Reg. No.



MANIPAL INSTITUTE OF TECHNOLOGY MANIPAL A Constitutent Institution of Manipal University

SIXTH SEMESTER B.TECH (INSTRUMENTATION AND CONTROL ENGG.) END SEMESTER EXAMINATIONS, APRIL/MAY 2017

SUBJECT: INSTRUMENTATION SYSTEM DESIGN [ICE 4007]

Time: 3 Hours

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MAX. MARKS: 50

Instructions to Candidates:	
Answer ALL the questions.	

- Missing data may be suitably assumed.
- 1A. Using suitable circuits and equations explain how a series mode interference affects a 5 current transmission system. Discuss the effect of common mode interference in the same circuit.
- 1B. Discuss the role of input impedance and output impedance w.r.t. loading error of a 3 measurement system. How can loading effects be reduced?
- 1C. At the input, an amplifier has a signal level of $3\mu V$ and a noise voltage level of $1\mu V$. 2 If the voltage gain of the amplifier is 20, what is the signal to noise ratio at the output?
- 2A. An RTD with α=0.0035/°C and R=300Ω at 25°C will be used to measure the 5 temperature of hot gas flowing in a pipe. The dissipation constant is 25mW/°C, and the time constant is 5.5 s. Normal gas temperature is in the range of 100°C to 220°C. Design a system by which the temperature variation is converted into a voltage of 2V to +2V. Assume self-heating to be 0.5°C and RTD to be linear.
- 2B. Pulses for a stepping motor are being transmitted at 2000 Hz. Design a filter to 3 reduce 60 Hz noise but reduce the pulses by no more than 3dB.
- 2C. Describe Inductive and reluctive types of load cells. How they differ from 2 magnetostrictive load cells?
- 3A. A K-type thermocouple measurement system (50μV/°C) must provide an output of 0 5 to 2.5 V for a temperature variation of 500°C to 700°C. A three terminal solid-state sensor with 12mV/°C will be used to provide reference compensation. Develop the complete circuit for the measurement system..
- 3B. Using neat schematic describe any two types of intensity modulated fiber optic 3 sensors.
- **3C.** Discuss any one application of smart sensor.

- 4A. Explain five types of pressure taps used for differential pressure flow measurement 5 systems.
- 4B. Using an appropriate application discuss how two wire or three wire transmitter 3 selection can be done.
- **4C.** How can the non-linearity of a potentiometer displacement sensor reduced?
- 5A. A microprocessor based level measurement system based on the principle of 5 dielectric constant variations due to change in level is to be designed. Changes of level affect the dielectric constant, which in turn makes variation in capacitance.
 (i)Discuss about the hardware requirement 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.
- **5B.** Discuss different types of control panels.
- **5C.** What is meant by instrument data sheet? What is its significance?

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