Ex/B.Sc./PHY/22/HO7/GR-A/64/2018

BACHELOR OF SCIENCE EXAMINATION, 2018

(2nd year, 2nd Semester)

PHYSICS (HONOURS)

Paper-HO7

Time: Two hours. Full Marks: 50

The figures in the margin indicate full marks.

Use a separate Answer-script for each group

GROUP-A

Answer any *five* questions (5 x 5 = 25)

1. What is fringe width? Derive an expression of fringe width for Newton's ring and show that it becomes narrower with the increase of order number. [1 + 2 + 2]

2. Determine the small difference of wavelength of light from a source by using the Michelson interferometer. Do you obtain interference fringe without the compensatory glass plate in Michelson interferometer? [3 + 2]

3. Discuss in detail of "Zone Plate" and its similarity with a convex lens. [4+1]

4. Discuss the missing order in double slit diffraction pattern and draw the schematic diagram of it when the widths of the clear space and opaque space are equal. [3 +2]

5. What is "Replica grating"? Show that the angular dispersion of a grating is directly proportional to the number of rulings per unit length and also to the order number of the spectra. Compare grating spectrum with the prism spectrum. [1 + 2 + 2]

6. State the assumptions in Lorentz's theory of normal dispersion. Write down the Lorentz normal dispersion equation and hence show that Cauchy's dispersion formula can be obtained from it. [2 + 1 + 2]

[P.T.O]

7. Newton's rings are formed by a light of wavelength 589.3 nm, which reflected normally from a plano convex lens and a plane glass plate with a liquid between them. The diameter of the "n"th and "n+10"th bright rings are 2.18 mm and 4.51 mm respectively. Determine the refractive index of the liquid when the radius of curvature of the lens is 90 cm. [5]

8. Calculate the length of the base of 60° prism which can resolve sodium D-lines (589.0 589.6 nm) at minimum deviation. Given refractive index of glass at wavelengths 546.1, 589.3 and 643.8 nm are 1.6546, 1.6499 and 1.6434 respectively. [5]

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GROUP-B

Answer any **FIVE** questions (5×5=25 Marks)

1. State Thevenin's theorem. Is it applicable to both dc and ac? Is it an independent law or can be derived from Kirchhoff's laws? What do you mean by an ideal current source ?

2. The four arms of a Wheatstone bridge have resistances $r_1 = 100\,\Omega$, $r_2 = 10\,\Omega$, $r_3 = 50\,\Omega$ and $r_4 = 4\,\Omega$. A galvanometer of resistance 20 Ω is connected between the junctions (r_1, r_2) and (r_3, r_4) . A cell of *emf* 10 V is connected between the junctions (r_1, r_3) and (r_2, r_4). Apply Thevenin's theorem to find the current through the galvanometer.

3. Instantaneous value of a nonsinusoidal ac current is given by

$$i(t) = I_0 + \sum_{n=1}^{\infty} I_n \sin(n\omega t + \phi_n)$$

where the symbols have their usual meaning. Find the rms value of the current.

4. Show that maximum power will be transferred from a source to a load when the load impedance is a complex conjugate of the internal impedance of the source. Cite one practical example where this idea is used.

5. What do you mean by current and voltage resonances in series LCR circuit? Find the corresponding resonant frequencies in terms of circuit parameters.

6. A capacitor of capacitance C is connected by leads of resistance r to a coil of inductance L having resistance R. An ac emf $v = V_0 \cos \omega t$ is now applied across the coil. Show that the impedance of the circuit will be independent of the frequency if $R = r = \sqrt{L/C}$.

7. Two tuned circuits each containing an inductor, a capacitor and a small resistance are coupled inductively. An ac emf $v = V_0 \cos \omega t$ is now set up in one of them by an oscillator of variable frequency. Discuss how the current in the second circuit varies with the frequency ω.