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(Please write your Exam Roll No.) Exam Roll No. 00820932819

END TERM EXAMINATION

FIRST SEMESTER [B.TECH] NOVEMBER-DECEMBER 2019

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) In case of Newton's rings obtain the relation between the dark ring diameter and air film thickness. **(2.5)**

(b) At what angle β above the horizon is the Sun, when a person observing its rays reflected in water (n=1.33) finds them linearly polarized along the horizontal? (Refer the figure) **(2.5)**

(c) What is optical pumping? How does it help in achieving population inversion in a LASER? **(2.5)**

(d) A plane diffraction grating has 40000 lines. Determine its resolving power in 2nd order for a wavelength of 5000Å. **(2.5)**

(e) Calculate the thickness of (i) quarter wave plate and (ii) half wave plate, given λ=5000 Å, μ=1.544, μ_e=1.553. **(2.5)**

(f) What was the objective of conducting Michelson-Morley experiment? Discuss the negative result obtained. **(2.5)**

(g) Information carrying capacity of optical fiber system is far more superior to Copper cable system. Justify. **(2.5)**

(h) How is depth of sea determined using Ultrasonic waves? **(2.5)**

(i) Why does moving rod appear shorter than its real length. Explain using the derivation. **(2.5)**

(j) 1gm of Radium is reduced to 2.1 mg in 5 years by α-decay. Calculate the half-life of Radium. **(2.5)**

UNIT-I

Q2 (a) Explain why interference effects are not observed when light reflected from the two surfaces of a window pane combine. **(3)**

(b) Newton's rings are formed by a light of wavelength 4000Å. **(4)**

(i) Between the 3rd and 6th bright fringe, what is the change in thickness of the air film?

(ii) If the radius of curvature of the curved surface is 5.0cm, what is the radius of 3rd bright fringe?

(c) A drop of liquid of volume 0.2 cm^3 is dropped on the surface of the tank water of area 1m^2. The drop spreads uniformly over the whole surface. White light is incident normally on the surface. The spectrum contains one dark band whose centre gas wavelength 5500Å in air. Find the refractive index of the liquid. **(2.5)**

(d) What will happen to Biprism fringes if **(3)**

(i) angle of biprism in increased

(ii) width of slit is increased continuously.

P.T.O.

Q3 (a) For the Fraunhoffer diffraction by a single slit, what is the effect of increasing
(i) Slit width
(ii) wavelength **(3)**
(b) Describe the overall effect of diffraction grating with a suitable diagram. **(3)**
(c) Find the minimum number of lines required in a grating to resolve two spectral lines of wavelength 5890Å and 5896Å in 2nd order diffraction. **(2.5)**
(d) Distinguish between single slit and double slit diffraction patterns. **(2)**
(e) What is meant by resolving power and dispersive power of an optical instrument? **(2)**

UNIT-II

Q4 (a) What is meant by plane polarized, circularly polarized and elliptically polarized light? Show that the plane polarized and circularly polarized lights are special cases of elliptically polarized light. **(4)**
(b) Explain the phenomenon of double refraction in Calcite crystal. Give the construction and theory of (i) quarter wave plate and (ii) half wave plate. Where is quarter wave plate used? **(5)**
(c) Describe Laurent's half shade polarimeter. **(3.5)**

Q5 (a) Explain the important characteristics of a LASER beam and compare them with those of ordinary light. **(3)**
(b) Describe the working of He-Ne LASER, explaining its energy level diagram. **(4)**
(c) Describe the phenomenon of (i) absorption, (ii) spontaneous emission, (iii) stimulated emission. **(3)**
(d) Obtain the relation between Einstein A and B coefficients. **(2.5)**

UNIT-III

Q6 (a) With the help of suitable diagram, explain the principle, construction, and working of an optical fiber as wave guide. **(5)**
(b) Explain the transmission of signal in step index and graded index fiber. **(3)**
(c) What is acceptance angle. Explain using suitable diagram. **(2.5)**
(d) A glass clad fiber is made with the core glass of refractive index 1.5 and the cladding is doped to give a fractional index difference of 0.0005. Find (i) cladding index, (ii) numerical aperture. **(2)**

Q7 (a) What are the different types of ultrasonic wave propagation? **(2)**
(b) What are the advantages and drawbacks of magnetostriction method? **(3)**
(c) Write about Piezoelectric detection of ultrasonic waves. **(4)**
(d) Determine the velocity of the ultrasonic wave produced by a Piezoelectric oscillator. The density of Quartz crystal is 2650 Kg/m^3 and the Young's modulus of Quartz is $7.9 \times 10^{10} Nm^{-3}$. **(3.5)**

UNIT-IV

Q8 (a) Derive and explain the concept of Time Dilation. **(2)**
(b) Deduce the relativistic velocity addition theorem. Show that it is consistent with the Einstein's second postulate. **(5)**
(c) Deduce the expression $E=mc^2$. **(3)**
(d) Find the velocity of a particle, when its mass increases by three times. **(2.5)**

Q9 (a) Why do we say that a nucleus behaves like a drop of a liquid? What are the essential features which are common in a drop of liquid and a nucleus? **(3)**
(b) What is the difference between half life and mean life in radioactivity? **(2)**
(c) Fission of one atom of U^{235} releases 200MeV of energy. What mass of U^{235} would be used up in a reactor to supply 1 million kilowatt power for one year? **(2)**
(d) Describe the construction and working of Geiger-Muller counter. **(3.5)**
(e) A magnetic field of 8.0×10^3 gauss at 50 cycles/sec is applied in a Betatron. The stable orbit diameter is 30 inches. Calculate the final energy of electrons and the average energy gained per revolution. **(2)**

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