



SVKM'S NMIMS
MUKESH PATEL SCHOOL OF TECHNOLOGY MANAGEMENT & ENGINEERING

Program: B. Tech (All Streams)

Academic Year: 2018-2019

Year: I Semester : I

Subject: Engineering Physics

Marks: 70

Date : 10 January 2019

Time: 2.00 pm to 5.00 pm

Durations: 3 (hrs)

No. of Pages: 02

Re-examination (2017-18)

Instructions: Candidates should read carefully the instructions printed on the question paper and on the cover of the Answer Book, which is provided for their use.

- 1) Question No. 1 (ONE) is compulsory.
- 2) Out of remaining questions, attempt any FOUR questions.
- 3) **In all FIVE questions to be attempted.**
- 4) All questions carry equal marks.
- 5) **Answer to each new question to be started on a fresh page.**
- 6) **Figures in brackets on the right hand side indicate full marks.**
- 7) **Assume suitable data, if necessary.**

[Data given: Electronic mass, $m_e = 9.1 \times 10^{-31}$ kg, Electronic charge, $e = 1.6 \times 10^{-19}$ C, Planck's constant, $h = 6.625 \times 10^{-34}$ J-s = 4.14×10^{-15} eV-s, speed of light, $c = 3 \times 10^8$ m/s, Boltzmann's constant, $k = 8.625 \times 10^{-5}$ eV/K.]

Q. 1 Attempt any seven

- a. What is a crystal? How it is different from the amorphous materials? [2]
- b. Explain two types of point defect with proper diagram. [2]
- c. Draw the following plane and direction with reference to the cubic unit cell (3-12), [110]. [2]
- d. How can Lissajous patterns be used to find out unknown frequencies using a cathode ray oscilloscope? [2]
- e. Explain isotope effect of superconductor. [2]
- f. Define any two electrical properties of materials. [2]
- g. Why it is not possible to obtain laser with a two level system? [2]
- h. Optical power of 1 mW is launched into an optical fiber of length 100 m. If the power emerging from the other end is 0.2 mW, calculate the fiber attenuation. [2]
- i. What are coherent waves? How do we define optical path? [2]

Q. 2

- a. What are ligancy and critical (limiting) radius ratio? Calculate the critical radius ratio for ligancy 6. [6]

- b. Determine the wavelength of X-ray beam incident at 12° for the first order reflection from a calcite crystal, if the inter-planar spacing for the crystal is 3.035 \AA . [4]
- c. An electron beam passes through a magnetic field of $3 \times 10^{-3} \text{ wb/m}^2$ and an electric field of $6 \times 10^4 \text{ V/m}$ both acting simultaneously at right angles to each other and to the path of electrons. If the electrons path remains unchanged, find the speed of electrons. If the electric field is removed what will be the radius of the electron path? [4]

Q. 3

- a. What is a Hall effect? How it can be used to determine (i) mobility (ii) carrier concentration. [6]
- b. The electron and hole mobilities in a Si sample are 0.135 and $0.048 \text{ m}^2/\text{V-s}$ respectively. If the conductivity of intrinsic Si at 300 K is $4.39 \times 10^{-4} (\Omega\text{-m})^{-1}$, determine the intrinsic carrier concentration of Si at that temperature. [4]
- c. A step index fiber has a core diameter of $40 \text{ }\mu\text{m}$ and core and cladding refractive indices are 1.461 and 1.456 , respectively. It's working at a wavelength of 850 nm . Find out the V-number and the number of modes guided in the core. [4]

Q. 4

- a. Obtain the expression for velocity of an electron moving in a mutually perpendicular electric and magnetic field. Hence explain the working of a velocity selector. [6]
- b. Differentiate between type I and type II superconductors. [4]
- c. The transition temperature of mercury with atomic mass of 199.5 amu is 4.185 K . Find the transition temperature of its isotope with atomic mass 203.4 amu . [4]

Q. 5

- a. Derive the conditions for constructive and destructive interference in a plane parallel film due to reflected light with proper diagram. [6]
- b. Define and derive an expression for the dispersive power of a grating. [4]
- c. What are the advantages of optical fiber *vis-à-vis* conventional metal wires? [4]

Q. 6

- a. Explain the construction and working of any gas laser. [6]
- b. Discuss different loss mechanisms encountered in an optical fiber. [4]
- c. Ruby laser has its metastable state at 1.79 eV above the ground level from which the stimulated emission produces laser light. Calculate the wave length of the light. If 1.1 mole of Cr^{+3} ions are involved in population inversion process in a pulse, calculate the pulse energy. [4]

Q. 7

- a. Describe three of mechanical properties of materials. [6]
- b. Write short notes on different medical applications of ultrasonic waves. [4]
- c. Calculate the frequency of the ultrasonic wave produced due to an iron rod of length 12 cm used in magnetostriction oscillator. Density from iron = $7.23 \times 10^3 \text{ kg/m}^3$. Young's modulus of iron = $11.6 \times 10^{10} \text{ N/m}^2$. Why ultrasonic waves are used for echo sounding technique. [4]