2018

2nd Semester

PHYSICS

(Honours)

PAPER—C4P

(Practical)

Full Marks : 20

Time : 2 Hours

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

Answer *one* questions.

1. To determine the frequency of an electric tuning fork by Melde's experiment and verify λ^2–T law for ***either transverse or longitudinal*** (with respect to length of the thread) vibration of the tuning fork arm.

[Weight of the hanger and mass per unit length of the thread will be supplied].

(a) Working formula 2

(b) Readings for λ^2 – T graph for five different weights on the hanger. 8

(c) Drawing λ^2 – T graph 3

(d) Determination of frequency of the tuning fork from graph. 2

2. To investigate the normal modes and resonance of coupled pendula.

[Two identical compound pendula (rod-mass system) of equal time period suspended from a rigid support and coupled by an un-stretched horizontal spiral spring are to be used. Spring constant of the given spring will be supplied]

(a) Working formula. 4

(b) Readings for time periods of (i) in phase oscillation (T_1), (ii) out of phase oscillation (T_2) (iii) beat oscillations (T_C) and (iv) beats (T_B).

[Readings for at least 30 oscillations in each case is to be taken. Least count of the stop watch is to be noted]. 8

(c) Comparison of measured values of T_C and T_B with calculated values. 2

(d) Determination of coupling coefficient. 1

3. Frequency ratio of two sinusoidal signals from Lissajous Figures with the help of a CRO.

[Two function generators are to be provided. Frequency of one function generator will be fixed and unknown to the student: frequency of other function generator will be adjusted so that the ratio of number of loops along two perpendicular axes are 1:1, 2:3, 1:2, 1:3, 1:4. (or any 5 sets of ratio of small integers given by the examiner)].

(a) Theory. 3

(b) Readings for frequency ratio of two sinusoidal signals. 9

(c) Calculation of unknown frequency. 3

4. Phase difference of two sinusoidal signals from Lissajous Figures with the help of a CRO.

[Signals of different phases can be obtained with the help of an RC circuit driven by a sinusoidal voltage. Voltage across RC combination and voltage across R can be taken as the two signals. Values of R & C are to be given.].

(a) (i) Working formula for phase difference from Lissajous ellipse. 2

(ii) Working formula for phase difference of voltages across RC combination and across R. 2

(b) Circuit diagram and implementation. 2

(c) Readings for phase differences (3 sets for 3 different R). 6

(d) Calculation of practical and theoretical phase differences from formula (i) and (ii) and comparison. 3

5. Schuster's focusing and determination of angle of prism.

(a) Working formula for angle of prism. 2

(b) Description of minimum deviation, normal & slanting position and Schuster's focusing. 3

(c) Performing Schuster's focusing (to be verified by the examiner). 2

(d) Vernier constant of the spectrometer. 1

(e) Readings for angle of prism. (Take two sets of readings for left to right and right to left movement of the telescope) 6

(f) Calculation of angle of prism. 1

6. To determine refractive index of the Material of a prism using sodium source. [Angle of prism is to be supplied]

(a) Working formula. 2

(b) Description of minimum deviation, normal position, slanting position and Schuster's focusing. 3

(c) Performing Schuster's focusing (to be verified by the examiner). 2

(d) Readings for sodium yellow line with the prism at minimum deviation position. (Take two sets of readings for left to right and right to left movement of the telescope). 4

(e) Readings for direct rays. 2

(f) Calculation of refractive index. 2

7. To determine the dispersive power of the material of a prism using mercury/helium source.

   (a) Working formula. 2

   (b) Performing Schuster's focusing (to be verified by the examiner). 2

   (c) Readings for deviation of three specified colours of mercury/helium source. (Two extreme colours and the mean colour). 6

   (d) Readings for direct rays. 2

   (e) Calculation of refractive indices of the three colours and dispersive power. 2+1

8. To determine the Cauchy constants of the material of a prism using mercury/helium source. [Value of minimum scale division and V.C. of spectrometer are to be supplied. Two colours are to be specified and their wavelength will be supplied].

   (a) Working formula. 2

   (b) Performing Schuster's focusing (to be verified by the examiner). 2

   (c) Readings for deviation of two specified colours of mercury/helium source. 5

   (d) Readings for direct rays. 2

   (e) Calculation of refractive indices and Cauchy constants. 2+2

9. To determine the wavelength of sodium source using Michelson's interferometer.

   [Least count of the micrometer screw is to be supplied].

