Dr Rom Ninas Ma	11/5/2022 Poll No
National Institute of Tec. Examination: B.Tech. End Ser	hnology, Hamirpur (H.P.) mester Examination, May-2023
Branch : Open Elective	Semester : VI th
Course : Sensors & Transducers	Code : EE-380
Time: 03:00 Hours	Maximum Marks: 50

Instruction: Attempt all the questions.

Q. 1. In a test, temperature is measured 100 times with variations in apparatus and procedures. After applying the corrections; the results are:

Temperature °C	397	398	399	400	401	402	403	404	405
Frequency of occurrence	1	3	12	23	37	16	4	2	2

Calculate: (a) arithmetic mean, (b) mean deviation, (c) standard deviation, (d) the probable error of one reading, (e) the standard deviation and the probable error of the mean, and (f) the standard deviation of the standard deviation. [06]

- Q. 2. A 10,000 Ω variable resistance has a linearity of 0.1 % and the movement of contact arm is 320°. (a) Determine the maximum position deviation in degrees and the resistance deviation in ohm. (b) If this instrument is to be used as a potentiometer with a linear scale of 0 to 1.6 V determine the maximum voltage error. [04]
- **Q. 3.** A single strain gauge having resistance of 120 Ω is mounted on a steel cantilever beam at a distance of 0.15 m from the free end. An unknown force F applied at the free end produces a deflection of 12.7 mm of the free end. The change in gauge resistance is found to be 0.152 Ω . The beam is 0.25 m long with a width of 20 mm and a depth of 3 mm. The Young's modulus for steel is 200 GN/m². Calculate the gauge factor. **[05]**
- **Q. 4.** A thermistor has a resistance of 3980 Ω at the ice point (0°C) and 794 Ω at 50°C. The resistance-temperature relationship is given by $R_T = aR_0 \exp(b/T)$. Calculate the constants *a* and *b*. Also calculate the range of resistance to be measured in case the temperature varies from 40°C to 100°C. [05]
- Q. 5. A steel cantilever is 0.25 m long, 20 mm wide and 4 mm thick. (a) Calculate the value of deflection at the free end for the cantilever when a force of 25 N is applied at this end. The modulus of elasticity for steel is 200 GN/m². (b) An LVDT with a sensitivity of 0.5 V/mm is used. The voltage is read on a 10 V voltmeter having 100 divisions. Two tenths of a division can be read with certainty. (c) Calculate the minimum and maximum value of force that can be measured with this arrangement.
- Q. 6. Describe the construction, principle of working and applications of Variable Reluctance transducers. [05]
- Q. 7. A capacitive transducer is made up of two concentric cylindrical electrodes. The outer diameter of the inner cylindrical electrode is 3 mm and the dielectric medium is air. The inner diameter of the outer electrode is 3.1 mm. Calculate the dielectric stress when a voltage of 100 V is applied across the electrodes. Is it within safe limits? The length of electrodes is 20 mm. Calculate the change in capacitance if the inner electrode is moved through a distance of 2 mm. The breakdown strength of air is 3 kV/mm.
- Q. 8. Explain the different principles of working of capacitive transducers.
- Q. 9. A barium titanate pickup has dimensions of 5 mm × 5 mm × 1.25 mm. The force acting on it is 5 N. The charge sensitivity of barium titanate is 150 pC/N and its permittivity is 12.5 × 10⁻⁹ F/m. If the Modulus of elasticity of barium titanate is 12 × 10⁶ N/m², calculate the strain. Also calculate the charge and capacitance. [05]
- Q. 10. Describe the construction, principle of working and applications of Hall Effect transducers.

**** All the Best ****

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