## 4203 – PROCESS CONTROL

| Teaching Schedule Per Week | | | Progressive Assessment | | Examination Schedule (Marks) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Theory | | Practical Ex. | Total |
| Lectures | Practical | Credits | | | | | | |
| 3 | 2 | 5 | 25 | 25 | 3Hrs | 100 | 50/or | 200 |

| Pre-requisite | Source |
|---|---|
| 4219 | INC |

| Semester | Theory | Test | Total | TW | PR | Gr Total |
|---|---|---|---|---|---|---|
| | 75 | 25 | 100 | 25 | 50 | 175 |

Rationale: The evolution of digital computers has brought about tremendous change in process industries. Most of the process industries are automatically controlled. The course deals with different types of controllers, their configuration and characteristics. It also deals with use of computers in process control.

| COURSE CONTENTS | Hrs. | Mks. |
|---|---|---|
| | 3 | 5 |

**1. PROCESS CONTROL SYSTEM**

Concept of control system. Block-diagram showing elements of process control system. Concept of analog and digital processing with typical example of regulation of temperature showing: Analog process control, Supervisory digital control, Direct digital control, Programmable controller, Standard signals.

| | | |
|---|---|---|
| **2. DISCRETE STATE PROCESS CONTROL**<br>Concept of discrete state process control. Characteristics of the system; Discrete state variables, continuous control; Discrete state control; Composite discrete/continuous control, process specifications, event sequence description, flowcharts of the event sequence. Ladder diagram: Concept of ladder diagram, ladder diagram elements, ladder diagram example (simple relay for a latch). Programmable controllers, relay sequences, programmable controller elements (with typical wiring to I/p & O/p module), programmable controller operation, typical example showing programming. | 10 | 20 |
| **3. CONTROLLER PRINCIPLES**<br>Process characteristics, process equation, process load, process lag, self-regulation. Control system parameters, error, variable range, control parameter range, control lag, dead time, cycling. Concept, characteristics and application of discontinuous controller modes, continuous controller modes, composite controller modes.. | 10 | 20 |
| **4. ANALOG CONTROLLER**<br>Elements of analog controllers, diagram description and implementation of all types of controller modes using OPAMPS, pneumatic controller (p, pi, pd & pid) | 6 | 15 |
| **5. DIGITAL CONTROLLERS**<br>Simple and multiple variable alarm in process control, alarm Interlocking. Computers in process control (block diagram only), data logging system (fixed loggers DAS, portable data loggers), computer supervisory control, computer based controllers. | 6 | 15 |
| **6. CONTROL LOOP CHARACTERISTICS**<br>Control system configurations, single variable, cascade control, multivariable. Control system quality, loop disturbances, optimum control, measurement of quality. Stability. Process loop tuning. | 5 | 10 |
| **7. FINAL CONTROL OPERATION**<br>Elements of final control operation (Block diagram). Signal conversions (analog, digital and pneumatic). Actuators (analog, electrical, cylinder). Control elements (mechanical, electrical, & fluid valves). Constructional details of the control valve. Definition of valve Cv. Valve positioners. | 8 | 15 |
| **Total** | 48 | 100 |

Notes: Treatment to this course should be restricted to block diagrams only. There should be no mathematical derivations & no design).

## LIST OF PRACTICALS:

(Minimum 10 experiments)

1. To find characteristics of electrical actuators (d. c /a. c motors, stepper motor) 2 turns
2. To find Characteristics of signal convertors (relays, solenoids, motor control circuits, ADC/DAC 3 Turns
3. To study buzzer circuit.
4. To find characteristics of Air valve.
5. To build and test electronic controller (diff. Modes) 3 Turns
6. To find open loop characteristics of single loop controller 2 turns.
7. To find closed loop characteristics of flow control system
8. To find characteristics of positional control system (all modes) 3 turns
9. To study on / off temperature controlled system
10. To study light controlled on/off system
11. To study symbols of process control elements
12. To study the valve positioners
13. To identify various components of a control valve.

## TEXT BOOKS:

Control System Technology by Curtis Johnson

## REFERENCE BOOKS:

Control Technology by Chesmond