NEW

Part–III 3-Tier

2019

PHYSICS

PAPER—VIII

(Honours)

(PRACTICAL)

Full Marks : 100

Time : 6 Hours

The figures in the right-hand margin indicate full marks.

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

Answer any *one* question from Group—A and *one* question from Group—B.

Group—A

(*Marks : 50*)

1. Find the number of rulings per cm. of the given plane transmission grating using light of known wavelength. Hence measure the resolving power of grating and

wavelength separation ($\Delta\lambda$) of D_1 and D_2 lines of Sodium using a slit of adjustable width.

(a) Working formula. 5

(b) Schuster's method of focussing (to be written and implemented). 2+3

(c) Setting of grating surface for normal incidence. 3

(d) Reading for determination of number of lines per cm of the grating (for 2 orders). 10

(e) Measurement of the width of the adjustable slit for just resolution of two lines (for any one order). 8

(f) Calculation of the resolving power of grating. 3

(g) Calculation of $\Delta\lambda$. 3

(h) Proportional error. 3

2. Determine the wavelength of the given monochromatic light by Fresnel's Biprism method.

(a) Working formula. 4

(b) Measurement of fringe width (for two distances between the slit and the eye-piece differing by not less than 20 cms.). 16

(c) Measurement of the distance between two coherent virtual sources (for two different positions of eye-piece). 10

(d) Calculation. 4

(e) Proportional error. 4

(f) Discussion. 2

3. Draw the (B–H) loop of the given specimen in the form of an anchor ring and find the energy loss per cycle.

(a) Working formula. 4

(b) Table for physical constants. 2

(c) Circuit diagram and implementation of the circuit. 3+3

(d) Data for (I′ – d′) graph. 5

(e) Drawing of (I′ – d′) graph. 3

(f) Data for (B–H) graph. 12

(g) Drawing of (B–H) graph. 5

(h) Calculation. 3

4. Determine the self-inductance of two different coils by Anderson's bridge. (Take at least three sets of readings with each coil).

(a) Working formula. 5

(b) Circuit diagram and implementation of the circuit. 2+3

(c) Data for the measurement of resistance of the coils. 8

(d) Data for the measurement of self-inductance of the coils (ac balance). 12

(e) Plot of $\frac{1}{C}$ *vs.* r graphs for two coils. 4

(f) Calculation of self inductance of the coils (directly from r values and also from graphs). 4

(g) Discussion on the results. 2

5. Determine the Fourier's spectrum of square and triangular waveforms using parallel resonant circuit and CRO.

(a) Theory for square and triangular waveforms. 3+3

(b) Circuit diagram and implementation of the circuit. 2+3

(c) Data for frequency response of parallel resonant circuit using sine wave. (Measure amplitudes of input and output voltages and phase differences between them). 6+4

(d) Drawing of frequency response graph showing amplitude resonance. 3

(e) Determine of resonance-frequency. 2

(f) Data for Fourier spectrum of square and triangular waveforms. 4+4

(g) Drawing of graphs for the Fourier spectrum analysis of square and triangular waveforms. 2+2

(h) Discussion on the results. 2

6. Determine the value of Stefan's constant (σ). (Diameter, mass and the specific heat of the disc are to be supplied.)

(a) Working formula. 3

(b) Circuit diagram and implementation of the circuit. 3+3

(c) Data for $(\theta - x)$ graph. 6

(d) Drawing of $(\theta - x)$ graph. 3

(e) Calculation of $\frac{d\theta}{dx}$ from graph. 3

(f) Data for (t–x) graph. 8

(g) Drawing of (t–x) graph. 3

(h) Calculation of $\frac{dx}{dt}$ from graph. 3

(i) Table for computing σ. 2

(j) Calculation. 3

7. Determine the number of lines per cm. of the plane transmission grating using light of known wavelength and then find out the wavelength of the unknown spectral lines (to be specified by the examiner) of Hydrogen. Also find the value of Rydberg constant.

(a) Working formula. 5

(b) Schuster's method of focussing. (to be written and implemented) 2+3

(c) Setting of grating surface for normal incidence. 4

(d) Data for measuring the rulings per cm. (for two orders). 10

(e) Data for finding the wavelengths of three unknown lines (for first order only). 10

(f) Calculation of Rydberg constant. 4

(g) Proportional error. 2

8. Measure the susceptibility of a liquid sample ($FeCl_3$) solution by Quincke's method.

   (a) Working formula. 4

   (b) Data for calibration of electromagnet (Maximum limit of current to be supplied). 5

