NEW

3-Tier

2015

PHYSICS

(Honours)

PAPER—V

(PRACTICAL)

Full Marks : 100

Time : 2×6 Hours

The figures in the margin indicate full Marks.

Perform any *one* experiment from each group.

Group—A

(*Marks : 40*)

[Experiment — 30, Laboratory Note Book — 5, Viva Voce — 5]

1. Determine the Young's modulus of elasticity for the material of the given bar by the method of flexure. (For two different lengths of the bar).

   (a) Working formula. 2

   (b) Measurements of length, breadth and depth. 1+(1+2)+(1+2)

   (c) Load (m) ~ depression (l) data. 9

   (d) Load – depression graphs and calculation of (m/l). 4+1

(e) Calculation of Y. 1

(f) Proportional error. 2

(g) Discussion. 2

(h) Accuracy. 2

2. Determine the modulus of rigidity (η) of the material of a given wire by dynamical method. (Use two different cylinders of known mass).

(a) Working formula. 2

(b) Radii of the two cylinders (two sets for each). 1+4

(c) Radius of the wire (Five sets of perpendicular readings.) 1+5

(d) Lengths of the suspension wire. 2

(e) Time period of oscillation. 6

(f) Calculation. 3

(g) Proportional error. 2

(h) Discussion. 2

(i) Accuracy. 2

3. Determine the surface tension of water by the capillary rise method and verify Jurin's law. (Use at least four tubes of different radii).

(a) Working formula. 2

(b) Vernier constant of travelling microscope. 1

(c) Length of the pointer. 2

(d) Heights of the liquid columns. 5

(e) Radii of the tubes (r). 8

(f) Data for $\frac{1}{r}$ versus effective height (h) graph. 2

(g) $\frac{1}{r}$ versus h graph and Jurin's law verification. 2+1

(h) Calculation of surface tension. 1

(i) Proportional error. 2

(j) Discussion. 2

(k) Accuracy. 2

4. Determine the coefficient of viscosity by capillary flow method.

(a) Working formula. 2

(b) Length of the capillary tube. 1

(c) Radius of the capillary tube (at its two ends measured by a travelling microscope). 1+3

(d) Temperature of water. 1

(e) Data for difference of liquid levels (h) and flow rate (v). [At least five h values]. 10

(f) h ~ v graph. 3

(g) Calculation of η. 2

(h) K. E. correction. 1

(i) Proportional error. 2

(j) Discussion. 2

(k) Accuracy. 2

5. Verify Stoke's law for all of spherical balls of different radii (at least three) through a viscous liquid of known specific gravity and determine the co-efficient of viscosity of the liquid.

(a) Theory. 2

(b) Diameter and density of the balls. 4+3

(c) Temperature of the liquid. 1

(d) Determination of the terminal velocity region for the biggest ball. 3

(e) Determination of terminal velocity (v) with correction for wall effect and end effect. 6+2

(f) r^2 versus v graph to verify Stoke's law. 3+1

(g) Calculation of η. 2

(h) Discussion. 2

(i) Accuracy. 1

6. To determine the horizontal component of the earth's magnetic field by magnetometer. [at least three different position of bar magnet for each side]

(a) Working formula. 3

(b) Measurement of length and breadth of the bar magnet by slide calipers (v.c. to be determined). 2+2+1

(c) Measurement of mass of bar magnet. 3

(d) Readings of the deflection magnetometer. 3×3
(Eight readings for each slide i.e. total sixteen readings for each position of bar magnet])

(e) Measurement of time period of oscillation of the bar magnet. 3

(f) Calculations. 3

(g) Proportional error. 2

(h) Accuracy. 2

7. Determine the focal length of a concave lens by combination method and also determine the refractive index of the material of the concave lens by measuring its radius of curvature by a spherometer.

(a) Working formula. 3

(b) Data for index correction. 1

(c) Data for focal lengths of the convex lens and the lens combination (2 sets of data for each). 4+4

(d) Calculation of focal lengths. 2

(e) Spherometer constants and radii of curvature of the *concave lens.* 2+6

(f) Calculation of refractive index. 2

(g) Proportional error. 2

(h) Discussion. 2

(i) Accuracy. 2

8. Determine the wavelength of a monochromatic light by Newton's ring expt.

(a) Working formula. 3

(b) Spherometer constants and radius of curvature of the lens. 2+3

(c) Vernier constant of the microscope. 1

(d) Data for ring diameters (D_n) and calculation of D^2_n (at least eight rings). 8+2

(e) Graph of D^2_n *vs.* n. 3

(f) Calculation of wavelength using the graph. 2

(g) Proportional error. 2

(h) Discussion. 2

(i) Accuracy. 2

9. Level and adjust a spectrometer for parallel rays. Measure the angle of the prism with the help of the spectrometer. Determine the refractive index of the material of the prism for two specified rays and the mean ray. Hence calculate the dispersive power of the material of the prism, within the wavelength region considered.

