B. Tech. Examination 2022-23

(Odd Semester)

PHYSICS - I

Time : Three Hours] *[Maximum Marks : 60*

Note :– Attempt all questions.

SECTION–A

1. Attempt all parts of the following : $8 \times 1 = 8$

   (a) What is non-inertial frames of reference?

   (b) Why a moving rod appears shorter than its real length?

   (c) What is dispersive power?

   (d) What do you mean by grating element?

   (e) Wha do you mean by fringe width?

(f) Define population inversion.

(g) What is numerical aperture?

(h) What is a hologram?

SECTION–B

2. Attempt any parts of the following: 4×3=12

(a) At what speed should a clock be moved so that it may appear's to lose one minute in each hour?

(b) A communication system uses a 10 kilometer fiber having a loss of 2.5 dB/km. Calculate the output power if the input power is 500 μW.

(c) White light is incident on a soap film at an angle $\sin^{-1}(4/5)$ and the reflected light is observed with a spectroscope. It is found that two consecutive dark bands corresponds to wavelength (λ), 6.1×10^{-5} cm and 6.0×10^{-5} cm. If the refractive index of the film be (4/3), calculate the thickness.

Calculate the specific rotation if the plane of polarisation is turned through 26.4^0, traversing 20 cm length of 20% sugar solution.

SECTION–C

Note :- Attempt all questions. Attempt any two parts from each question. 5×8=40

3. (a) Show that the diameter D_n of the n^{th} Newton's ring, when two surfaces of radii R_1 and R_2 are placed in contact, is given by the relation :

$$\frac{1}{R_1} \pm \frac{1}{R_2} = \frac{4n\lambda}{D_n^2}$$

(b) Give the construction and theory of plane transmission grating and explain the formation of spectra by it. Explain what are the absent spectra in the grating?

(c) What is polarised light? How will you produce and detect plane, elliptically and circularly polarised light?

4. (a) Derive the Galilean transformation equations and show that its acceleration is invariant under Galilean transformation.

(b) Deduce Einstein's mass-energy relation $E = mc^2$ and discuss it. Give some evidence showing its validity.

(c) State and explain acceptance angle and acceptance cone of an optical fiber. Deduce the expression for numerical aperture.

5. (a) Discuss the effect of introducing a thin plate in the path of one of the interferring beams in biprism experiment. Deduce the expression for the displacement of fringes.

(b) Draw a neat diagram of He-Ne laser and describe its method of working. Discuss its important applications.

(c) What is the basic principle of holography? Discuss the main characteristic and applications of holography.

6. (a) Derive Borentz transformations and use them to find out the expression for length contraction.

(b) Define specific rotation. Describe the construction and working of laurent's half shade polarimeter.

(c) What are Einstein's coefficients? Obtain a relation between them. Also discuss the essential conditions for laser action.

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