B.E.(with Credits)-Regular-Semester 2012-Instrumentation Engineering Sem VII

# IN - Instrumentation System Design

P. Pages : 2 **GUG/W/16/6615**

Time : Three Hours * 4 6 9 9 * Max. Marks : 80

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Notes : 1. All questions carry equal marks.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Illustrate your answers wherever necessary with the help of neat sketches.

**1.** a) Explain the various criteria for selection of Temperature transducers. **6**

b) List various temperature sensors used in process automation. Draw and explain the temperature measurement using RTD with appropriate signal conditioning system. Explain various RTD connection configurations used in temperature measurement. **10**

**OR**

**2.** a) State and explain static & dynamic characteristics of an instruments. **6**

b) The sensor output range of 2 mV to 20 mV as the variable varies over the range of temperature from $T_{min}$ to $T_{max}$. Develop the signal conditioning so that this becomes 0–5V. The circuit must have very high input impedance. **10**

**3.** a) Explain the concept of zero and span adjustment in transmitters. **6**

b) Why current transmission is preferred in automation industry? Draw and explain the components of 4-20 mA 2-wire type transmitter. **10**

**OR**

**4.** a) Write a short note on Smart Transmitter. **8**

b) Draw and explain flow measurement using orifice plate. Draw the different types of orifice plate and give application of each. **8**

**5.** a) Explain the level measurement using capacitive probe. Draw the block diagram for signal conditioning circuit required for it and also explain each block. **10**

b) Write a short note on I/P converter. **6**

**OR**

**6.** a) With the help of suitable diagram, explain the pressure measurement using strain gauge. Draw the appropriate signal conditioning circuit also. **10**

b) What are the factors that affects on the sensitivity of pressure transducer? Explain in details. **6**

**7.** a) Find the $C_V$ and valve size that must allow 150 gal of ethyl alcohol/min with a specific gravity of 0.8 at its maximum pressure of 50 psi. **6**

(Given : valve size (inches) $C_V$

| | |
|---|---|
| ½ | 3 |
| 1 | 14 |
| 1½ | 35 |

b) What are the different types of pumps? Explain the characteristics of pumps. **10**

**OR**

**8.** a) If a control valve has rangeability R=30 and max. stem travel is 5 cm and is to be open half under normal condition. Find $Q_{min}$ and $Q_{max}$ and also stem opening for 100 $m^3$/hr flow. **6**

b) Write a short notes on : **10**

i) Actuators and actuator sizing.

ii) Pumps and its selection criteria.

**9.** a) Suggest a suitable scheme for microcontroller based data acquisition. Explain each block in detail. **8**

b) Draw the bathtub curve and discuss its three important regions. **8**

**OR**

**10.** a) Explain k-out-of-m type redundancy. Assume that an aircraft has three identical and independent engines. At least two engines must operate normally for aircraft to fly successfully. The engine reliability is 0.97. Calculate the reliability of the aircraft with respect to engines. **10**

b) Design a logic circuit for alarm annunciator. **6**

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