**GUJARAT TECHNOLOGICAL UNIVERSITY**

**CHEMICAL (COMPUTER AIDED PROCESS DESIGN) (16)**

Computerized Process Control

SUBJECT CODE: 3711603

SEMESTER: I

**Type of course: Program Elective - I**

**Prerequisite:** Instrumentation and Process Control

**Rationale:** In this subject emphasis is given on Computerised process control, leading finally to application in chemical process plants. The first part of this subject deals with Automation and computer interface. The second part gives highlights on Feedback and Advanced Control systems. The third part includes its application in the field of chemical engineering like liquid level systems, heat exchanger etc.

**Teaching and Examination Scheme**:

| Teaching Scheme | | | Credits | Examination Marks | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|
| L | T | P | C | Theory Marks | | Practical Marks | | |
| | | | | ESE(E) | PA (M) | PA (V) | PA (I) | |
| 3 | 0 | 0 | 3 | 70 | 30 | 0 | 0 | 100 |

**Content**

| Sl. No. | Topic | Teaching Hours | Module Weightage (%) |
|---|---|---|---|
| 1. | **Computers and Interfacing:**<br><br>Introduction to Digital Computers, Computer process interface for data acquisition and control, Distributed digital computer control. | 12 | 22 |
| 2. | **Analysis and design of feedback control systems**<br><br>Conventional (classical) single-loop feedback control systems: Servo and regulatory response characteristics, Stability analysis methods, Control system design by frequency response, | 12 | 22 |
| 3. | **Analysis and Design of Advanced Control Systems**<br><br>Feedback control of systems with large dead-time or inverse response, Multiloop control-cascade, Selective and split-range control, Feed forward control, Ratio control, Adaptive control, Inferential control. | 16 | 30 |
| 4. | **Design of Controller and control valves**<br><br>PID controller, PID controller design (tuning) methods, Process identification, Control valves | 8 | 15 |
| 5. | **Examples of Experimental Computer Control of Processes:** Computer Control of liquid level system, A heat exchanger, A fed batch fermentor, Temperature Control for plastic injection | 6 | 11 |

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|---|---|---|---|
| | molding processes, On-line optimizing control of a distillation column. | | |

**Reference Books:**

1. Stephanopoulos G., "Chemical Process Control", Prentice Hall. 1984
2. Coughanowr D.R. and LeBlanc S., "Process Systems Analysis and Control", 3rd Ed., McGraw Hill. 2008
3. Seborg D.E., Edgar T.F. and Mellichamp D.A., "Process Dynamics and Control", 3rd Ed., Wiley. 2010
4. Bequette B.W., "Process Control – Modeling, Design and Simulation", Prentice Hall. 2003 5. Roffel B. and Betlem B., "Process Dynamics and Control-Modeling for Control and Prediction", Wiley. 2006
6. Chidambaram M., "Computer Control of Process", Narosa Publishing house, 2003

**Course Outcome:**

At the end of the course, the student will be able to:

1. Understand the concept of automation and Distributed control system
2. Understand Feedback and Advanced Control Systems
3. Understand Design of Controller and Control Valve
4. Applications of advanced process control systems

**List of Open Source Software/learning website:**

1. Students can refer to video lectures available on the websites including NPTEL lecture series.
2. Students can refer to the CDs available with some reference books for the solution of problems using softwares/spreadsheets. Students can develop their own programs/spreadsheets for the solution of problems.
3. Literature available on Process Control and automation

   MIT Open course lecture on Process Dynamics