* U A - 6 0 0 9 *

UA-6009

First Year B. E. (Sem. I & II) Examination

April/May – 2012

Engg. Physics

Time : 3 Hours] [Total Marks : 100

Instruction :

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ F. Y. B. E. (SEM. 1 & 2)

Name of the Subject :

☛ ENGG. PHYSICS

☛ Subject Code No. : 6 0 0 9 ☛ Section No. (1, 2,.....) : Nil

Seat No. :

Student's Signature

Q.1 (a) Write the answer in short: **[10]**

(1) What are matter waves?
(2) Define bireferences.
(3) Laser light is a Polychromatic source. - True/False?
(4) State the types of coherence.
(5) What is the necessary condition to occur diffraction?
(6) Define diffraction grating.
(7) State the Malus law
(8) What is called population inversion?
(9) What is Ruby?
(10) Define interference.

(b) Answer any **two** questions from the following: **[12]**

(1) Obtain the relation between Einstein's coefficients.
(2) State the characteristics of ordinary and extra ordinary beam in detail.
(3) Discuss the Fraunhofer diffraction of circular aperture. Show that the first diffraction minimum is obtained at $\theta = 1.22\ \lambda f / d$

Q.2(a) Answer any **one** questions from the following: **[6]**

(1) Explain the construction and working of He-Ne laser.
(2) Give the characteristics and applications of laser.

(b) Solve any **one** from the following **[4]**

(1) A laser beam $\lambda = 6000\text{Å}$ on earth focused by lens of diameter 2 m on the moon. How big is the spot on the moon? (Distance between earth and moon is 4×10^5 km).
(2) What will be the wavelength of the emitted radiation when a H_2 atom is excited from its ground state(n=1) where its energy level $E_1 = -21.8 \times 10^{-19}$ J to the higher level(n=2) where energy level $E_2 = -5.4 \times 10^{-19}$ J and then falls back to the ground state E_o. ($h = 6.6 \times 10^{-34}$, $c = 3 \times 10^8$ m/sec).

Q.3 (a) Answer any **two** from the following [12]

(1) Explain the formation of Newton's rings and prove that the radius of the n^{th} dark ring is directly proportional to the square root of the natural number of the ring.

(2) Explain the term interference. Derive the equation for intensity at any point on the screen in Young's double slit experiment.

(3) State the derive Malus law for plane polarized light.

(b) Solve any **two** from the following [6]

(1) The diameter of 12^{th} dark ring changes from 1.52 cm to 1.32 cm when the liquid of refractive index μ is introduced between plate and lens. Calculate the refractive index of liquid.

(2) Two coherent sources of monochromatic light of wavelength 6000 Å. Produce an interference pattern on a screen kept at a distance of 200 mm from them. The distance between two consecutive bright fringes on the screen is 1.5 mm, find the distance between the two coherent sources.

(3) Calculate the minimum number of lines in a grating which will just resolve the sodium lines in the first order spectrum. The wavelengths are 5890 Å and 5896 Å.

Q.4 (a) Write the answer in short: [10]

(1) Define black body.

(2) State Ampere's law.

(3) Write Stefan's fourth power law.

(4) What do you meant by absorption and emission?

(5) Define spectral radiang.

(6) What is the Compton shift for scattery angle of $\phi = 90°$.

(7) Write the two units of strength of magnetic field.

(8) What is the main use of hall Effect?

(9) What will be the wavelength associated with electron moving with velocity 10^7 m/s?

(10) State Bragg's equation for X-ray diffraction.

(b) Answer any **two** questions from the following: [12]

(1) What is meant by high energy particle accelerator? Explain the construction and working principle of the cyclotron or betatron.

(2) What is a solenoid? Using Ampere's theorem, set up an expression for the magnetic induction (B) at a point on the axis of an infinitely long solenoid.

(3) Define three magnetic vectors. Derive an expression $B = \mu_0 H + \mu_0 \mu$.

Q.5(a) Answer any **one** questions from the following: [6]

(1) What is meant by cavity radiator? Why it is called ideal source of light? Give the Planck's hypothesis for cavity radiation. Give his spectral radiancy formula account the spectral radiancy distribution for cavity radiator.

(2) State the de=Broglic hypothesis for matter waves.Show that (a) the wavelength of the waves associated with electron accelerated under potential difference equal to V volt is (a) $\lambda = h / \sqrt{2}\, MeV$ (b) $uv = c^2$ symbols have their usual meaning.

(b) Solve any **one** from the following **[4]**

(1) What is a Toroid? Use Ampere's theorem to get toroid magnetic field at an inner point.

(2) A monovalent metal strip 1 cm wide and 0.5 cm thick is placed in the magnetic field of B = 1.2 tesla. If current of 50 Amp is set up in the strip, what hall potential difference appeals across the strip ? ($n = 8.4 \times 10^{28}$).

Q.6 (a) Answer any **two** from the following **[12]**

(1) Write the energy formula for electron in Hydrogen atom using (a) and (b); derive the formula. For frequency of the emitted photon and explain the Balmer spectrum.

(2) What is the photoelectric effect? Define the terms: (a) Threshold frequency (b) Shopping potential. Give the main features of the photoelectric effect.

(3) What is Compton's effect? Write an expression for Computon's shift and explain the experimental results.

(b) Solve any **two** from the following **[6]**

(1) X-ray with $\lambda = 1 \times 10\text{-}8$ cm are scattered from carbon block. The scattered radiation is viewed at 60° to the incident beam. What is the Compton's shift?

(2) A mass spring system has mass M = 1.5 kg and spring constant K = 20 N/m and is oscillating with an amplitude of 1.0 cm. If energy is quantized, what is the quantum number?

(3) Photoelectric threshold of a metallic silver 1.1 eV. Determine weather the metal shows photoelectric effect for the wavelength 5800 Å.