   (a) Working formula and principle. 3

   (b) Adjustment of the apparatus to obtain sharp circular fringes. (To be verified by the examiner). 2

   (c) Readings for the displacement (x) of mirror and number (m) of bright fringes crossing the crosswire. (At least 4 sets of readings for crossing of about 10 fringes in each case). 8

   (d) Calculation of wavelength. 2

10. To determine wavelength of sodium light using Fresnel Biprism. [Separation between the virtual sources and least count of the micrometer is to be supplied]

   (a) Working formula. 2

   (b) Setting up of the apparatus for obtaining fringes and alignment of the apparatus. (To be verified by the examiner). 3

   (c) Readings for fringe width at two position of the eyepiece differing by at least than 20 cm. (At each position at least 4 readings with a gap of three fringes in between two readings are to be taken). 8

   (d) Calculation of wavelength. 2

11. To determine wavelength of sodium light using Newton's Rings. [Radius of curvature of the convex surface of the

plano-convex lens and the least count of the micrometer screw are to be supplied]

(a) Working formula. 2

(b) Readings for D_m^2 Vs. m (ring number) graph. [Take at least 5 readings]. 8

(c) Drawing D_m^2 Vs. m graph. 3

(d) Calculation of wavelength from the graph. 2

12. To determine the number of rulings per mm of a plane transmission grating. [V.C. of the spectrometer is to be supplied].

(a) Working formula. 2

(b) Performing Schuster's focusing (to be verified by the examiner). 2

(c) Readings for setting up of the grating surface for normal incidence. 3

(d) Readings for deviation of sodium yellow line for three orders. (Wavelength will be supplied by the examiner). 6

(e) Calculation of number of rulings per mm. 2

13. *To determine wavelength of spectral lines of Hg source* using plane diffraction grating.

[3 colours are to be specified by the examiner. Number of rulings per mm is to be supplied. V.C. of the spectrometer is to be supplied]

(b) Performing Schuster's focusing (to be verified by the examiner). 2

(c) Readings for setting up of the grating surface for normal incidence. 3

(d) Readings for deviation of the specified spectral lines (for any one order). 6

(e) Calculation of wavelengths. 2

14. To determine resolving power and dispersive power of a plane diffraction grating. [Number of rulings per mm (m) and number of rulings illuminated by the collimated incident beam ([N) are to be supplied. V.C. of the spectrometer is to be supplied].

(a) Working formula. 2

(b) Performing Schuster's focusing (to be verified by the examiner). 2

(c) Readings for setting up of the grating surface for normal incidence. 3

(d) Readings for deviation of two spectral lines specified by the examiner. (Readings for any two orders, as may be specified by the examiner). 6

(e) Calculation of resolving power and dispersive power. 2

2018

2nd Semester

PHYSICS

(Honours)

PAPER—C4P

(Practical)

Full Marks : 20

Time : 2 Hours

[Instructions to the Examiners]

1. Experiments are to be allotted to the students on the basis of lottery.

   2nd chance may be given to a student without deduction of any marks.

   2 marks is to be deducted for each subsequent chance.

2. At least one reading taken by the student in each table is to be signed by the examiner.

3. The steps of the experiments, marked as 'to be verified by the examiner', are to be signed by the examiner, after verification, with comment.

4. In the L.N.B, the student will get 2 marks for 9 or more properly signed experiments, 1½ for 7-8 properly signed experiments, 1 for 4-6 properly signed experiments and ½ for 1-3 properly signed experiments of the syllabus.

5. If the student suffers from any defect in the instruments / apparatus given to her/him, this should be noted in the answer script by the examiner and should be taken care of at the time of evaluation.

6. Any help done to any student (like Schuster's focusing, bringing fringes, setting the grating surface for normal incidence, bringing Lissajous figures in CRO screen etc.) by the examiner will accompany necessary comment of the examiner on the answer script of the student and marks will be deducted partly or fully for this step as the case may be.

7. The experiment of coupled pendulum (in question no. 2) may be designed by any other method, than that given

in the question paper, with prior consultation with the Chairman, Board of Studies. Because different colleges might have performed this experiment in different ways since the name of this experiment mentioned in the syllabus ["To investigate the motion of coupled oscillators"] is not specific and not suggestive for a particular method.

8. In question no. 14, for determination of resolving power of the grating, the number of rulings (N) of the grating illuminated by the collimated incident beam is to be supplied to the student. This N can be estimated as follows:

The incident beam from the collimator is a parallel beam, since we make it parallel by Schuster's method. Also the width of the slit fitted at the source end of the collimator is set nearly equal to ~0.5 mm during adjustment of the instrument. Clearly, the thickness of the collimated incident beam will be of the order of 1 mm(considering broadening of the beam). So this beam will illuminate an equal (~1mm) portion of the grating. This portion contains about 300 lines for a grating of 300 lines/mm and about 600 lines for a grating of 600 lines/mm.

Thus N = 300 for a grating of 300 lines/mm (7500 LPI) and 600 for a grating of 600 lines/ mm (15000 LPI).

Experiment :	***15 Marks***
Laboratory Note Book :	***02 Marks***
Viva-Voce :	***03 Marks***

———