



**GENERAL INSTRUCTIONS TO THE CANDIDATES**

1. Candidates are instructed to answer the questions as per Bloom's Taxonomy knowledge level (K<sub>1</sub> to K<sub>6</sub>)
2. Candidates are strictly instructed not to write anything in the question paper other than their roll number.
3. Candidates should search their pockets, desks and benches and handover to the Hall Superintendent/ Invigilator if any paper, book or note which they may find therein as soon as they enter the examination hall.
4. Candidates are not permitted to bring electronic watches with memory, laptop computers, personal systems, walkie-talkie sets, paging devices, mobile phones, cameras, recording systems or any other gadget / device /object that would be of unfair assistance to him / her.
5. Corrective measures as per KCT examination policies will be imposed for malpractice in the hall like copying from any papers, books or notes and attempting to elicit the answer from neighbours.

**B.E DEGREE EXAMINATIONS: DEC 2015**

(Regulation 2014)

Third Semester

**ELECTRONICS AND INSTRUMENTATION ENGINEERING**

U14EIT302: Sensors and Transducers

**Time: Three Hours**

**Maximum Marks: 100**

**Answer all the Questions:-  
PART A (10 x 1 = 10 Marks)**

1. Matching the following

CO5 [K<sub>2</sub>]

List I		List II	
A. LVDT		i. Stress analysis	
B. Hot wire anemometer		ii. Displacement	
C. Hall effect transducer		iii. f low	
D. Strain gauge		iv. Current&voltage	

- |    | A   | B   | C  | D   |
|----|-----|-----|----|-----|
| a) | ii  | iii | iv | i   |
| b) | ii  | iv  | i  | iii |
| c) | iii | ii  | iv | i   |
| d) | iv  | ii  | i  | iv  |

2. The dimension for power is CO1 [K<sub>1</sub>]
- a)  $M^2L^2T^{-2}$  b)  $M^2L^2T^2$
- c)  $ML^2T^{-3}$  d)  $ML^2T^{-2}$
3. In measurement systems, which of the following are undesirable static characteristics? CO2 [K<sub>2</sub>]
- a) Sensitivity and accuracy b) Drift, static error and precision
- c) Reproducibility and non linearity d) Drift, static error, dead zone and non linearity
4. In second order system, the frequency of damped oscillations is 18 rad/s. The value of damping factor is 0.866. The natural frequency of oscillations is CO2 [K<sub>2</sub>]
- a) 17.6 rad/s b) 19.3 rad/s
- c) 36 rad/s d) 9 rad/s
5. Consider the following statements CO3 [K<sub>3</sub>]
1. Thermistor is more sensitive than platinum resistance thermometer
2. The resistance of thermistor is solely a function of its absolute temperature whether the source of heat is external or internal.
3. Thermistor has linear temperature-resistance relationship
4. Thermistor has linear negative temperature coefficient
- Of the Statements, the correct statements are
- a) 1 and 2 b) 3 and 4
- c) 1, 2, 3, 4 d) 1, 2 and 4
6. Air cored transducers are suitable for use CO3 [K<sub>2</sub>]
- a) At lower frequencies b) At higher frequencies
- c) At equal frequencies d) As are employed for iron cored transducers.
7. **Assertion(A):** Capacitive transducers can be used for measurement of liquid level. CO4 [K<sub>2</sub>]  
**Reason (R):** The principle of operation used in this case is change of dielectric medium.
- a) Both A and R are true and R is correct explanation of A b) Both A and R are true but R is not correct explanation of A
- c) A is true R is false d) A is false R is true
8. **Assertion (A):** An RTD uses platinum coil. CO3 [K<sub>2</sub>]  
**Reason (R):** Platinum is a very stable material.
- a) Both A and R are true and R is correct explanation of A b) Both A and R are true but R is not correct explanation of A
- c) A is true R is false d) A is false R is true

9. Some of the functional building blocks of the measurement system are PSE (Primary sensing element), VCE (variable conversion element), DTE(Data Transmission element),VME(variable manipulation element), DPE(data presentation element). The correct sequential connection of functional building blocks for an electronic pressure gauge will be
- a) PSE,VME,VCE,DPE,DTE                      b) PSE,VCE,VME,DTE,DPE  
 c) DTE,DPE,VCE,PSE,VME                      d) PSE,VCE,DTE,DPE,VME
10. Which of the following effects is used in measurement of magnetic flux?                      CO5 [K<sub>2</sub>]
- a) Hall effect    b) Piezoelectric effect  
 c) Photoelectric effect                              d) Seebeck effect

**PART B (10 x 2 = 20 Marks)**

**(Answer not more than 40 words)**

11. Identify the functional elements of measurement system.                      CO1 [K<sub>2</sub>]
12. Review the classification of transducers.                      CO1 [K<sub>2</sub>]
13. Report the different standard inputs for studying the dynamic response of a system.                      CO2 [K<sub>2</sub>]
14. Define hysteresis and sensitivity.                      CO2 [K<sub>2</sub>]
15. A platinum resistance thermometer has a resistance of 100Ω at 25°C. Find its resistance at 65°C if the platinum has a resistance temperature coefficient of 0.00392/°C.                      CO3 [K<sub>2</sub>]
16. Summarize gauge factor.                      CO3 [K<sub>2</sub>]
17. Recall the working principle of induction potentiometer.                      CO4 [K<sub>2</sub>]
18. Sketch the frequency response of capacitance transducers.                      CO4 [K<sub>2</sub>]
19. Tell magnetostrictive effect.                      CO5 [K<sub>2</sub>]
20. Record the parameters that influence selection of transducer (any 4).                      CO5 [K<sub>2</sub>]

**Answer any FIVE Questions:-**

**PART C (5 x 14 = 70 Marks)**

**(Answer not more than 300 words)**

**Q.No. 21 is Compulsory**

21. (i) Identify the various types of errors and their sources for a measurement system.                      (10) CO1 [K<sub>2</sub>]  
 Also discuss the methods of eliminating or fixing the errors.

(ii) The solution for unknown resistance for a wheat stone bridge is  $R_x = \frac{R_2 R_3}{R_1}$  (4) CO3 [K<sub>3</sub>]

where  $R_1 = 500 \Omega \pm 1\%$ ,  $R_2 = 615 \Omega \pm 1\%$ ,  $R_3 = 100 \Omega \pm 0.5\%$ . Determine the magnitude of the unknown resistance and the limiting error in percent and in ohm for the unknown resistance  $R_x$ .

22. Temperature of metal bath is measured 100 times with variation in apparatus, procedures and persons. The readings are tabulated below. CO1 [K<sub>3</sub>]

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

Calculate (i) Arithmetic Mean (ii) Mean Deviation (iii) Standard deviation (iv) Probable error of one reading (v) standard deviation and probable error of the mean.

23. Build the step response and ramp response of first order instruments with necessary equations. Sketch the response curves and also find the steady state error in each case. CO2 [K<sub>3</sub>]

24. (i) Discuss about Resistance temperature characteristics and current-voltage characteristics of thermistor. (7) CO3 [K<sub>2</sub>]

(ii) Describe the construction and working principle of Constant Current type and Constant Temperature type anemometers. (7) CO3 [K<sub>2</sub>]

25. Elaborate in detail the construction and working principle of LVDT with neat diagrams. Also list its advantages and disadvantages. CO4 [K<sub>2</sub>]

26. (i) Describe the construction, principle of working and applications of Hall effect transducer. (8) CO5 [K<sub>2</sub>]

(ii) Discuss the different modes of operation of piezoelectric transducer. (6) CO5 [K<sub>2</sub>]

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