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III SEMESTER B.TECH. (MECHATRONICS ENGINEERING) END SEMESTER EXAMINATIONS, JAN 2020

SUBJECT: SENSORS AND INSTRUMENTATION [MTE 2155]

(02/01/2019)

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- ✤ Answer ALL the questions.
- Data not provided may be suitably assumed
- ✤ Graph sheets will be provided

1 4	Evenloin the operation of transducer which can be used to measure the flow rate	05	CO2
IA.	explain the operation of transducer which can be used to measure the now-rate	05	COS
	of the fluid for the following cases.		
	1) with suspended particles (Through Doppler effect of acoustic waveform)		
	11) Without suspended particles (Through transit time of acoustic waveform)		
	(Figures: 2M, explanation: 3M)		
1B.	List out any two points from the construction point of view of electromechanical	03	CO1
	indicating instruments, so that the moving parts does not cause very high power		
	consumption? Also, mention any two types of support system for the moving		
	element in the electromechanical indicating instruments.		
	······································		
1C.	Distinguish between R-TRIG and F-TRIG in PLC ladder logic	02	CO2
10.		02	002
2A	Draw ladder logic for the following Boolean expression:	05	CO2
	$\overline{A} + (\overline{A} + (\overline{B}\overline{C}(A + \overline{B}\overline{C}))))$		
2B	Describe the construction and working of the temperature sensor for the	03	CO3
	situation where you have to measure temperature of a process, but the only raw		
	materials available are two different metal strips with which you can build your		
	temperature sensor. (Construction: 1.5M, working: 1.5M)		
	······································		
2C	Describe how air can be utilized for damping of the moving system in	02	CO1
	electromechanical instruments	•	001
	electronicentanear instruments.		
34	Explain in terms of Resistivity. Stability and susceptibility of contamination why	05	CO3
JA	Platinum is used for the manufacturing of any temperature detecting system	05	005
	Draw the circuit diagram to determine resultant output voltage when three		
	Thermosouples are connected in series. State the role of 'Swamping registeres'		
	in normolouples are connected in series. State the role of Swamping resistance		
	in parallel connected 1 nermocouples.		

3B	Identify the OSI model layer for each of the below given services in networking	03	CO4
	 systems: a) Time-out of Student Life Cycle Management (slcm) b) External cable connection to the computer or controller c) Mozilla Firefox, Instagram 		
3C	Describe how Resistance Temperature Detector is used along with Wheatstone Bridge for the measurement of unknown temperature of an object. State any one difference between Resistance Temperature Detector and Thermistor.	02	CO3
4 A	 i) Explain with a relevant example, how the combination of two different transducers can be utilised for the measurement of applied pressure. (Hint: one of the transducers is an elastic element) ii) Mention any four parameters for selecting a specific material for manufacturing of bellows pressure-sensors. (3M+2M) 	05	CO3
4B	A wattmeter with a range of (0-1000) W has an error of $\pm 1\%$ of full scale deflection. If the true power is 100W, what would be the range of output? Suppose the error is specified as percentage of true value, what would be the range of the output?	03	CO1
4C	Explain in brief the operation of Tachometer type of encoder for velocity measurement of shaft. Also, state the reason why Gray coding is preferably used over the Binary coding while using encoder for position detection of the rotating shaft.	02	CO3
5 A	Describe the working principle of the flow meter which utilizes von Karman effect for the measurement of flow rate of steam in thermal power plants. Also, explain the role of gravitational force, drag force and buoyancy in the flow rate measurement of vertical flowing fluids. (3M+2M)	05	CO3
5B	Write a ladder logic program that will turn ON light when a count reaches 20. The light has to go OFF when the count 30 is reached. (Use appropriate comparator function block)	03	CO2
5C	State the role of SCADA in Plant-HMI level of any process control industry and also, what is the significance of 'Networking' in the field of sensors and instrumentation?	02	CO4