(a) Working principle. 3

(b) Spectrometer constants. 1

(c) Levelling and adjustment for parallel rays. 3

(d) Data for angle of the prism. 5

(e) Direct reading. 2

(f) Minimum deviation for three different colours. 9

(g) Calculation. 3

(h) Discussion. 2

(i) Accuracy. 2

10. Study the reverse characteristics of a given Zener diode to find its Zener voltage and a.c. resistance. Also study the load regulation and line regulation characteristics.

(a) Theory and Schematic circuit diagram. 4

(b) Circuit implementation. 2+1+1

(c) Data for V–A characteristic in reverse bias. 3

(d) V–A characteristic curves. 2

(e) Determination of Zener voltage and a.c. resistance from the graphs. 2

(f) Data for load regulation and line regulation. 3+3

(g) Load regulation and line regulation curves. 3+3

(h) Percentage regulation at specified load current. 1

(i) Accuracy. 2

11. Study the regulation characteristics of a bridge rectifier without any filter and with two different capacitor filters for a given input. Determine the ripple factor (γ) and percentage regulation in each case.

(a) Working formula and schematic diagram. 2+2

(b) Circuit implementation. 3

(c) Data for voltage regulation. 6

(d) Voltage regulation curves. 3

(e) Percentage voltage regulation for a specified current. 3

(f) Measurement of ripple factor. 9

(g) Discussion on voltage regulation and ripple factor. 2

12. Study the input and output characteristics of a given n–p–n or p–n–p transistor in CE mode to find d.c. and a.c. *current gains, output* admittance and input impedance.

(a) Working formula and Schematic circuit diagram. 4

(b) Identification of base. 1

(c) Circuit implementation. 3

(d) Data for input characteristic for one given value of V_{CE}. 2

(e) Input characteristic curve. 2

(f) Data for output characteristics with three specified base currents. 6

(g) Output characteristic curves. 6

(h) Determination of β_{dc}, β_{ac}, the output admittance in the active region and input impedance. 4

(i) Accuracy. 2

13. Draw the static and dynamic mutual characteristics of a triode valve. Hence find the amplification factor (μ), a.c. plate resistance (r_p) and voltage gain (A_v).

(a) Working formula and schematic circuit diagram. 4

(b) Circuit implementation. 3

(c) Data for static mutual characteristics (3 sets). 6

(d) Data for dynamic characteristics (2 sets.) 4

(e) Static and dynamic characteristic curves. 6

(f) Calculation of μ and r_p from linear portion of the static characteristics. 2

(g) Calculation of A_v from dynamic characteristics. 1

(h) Verification of the relation connecting A_v, μ, r_p and R_L with comments. 2

(i) Accuracy. 2

Group—B

(Marks : 50)

(Experiment — 40, Laboratory Note Book — 5, Viva Voce — 5]

14. Determine the thermal conductivity of a bad conductor by Lees and Chorlton's method.

(a) Working formula. 3

(b) Measurements of diameter and thickness (at two places) of the disc. 2+6

(c) Steady state temperature with initial temperature correction. 4+1

(d) Data for cooling curve. 8

(e) Drawing of cooling curve. 4

(f) Data for Bedford's correction. 2

(g) Calculation. 4

(h) Proportional error. 2

(i) Discussion. 2

(j) Accuracy. 2

15. Calibrate the given polarimeter for an active solution of different concentrations by volume. Hence find out the concentration of a given active solution of the same solute and determine the specific rotation of the solution.

(a) Working formula. 3

(b) Vernier constant. 1

(c) Data for pure water. 2

(d) Preparation of solutions of six different concentrations. 8

(e) Data with solution of known strength for 'C – θ' graph. 12

(f) 'C ~ θ' graph. 3

(g) Concentration of the given active solution. 3

(h) Specific rotation. 2

(i) Proportional error. 2

(j) Discussion. 2

(k) Accuracy. 2

16. Study the intensity distribution of diffraction pattern of a grating by Laser and LDR. Also determine the wavelength of the laser light.

