Course Type	Course Code	Name of Course	L	T	P	Credit
DC	NCHC509	Advanced Process Control	3	1	0	4

Course Objective

- To provide theoretical background with detailed mathematical analysis of dynamic behaviour of chemical process systems.
- To emphasize process control techniques that are used in practice, including stability analysis and design of control systems.

Learning Outcomes

- Students will have basic and advanced control strategies and algorithms and shall be able to design control systems needed for chemical processes.

Unit No.	Description of Lectures	Class Hours	Learning Outcomes
1.	**Introduction:** Introduction, modelling of dynamic behaviour of chemical processes, transfer function and state–space representation.	**6 L + 3 T**	Students will be introduced to the importance of process modelling and will know how to represent a system using the transfer function and state-space method.
2.	**Dynamic analysis:** Dynamics of chemical processes, frequency response analysis	**8 L + 2 T**	Students will get acquainted with the dynamic analysis of chemical processes.
3.	**Design of controllers and tuning techniques:** Design of conventional controller, performance criteria, controller tuning, Ziegler-Nichols tuning, empirical methods of tuning.	**6 L + 2 T**	Students will learn the design of controllers and their tuning techniques.
4.	**Stability analysis:** Stability analysis in transfer function and state–space domain.	**6 L + 2 T**	Students will get acquainted with the stability analysis.
5.	**Advanced control system:** Analysis and design of complex control schemes – cascade control, feedforward control, split-range control, ratio control and inferential control	**6 L + 2 T**	Students will be introduced to various advanced control systems.
6.	**MIMO:** Synthesis and analysis of MIMO control processes, interaction of control loops, relative gain array and the selection of loops, and decoupling strategies.	**6 L + 2 T**	Students will get acquainted with the analysis of MIMO control processes.
7.	**Model based control:** Model predictive control and its implementation.	**4 L + 1 T**	Students will know the basics of model-based control.
	Total	**56**	

Textbooks:

1. Stephanopoulos, G. (2008). *Chemical Process Control: An Introduction to Theory and Practice*. 3rd Ed. Prentice Hall.
2. Seborg, D. E., Mellichamp, D. A., Edgar, T. F., and Doyle, F. J. (2009). *Process Dynamics and Control*. 2nd Ed., John Wiley & Sons.

Reference Books:

1. Ogunnaike, B. A., and Ray, W. H. (1994). Process *Dynamics, Modeling and Control*. Oxford University Press.
2. Bequette, B. W. (2013). *Process Control: Modeling, Design and Simulation*, Prentice Hall India