   (c) Graph for calibration of electromagnet. 3

   (d) Data for preparation of solution (for a particular concentration). 4

   (e) Data for ($h-B^2$) graph (at least 5 readings). 10

   (f) Drawing of ($h-B^2$) graph. 5

   (g) Calculation. 4

   (h) Proportional error. 3

   (i) Discussion. 2

9. Use a p–n junction diode for the measurement of (i) band gap energy of semiconductor and (ii) unknown temperature.

   (a) Working formula. 4

   (b) Circuit diagram and implementation of the circuit. 3+3

   (c) Data for forward bias characteristics of diode at room temperature. 7

   (d) Drawing of log I *vs.* V graph. 3

   (e) Calculation of η. 2

(f) Data for reverse saturation current (I_s) at different temperatures (T). 10

(g) Drawing of log (I_s) vs. $\frac{1}{T}$ graph. 3

(h) Calculation of band gap energy. 3

(i) Discussion. 2

10. Determine Planck's constant by using a Scooter bulb and a given monochromatic filter.

(a) Working formula. 5

(b) Circuit diagram and implementation of the circuit. 3+3

(c) Measurement of bulb resistance at room temperature by multimeter. 2

(d) Data for log P_b (bulb-power) *vs.* log R (bulb-resistance) graph. 6

(e) Drawing of (log P_b – log R) graph. 3

(f) Calculation of γ in temperature-resistance relation. 3

(g) Calculation of bulb-temperature (T_b) from different values of R. 3

(h) Data for I_{LDR} (LDR current) *vs.* $\frac{1}{T_b}$ graph. 6

(i) Drawing of ($\ln(I_{LDR})$ – $\frac{1}{T_b}$) graph. 3

(j) Calculation of Planck's constant. 3

11. Calibrate a Hall Probe (4-terminal) / Hall IC (3-pin) with the help of a ballistic galvanometer for using it to study the variation of magnetic field of an electromagnet with the magnetising current.

(a) Working formula. 5

(b) Circuit diagram and implementation of the circuit. 2+2

(c) Table for physical constants. 3

(d) Data for $(I' - d')$ graph. 5

(e) Drawing of $(I' - d')$ graph. 3

(f) Calculation of m. 2

(g) Data for variation of magnetic induction (B) with different magnetising current (I) using ballistic galvanometer. 5

(h) Data for calibration of the Hall probe / Hall IC (for magnetising currents same as in (g). 8

(i) Drawing of B *vs.* Hall Voltage graph (calibration curve). 3

(j) Determination of proportionality constant (k') for Hall probe / Hall IC. 2

Group—B

(*Marks* : 20)

1. Write an algorithm for any one of the following problems and transfer it to the FORTRAN / C program and show the result. 4+10+2

(a) Sort the following 10 data in ascending order.

732, −151, 663, 822, −33, 0, −52, 231, 521, −73

(b) Find the mean and median of the following values : (A set of nine numbers will be supplied by the examiner).

(c) Write a program and run to check a number is prime or not (Prime and unprime numbers will be specified by the examiner).

(d) Find the sum of the following series : 5+5

(i) $1^2 + 3^2 + 5^2 + \cdots + 49^2$

(ii) $1+\frac{1}{3^2}+\frac{1}{5^2}+\frac{1}{7^2}+\cdots+\frac{1}{99^2}$

(e) Find the sum of the following series :

$$S = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} \cdots \frac{(-1)^n x^{2n}}{(2n)!}$$

Write correlation upto 4 decimal place (x and n to be supplied by the examiner).

(f) Write a program for addition and multiplication of two matries [A] and [B] of order 3×3 ([A] and [B] to be supplied by the examiner). 5+5

(g) Find a root of the $x = \text{Sin}(x)$ equation using Newton-Raphson method. The root should be current upto 6 decimal place. 10

(h) Compute the tranpose of the matrix of order (4×3) and find the sum of elements of the transpose matrix.

(i) Find a root of the equation $x^3 - 4x - 9 = 0$ using disection method starting with [2, 3] as initial interval. The root should be correct upto 6 decimal place.

(j) Find out the value of the integral with the help of Simpson rule :

$$\int_{-1}^{2} (x^3 - 3x^2 - x + 3) dx$$

Remarks :

1. Marks distribution :

Group—A :

Laboratory Note Book	:	5
Viva-Voce	:	5
Experiment	:	40

Group—B :

Laboratory Note Book	:	4
Programming	:	16
Total	:	70

(Continued)

2. Experiment in Group-A and Computer programming in Group-B will be allotted on the basis of lottery by drawing cards. Second chance may be given to a student without any deduction in marks. But 2 marks for Group-A experiment and 1 mark for programming in Group-B will be deducted for each subsequent chance. Each examinee should write the theory and circuit diagram in front of examiners.

3. Examiners are requested to put their signatures strictly with comments for in case of circuit implementation, setting up the experiment and inconvenience caused by instrumental defects (if arises). In case of failure of the student to implement the circuit, the correct theoretical circuit may be given to him with proper deduction of marks. Finally the student has to implement the circuit by himself alone. At least one data taken in different parts of the experiment should be signed by the examiner.

4. In computer programming separate machines should be provided for each examinee. In case of shortage of machines examinees may be allowed for programming in different time slot.

5. Each examinee should write the algorithm and program in front of examiners and then go to the computer. The execution of the program should be verified by the examiners with proper comments.

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VIII(b)

Project

(Marks : 30)

This work should be an experimental one with special reference to the techniques into practical classes. This may be application oriented or some simple law / experimental verification.

1. The project will be evaluated at the practical centres by the coordinators (Paper VII and VIII) in consultation with examiners and internally by Physics departments of Colleges. The coordinator (Paper VIII) will average the mark and submit it to the University.

2. Distribution of marks :

(a) Nature of work	:	10
(b) Presentation	:	10
(c) Viva	:	10
Total	:	30