(a) Theory. 3

(b) Spectrometer constant. 1

(c) Setting of the grating for normal incidence. 5

(d) Measurement of relative intensity with respect to the central maximum and diffraction angle (upto fourth order). 10+10

(e) Calculation of wavelength. 2

(f) Bar chart for relative intensity distribution. 5

(g) Discussion. 2

(h) Accuracy. 2

17. Study the variation of the thermo e.m.f. 'e' with temperature 't' of the test junction of a thermocouple at six different temperatures (room temperature to boiling point of water), keeping the cold junction in an ice bath. Hence obtain the mean thermo-electric power within the temperature range 40°C to 80°C. Also find the melting / freezing point of a given solid.

(a) Working formula and circuit diagram. 2+2

(b) Circuit implementation. 3

(c) Resistance of Potentiometer wire. 6

(d) 'e' at different temperatures. 15

(e) Data for melting / freezing point. 3

(f) 'e ~ t' curve 3

(g) Determination of thermo electric power and melting / freezing point. 2

(h) Proportional error. 2

(i) Accuracy. 2

18. Study the variation of resistance with temperature of a given thermister for two given constant voltages (set by the examiners). Hence find the melting / freezing point of a given solid. Also find the band gap from the thermister characteristics.

(a) Working formula and circuit diagram. 2+2

(b) Circuit implementation. 3

(c) Data for thermister characteristics. (two sets for two different voltages.) (at least seven readings for each.) 7×2

(d) Recording of thermister current with time during melting / freezing. 4

(e) Thermister characteristics (two separate graphs). 3×2

(f) Drawing of melting / freezing curves. 3

(g) Determination of melting / freezing point from two characteristics curves. 2

(h) Determination of band gap from two graphics. 2

(i) Accuracy. 2

19. Study the growth and decay pattern in dc C–R circuit. Hence find the time constant of the circuit. Two different combinations of C–R to be studied.

(a) Working formula and circuit diagram. 2+2

(b) Circuit implementation. 3

(c) Data for growth and decay for one set of C–R combination (at least eight readings for each). 4+4

(d) Data for growth and decay for another set of C–R combination (at least eight readings for each). 4+4

(e) Drawing of growth and decay curves for two C–R combinations in two separate graphs. 4+4

(f) Determination of time constants from each. 4

(g) Comparison with theoretical value of time constant. 3

(h) Accuracy. 2

20. Determine the boiling point of a given liquid using platinum resistance thermometer.

(a) Working formula and circuit diagram. 2+2

(b) Circuit implementation. 3

(c) Electrical mid point. 2

(d) Data for resistance of Pt coil at three different temperatures. 15

(e) Evaluation of 'ρ' of the bridge wire. 3

(f) Barometric height and boiling point of water. 3

(g) Calculation of resistance, 't_{Pt}' and boiling point. 3+1+2

(h) Proportional error. 2

(i) Accuracy. 2

21. With the help of a ballistic galvanometer, determine the mutual inductance (M) of the given pair of coils for at least thirteen different inclinations (ϕ) from 0° to 180°. Draw the 'M ~ ϕ' graph.

(a) Working formula and circuit diagram. 2+2

(b) Circuit implementation. 3

(c) Period of oscillation. 4

(d) Measurement of log decrement. 4

(e) Steady deflection. 2

(f) Ballistic throws for different inclinations. 13

(g) Calculation of M and 'M ~ ϕ' graph. 2+4

(h) Proportional error in M at $\phi = 0°$. 2

(i) Accuracy. 2

22. Determine the strength of magnetic field values between the pole pieces of an electromagnet due to different d.c. magnetising currents by a search coil, a ballistic galvanometer and a standard solenoid. Draw the 'I ~ B' curve. (Constants of search coil and solenoid are supplied).

(a) Working formula and circuit diagram. 2+2

(b) Circuit implementation. 3

(c) Data (four) for 'I ~ d' graph. 4

(d) 'I ~ d' graph. 3

(e) Ballistic throws for at least seven magnetising currents. 14

(f) Calculation of B. 4

(g) 'I ~ B' graph. 4

(h) Discussion. 2

(i) Accuracy. 2

23. Draw the resonance curve of a circuit containing a capacitor, a resistor and a coil of unknown inductance in series. Calculate the value of inductance from the resonant frequency. Repeat the observations with another resistor. Find the Q factors for both the L–C–R combinations.

