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| 6th Semester | Process Instrumentation and Control in Mineral Engineering | L-T-P 3-0-0 | 3 Credits |
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Module I:**(09 Hours)**

Introduction: Process and process objectives, Need for process control; justification in terms of overall technical and economic benefits. Dynamic nature of control operation, Controllable and non-controllable operating variables; Selection of variables, Defining control objectives; identification of process and plant constraints.

Module II:**(09 Hours)**

Basic Structure for Control System Design; Dynamic modelling with examples, Transfer function and block diagram, Standard process inputs; Response of first order and second order systems, Problems related to response determination.

Module III:**(09Hours)**

Types of Control Actions: Feed Forward and feedback control; construction of a feedback controller; final control elements, proportional action, integral action and derivative action; tuning of feedback controllers; multiple input control; ratio control and cascade control. Process control in process industries.

Module IV:**(09 Hours)**

Basic concepts and qualities of measurement, Instruments used for measurement of level, flow rate, pressure, pulp density, temperature etc. Other industrial measuring instruments like On-line particle size distribution, Metallurgical grade analysis and coal ash analysis, ball mill load and other required measurements.

Books:

- [1] Chemical Process Control: An Introduction to Theory and Practice, George Stephanopoulos, PHI Learning
- [2] Instrumentation: Devices and Systems, Second Edition by C Rangan, G Sarma, and V S V Mani, McGraw-Hill.
- [3] Process Systems Analysis and Control, Third Edition by D R Coughanowr and S E LeBlanc, McGraw-Hill
- [4] Process Dynamics and Control, Fourth Edition, Dale E. Seborg, Thomas F. Edgar, Duncan A. Mellichamp, Francis J. Doyle III, Wiley