AUTUMN END SEMESTER EXAMINATION-2014

1st Semester B.Tech / B.Tech Dual Degree

PHYSICS-I PH-101

(Back-2013 Admitted Batch)

Full Marks: 60 **Time: 3 Hours**

Answer any SIX questions including Question No.1 which is compulsory.

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable and all parts of a question should be answered at one place only.

1. All bits should be answered serially. [2 × 10

a) When do you get spherical and plane wavefronts?

b) Can two candles be taken as coherent sources? Explain.

c) What are the differences between interference and diffraction?

d) A plane diffraction grating of width 2.5cm has 12500 rulings. What is the grating element?

e) State Malus Law.

f) The refractive index of for water is 1.33. Calculate the polarization angle for water.

g) Why is spontaneous emission incoherent? Explain.

h) An optical fiber has the core and cladding refractive indices are 1.55 and 1.50 respectively.
Calculate numerical aperture and acceptance angle.

i) Show that $\oint \boldsymbol{r}.\boldsymbol{ds} = 3V$, where S is a closed area enclosing volume V.

j) Define pointing vector. Explain its physical significance.

2. a) Derive the conditions for maxima and minima when a thin parallel film of uniform thickness is illuminated by monochromatic light. Show that the interference pattern in reflected and transmitted systems is complimentary. [6

b) In a Newton's rings experiment the diameter of 10^{th} dark ring changes from 1.40cm to 1.27cm, when a liquid is introduced between the lens and the glass plate. Calculate the refractive index of the liquid. [2

3. a) Deduce an expression for the intensity distribution due to Fraunhofer diffraction at a single slit illuminated by parallel beam of monochromatic light. Discuss the conditions for getting principal maxima, secondary maxima and minima. Show the result graphically. [6

b) How many lines per centimeter are there in a grating which gives an angle of diffraction equal to 30^0 in the first order of the light of wavelength 6000Å? [2

4. Establish Maxwell's equations in electromagnetism, mentioning the laws represented by these equations. [8

5. a) Explain step index and graded index optical fibre. Derive expression for acceptance angle and numerical aperture of a step index optical fibre. [6

b) Find the speed of electromagnetic waves in free space. [2

6. a) Explain with neat diagram, the construction and working principle of Ruby Laser. [6

b) If a_1 and a_2 are the amplitudes of two inferring waves, what is the ratio of amplitudes and intensities at maxima and minima. [2

7. Give the construction of Nicol prism. Explain its action as a polarizer and analyzer. [8

8. Write notes on the following (any two). [4+4

a) Determination of wavelength of a monochromatic light by Newton's ring apparatus

b) Absent spectra in plane diffraction grating

c) Electromagnetic wave equations for electric field and magnetic field in free space

C = velocity of light = 3×10^8 m/s, 1Å = 10^{-8}cm

1 inch = 2.54 cm

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