1E2003

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1E2003

B. Tech. I Sem. (Back) Exam., Dec. - 2017

103 (O) Engineering Physics - I

Time: 3 Hours **Maximum Marks: 80**

Min. Passing Marks: 26

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.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

UNIT-I

Q.1 (a) Explain the working of Michelson's interferometer with the help of schematic diagram. How will you use it to measure wavelength separation between two closely spaced lines (say D_1 and D_2 lines) of Sodium lamp? [4+6=10]

(b) What happens in case of Newton's rings if Plano- convex lens is replaced by a Plano -concave lens? [3]

(c) In a Newton's ring experiment, the diameter of 10^{th} ring changes from 1.50 cm to 1.25 cm when a liquid is introduced between the lens and the plate. Calculate the refractive index of the liquid. [3]

OR

Q.1 (a) How will you measure wavelength of light used in Newton's ring experiment? Derive the formula used. [7+3=10]

(b) Explain why a thin film illuminated with white light exhibits many colours? [3]

(c) When the movable mirror of Michelson's interferometer is moved through 0.05896 mm, a shift of 260 fringes is observed. What is the wavelength of light used? [3]

UNIT-II

Q.2 (a) Using the concept of electric vector of electromagnetic wave, discuss plane, circularly and elliptically polarized light in detail. [10]

(b) How will you differentiate the three sources of light having the same physical appearance; partially polarized, elliptically polarized and mixture of unpolarized and circularly polarized light. [3]

(c) 90 gm of impure sugar when dissolved in a litre of water gives an optical rotation of 10.9° when placed in a tube of length 20 cm. If use specific rotation of sugar is $66°(cm)^{-1}\ (gm/cc)^{-1}$, find the percentage purity of Sugar sample. [3]

OR

Q.2 (a) Describe the construction and working of Biquartz's Polarimeter. How it is used to determine the specific rotation of glucose solution. [6+4=10]

(b) Explain the working of a Nicol prism. Mention its limitations. [3+1=4]

(c) Plane polarized light is incident on a piece of quartz cut parallel to optic axis. What is the least thickness for which the ordinary and the extraordinary rays combine to form plane polarized light.

(Given $\mu_o = 1.5442$, $\mu_E = 1.5533$ and $\lambda = 5000$ A°) [2]

UNIT-III

Q.3 (a) Discuss the phenomenon of Fraunhofer's diffraction at single slit and show that the relative intensities of successive maxima are

$$1 : \frac{4}{9\pi^2} : \frac{4}{25\pi^2} : \frac{4}{49\pi^2} \ \ldots\ldots\ldots$$ [10]

(b) In particular grating the Sodium doublet (5890 A° and 5896 A°) is viewed in 4th order at 86° to the normal and is barely resolved. Find- [2+2+2=6]

(i) the grating spacing

(ii) the resolving power of grating, and

(iii) the least wave length difference, that can be resolved

OR

Q.3 (a) Explain Rayleigh criterion for resolution and apply it to deduce an expression for due resolving power of a diffraction grating. [3+6=9]

(b) Derive the condition of absent spectra in diffraction grating. [3]

(c) Diffraction pattern of a single slit of width 5 mm is formed by a lens of focal length 50 cm. Calculate the distance between the first dark and the next bright fringe from the axis. (Given $\lambda = 5000$ A°) [4]

UNIT-IV

Q.4 (a) Describe the formation of energy bands in solids and hence explain how it helps to classify the solids into conductor, semiconductor and insulators [6+4=10]

(b) Why, crystals are suitable for the study of diffraction of X-rays. [2]

(c) A semiconducting crystal 10 mm long, 6 mm wide and 2 mm thick has a magnetic flux density of 0-6 Weber/m^2 applied from front to back perpendicular to the largest faces when a current of 20 mA flows length wise through the specimen, the voltage measured across its width is to be 38 μv, what is the Hall coefficient of this semiconductor. [4]

OR

Q.4 (a) Explain the terms mobility of charge carriers and Hall Effect. Obtain an expression for the Hall coefficient in terms of the density of conduction electrons and explain how it is used to determine the mobility of charge carries. [2+2+6+2=12]

(b) Derive an expression for the band gap of a semiconductor and explain how it is calculated experimentally. [4]

UNIT-V

Q.5 (a) State the postulates of the special theory of relativity and derive the expression for velocity transformation. [2+8=10]

(b) Prove that the particle having rest mass zero is always moving with velocity of light. [3]

(c) A stationary body explodes into two fragments each of rest mass 2.0 kg that moves apart at speeds of 0.8c relative to the original body. Find out the rest mass of the original body. [3]

OR

Q.5 (a) Derive relativistic expression for the mass of a particle moving with velocity-v [8]

(b) What is relativity of simultaneity and relativity of colocality? Explain. [4]

(c) A radioactive atom moves with a velocity v = 0.2c along the x – axis of the system s. It emit a β - particle of velocity 0.85c relative to the system s' in which the radioactive atom is rest. Find its speed relative to s. [4]
