

Enrolment No:



**UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**

**End Semester Examination**

**Course: Instrumentation, Control and Automation**

**Program: M. Tech REE/ES**

**Course Code: EPEC 7003**

**Instructions:**

**Semester: I**

**Time 03 hrs**

**Max. Marks: 100**

1. Attempt all questions serially as per question paper.
2. Answer should be neat and clean. Draw a free hand sketch for circuits/tables/schematics wherever required.

**SECTION A - 30 Marks**

S. No.	Attempt all questions.	Marks	CO
Q 1	Implementing SCADA in power industry increase profitability and reliability. Justify this statement.	5	CO4
Q2	The characteristics equation of a system in differential form is $\ddot{x} - (K + 2)\dot{x} + (2K + 10)x = 0$ Find the values of K for which the system is (i) stable (ii) limited stable and (iii) unstable.	5	CO2
Q 3	What do you understand by orifice meter? Explain the working of orifice meter with suitable diagram?	5	CO1
Q 4	What do you mean by the K-type thermocouple? What is the measuring range of K-type thermocouple?	5	CO2
Q 5	What do you understand by transducer? Differentiate between (i)Active and passive transducers (ii) Primary and secondary transducers	5	CO1
Q 6	Explain the block diagram of generalized control loop process.	5	CO2

**Section B – 50 Marks**

Q 7	Elucidate the mathematical equation of PID controller. What is the advantage of PI controller over PD controller?	10	CO 1
Q 8	Explain the role of communication in SCADA. Enumerate various available communication modes for communicating RTU & MTU. Describe the features and economic benefits of SCADA system.	7+3	CO4

Q 9	What do you understand by first order instrument? Draw the diagram and working principle of any first order instrument.	10	CO2
Q 10	What are sensor available for pressure measurement? Explain the working of bellows.	10	CO1
Q11(a)	Obtain the transfer functions for the following systems with state-space models available as:  a. $\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u; \quad y = [1 \quad 0] \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + [0]u$	10	CO3
(b)	Explain the concepts of observability and controllability with reference to linear time invariant systems. Find the controllability of the system described by the state equation.  $\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -2 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 3 \end{bmatrix} u$		
<b>SECTION C, 20 Marks</b>			
Q12 (i)	What do you understand by automation? Differentiate between different types of automation. Draw automation pyramid in with all the stages. How automation is changing with IT and communication, explain with an example?	15	CO4
(ii)	Elucidate the significance of PLC in industrial automation	5	