

U.G. 3rd Semester Examination - 2020

PHYSICS

[HONOURS]

Course Code : PHY-H-CC-P-06

(Thermal Physics)

[PRACTICAL]

Full Marks : 20

Time : 2 Hours

The figures in the right-hand margin indicate marks.

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

Answer any **two** of the following: $10 \times 2 = 20$

1. What do you mean by the coefficient of linear expansion? What is its unit? How will this coefficient change if (i) the length is expressed in inches instead of a centimetre (ii) the temperature is expressed in Fahrenheit instead of Celsius? Briefly describe (with suitable diagram) the basic principle of determination of coefficient of linear expansion of a metal rod using an optical lever. Why should we keep the meter scale at a long distance from the mirror in an optical lever arrangement?
1+1+2+5+1

2. Define coefficient of thermal conductivity. What is the unit of it? Write down the working formula for

[Turn Over]

the measurement of the coefficient of thermal conductivity for a material used in Searle's method. Briefly describe the working principle (with the necessary diagram) to illustrate the method. Why do we want to avoid the radial flow of heat in this method? Is this method suitable for a bad conductor?

1+1+1+5+1+1

3. Write down the working formula for the measurement of thermal conductivity of a non-metallic solid using Lee's disc method. Briefly describe the experimental arrangement (with necessary diagram) and the basic principle of this method. At what temperature, do we find the rate of radiation? Can this method be used in the case of a good conductor and why? Can this method be used in the case of liquids?
1+5+1+1+2
4. What do you mean by temperature coefficient of resistance (α)? What is its unit? Why have you chosen platinum for this purpose? Describe briefly with a suitable circuit diagram, the role of Callendar and Griffith's bridge in measuring α using a platinum resistance thermometer. What is the function of compensating leads in the platinum resistance thermometer? Resistance of a Pt-thermometer is given as R_0 (resistance at 0°C) = 2.57Ω , R_{100} (resistance at 100°C) = 3.57Ω and $R_t = 2.89 \Omega$.

Calculate t on platinum scale and on Celsius scale.

1+1+1+4+1+2

5. What are the thermocouple and thermoelectric effects? What are the neutral temperature and temperature of inversion of a thermocouple? Write down the working formula and draw the circuit diagram for measurement of the thermo-e.m.f. of a copper-constantan thermocouple by using a potentiometer. How do we calibrate the potentiometer in this experiment? What are the values of thermo-e.m.f. in a copper-constantan and a copper-iron thermocouple? 2+1+2+3+1+1

6. What is meant by the mechanical equivalent of heat? Write down the working formula and the basic principle (with suitable diagram) for the measurement of the mechanical equivalent of heat by using Callendar and Barne's constant flow calorimeter. Are you using A.C. or D.C for heating the coil? How much potential difference do we apply in the experiment? What if a large potential difference is applied? Why is the heating coil taken in the form of a helix in this experiment?

1+2+3+1+1+1+1
