22PCM301T					Instrumentation and Process Dynamics					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
2	0	0	2	2	25	50	25	--	--	100

COURSE OBJECTIVES

- To have a clear idea of Instrumentation and process dynamics
- To understand the basic aspects of process instrumentation and control terminology
- To study the piping and instrumentation diagrams.
- To understand process modelling and dynamics.
- To be able to develop fundamental process models.
- To study the stability and dynamic performance of processes.

Unit I : Meaurement and Instrumentation **6 Hr.**

Sensors and transducers, physical, chemical and biosensors. Pressure, temperature, level, flow, concentration and pH measurements. Measurement errors and accuracy, signal conditioning. Process control terminology; input and output variables, controlled variables, manipulated variables, set point. Measured and unmeasured variables, Block diagram, positive and negative feedback, distributed control system, SCADA, D/A, A/D conversions. Quality control and reliability.

Unit II: **Piping and Instrumentation diagram** **6 Hr.**

Symbols and layout. Basic symbols, instrument lines, Design of piping systems, pipe size selection, economic pipe diameter, valve selection, pump selection, control valves, general controller symbols, failure modes etc.

Unit III: **Process Modelling and dynamics** **7 Hr.**

Process modelling and its necessity, classification of models, development of models from fundamental laws, input-output models. Concept of transfer function, properties of transfer functions, Development of dynamic models for thermometer, thermocouple, dynamics of liquid level, dynamics of non-interacting and interacting systems, forcing functions. Dynamics of more complex systems, first order plus dead time, second order, pure gain and pure capacity process, lead lag system.

Unit IV: **Process Analysis and Dynamic Performance** **7 Hr.**

Input-output stability, effect of zeros, frequency response and its evaluation for common system. Bode diagrams, Nyquist diagrams, Rouths criterion and root locus method. Elements of control strategies.

Max. 26 Hr.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1: Understand the function of basic process instruments
CO2: Generalise the basic control terminology and P&I diagrams
CO3: Demonstrate process models and their classification.
CO4: Analyse various process models.
CO5: Develop the dynamics of complex processes.
CO6: Evaluate the stability of processes.

TEXT / REFERENCE BOOKS:

1. Ogunnake, B, A. and Harmon Ray, W. , Process Dynamics, Modelling and Control, Oxford University press, 1984.
2. Stephanopoulous, G., Chemical Process Control, Prentice-Hall International editions, 1984.
3. Sarkar, P,K., Advanced process dynamics and control, PHI learning private Limited, 2015.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100	**Exam Duration: 3 Hr.**
Part A: 10 Questions each carrying 5 marks	50 Marks
Part B: 5 Questions each carrying 10 marks	50 Marks