(a) Working formula and circuit diagram. 4

(b) Circuit implementation. 1

(c) Current versus frequency data for the L–C–R combinations. 10

(d) Resonance curves. 6

(e) Determination of L and Q from resonance curves. 2+4

(f) Comparison of Q with theoretical values. 2

(g) Data for phasor diagram at resonance for any one L–C–R combination. 4

(h) Phasor diagram at resonance. 3

(i) Discussion. 2

(j) Accuracy. 2

24. Study the characteristic of a ballistic galvanometer by steady deflection method and standard capacitor method.

(a) Working formulae and circuit diagrams for each method. 4+4

(b) Circuit implementations. 2+2

(c) Period of oscillation. 3

(d) Scale to galvanometer distance. 1

(e) Galvanometer resistance by half deflection method. (Data with three current values for a shunt resistance). 6

(f) Calculation of galvanometer constant following steady deflection method. 3

(g) Throw due to capacitor discharge. (Three different voltages to be applied for charging). 6

(h) Log decrement. 4

(i) Calculation of galvanometer constant following standard capacitor method. 3

(j) Comparison of galvanometer constant obtained from two methods and comments. 2

25. Determine the average resistance per unit length (ρ) of a bridge wire by Carey Foster's method. Hence determine the given unknown resistance (R). Also determine R with the help of a P.O. box.

(a) Working formula and circuit diagram. 4

(b) Circuit implementation. 3

(c) Measurement of ρ (5 sets of readings). 11

(d) Measurement of R by Carey Foster's method (5 sets of readings). 11

(e) Measurement of R by P.O. box. 5

(f) Proportional error. 2

(g) Comments on measurements by the two methods. 2

(j) Accuracy. 2

26. Make a series CR circuit with suitable capacitor and resistances to an a.c. source to study the current-voltage relationship and to study the variation of reactance of the capacitor with frequency of the a.c. sources

(a) Working formula and circuit diagram. 3

(b) Circuit implementation. 2

(c) Data for I versus V_C graph at least for four input voltage for each frequency.

(Take four frequencies say 50Hz, 100Hz, 150Hz, 200Hz). 4×4

(d) Draw I ~ V_c graph for four input frequencies and obtain $1/Z_c$ for each case. 4×3

(e) Draw $\frac{1}{Z_c} \sim f$ graph and determine C from graph. 3

(f) Discussion. 2

(g) Accuracy. 2

Group—C

(Marks : 10)

(Experiment — 7, Laboratory Note Book & Viva Voce — 3]

Answer *one* question in Fortran or in C.

1. Write a program to find the maximum among N numbers and verify it for a given set of data. 3+4

2. Write a program to arrange N numbers in ascending order and verify it for a given set of numbers. 3+4

3. Write a program to compute mean, median and mode of a set numbers and verify it for a given set of numbers. 3+4

4. Write a program to compute the sum of a GP series term by term and verify it for a given series. 3+4

5. Use origin software to draw a mean graph with given set of data with proper label and scale

5+2

6. Write a program to find the roots of a quadratic equation: $ax^2 + bx + c = 0$ and verify it for given values of a, b and c.

3+4

7. Write down a program to find the area of a circle, given by the equation : $x^2 + y^2 = a^2$ and verify it for given value of a.

3+4

NEW

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2015

PHYSICS

(Honours)

PAPER—V

(PRACTICAL)

Full Marks : 100

Time : 2×6 Hours

The figures in the margin indicate full Marks.

Instructions to the Examiners.

1. At least eleven experimental set-ups to be arranged for each of Group—A & Group—B.
2. Second chance of drawing cards may be allowed without deducting marks. However, for third chance, 3 marks for Group—A and 4 marks for Group—B must be deducted.
3. At least two readings for each experiment of Group—A & Group—B should be checked and signed by the examiners.
4. If working formula of circuit diagram are found wrong before starting the experiment the examinee may be told to make it correct in front of the examiners without penalising. Otherwise, formula and circuit diagram should be supplied with deduction of marks allotted for it.

5. If an examinee is provided help for performing an experiment (data recording, making circuit, focussing of optical instruments etc.) then the nature of help provided should be written on the answer script and marks should be deducted accordingly.

6. Examiners are to give different set of data for Group—C experiments to different examinees. Each examinee has to take print out of the results of Group—C or to show the results to the examiners. Each examinee may be provided a computer for maximum 45 minutes.

7. In Laboratory Note Book, 2 marks for 6–7, 3 marks for 8–10, 4 marks for 11–13 and 5 marks for more than 13 properly signed experiments may be awarded.

N.B. The evaluated answer scripts should be sent to the H.E. within one month from the date of completion of the examination.

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