UCH 506 PROCESS INSTRUMENTATION AND CONTROL

L	T	P	Cr
3	1	2	4.5

Course Objectives:
To analyze the system behavior for the design of various control schemes, and to gain knowledge of different process instruments.

Introduction: General Principles of process control, Time domain, Laplace domain and frequency domain dynamics and control.

Linear Open-loop Systems: Laplace domain analysis of first and second orders systems, Linearization, Response to step, pulse, impulse and ramp inputs, Physical examples of first and second order systems such as thermocouple, level tank, U-tube manometer, etc., Interacting and non-interacting systems, Distributed and lumped parameter systems, Dead time.

Linear Closed-loop Systems: Controllers and final control elements, Different types of control valves and their characteristics, Development of block diagram, Transient response of simple control systems, Stability in Laplace domain.

Frequency Response: Frequency domain analysis, Control system design by frequency response, Bode stability criterion, Different methods of tuning of controllers.

Process Applications: Introduction to advanced control techniques as feed forward, feedback, cascade, ratio, etc., Application to equipment such as distillation-columns, reactors, etc.

Instrumentation: Classification of measuring instruments, Elements of measuring instruments, Instruments for the measurement of temperature, pressure, flow, liquid level, and moisture content, Instruments and sensors for online measurements.

Laboratory Work: Dynamics of first order and second order systems, Valve characteristics, Interacting and non-interacting systems, Flow, level and temperature measurement and their control using proportional, proportional-integral and proportional-integral-derivative control action, Manual and closed loop controls, Positive and negative feedback control, Tuning of controller, Step, pulse, impulse and frequency response.

Course Learning Outcomes (CLO):

The students will be able to:

1. set up a model, analyse and solve the first and second order system for its dynamic behaviour
2. evaluate the process stability in Laplace domain
3. design control system using frequency response analysis
4. identify advanced control techniques for chemical process.

Text Books:

1. *Coughanowr, D.R. and LeBlanc, S.E., Process Systems Analysis and Control, McGraw Hill (2009).*
2. *Eckman, D.P., Industrial Instrumentation, John Wiley & Sons (2004).*

Reference Books:

1. *Stephanopoulous, G., Chemical Process Control: An Introduction to Theory and Practice, Prentice Hall of India (1984).*
2. *Harriott, P., Process Control, Tata McGraw Hill (1972).*

Evaluation Scheme:

S. No.	Evaluation Elements	Weightage (%)
1	MST	25
2	EST	35
3	Sessional (May includes lab/ tutorials/ assignments/ quiz's etc)	40