1E1003

Roll No. _____ [Total No. of Pages : 4]

1E1003

B.Tech. I - Sem.(Reback) Exam - Jan-Feb. 2012

103(O) - Physics

(Common to all Branches of Engg.)

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

Min. Passing Marks : 24

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. **Non-programable calculator** 2. **Nil**

UNIT - 1

Q(a) (i) Explain the formation of newtons rings in reflected light. Prove that the radius of the bright rings are proportional to the square root of the positive odd integer. 6

(ii) Explain the method for measurement of wavelength seperation between two closely spaced lines of sodium lamp. 4

(iii) How will you find whether a beam of light is plane-polarised, circularly polarised or elliptically polarised. 4

(iv) Plane polarized light is incident on a piece of quartz cut paralles to the axis. Find the least thickness for which the ordinary and extra ordinary rays combine to form plane polariged light given that.

$\mu_o = 1.5442$, $\mu_E = 1.5533$, $\lambda = 5 \times 10^{-5}$cm. 2

OR

(b) (i) What is optical rotation? Describe a polarimeter using a biquartz plate and explain how you would use it to find the specific rotation of an optically active substance. 6

(ii) Describe the construction and working of a Nicol prism and explain how it produces plane polarised light. 6

(iii) In a Michelson interferometer, when 100 fringes were shifted, the final reading of the screw was found to be 10.735mm. If the wavelength of the light was $5.92*10^{-7}$ m, what was the initial reading of the screw? 4

UNIT - 2

2(a) (i) Give the construction and theory of a plane transmission grating and explain the formation of spectra. How you would use it to find the wavelength of light. 6

(ii) Describe the method of recording the hologram and reconstruction of image from it. What advantages does a hologram possess over an ordinary photograph? 6

(iii) Sodium light is incident normally upon a plane transmission grating of 6000 lines/cm. Calculate the angular seperation of sodium lines of wavelengths 5896A° and 5890A° in second order spectrum. 4

OR

2(a) (i) Explain what is meant by resolving power of a grating? Deduce an expression for the same and discuss its dependence on vorious constants of grating. 6

(ii) Drive the condition for the missing order spectra for a diffraction grating. What patriculer order spectrum would be absent if the width of transparencies and opacities at a grating are equal? 6

(iii) A diffration grating used at normal incidence gives a green line $\lambda_1 = 5400$ Å in a certain order coincided on a violet line $\lambda_2 = 4050$Å if the next higher order. If the angle of diffraction is 53^0 how many lines are there in one am of the grating. 4

UNIT - 3

3.(a) (i) Derive the relation between Einstein's cofficient and discuss the results. 6

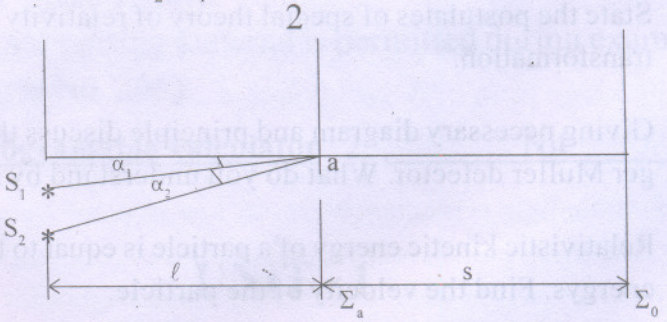
(ii) What is an optical fibre ? What do you mean by numerical aperture of an optical fibre? Find an expression for the numerical aperture of a step index optical fibre. 6

(iii) A typical optical fibre ($n_1 = 1.50$) with cladding ($n_2 = 1.40$) is used in water ($n_w = 1.33$) enviornment. Determine (i) the numerical aperture and (ii) the maximum acceptance angle. 4

OR

3(a) (i) Define visibility. Figure shows two incoherent quasimonochromatic point sources illuminating two pinholes in a mask. Show that the fringes formed on the plane of observation have minimum visibility when

$$a(\alpha_2 - \alpha_1) = \frac{m}{2}$$ 6



(ii) Describe the construction and working of He-Ne gas laser. How is population inversion achieved in such a laser. 6

(iii) A laser sources has a wavelength of 7000 A° and aperture 5mm. The laser beam is sent to moon, the distance of which from earth is 4×10^8 m. Calculate the arial spread when the beam reaches the moon. 4

UNIT - 4

4(a) (i) Explain why Compton effect is not observed experimentally for visible rays. Explain Compton scattering and obtain an expression for shift in wavelength af the scattered photon. 6

(ii) Derive Schrodinger time independent wave equation. Explain the followin : (i) Physical significance of the Wave function (ii) Normalised and orthogonalised wavefunction . 6

1E1003

(iii) Calculate the number of energy states available for the electrons in a cubical box of side 1 cm below Fermi Energy 3 ev. 4

OR

4(a) (i) What is tunnel effect. write dawn schrodingai equations for potantial barrier problem and steps to find out the transmission ctticient of a particle having less energy than the height of potantial barrier. 6

(ii) What is te density of stater in inetals obtain an expression for the density of stater for free electron gas in betal and hence find expression for the fermi energy. 6

(iii) For Potassium, the fermi energy is 2.14 ev and the density of electrons is 1.4X10 28/ m 3. Find the electron density of a metal for which fermi energy is 4.72 ev. 4

UNIT-5

5(a) (i) State the postulates of special theory of relativity and deduce Lorentz transformation. 6

(ii) Giving necessary diagram and principle discuss the working af a Geiger Muller detector. What do you understand by self quenching. 6

(iii) Relativistic kinetic energy of a particle is equal to three times the mass energys. Find the velocity of the particle. 4

OR

5.(a) (i) State the postulates of the spacial theory of relativlty and derive expression for velcity transformation. 6

(ii) Through a schematic diagram, explain operation of a scintillation counter. How shall you select phosphor for protons, β- particale, slow neutrons and fast neutrons. Obtain an expression for output voltage pulse when radiation of energy E falls on the counting system. 6

(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. 4