2018

CBCS

3rd Semester

PHYSICS

PAPER—C6P

(Honours)

(Practical)

Full Marks : 20

Time : 2 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.

Illustrate the answers wherever necessary.

Thermal Physics Lab.

Distribution of Marks : ***LNB–02; Viva–03; Experiment–15***

Write an experiment (any *one*) : 1×15

1. A fluid is flowing through a horizontal tube containing a metal thick coil placed axially along its length. A suitable

current is allowed to pass through its coil. Note the temperature difference recorded by the thermometers placed at the intel and at the outlet respectively. Note the potential difference across the coil and the current through it, also measure the volume of the fluid flowing per second through the tube. Repeat there steps for three different sets of currents and voltages. Hence find the specific heat of the fluid. Distribution of Marks :

(i) Theory (Circuit diagram and working formula) 2+3

(ii) Initial steady temperature difference of the thermometers. 1

(iii) Setting different (at least three) current through the coil and noting the potential differences record the steady temperature difference of the thermometers. 3

(iv) Collection of fluid for the sets of current. 3

(v) Calculation. 2

(vi) Accuracy. 1

2. Measure the thermal conductivity of copper using the Searle's Bar method. Note the temperature differences recorded by the thermometers placed at the inlet, at the

out let of coiled tube and that between the thermometers placed at the points on the bar. Allow steam to pass through the steam chest and wait till the steady state is reached. (Specific heat capacity of water--4.18 J/gm/°C

Distribution of marks :

(i) Theory (working formula and figure). 2+1

(ii) Initial steady temperature difference of thermometers used in the coiled tube. 1

(iii) Measure temperature of four thermometers. 2

(iv) Collection of water in a given time 't'. 3

(v) Vernier constant of slide callipers. 1

(vi) Diameter of the bar. 1

(vii) Distance between the thermometer on the bar. 1

(viii) Calculation. 2

(ix) Accuracy. 1

3. Determine the thermal conductivity of a bad conductor in the form of a disc by Lee's and Charlton's method.

To be supplied :

(i) Mass and thickness of the lower disc

(ii) Diameter and thickness of the bad conducting body.

Distribution of marks :

(i) Theory (working formula with Bedfor's correction)	2
(ii) Initial error of the thermometers.	1
(iii) Time-temperature record during heating.	3
(iv) Time-temperature record during cooling.	3
(v) Graph to find the rate of cooling.	2
(vii) Bedford's Correction.	1
(viii) Calculation.	2
(ix) Accuracy.	1

4. Determine the boiling point 't' of the given liquid using the given platinum resistance thermometer. Evalute 't' by one successive approximation method. (steam point to be supplied)

(i) Theory (Circuit diagram and working formula) 1+1

(ii) Data for electrical mid point. 1

(iii) Data for determination of the resistance of the platinum coil in ice, steam and boiling point of the liquid. 2+2+2

(iv) Evaluation of P of the bridge-wire.. 2

(v) Calculation of resistance at the temperatures. 2

(vi) Evaluation of t_{pt}. 1

(vii) Evaluation of the boiling point 't'. 1

5. Measure the resistance of potentiometer wire (R_p) Investigate the variation of the thermo-emf 'e' with temperature 't' of the test junction of the given thermocouple (the reference junction is kept in ice bath).

Plot the e-t graph with in 0°C and 80°C (taking at least eight readings). Calculate the thermo-electric power at 50°C.

Distribution of marks :

(i) Theory (Circuit diagram and working formula) 1+1

(ii) Data for the calculation of R_p. 2

(iii) Calulation of R to be put in series with the potentiometer wire for $5\mu V/cm$ drop. 1

(iv) Data for e-t graph. 4

(v) Calculation of thermo-emf 'e'. 2

(vi) e-t graph. 2

(vii) Determination of thermo-electric power from the graph. 1

(viii) Accuracy. 1

6. Calibrate a thermocouple within the temperature range of 80°C and room temperature (cold junction to be maintained at ice bath) using null point length (l) Vs. temperature (t) graph. Find the melting point of a given substance using the calibration curve. (Resistance of the potentiometer to be supplied)

Distribution of marks :

(i) Theory (Circuit diagram and working formula) 1+1

(ii) Calculation of R to be put in series with the potentio meter wire for 5μV / cm drop. 1

(iii) Data for (null-point length-temperature) graph. 3

(iv) Null point length-temperature graph. 1½

(v) Data for null point length-time graph during melting or freezing. 4

(vi) Null point length-time graph. 1½

(vii) Evaluation of melting point using calibration curve. 1

(viii) Accuracy. 1

7. Calibrate a thermocouple to measure temperature in a specified range *(prefferably* 40°C to 80°C or more) by direct measurement using OPAMP difference amplifier.

(a) Theory. 2

(b) Circuit diagram and offset null adjustment. 2

(c) Hot junction temperature vs. output voltage data for at least six different temperatures. 6

(d) Calibration curve (hot junction temperature vs output voltage). 3

(e) Calculation of thermo-emf at 60°C temperature from graph. 2

8. Determine the coefficient of thermal conductivity of copper (Cu) by Angstrom's Method.

(a) Theory. 2

(b) Recording of Experimental data. 9

(c) Results and calculations 4