

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION)**

CLASS: BTECH
BRANCH: EEE

SEMESTER: 5TH
SESSION: MO/2022

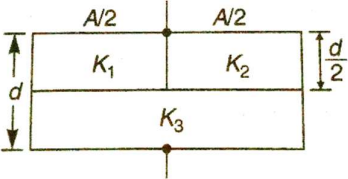
SUBJECT: EE413 SENSORS AND TRANSDUCERS

TIME: 2 HOURS

FULL MARKS: 25

INSTRUCTIONS:

1. The total marks of the questions are 25.
2. Candidates attempt for all 25 marks.
3. Before attempting the question paper, be sure that you have got the correct question paper.
4. The missing data, if any, may be assumed suitably.
5. Tables/Data handbook/Graph paper etc. to be supplied to the candidates in the examination hall.

| | | | CO | BL |
|----|--|-----|------------|-----|
| Q1 | (a) Define resolution and selectivity of a sensor. | [2] | CO1 | BL1 |
| Q1 | (b) When is radiation method used for temperature measurement? State the main components of a radiation pyrometer? | [3] | CO1 | BL1 |
| Q2 | (a) List the desirable properties for selection of a material for strain gauge construction? | [2] | CO1 CO2 | BL1 |
| Q2 | (b) Explain the operating principle of an LVDT with proper diagram and mathematical relations. What are the applications of LVDT? | [3] | CO1 CO3 | BL2 |
| Q3 | (a) A Pt resistance thermometer measures temperature between 0 - 200°C. The resistance $R_T \Omega$ at $T^\circ\text{C}$ is given by $R_T = R_0 (1 + \alpha T + \beta T^2)$. $R_0 = 100 \Omega$, $R_{100} = 138.5 \Omega$, $R_{200} = 175.83 \Omega$. (i) Using the above information, solve for the values of α and β . (ii) Find the non-linearity at 100°C as a percentage of full-scale deflection. | [2] | CO1 CO2 | BL3 |
| | (b) A parallel plate capacitive sensor of area 'A' and separation of 'd' consists of multiple dielectric mediums with dielectric constants (K_1 , K_2 and K_3) as shown in the figure. Now, a single medium of dielectric constant K is to be used to have the same capacitance between the two electrodes. Solve the problem to find the value of K? | [3] | CO1 CO2 | BL3 |
| |  | | | |
| Q4 | A permanent magnet is attached to an object. Explain how a magnetostrictive sensor can be used to determine the position of the object. | [5] | CO1 CO3 | BL2 |
| Q5 | (a) Differentiate between photoconductive and photovoltaic cells. | [2] | CO1 | BL4 |
| Q5 | (b) An experiment to calibrate a Cu-Constantan thermocouple is conducted. With cold junction temperature at 0°C, the emfs obtained at 100°C and 445°C are 5mV and 25mV respectively. Assuming a second order relation between thermo-emf and temperature difference, solve the problem to find the following. (i) Constants 'a' and 'b'. (ii) If the thermocouple indicates an emf of 2mV with a cold junction temperature at 40°C, find the unknown hot junction temperature. (iii) If cold junction is maintained at 40°C, what would be the emf when the hot junction is at 500°C? | [3] | CO1 CO2 | BL3 |