CITY COLLEGE
Semester-V Online Practical Examination (CBCS) 2020-21
Physics Honours
Paper: CC-12: Solid state Physics

Time: 1 hr. 30 min.   **Full Marks: 30**

Answer any one question:-

1. a) Write down the working formula for the determination of energy band gap of a semiconductor by Four-probe method.   5
    b) Draw the necessary circuit diagram.   3
    c) Derive the expression for ρ with necessary diagram.   5+2
    d) From the data given below calculate resistivity and draw $\log_{10}\rho$ versus $\frac{1}{T}$ graph.   5+5
    e) Hence determine the value of energy band gap (E_g) of the given sample.   3
    f) From your result identify whether the given sample is Ge or Si?   2

Given:-
Distance between the probes S = 0.2 cm.
Thickness of the crystal W = 0.05 cm.
Correction factor = 5.89
Variation of voltage V with temperature T at a constant current I = 3.0 mA

Temperature T in K	Voltage V in mV
307	263
315	245
323	214
331	181
339	146
347	115
355	91
363	71
371	56
379	44

2. a) Draw the necessary circuit diagram for drawing B-H loop of a specimen given in the form of an anchor ring.   6

For calibration of the galvanometer use standard solenoid.

Given:-

Number of turns per unit length of the primary of the anchor ring (n_1)	1486 m^{-1}
Number of turns in the secondary of the anchor ring (n_2)	100
Number of turns per unit length of the primary of the solenoid (n_3)	486 m^{-1}
No of turns in the secondary of the solenoid (n_4)	2000
Mean diameter of the core of the anchor ring (D_1)	0.01 m
Mean diameter of the primary of the solenoid (D_2)	0.027 m
Mean value of I/d (When current in the primary of the solenoid changes from +I to –I, the deflection on the galvanometer scale is d)	54.2 A/m

b) Let the values of the magnetic field within the specimen are B_1 and B_2 when the magnetising current (through the primary of the anchor ring) values are I_1 and I_2 respectively. When the current changes from I_1 to I_2, galvanometer shows a deflection d_1. Express $(B_1 – B_2)$ in terms of d_1, I/d and the constants mentioned in the above table.   4

c) Given :- $I_1 = 3.5$ A

I_2 (in A)	d_1 (in cm)
-3.5	21.4
3.0	0.4
2.5	0.8
2.0	1.6
1.5	2.4
1.0	3.5
0.5	5.0
0.0	7.4
-0.5	11.5
-1.0	16.2
-2.0	19.0
-3.0	20.6

Find B_1, H_1. For all given I_2 find B_2, H_2.   (2+2) + (5+5)

d) Draw the part of B-H loop with the data you have. (Use only B_2, H_2 values that you have calculated.)   6

Answer scripts must be emailed to sem5hcityphysics@gmail.com within 15 minutes of the end of the examination.