

**BITS,PILANI- DUBAI CAMPUS**

**Knowledge Village, Dubai**

**Year III – Semester I 2004 – 2005**

**TEST I (Closed Book)**

**Course No: INSTR UC381**

**Course Title: Transducers & Measurement Systems**

**Date: 17.10.04**

**Time:50 Minutes**

**M.M = 20(20%)**

**I EACH PART OF THIS QUESTION CARRIES 1 MARK.**

**(10)**

1. **Define Transducer and give an example.**
2. .... & ..... Stages are called as 'Intermediate stage' of generalized measurement system.
3. .... & ..... are the modifying inputs of 'U'tube manometer.
4. **Define Range & Span.**
5. **Define linearity.**
6. **Time Constant is defined as .....**
7. **Ranges of Rotary Potentiometer and helipots are ..... & .....**
8. **What are the advantages of High permeability Ni – Iron core in LVDT?**
9. **Mention any two trade names of Synchros.**
10. **A Hall effect transducer is used for the measurement of a magnetic field of  $0.5\text{Wb}/\text{m}^2$ . The 2 mm thick slab is made of Bismuth for which the Hall's coefficient is  $-1 * 10^{-6} \text{Vm} (\text{A} \cdot \text{Wb} \cdot \text{m}^{-2})$  and the current is 3A. Find the output voltage.**

**II. Derive the response of second order system for UNDERDAMPED case and when the input is unit step. (5)**

**III. Derive the GAUGE FACTOR of the strain gauges. (5)**

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**Year III – Semester I 2004 – 2005**

**TEST II (Open Book)**

**Course No: INSTR UC381**

**Course Title: Transducers & Measurement Systems**

**Date: 05.12.04      Time: 50 Minutes      M.M = 20(20%)**

**NOTE : ONLY TEXT BOOKS ARE ALLOWED.**

**I EACH PART OF THIS QUESTION CARRIES 1 MARK.**

**(10 Marks)**

1. In load cell , the compressive load will cause ..... Strain in the vertical gauges.
2. What is Thomson effect?
3. For positive strain the permeability will.....( Increase / Decrease)
4. Which gauge is used to measure very low pressure measurement?
5. What is Thermopile?
6. What is the principle of Filled system thermometer?
7. a.  $1 \text{ Kg / Cm}^2 = \dots\dots\dots \text{ MPa.}$   
b.  $1 \text{ atmosphere(atm) = } \dots\dots\dots \text{ Psi}$
8. For down to above 1mm of Hg the thermal conductivity is independent of pressure..... True / False.
9. What is gauge pressure?
10. For rapid changes of temperature, bimetallic thermometer is ..... ( Most suitable / Unsuitable)

2. A diaphragm pressure gauge is to be constructed of spring steel ( $E = 200\text{GN/ m}^2$ ,  $\nu = 0.3$ ) 5.0 cm in diameter and is to be designed to measure a maximum pressure of 1.4Mpa. Calculate the thickness of the gauge required so that the maximum deflection is one – third of this thickness.

( 2.5 marks)

3.Explain the use of temperature transducer for the measurement of low pressure.

(2.5 Marks)

4 .A platinum resistance thermometer is used to interpolate the triple point of water ( $0^\circ \text{C}$ ), the boiling point of water ( $100^\circ \text{C}$ ) and the freezing point of zinc ( $419.6^\circ \text{C}$ ).The corresponding resistance values are  $100.0\ \Omega$ ,  $138.5\ \Omega$ ,  $253.7\ \Omega$ .

Find the Algebraic form and the numerical form of the interpolation equation.

(5 Marks)

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Year III – Semester I 2004 – 2005

**COMPREHENSIVE EXAMINATION (Closed Book)**

**Course No : INSTR UC381**

**Course Title : Transducers & Measurement Systems**

**Date : January 13<sup>th</sup> 2005**

**Time : 3 Hours**

**Max.Marks : 80 (40 %)**

**NOTE:**

**1. ANSWER ALL QUESTIONS FROM PART A & ANY SIX QUESTIONS FROM PART B.**

**2. DRAW THE CORRESPONDING FIGURES, BLOCKDIAGRAMS, CIRCUIT DIAGRAMS & GRAPH FOR PART B.**

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**PART - A**

**(2 x 10 = 20)**

1. Define Dead Zone & Three time constant.
2. A Variable reluctance type tachometer has 60 rotor teeth. The counter records 3600 counts per second. Determine the speed in RPM.
3. Explain the law of intermediate metals.
4. Mention any four highlights of thermistors.
5. Mention the types & the corresponding handling particles of orifice plates.
6. a .Which flow meter is used for measurement of flow for slurries, sludge's and electrically conducting liquids.  
b. Which is the parallel plate and dielectric for non-conducting liquid level measurement.
7. Explain Karman Vortex.
8. What are the ideal characteristics of operational amplifier?

9. Draw and explain the response of Notch filter.  
10. What are the types of amplitude demodulation?

**PART - B**

(6\* 10 = 60)

1. a. Derive the response of first order system when the input is Ramp. (5)  
b. Derive the response of second order system for the critical damped, Unit step input. (5)
2. Explain the working principle, advantage & disadvantages of LVDT with a neat diagram. (10)
3. a. What is the basic requirement of conducting materials for RTD. (3)  
b. Why ordinary Wheatstone bridge is not used for measurement of temperature using RTD. (2)  
c. Explain the methods suggested to measure temperature using RTD(5)
4. a. A barium titanate piezo - electric crystal pickup has the dimensions of 5mm\*5mm. Thickness is 1.25mm. The force acting on it is 5N. The charge sensitivity of barium titanate is 150pC/N and its permittivity is  $12.5 \times 10^{-9}$  F/m. If the modulus of elasticity of barium titanate is  $12 \times 10^6$  N/m<sup>2</sup>, Calculate voltage sensitivity, voltage generated, strain, charge and capacitance. (7.5)  
b. Which device is used for measurement of temperature between 1400°C to 3000°C. Explain the principle. (2.5)

- 5.a .Explain the device which works on the principle of collision of high Speed electron of atoms. (5)
- b. Explain the principle of volumetric flow rate measurement by Variable area flow meter (5)
- 6.a. Derive the output voltage of Inverting and Non- inverting Operational amplifier. (5)
- b. Explain the different stages of Instrumentation amplifier .Find the output voltage.(5)
- 7.a.How the stored data can be retrieved in electrical form again? Explain. (5)
- b.Explain the recorder which records the data with respect to Variables. (5)