

CBCS Scheme

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BANGALORE - 560 037

15PHY12/22

First/Second Semester B.E. Degree Examination, June/July 2018 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: Planck's constant $h = 6.63 \times 10^{-34}$ JS, Mass of electron $M_e = 9.11 \times 10^{-31}$ kg
Boltzmann constant $K = 1.38 \times 10^{-23}$ J/K, Avogadro's number $N_A = 6.025 \times 10^{+26}$ /Kmole,
Velocity of light $C = 3 \times 10^8$ m/s. mass of neutron $m_n = 1.678 \times 10^{-27}$ kg.

Module-1

- 1 a. Define Group velocity and phase velocity show that group velocity is less than phase velocity. (06 Marks)
- b. Using Schrodinger's time independent wave equations arrive at the expression for eigen values. (06 Marks)
- c. A particle of mass $\frac{0.65 \text{ MeV}}{C^2}$ has Kinetic energy 80eV. Find the de-Broglie wavelength, group velocity and phase velocity of de-Broglie (where C is velocity of light). (04 Marks)

OR

- 2 a. Set up dimensional time independent Schrödinger wave equation. (06 Marks)
- b. What is a black body? Discuss why the Blackbody radiation spectrum could not be explained by the Wien's and Rayleigh Jean's theories. (05 Marks)
- c. Compare the energy of a photon with that of a neutron when both are associated with wavelength of 1°A . (05 Marks)

Module-2

- 3 a. What are the assumptions of classical free electron theory? Define i) Mean free path ii) Drift velocity. (06 Marks)
- b. What is Fermi factor? Discuss the dependence of Fermi factor on temperature and effect on occupancy of energy levels. (06 Marks)
- c. Calculate the Fermi temperature (T_F) and Fermi Velocity (V_F) in case of copper metal with Fermi energy 6.8eV. (04 Marks)

OR

- 4 a. Explain the merits of Quantum free electron theory. (06 Marks)
- b. Describe the types of superconductors. (05 Marks)
- c. What is superconductivity? Explain the working of Maglev vehicles. (05 Marks)

Module-3

- 5 a. With suitable diagrams, explain the types of optical fibers. (06 Marks)
- b. Describe construction and working of semiconductor laser with energy band diagram. (06 Marks)
- c. A laser pulse with power per pulse of 1mW lasts 10ns. If the number of photons emitted per pulse is 3.491×10^7 . Calculate wavelength of laser. (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.

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OR

- 6 a. Explain the terms population inversion and metastable state. Discuss the requisites of a typical laser. (06 Marks)
- b. What is attenuation? Discuss various factors that contribute to loss of signal strength during propagation of light through optical fiber. (06 Marks)
- c. Numerical aperture of an optical fiber is 0.3 when surrounded by air. Determine the refractive index of its core given the refractive index of cladding is 1.59. Also find the acceptance angle when it is in a medium of refractive index 1.33. (04 Marks)

Module-4

- 7 a. Define Miller indices and obtain expression for inter-planar spacing in terms of Miller Indices in cubic structure. (06 Marks)
- b. What is polymorphism and Allotropy? Show that Atomic packing factor in SCC is 0.52 and in fcc is 0.74. (06 Marks)
- c. Draw the following crystal planes (132), (001), (101) and (OTO). (04 Marks)

OR

- 8 a. Define atomic packing factor and co-ordination number Determine the co-ordination number in BCC structure. (04Marks)
- b. Discuss briefly the seven crystal systems. Draw crystal structures for cubic system. (08 Marks)
- c. A monochromatic beam of electrons with Kinetic energy 235.2eV undergoes first order Bragg reflection in a crystal at a glancing angle of $9^{\circ}12'35''$. Calculate the interplanar spacing. (04Marks)

Module-5

- 9 a. What are nano-materials? Explain the Arc discharge method of manufacturing Carbon nanotubes. (06 Marks)
- b. Explain the principle construction working of scanning Electron microscope with neat sketch. (06 Marks)
- c. Define terms : i) Shock wave ii) Mach number iii) Subsonic iv) Supersonic waves. (04 Marks)

OR

- 10 a. Describe the hand operated Reddy shock tube with a neat diagram. (06 Marks)
- b. Explain the Sol-Gel method of manufacturing nanomaterials. (05 Marks)
- c. Discuss five important applications of shock waves. (05 Marks)

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