2E1003

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B. Tech. I Year II Semester (Old Back) Examination, June/July-2011

Physics

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

Min. Passing Marks : 24

Instructions to Candidates:

*Attempt overall **five** questions selecting **one** question from **each** unit. All questions carry **equal** marks.*

Unit - I

1. a) i) Describe the construction and working of Michelson inter Ferometer. How would you use it to measure the wavelength of monochromatic light? **(8)**

ii) Show that the plane polarised and circularly polarised light are special case of elliptically polarised light. **(6)**

iii) The refractive indices of some transparent material for right handed and left handed circularly polarised light of sodium (wavelength 5893 A°) are 1.54427 & 1.54420 respectively. Calculate the specific rotation of that material. **(2)**

OR

b) i) Show that the linearly polarised light can be represented as a superposition of two circularly polarised lights of suitable amplitude and phases. **(8)**

ii) Explain the formation of Newton's rings in reflected light. Prove that the diameters of the dark rings are proportional to the square root of the natural numbers. **(6)**

iii) A single layer of coating of thickness $\frac{\lambda}{4}$ is deposited on a convex lens of $\mu g = 1.9$ to reduce its reflectivity minimum. What is the refractive index of coating? **(2)**

Unit - II

2. a) i) With necessary theory explain the formation of spectrum by a plane transmission grating when composite light falls on it normally. (7)

ii) Explain Rayleigh's criterion of resolution. (5)

iii) Describe the method of recording the hologram and reconstruction of image from it. (4)

OR

b) i) Derive an expression for the intensity of diffracted light in the Fraun hofer's diffraction due to a single slit. (7)

ii) Give briefly the requirements for holography and mention various properties of a hologram. (5)

iii) Derive an expression for the resolving power of a grating. (4)

Unit - III

3. a) i) Compare coherence in the case of an ordinary source and a LASER. (4)

ii) Explain the terms absorption, spontaneous emission and stimulated emission. (4)

iii) Write notes on following :-

a) optical fibre (2)

b) High intensity of LASER (2)

c) High directionality of LASER (2)

d) Q-switching. (2)

OR

b) i) Derive the relation between Einstein's coefficient and discuss the result. (4)

ii) Describe the laser action in He-Na laser with energy diagram. (4)

iii) a) What is mode locking? (2)

b) Discuss the application of laser in scientific investigations. (2)

c) What is semiconductor laser? **(2)**

d) In a typical optical fibre the refractive indices of the core and cladding materials are 1.55 and 1.53 respectively. Calculate the numerical aperture of the optical fibre. **(2)**

Unit - IV

4. a) i) Explain the term threshold frequency and stopping potential. How does the emission of photo electron depend on the intensity and the frequency of incident light? **(4)**

ii) What is compton scattering? Obtain an expression for shift in wavelength of the scattered photon by compton scattering. **(6)**

iii) a) Mention the differences between photo electric effect and compton effect. **(2)**

b) Discuss the physical interpretation of wave function and its properties. **(2)**

c) Find the lowest energy of an electron confined to move in one dimensional potential box of length $1A^{o}$. **(2)**

OR

b) i) Describe Heisenberg's uncertainty principle and apply it to explain non-existence of electron in nucleus. **(3)**

ii) What is potential barrier? Calculate the reflection and transmission coefficients of rectangular potential barrier for $E > V_o$. Also prove that the transmission coefficient will be one for certain values of energy. (7)

iii) a) Defining fermi energy, explain the Fermi-Dirac distribution law. **(2)**

b) Write a note on Sommer field theory of free electrons. **(2)**

c) Calculate the number of energy states available for the electrons in a cubical box of side 1cm below Fermi energy 3 eV. **(2)**

Unit - V

5. a) i) State the postulates of special theory of relativity and deduce Lorentz transformations. **(7)**

ii) Show that relativistic invariance of conservation of momentum leads to variation of mass with velocity. **(7)**

iii) If 1 gram of matter could be converted entirely into energy, what would be the cost of energy so produced at Rs. 2 per KWh? **(2)**

OR

b) i) Describe the principle of radiation detector based on the production of ionization. Hence explain the difference between them. **(7)**

ii) Explain the terms plateau, avalanche, quenching and dead time in Geiger-Muller counter. How quenching is achieved in it? **(7)**

iii) In a GM counter on an average 10^{10} electrons/count are collected. If count rate is 10 per second, then find the ionisation current. **(2)**
