1E2003

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1E2003

B. Tech. I - Sem. (Back) Exam., Dec. 2019

Common to all Branch

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) Describe the construction and working of Michelson interferometer. How would you use it to measure the wavelength of monochromatic light? [5+5=10]

(b) When a thin film of a transparent material of refractive index 1.5 for wavelength 5890 Å is inserted in one of the arms of a Michelson's interferometer, a shift of 65 circular fringes is observed. Calculate the thickness of the film. [6]

OR

Q.1 (a) Explain the formation of the Newton's rings in reflected light. Prove that the diameter of dark rings are proportional to the square root of the natural number. [5+5=10]

(b) In Newton's ring experiment by reflected light the diameters of the 4^{th} and 12^{th} dark rings are 0.4cm and 0.7cm, respectively. Find the diameter of the 20^{th} dark ring. What will be the order of dark ring which is formed where the thickness of air film is equal to wavelength of light used. [5+1=6]

UNIT- II

Q.2 (a) Using the concept of electric vector of electromagnetic wave, discuss plane, circularly and elliptically polarized light. [8]

OR

(b) What is Quarter wave plate? Explain how it is used to analyse - [2+3+3=8]

(i) Elliptically polarized light and

(ii) Circularly polarized light

Q.2 (a) What do you mean by optical rotation. Discuss how will you measure specific rotation of sugar solution using Laurent's half shade Polarimeter. [8]

OR

(b) A tube of sugar solution 20cm long is placed between crossed Nicols and illuminated with light of wavelength 6000 Å. If the optical rotation produced is 13° and the specific rotation is $65°(cm^{-1})\ (g/cm^3)^{-1}$, determine the strength of the solution. [8]

UNIT- III

Q.3 (a) Discuss Fraunhofer's diffraction due to simple slit. Derive the expression for its intensity and show that the intensities of first and secondary maxima are respectively $\frac{1}{22}$ and $\frac{1}{61}$ of the intensity of central maxima. [8]

(b) Examine if two spectral lines of wavelength 5890Å and 5896Å, can be clearly resolved in the- [8]

(i) First order and

(ii) Second order by a diffraction grating 2cm wide and having 425 lines/cm.

OR

Q.3 (a) Give theory of plane transmission grating and show how will you determine wavelength of light. [8]

(b) Parallel light (5000 Å) is normally incident on a slit. The central maxima spreads out at 30° on both sides of the direction of the incident light. Calculate the width of slit. For what width of the slit, the central maxima would spread out to 90° from the direction of incident light? [6+2=8]

UNIT- IV

Q.4 (a) What do you mean by the term "bonding in solid" Explain covalent and metallic bonding. [2+3+3=8]

(b) The Hall voltage for the metal sodium is 0.001mV measured at current I=100mA and magnetic field B=2 Tesla. The width of the specimen and conductivity of sample are 0.05mm and $2.09\times10^{7}\ \Omega^{-1}\ m^{-1}$, respectively. Calculate – [8]

(i) The number of carriers per cubic meter in sodium and

(ii) The mobility of electrons in sodium.

OR

Q.4 (a) Derive an expression for the conductivity of a semiconductor. [8]

(b) Write short notes on the following –

(i) X-ray diffraction & Bragg's law [4]

(ii) Hall effect [4]

UNIT- V

Q.5 (a) Using principal of special theory of relativity, derive expression for relativistic variation of mass with velocity. [8]

(b) Show that addition of any velocity to the velocity of light merely reproduces the velocity of light [4]

(c) Show that massless particles can exist only if they move with the speed of light. [4]

OR

Q.5 (a) Deduce Einstein's mass-energy relation $E=mc^2$. Show that the total energy E and momentum p are related as $E^2 = p^2c^2 + m_0^2c^4$, where m_0 is the rest mass and c is speed of light.. [6+4=10]

(b) The mean life time of muon at rest is 2.2×10^{-6} sec. Calculate the average distance it will travel in vacuum before decay, if its velocity is 0.9c. [6]
