23/05/2017

F.E. SEM - II CBSGS / MAY 2017

Q. P. Code: 11965

Time: 2 Hours **Marks: 60**

N.B. 1) **Question No.1** is compulsory.

2) Attempt **any three** questions from **Q. No. 2 to 6.**

3) Figures to the right indicate **full marks.**

Q.1 Attempt any **FIVE.** 15

a) Why does an excessively thin film appear to be perfectly dark when illuminated?

b) A grating has 620 rulings /mm & is 5.05 mm wide. What is the smallest wavelength interval that can be resolved in the third order at λ = 481 nm?

c) Why would you recommend use of optical fibre in communication system?

d) An electron is bound in a one dimensional potential well of width 2 A^0 but of infinite height. Find its energy values in the ground state and first excited state?

e) Explain the measurement of frequency of AC signal using Cathode Ray Oscilloscope?

f) Distinguish between spontaneous emission & stimulated emission?

g) Define superconductivity, critical temperature & critical magnetic field.

Q.2 a) How is Newton's ring experiment used to determine wavelength of a monochromatic source of light? In Newton's rings experiment the diameter of n^{th} & $(n+8)^{th}$ bright rings are 4.2 mm & 7 mm respectively. Radius of curvature of the lower surface of lens is 2m. Determine the wavelength of light? 8

b) An optical fibre has core diameter of 6 μ m and its core refractive index 1.45. The critical angle is 87^0. Calculate I) refractive index of cladding ii) acceptance angle Iii) the number of modes propagating through fibre when wavelength of light is 1 μ m. 7

Q.3 a) With neat energy level diagram explain principle, construction & working of He- Ne laser? 8

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b) Derive condition for maxima & minima of the light reflected from a thin transparent film of uniform thickness. A parallel beam of sodium light strikes a film of oil floating on water. When viewed at an angle of 30^0 from normal, 9^{th} dark band is seen. Determine the thickness of the film. Refractive index of oil is 1.46, λ=5890 A^0. 7

Q.4 a) Explain experimental method to determine the wavelength of spectral line using diffraction grating? 5

b) Show that an electron cannot pre-exist in free state in a nucleus. 5

c) Distinguish between type I & type II superconductor? 5

Q.5 a) A diffraction grating used at normal incidence gives a yellow line (λ =6000 A^0) in a certain spectral order superimposed on a blue line(λ = 4800 A^0) of next higher order if the angle of diffraction is $\sin^{-1}(3/4)$, calculate the grating element? 5

b) Derive one dimensional time dependent Schrodinger's equation for matter waves? 5

c) With neat diagram explain construction & working of Scanning Electron Microscope. 5

Q.6 a) Find the de Broglie wavelength & velocity of an α particle of energy 1 keV. Given Mass of α particle = 6.68×10^{-27} kg. 5

b) Derive Bethe's law for electron refraction? 5

c) What are Carbon Nano tubes? Explain properties of Nano tubes? 5

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