(Please write your Roll No. immediately) Roll No. .....

Mid- Term Examination

First Semester [B.Tech.]
Paper code: ETPH-103
Time: 1:30 Hrs.

September 2017
Sub: Applied Physics-I
Max. Marks: 30

NOTE: Attempt Q. No. 1, which is compulsory and two more questions from the remaining.

1. (a) Explain, why interferences fringes are circular in Newton's Ring. (2)

   (b) A light source emits light of two wavelengths $\lambda_1 = 4300$ Å and $\lambda_2 = 5100$ Å. The source is used in a double slit interference experiment. The distance between the source and the screen is 1.5 m and the distance between the slits is 0.025 mm. calculate the separation between the third order bright fringes due to these two wavelengths. (2)

   (c) Distinguish between Fresnel and Fraunhofer class of diffraction. (2)

   (d) State Brewster's law. Show that when a ray is incident at polarizing angle, the reflected ray is perpendicular to refracted ray. (2)

   (e) Calculate the thickness of (i) a quarter wave plate and (ii) a half wave plate given that $\mu_e = 1.553$ and $\mu_o = 1.544$ and $\lambda = 5000$ Å (2)

2. (a) Discuss the phenomenon of interference of light in thin films and obtain the conditions of maxima and minima. Show that the interference patterns in reflected and transmitted lights are complimentary. (4)

   (b) Describe and explain the formation of Newton's ring in reflected light. Hence, derive an expression for diameter of n^{th} dark ring. (4)

   (c) Light of wavelength 600 nm falls normally on a thin wedge shaped film of refractive index 1.4, forming fringes are 2 mm apart. Find the angle of wedge. (2)

3. (a) Discuss the Fraunhofer diffraction at a single slit and show that the relative intensities of the maxima are nearly in the ratio of $1 : 4/9\pi^2 : 4/25\pi^2 : 4/49\pi^2$ .....(6)

   (b) A plane transmission grating has 6000 line/cm. Calculate the highest order of spectrum, which can be observed with light of wavelength 400 nm. (2)

   (c) What particular spectrum of plane transmission grating would be absent if the width of the transparencies and opacities of the grating are equal? (2)

4. (a) Explain the construction and working of a *Nicol Prism* used to produce polarized light (5)

   (b) What is the specific rotation? Describe construction and working of Laurent's half shade polarimeter. (5)

(Please write your Exam Roll No.) Exam Roll No. 35210403617

END TERM EXAMINATION

FIRST SEMESTER [B.TECH] DECEMBER 2017

Paper Code: ETPH-103 **Subject: Applied Physics-I**

(Batch 2013 Onwards)

Time: 3 Hours **Maximum Marks: 75**

Note: Attempt any five questions including Q no.1 which is compulsory. Select one question from each unit. Draw neat scientific diagrams wherever necessary. Work in SI units. Assume data wherever necessary.

Q1 (a) Can non coherent sources produce interference? Justify your answer. **(2.5)**

(b) In a biprism experiment, the eye piece is placed at a distance of 1.2m from the source. The distance between the virtual sources was found to be 7.5×10^{-4}m. Find the wavelength of light if the eye piece is to be moved transversely through a distance of 1.888 cm for 20 fringes. **(2.5)**

(c) What particular spectra of plane transmission grating would be absent if the width of the transparencies and opacities of the grating are equal. **(2.5)**

(d) Differentiate between plane polarised, circularly polarised and elliptically polarised light. **(2.5)**

(e) What is *population inversion*? How is it achieved? **(2.5)**

(f) Calculate the numerical aperture, acceptance angle and critical angle of a fibre having core refractive index 1.5 and cladding refractive index 1.45. **(2.5)**

(g) Give experimental verification of the phenomenon of time ditation. **(2.5)**

(h) What are the properties of *ultrasonic waves*? **(2.5)**

(i) A rod 1 m long is moving along its length with velocity 0.6c. Calculate the length as it appears to an observer on the surface of earth. **(2.5)**

(j) Explain the function of electric and magnetic field in a cycloton. **(2.5)**

UNIT-I

Q2 (a) Describe the phenomenon of interference of light in thin film and obtain the condition of maxima and minima for reflected light. **(6)**

(b) Newton's rings are observed normally in reflected light of wavelength $5893\,\overset{0}{A}$. The diameter of the 10^{th} dark ring is 0.005m. Find the radius of curvature of the lens and thickness of air film. **(3.5)**

(c) Draw a labelled ray diagram depicting interference by a biprism. **(3)**

Q3 (a) Differentiate between Fresnel and Fraunhoffer diffraction. Show that the intensities of the maximum in diffarction due to single slit are in the ratio **(7)**

$$1 : \frac{4}{9}\pi^2 : \frac{4}{25}\pi^2 : \frac{4}{49}\pi^2 \ldots$$

(b) Light is incident normally on a grating 0.5cm wide with 2500 lines. Find the angles of diffraction for the principal maxima of the two sodium lines in the first order spectrum, $\lambda_1 = 5890\,\overset{0}{A}, \lambda_2 = 5896.\overset{0}{A}$ **(5.5)**

UNIT-II

Q4 (a) What is *specific rotation*? Describe the working of a Laurent's half shade polarimeter. How will you use it to find the specific rotation of sugar? **(6)**

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(b) Describe the construction of a Nicol prism and show how it can be used as a polarizer or as an analyzer. (3.5)

(c) Two nicols are oriented with their principle planes making an angle of 60°. What percentage of incident unpolarized light will pass through the system. (3)

Q5 (a) Discus with suitable diagram the principle, construction and working of He-Ne laser. Explain the role of He atoms in it. (6)

(b) Differentiate between *step index* and *graded index fibres*. Which of these types is better for wide area network (WAN) communication. (3.5)

(c) Consider a step index fiber for which $\mu_1 = 1.475$ and $\mu_2 = 1.460$ and $a = 2.5\mu m$ (a being core diameter). (i) What is the maximum value of θ. (ii) Calculate the number of reflections that would take place in traversing a kilometer length of the fibre. (3)

UNIT-III

Q6 (a) Write down the postulates of special theory of relatively. (2.5)

(b) Describe Michelson Morley experiment and explain the physical significance of negative result. (6)

(c) An electron has an initial speed of 1.4×10^8 m/s. How much additional energy must be imparted in it for its speed to double. (4)

Q7 (a) With the help of a neat diagram explain the working of a magnetostriction oscillator for generating ultrasonics. (6)

(b) Explain in detail how the ultrasonic pulse technique is used for non destructive testing of materials and for depth explorations. (4)

(c) A quartz crystal of thickness 0.001m is vibrating at resonance. Calculate the fundamental frequency. (2.5)

Given Y for quartz = 7.9×10^{10} N/m^2

and ρ for quartz = 2650 kg/m^3

UNIT-IV

Q8 (a) Explain the term *mean life time* of a radioactive substance. Show that the mean life of a radioactive substance is reciprocal to its decay constant. Hence obtain the relation between mean life and half life time of a radioactive substance. (6.5)

(b) Half life of radon is 3.8 days. After how many days will 1/100th. of radon sample be left behind. (4)

(c) What is the difference between *positron emission* and *electron capture*? (2)

Q9 (a) What is *cyclotron*? Discuss its construction, working and theory. What is cyclotron frequency? . (6)

(b) Differentiate between ionization chamber and geiger muller counter. (4)

(c) An ionization chamber exposed to a beam of α particle registered a current of 4.8×10^{-13} A. On the average 20 α particles enter the chamber per second. Assuming that in producing ion pairs 356eV per ion pair energy is needed, calculate the energy of the α-particle. (2.5)

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