Hall Ticket No | | | | | | | | | | | Question Paper Code: AHSB04

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Four Year B.Tech I Semester End Examinations (Supplementary) - January, 2019

Regulation: IARE – R18

WAVES AND OPTICS

Time: 3 Hours **(Common to AE | ME | ECE)** **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1. (a) Considering dual nature of electron, Derive Schrodinger's time independent wave equation for the motion of an electron. **[7M]**

   (b) An electron is accelerated by a potential difference of 150V. what is the wavelength of that electron wave. **[7M]**

2. (a) Using Planck's and Einstein's theory of radiation, Show that the wavelength associated with an electron of mass 'm' and kinetic energy 'E' is given by $\frac{h}{\sqrt{2mE}}$. **[7M]**

   (b) Calculate the minimum energy of an electron that can possess in an infinitely deep potential well of width 4nm. **[7M]**

UNIT – II

3. (a) On the basis of band theory classify the solids into conductor, semiconductor and insulator.**[7M]**

   (b) Calculate Hall voltage developed across the width of the slab of a metallic slab carrying a current of 30A is subjected to a magnetic field of 1.75T. The magnetic field is perpendicular to the plane of the slab and to the current. The thickness of the slab is 0.35cm. The concentration of free electrons in the metal is 6.55 x 10^{28}electrons/m^3. . **[7M]**

4. (a) Describe an experimental setup for the measurement of hall voltage and give its applications. **[7M]**

   (b) Calculate the density of charge carriers of semiconductor, given the Hall coefficient is -6.85 × 10^{-5} m^3/Coulomb. **[7M]**

UNIT – III

5. (a) Explain the working of ruby laser with a neat diagram. Mention its advantages and disadvantages. **[7M]**

   (b) Calculate the wavelength of emitted radiation from a semiconductor diode laser, which has a band gap of 1.44eV. **[7M]**

6. (a) With a neat diagram discuss principle and construction of optical fibre **[7M]**

   (b) An optical fibre has a core material of refractive index of 1.55 and cladding material of refractive index of 1.50. The light is lunched into in air. Calculate its numerical aperture. **[7M]**

UNIT – IV

7. (a) State and explain Huygens principle with a neat diagram. **[7M]**

   (b) Two slits 0.125mm apart are illuminated by a light of wavelength 4500 A°. The screen is 1m away, from the plane of the slit. Find the separation between 2nd bright fringe on both sides of the central maximum. **[7M]**

8. (a) What are Newton's rings and how are they formed ? Explain how Newton's rings setup can be used for the determination of wavelength of monochromatic source of light? **[7M]**

   (b) In a grating, which spectral line in 4th order will overlap with 3rd order line of 5419 A^0? **[7M]**

UNIT – V

9. (a) What is damped oscillation? Derive equation of motion for damped Oscillation. Discuss condition for over damped motion. **[7M]**

   (b) A body of mass 5 gms is subjected to an elastic force of 40 dyne/cm, and a frictional force of 5 dyne-sec/cm. If it is displaced through 2 cm and then released. Find whether the resulting motion is oscillatory or not? Also find the time period if it is oscillatory. **[7M]**

10. (a) Distinguish between free and forced oscillations. **[7M]**

    (b) The wave function for a light wave is given by E(z,t) = 103 sin π(3 x 10^6X - 9 x10^{14} t) Determine the speed, wavelength and frequency of the wave? **[7M]**

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