}$ C

Module-1

1 a. Write Planck's radiation law. Show how one can arrive at Wien's law and Rayleigh-Jeans law from Planck's law. **(06 Marks)**

b. Set up time-independent one dimensional Schrodinger's wave equation. **(06 Marks)**

c. A particle of mass 0.5 MeV/C^2 has kinetic energy 100 eV. Find its de Broglie wavelength, where C is the velocity of light. **(04 Marks)**

OR

2 a. State Heisenberg's uncertainty principle. Prove that electron does not exists inside the nucleus. **(07 Marks)**

b. Define phase velocity and group velocity. Obtain the relation between group velocity and particle velocity. **(05 Marks)**

c. A spectral line of wavelength 5461 A° has a width of 10^{-4}A°. Evaluate the minimum time spent by the electrons in the upper energy state. **(04 Marks)**

Module-2

3 a. Explain failures of classical free electron theory. **(06 Marks)**

b. What is meant by critical field in the case of super conductors. Explain Type I and Type II super conductors. **(06 Marks)**

c. Calculate the probability of an electron occupying an energy level 0.02 eV above and below the Fermi level at 200 K. **(04 Marks)**

OR

4 a. Define Fermi factor. Discuss the variation of Fermi factor with temperature and energy. **(07 Marks)**

b. Explain BCS theory of super conductivity. **(05 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 0.18 $m^2V^{-1}S^{-1}$ respectively. Calculate the intrinsic carrier density. **(04 Marks)**

Module-3

5 a. Explain the construction and working of semiconductor laser. **(06 Marks)**

b. What is attenuation? Explain the various mechanisms through which attenuation takes place. **(07 Marks)**

c. An optical fiber has a core material with refractive index of 1.55 and cladding refractive index of 1.50. The light is launched into it in air. Calculate its numerical aperture and the acceptance angle. **(03 Marks)**

OR

6 a. Describe the recording and reconstruction process in holography with the help of suitable diagrams. **(06 Marks)**

b. Describe different types of optical fiber, along with the typical core and cladding diameter, refractive index profile and mode of propagation sketches. **(06 Marks)**

c. The ratio of population of two energy levels is 1.059×10^{-30}. Find the wavelength of light emitted at 330 K. **(04 Marks)**

Module-4

7 a. Define Miller indices. Derive an expression for interplanar spacing interms of Miller indices. **(05 Marks)**

b. Explain the crystal structure of diamond. Show that packing factor for diamond is $\frac{\sqrt{3}}{16}\pi$. **(05 Marks)**

c. Describe the construction and working of Bragg's spectrometer. **(06 Marks)**

OR

8 a. Obtain the relation between atomic radius and the lattice constant in the case of BCC structure. Also find the atomic packing factor in the case of simple cubic and face centered cubic system. **(06 Marks)**

b. Explain unit cell and lattice parameters. Draw the crystal plane $(\bar{1}\ \ 3\ \ 2)$ in a cubic unit cell. **(06 Marks)**

c. A monochromatic X-ray beam of wavelength 0.7 A° undergoes first order Bragg reflection from the plane (3 0 2) of a cubic crystal at a glancing angle of 35°. Calculate the lattice constant. **(04 Marks)**

Module-5

9 a. Explain the construction and working of Reddy shock tube. Mention any one characteristics of Reddy tube. **(06 Marks)**

b. Write note on Ball milling method of preparation of nano materials. **(04 Marks)**

c. Explain the conservation of mass, momentum and energy with respect to shock wave. **(06 Marks)**

OR

10 a. Explain three different structures of carbon nano tube. Write any one properties of carbon nano tube. **(07 Marks)**

b. Define Mach number. Explain subsonic and supersonic waves. **(05 Marks)**

c. Describe the arc discharge method of preparing carbon nano tubes. **(04 Marks)**

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