1E2003
B. Tech I Sem. (Main/Back) Exam. Jan-Feb 2013
103 Engineering Physics – I
Common to all Branches

Time: 3 Hours

Maximum Marks: 80
Min. Passing Marks: 24

Instructions to Candidates:

Attempt any five questions, selecting one question from each unit. All questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

UNIT – I

Q.1 (i) Explain the working of Michelson's interferometer. How will you produce circular fringes with it? How will you measure the difference in wavelength between the D lines of sodium light? [4+4+4]

(ii) Write a note on the interference filters. [4]

OR

Q.1 (i) Explain how Newton's rings are formed and describe the method for determination of wavelength of light using Newton's rings. [4+4]

(ii) Newton's ring avengement is used with a source emitting two wavelengths λ_1 and λ_2. It is found that the nth dark ring due to λ_1 concides with $(n+1)^{th}$ dark ring due to λ_2. Find the diameter of the nth dark ring for wavelength λ_1 = 600nm if λ_2 = 590nm and radius of curvature of the lens is 0.9m [8]

UNIT-II

Q.2 (i) Explain what you mean by polarizations of light. Distinguish between polarised light and unpolarised light. [4+4]

(ii) Explain the phenomenon of double refraction in a calcite crystal. What happens when two such crystals are rotated relative to one another? [3+3]

(iii) Write a short note on the law of Malus. [2]

OR

Q.2 (i) What do you understand by a quarter-wave plate and a half–wave plate? If you are given a quarter-wave plate, a half-wave plate and a simple glass plate, how will you proceed to distinguish them from each other? [2+3]

(ii) Explain how a quarter – wave plate and a half – wave plate could be constructed. Describe their properties. [3+2]

(iii) A sugar solution in a glass tube of 20cm. length produces an optical rotation of $13°$. The solution is then diluted to one–third of its previous concentration. Estimate the optical rotation produced by a 30cm. long glass tube containing the diluted solution. [6]

UNIT-III

Q.3 (i) What do you mean by diffraction of light? What is the difference between interference and diffraction of light? [4+4]

(ii) Describe and explain the nature of fringes obtained with the help of a single slit placed in front of a parallel beam of monochromatic light. [4+4]

OR

Q.3 (i) Obtain an expression for the dispersive power of a grating. [4]

(ii) What are the differences between Grating and Prism spectra? [4]

(iii) For a given plane transmission grating having 5000 lines /cm. answer the following:

(a) For a wavelength of 600nm., what is the highest order of spectrum observed? [4]

(b) If opaque spaces are exactly twice the transparent spaces, which order of spectra will be absent? [4]

UNIT-IV

Q.4 (i) Explain what is 'ionic bonding'. Explain how the force of attraction between two atoms or ions vary as they are brought closer. [4+4]

(ii) (a) Define Fermi function and Fermi energy. [4]

(b) Explain with graph, the variation of Fermi function with temperature. [4]

OR

Q.4 (i) Describe the formation of energy band in solids and hence explain how it helps to classify the materials into conductors and insulators. [2+2]

(ii) In an intrinsic semiconductor show that the Fermi level lies in the middle of its forbidden gap. [4]

(iii) The energy gap of two intrinsic semiconductors A and B 0.36eV and 0.72eV respectively. Compare the intrinsic career density of A to B at 300K (Given $m_h = m_e = 9*10^{-31}$ Kg and 2kT = 0.052eV) [8]

UNIT-V

Q.5 (i) What is 'length contraction' and 'time dilation' in relativistic mechanics? Explain.

[4+4]

(ii) Describe experiment verification of time dilation. [8]

OR

Q.5 (i) Prove the relation $E^2 = p^2c^2 + m_o^2c^4$, where p is momentum, m_o is the rest mass and c is speed of light. [8]

(ii) Calculate the velocity of a particle having kinetic energy three times the rest mass energy. [8]