C.U.SHAH UNIVERSITY

FACULTY OF: Technology & Engineering
DEPARTMENT OF: Instrumentation & Control Engineering
SEMESTER: VI
COURSE: B.Tech
SUBJECT CODE: 4TE06BPC1
SUBJECT NAME: Basic Process Control

Teaching & Evaluation Scheme

Subject Code	Subject Name	Teaching Hours/Week				Credits	Evaluation Scheme/Semester							Total Marks
							Theory				Practical			
		Th	Tu	Pr	Total		Sessional Exam		University Exam		Internal		University	
							Marks	Hrs	Marks	Hrs	Pr/Viva	TW	Pr	
4TE06BPC1	Basic Process Control	4	0	2	6	5	30	1.5	70	3	--	20	30	**150**

OBJECTIVES:

1. To introduce the students about Process control and its strategies.
2. To make the students familiar with system modelling.
3. To make students learn various control strategies.
4. To make student learn controller tuning.

PREREQUISITES:

1. Basics Process control and controller modes.

Sr. No.	COURSE CONTENT	HOURS
1.	**INTRODUCTION:** Introduction to Process Control, Control objectives, benefits and simple process control examples.	4
2.	**PROCESS DYNAMICS:** **Mathematical Modeling Principles:** First order system, Second order system, Pure capacitive process, Multi capacity interacting & non interacting systems. Modeling procedure, linearization, Numerical solution of ordinary differential equations (ODE). **Modeling and Analysis for Process Control:**	10

	Input-output models and Transfer function, Block diagram, Frequency Response. **Dynamic behavior of typical processes:** Basic system elements, series structure of simple systems, parallel structure of simple systems, recycle structure, staged processes, multiple-input multiple-output systems.	
3.	**THE FEEDBACK CONROL:** Process and instrument elements of the feedback loop, block diagram, control performance measures for standard input changes, selection of variables for control, approaches to process control.	4
4.	**PROCESS CHARACTERISTICS AND CONTROL SYSTEM PARAMETERS:** Process equation, process load, process lag, self-regulation, Error, variable range, control parameter range, control lag, dead time, cycling, Direct and reverse action.	4
5.	**DISCONTINIOUS CONTROL MODES:** Two position mode, Case studies of two position control systems, Multi-position mode, An example of multi-position control mode, floating control mode.	4
6.	**CONTINIOUS CONTROL MODE:** Proportional control mode, integral control mode, derivative control mode **COMPOSITE CONTROL MODES:** Proportional – Integral (PI) control, Proportional – Derivative (PD) control, Proportional – Integral – Derivative (PID) control, Special terminology (proportional band, repeats per minute, rate gain, direct action, reverse action) **SLIDING MODE CONTROL:** Basic Overview	6
7.	**PID ALGORITHM:** Desired features of a feedback control algorithms, Proportional mode, integral mode, derivative mode, The PID controller, Analytic expression for a closed-loop response, importance of the PID controller.	5

8.	**PID Controller Tuning for Dynamic Performance:** Introduction, Factors in Controller Tuning, Determining Tuning Constants that Give Good Control Performance, Correlation for Tuning Constants, Fine-tuning the Controller Tuning Constants Zigler – Nichols Closed Loop Method, Controller tuning and stability important interpretation, Zigler – Nichols Open loop method (reaction curve method), summary of other tuning methods.	8
9.	**STUDY AND TUNING OF BASIC CONTROL LOOPS:** Flow control loop, Level control and Temperature control loop.	3
10.	**INTRODUCTION TO ADVANCE CONTROL STATEGIES:** Cascade Control, Ratio Control, Split Range Control and Feed-forward Control	4

Text Books:

1.) Process Control: Designing Processes and Control for Dynamic Performance by Thomas E. Marlin; Pub: McGraw – Hill, International Edition

2.) Process Control: Modeling, Design and Simulation by B. Wayne Bequette; Pub: Prentice – Hall India,.

3.) Process Control by Harriot.

4.) Instrument Engineers Handbook (Process Control) by B.G. Liptak

5.) Chemical Process Control by G. Stephanopolous.

Reference Books:

1.) Process Dynamics and Control by Dale E. Seborg, Thomas F. Edger, Duncan A. Mellichamp, Pub: Wiley India.

2.) Process Control Systems: Application, Design, and Tuning by F. G. Shinskey, Pub: McGraw Hill International Edition.

3.) Automatic Process Control by Donald P. Eckmen.

4.) Principles of Process Control by Patranabis, Pub: Tata - McGraw Hill.