

## CEPC3004 PROCESS DYNAMICS AND CONTROL (3-0-0)

### Overall course Objective:

The main objective of the course is to teach students about how to control output of the system by controlling various variables in a control system. To teach about the different control mechanisms, controllers, and order of process systems. So that they operate safely, efficiently, and reliably despite disturbances and changes in operating conditions.

### Module I: (12 Hrs)

Response of first order systems, Physical examples of first order systems Response of first order systems in series, Response of Second order systems, Transportation lag. Control System, controllers and final control elements, Block diagram of a Chemical Reactor Control system, closed loop transfer functions, Transient response of simple control systems.

### Module II: (08 Hrs)

Stability, Root locus, Frequency response, Control system design by frequency response.

### Module III: (10 Hrs)

Cascade control, feed forward control, ratio control, Dead time compensation, internal model control, controller tuning and process identification, control valves.

### Module IV: (10 Hrs)

Introduction to sampled data controllers, sampled data control of a first order process with transportation lag, Design of sampled data controllers, Digital computer simulation of control systems.

### Course Outcomes:

Upon successful completion of this course, a student will have/be able to:

- CO1: Identify hardware elements of process control system, develop mathematical model of systems from first principles leading to transfer function models.
- CO2: Derive transfer function models of controllers and compute the transient response under open loop and closed loop conditions.
- CO3: Evaluate the stability of the control system given a mathematical model of a control system including its components.
- CO4: Design a control system for robust performance using frequency response methods.
- CO5: Design various advanced control algorithms for chemical processes having specific problems.

### Text Books:

1. Process Systems Analysis and Control, 3rd ed. by D R Coughanowr and S E LeBlanc, McGraw-Hill.
2. Chemical Process Control: An Introduction to Theory and Practice by G Stephanopoulos, PHI.

### Reference Books:

1. Process Dynamics & Control by J M Douglas, PHI.
2. Computer Aided Process Control by S K Singh, PHI.
3. Outlines of Chemical Instrumentation Process Control, 3rd ed. by A Suryanarayana, Khanna Publishers.

### Digital Learning Resources:

1. Process Control and Instrumentation by Dr. P.K. Saha, Department of Chemical Engineering, IIT Guwahati, Link: <https://nptel.ac.in/courses/103/103/103103037/>
2. Process Control and Instrumentation by Dr. A.K. Jana and Dr. D. Sarkar, Department of Chemical Engineering, IIT Kharagpur, Link: <https://nptel.ac.in/courses/103/105/103105064/>
3. Chemical Process Control by Prof. Sujit Jogwar, Department of Chemical Engineering, IIT Bombay, Link: <https://nptel.ac.in/courses/103/101/103101142/>