

CBCS Scheme

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15PHY12/22

First/Second Semester B.E. Degree Examination, Dec.2017/Jan.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: $h = 6.625 \times 10^{-34}$ JS, $M_e = 9.1 \times 10^{-31}$ kg, $K = 1.38 \times 10^{-23}$ J/K,
 $C = 3 \times 10^8$ m/s, $e = 1.602 \times 10^{-19}$ C, $N_A = 6.025 \times 10^{+26}$ /k mol.

Module-1

- 1 a. Explain the energy distribution in the spectrum of a blackbody. (05 Marks)
- b. Set up time independent Schrödinger wave equation in one dimension. (07 Marks)
- c. A particle of mass $0.5 Me V/c^2$ has kinetic energy 100eV. Find its de-Broglie wavelength. (04 Marks)

OR

- 2 a. Define phase velocity and Group velocity. Show that group velocity is equal to particle velocity. (06 Marks)
- b. State and explain Heisenberg's uncertainty principle. (06 Marks)
- c. An electron is bound in one dimensional potential well of width 0.18nm. Find the energy value in eV of the second excited state. (04 Marks)

Module-2

- 3 a. What is superconductivity? Explain superconductivity on the basis of BCS theory. (06 Marks)
- b. Explain the failures of classical free electron theory. (06 Marks)
- c. Calculate the probability of an electron occupying an energy level 0.02 eV above the Fermi level at 400K in a material. (04 Marks)

OR

- 4 a. What is Fermi factor? Discuss the probability of occupation of various energy states by electrons at $T = 0^\circ\text{K}$ and $T > 0^\circ\text{K}$ on the basis of Fermi factor. (06 Marks)
- b. What is Meissner effect? Explain the working of maglev. (06 Marks)
- c. The electron mobility and hole mobility of silicon are $0.17\text{m}^2/\text{volt-sec}$ and $0.035\text{m}^2/\text{volt-sec}$ respectively at room temperature. If the carrier density is known to be $1.1 \times 10^{16}/\text{m}^3$, calculate the resistivity of silicon semiconductor material. (04 Marks)

Module-3

- 5 a. Derive the expression for energy density of radiation in terms of Einstein's coefficients. (06 Marks)
- b. With neat diagrams explain the different types of optical fibers. (06 Marks)
- c. A medium in thermal equilibrium at temperature 300K has two energy levels with a wavelength separation of $1\mu\text{m}$. Find the ratio of population densities of the upper and lower levels. (04 Marks)

OR

- 6 a. What is Holography? With a neat diagram, explain the construction, reconstruction of Hologram. (06 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.

- b. What is numerical aperture? Obtain an expression for numerical aperture in terms of refractive indices of core and cladding. (06 Marks)
- c. The attenuation of light in an optical fiber is 3.6dB/km, what fraction of its initial intensity remains after i) 1km ii) 3km? (04 Marks)

Module-4

- 7 a. What are Miller indices? Derive the expression for the interplanar spacing in terms of Miller indices. (06 Marks)
- b. Describe the construction and working of Bragg's X-ray spectrometer. (06 Marks)
- c. First order Bragg reflection occurs when a monochromatic beam of X-rays of wavelength 0.675\AA is incident on a crystal at a glancing angle of 45° . What is the glancing angle for third order Bragg reflection to occur? (04 Marks)

OR

- 8 a. Define coordination number and atomic packing factor. Calculate the coordination number for sc, bcc and fcc structures. (07 Marks)
- b. Derive Bragg's law. (05 Marks)
- c. Draw the crystal planes (100) (200) (001) and (011) in a cubic unit cell. (04 Marks)

Module-5

- 9 a. What is Mach number? Distinguish between acoustic, ultrasonic, subsonic and supersonic waves. (05 Marks)
- b. What are nanomaterials? Explain the Sol – Gel method of synthesis of nano-materials. (07 Marks)
- c. In a scanning electron microscope, electrons are accelerated by an anode potential difference of 60kV. Estimate the wavelength of the electron in the scanning beam. (04 Marks)

OR

- 10 a. What is a shock wave? Describe the construction and working of Reddy's shock tube. (07 Marks)
- b. What is a carbon nano tube? Explain how it is synthesized using pyrolysis method. (05 Marks)
- c. Mention the principle and three applications of SEM. (04 Marks)

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