

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)



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SEVENTH SEMESTER B.TECH (INSTRUMENTATION AND CONTROL ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2015

SUBJECT: INSTRUMENTATION SYSTEM DESIGN (ICE 429)Time: 3 HoursMAX. MARKS: 50

Instructions to Candidates:

- * Answer **ANY FIVE FULL** questions.
- Missing data may be suitably assumed.
- 1A. With the help of suitable circuit diagrams, obtain the Voltage-displacement relationship for 5 a loaded potentiometer displacement sensor. Discuss about the non-linear error due to loading.
- **1B.** What is meant by capacitive coupling. How does it affect the measurement signal?
- 1C. The dead zone of a pyrometer is 0.125% of span with calibration range is 400°C to 2 1000°C. What temperature change must occur for it to be detected by the pyrometer?
- 2A. Temperature is to be measured in the range of 250° C to 450° C. The sensor is a resistance **5** that varies linearly from 280Ω to 1060Ω for this temperature range. The power dissipated in the sensor must be kept below 5mW. Develop analog signal conditioning circuit that provides a voltage varying linearly from -5 to +5V for this temperature range. The load is a high-impedance recorder.
- **2B.** Discuss about Mueller-bridge configuration for RTD based temperature measurement. **3**
- **2C.** What are the advantages of LVDT over Potentiometer when used as displacement sensor? **2**
- 3A. (i) Discuss about Part-I and Part-II of AGA-Report-3 of flow meter standardization.(ii) What are the different installation effects that create a deviation from perfect fully developed flow.
- 3B. What are the cause and effects of cavitation in a control valve. How does cavitation differs 3 from flashing?
- 3C. Figure. 3C shows the piping requirements for various connections of a Venturi tube in a flow stream. Interpret different piping considerations to be taken care from the graph for different diameter ratios of the pipe.





- 4A. A proportional-derivative controller has a 0.4 to 2.0V input measurement range, a 0- to 5V 5 output, Kp=5%/% and KD=0.08% per (%/min). The period of the fastest expected signal change is 1.5 s. Design and Implement this controller with an op amp circuit.
- 4B. With the help of a neat schematic design of a measurement system for pressure using a 3 Bourdon tube as the primary element.
- 4CDiscuss triangulation method for laser based level measurement system2
- 5A. (i) Differentiate between 2-Wire and 3-Wire transmitters. 3+2
 (ii) Write a short note on HART communication protocol.
 5B. With the help of a neat schematic diagram explain how magnetostrictive load cells work. 3
- **5b.** With the help of a heat schematic diagram explain now magnetostrictive load cens work.
- **5C.** Discuss any one design of a level indicator using a reed switch.
- 6A. Develop a high-performance microcontroller-based biochemical analyzer to measure blood 5 glucose, display it in an LCD module and transmit the data to a remote location.
 - (i) Discuss the hardware required for developing the system.

(ii)Develop a suitable block diagram for the hardware implementation and a flow chart for the software implementation of the system.

- 6B. What is the significance of Instrument Tag Number? Explain different parts of an 3 Instrument Tag Number with the help of an example.
- **6C.** Briefly explain about any two types of annunciators.

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