Reg. No.					



Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)



SEVENTH SEMESTER B.TECH (INSTRUMENTATION AND CONTROL ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2015

SUBJECT: INSTRUMENTATION SYSTEM DESIGN [ICE 429]

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- ✤ Answer ANY FIVE FULL questions.
- Missing data may be suitably assumed.
- 1A. A temperature measurement system using a thermocouple is as shown below. The 5 thermocouple has a sensitivity of $40\mu V/^{\circ}C$ and a thevenin equivalent resistance of 20Ω . The amplifier has an input impedence of $2M\Omega$ and an output impedence of 75Ω . The indicator is a resistive load of $10k\Omega$. What is the percentage error in the measured temperature, due to loading effects at the different stages if the true temperature is $35^{\circ}C$.



- **1B.** Why does a current transmission has far greater inherent immunity to series mode **3** interference than a voltage transmission system?
- 1C. If $E_{TH}=1V$ and $V_{SM}=0.1V$ are the r.m.s values of Thevenin Equivalent and Noise Voltage 2 respectively of a measurement device, then what is the Noise factor of the instrument?
- 2A. A pressure sensor outputs a voltage varying as 100 mV/psi and has a 2.5-kΩ output 5 impedance. Develop an OpAmp based signal conditioning to provide an output of 0 to 2.5 V as the pressure varies from 50 to 150 psi.
- **2B.** A thermistor is to monitor room temperature. It has a resistance of $3.5 \text{ k}\Omega$. The dissipation **3** constant is P_D=5mW/°C. It is proposed to use the thermistor in the divider of Fig.1 to provide a voltage of 5.0 V at 20°C. Evaluate the temperature change in the sensor due to self-heating.



2C.	Briefly describe how an LVDT can be used as a secondary element for pressure measurement using a Bourdon tube.	2			
3A.	Discuss about five types of pressure taps used in differential pressure flow meters.	5			
3B.	An equal percentage control valve has a rangeability of 32. If the maximum flow rate is $100m^3/hr$, find the flow at 2/3 and 4/5 open settings.				
SC .	why are varve positioners used in a control varves?	4			
4A.	• A temperature-control system inputs the controlled variable as a range from 0 to 4 V. The output is a heater requiring 0 to 8 V. A PID is to be used with $Kp = 2.4\%$, $K_I = 9\%$ (% min), $K_D = 0.7\%$ (% min). The period of the fastest expected change is estimated to be 8 s. Develop an Electronic PID circuit.				
4B.	With the help of a neat schematic diagram explain the working of an I/P convertor.	4			
5A.	 (i)Draw the block diagram of a smart transmitter, and explain its different parts. (ii)Write a short note on HART protocol. 				
5B.	Discuss any three of the ISA approved Annunciator operating sequences	3			
5C.	What is the effect of ambient temperature changes on Resistance strain gauge sensors?	2			
6A.	Develop a microprocessor based moisture measurement system based on the principle of dielectric constant variations due to change in moisture. Changes of moisture content affect the dielectric constant which in tum makes variation in capacitance. (i)Discuss about 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.	5			
6R	What is an Instrument data sheet? What is its significance? How does it differ from an	3			
UD ,	instrument Index?	5			
6C.	Write short notes on:(i) Process flow diagram. (ii)Piping and Instrumentation diagram.	2			
