

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION- 2023

M.Tech.-I Semester (CS/IT/ECE/Civil/BT)

COURSE CODE (CREDITS): 21M11EC111 (3)

MAX. MARKS: 25

COURSE NAME: SENSOR AND SMART INSTRUMENTATION

COURSE INSTRUCTORS: Dr. HARSH SOHAL

MAX. TIME: 1 Hour 30 Minutes

Note: (a) All questions are compulsory.

(b) Marks are indicated against each question in square brackets.

(c) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

Q1. [CO1, CO2,] [6]

- a) What is the principle of operation of Piezo-electric Transducers? [1]
- b) What is Gauge pressure? How is it related to Atmospheric pressure? [1]
- c) What are the factors to be considered while selecting a manometric liquid for U tube manometer in industrial measurements? [2]
- d) Why should we avoid a measuring technique which involves subtraction of experimental results (quantities)? Explain with an example. [2]

Q2. [CO2, CO4] [6]

(a) What is calibration? Describe soft calibration with reference to smart instrumentation systems? Can we reduce Random Errors using calibration? Explain. [3]

(c) Near room temperature, the thermo emf generated in a copper-constantan couple is $60 \mu\text{V}$ per degree celsius. What is the smallest temperature that can be detected with a single such couple and a galvanometer of 90Ω resistances capable of detecting current as low as $8 \mu\text{A}$. [3]

Q3. [CO3] You are provided with an RTD, a thermister, a radiation pyrometer. You are asked to measure the temperature of a furnace (Temperature of the order of 2000 degree Celcius). Which of the above will be the best choice? Answer the question while discussing pros and cons of each of the given devices by plotting their characteristics. [5]

- Q4. [CO3] A platinum thermometer has a resistance of 80Ω at 25°C . Find its resistance at 65°C
- if the platinum has a resistance temperature co-efficient of $0.00392/^\circ\text{C}$.
 - If the thermometer has a resistance of 175Ω , calculate the temperature. [2+2]

Q5. [CO4] [4]

- (a) A capacitive transducer uses two quartz diaphragms of area 800 mm^2 separated by a distance of 3.0 mm . A pressure of 800 kN/m^2 when applied to the top diaphragm produces a deflection of 0.6 mm . The capacitance is 350 pF when no pressure is applied to the diaphragms. Find the value of capacitance after the application of a pressure of 800 kN/m^2 . [4]