(a) Theory and circuit diagram. 3+3

(b) Calculation for the components. 5

(c) Circuit implementation. 5

(d) Experimental results. 10

(e) Drawing of the waveforms. (for one frequency.) 4+4

(f) Comparison of experimental and theoretical values of the frequencies. 2

(g) Accuracy. 3

(h) Discussion. 1

3. Construct an astable multivibrator using IC-555 to generate symmetrical square-wave of frequencies 500Hz, 1KHz, 5KHz, 10KHz and 15KHz.

Compare the experimental values of frequency with theoretical values. Draw the output waveform at any two of the above frequencies.

(a) Theory and circuit diagram. 3+3

(b) Calculation for the components. 5

(c) Circuit implementation. 5

(d) Experimental results. 10

(e) Comparison of frequencies with theoretical values. 3

(f) Drawing of output waveform. (for two frequencies) 6

(g) Accuracy. 3

(h) Discussion. 2

NEW

Part–III 3-Tier

2016

PHYSICS

PAPER—VIII

(Honours)

(PRACTICAL)

Full Marks : 100

Time : 6 Hours

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

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

Group—A

(*Marks* : 55)

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 3 orders). 15

(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. 5

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

(c) Measurement of the distance between two Co-herent 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. 6

(e) Drawing of (I' – d') graph. 3

(f) Data for (B–H) graph. 12

(g) Drawing of (B–H) graph. 5

(h) Calculation. 3

(i) Determination of the energy loss per cycle. 2

(k) Discussion on the results. 2

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. 3+4

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

(d) Data for the measurement of self-inductance of the coils (ac balance). 15

(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 graphs showing amplitude resonance and phase resonance. 3+3

(e) Determine of resonance-frequency, inductance and dynamic resistance. 2+1+1

(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

(k) Proportional error. 3

(*l*) Discussion. 2

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). 15

(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). 4

   (c) Graph for calibration of electromagnet. 3

   (d) Data for preparation of solution (for two concentrations). 5

   (e) Data for ($h-B^2$) graph (at least 5 readings for each concentration). 15

   (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) Measurement of unknown temperature. 4

(j) Discussion. 3

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. 8

(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. 7

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

(j) Calculation of Planck's constant. 3

(k) Discussion on the result. 2

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. 3+3

(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. 8

(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 : 15)

1. Write a algorithm for any one of the following problems. Transfer it to the FORTRAN / C program and show the result. 3+8+2

(a) Find the sum of the following series :

$$S = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \ \cdots \ \frac{(-1)^n x^{2n-1}}{(2n-1)!}$$

with correlation upto 4 decimal places (x and n to be supplied by the examiner) and also find the sum of the terms containing positive sign. 6+2

(b) Compute the value of $\int_{1.75}^{5.25} \left(\sqrt{x} + \frac{x^3}{3}\right) dx$ by Simpson's $\frac{1}{3}$rd rule. 8

(c) Find m and c of a straight line y = mx + c using least square fitting method for the following set of values of (x, y) : 8

(x, y) = (–5, –6), (–4, –4.2), (–3, –2.1), (–2, 0), (–1, 2.1), (0, 4), (1, 6.2), (2, 8.3), (3, 10.4), (4, 12.3).

(d) Convert $(1010111)_2$ and $(110011)_2$ to their decimal equivalent and then find the sum of the corresponding decimal numbers. 6+2

(e) Compute the transpose of the matrix of order (4×3) and find the sum of elements of the transpose matrix. 6+2

(f) Add the matrices 2[A] and 3[B] of order (3×4). 8

(g) Convert $(45)_8$ to its equivalent decimal number and find the sum of all the corresponding decimal digits. 6+2

(h) Generate the following Fibonacci series :

0, 1, 1, 2, 3, 5, 8, 13, 21, 34 and find the sum. 8

Remarks :

1. Marks distribution :

Group—A :

Laboratory Note Book	:	5
Viva-voce	:	5
Experiment	:	45

Group—B :

Laboratory Note Book	:	2
Programming	:	13
Total	:	70

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 4 marks for Group-A experiment and 2 marks 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 an 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.

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 centrally evaluated by the corresponding coordinator and internally by Head of the Department of the college in consultation with supervisors. The co-ordinator will average the mark and submit to the University. The board of studies will recommend the centre for central evaluation of the project work.

2. Distribution of marks :

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