GUJARAT TECHNOLOGICAL UNIVERSITY

M.E. Chemical Engineering

Semester: I

Subject Name: **Advance Instrumentation & Process Control**

Sr.No	Course Content
1.	**Industrial Automation:** Overview, Introduction, Aims of plant automation, Computer-based plant automation concepts, Distributed computer control
2.	**Computers and Interfacing:** Introduction to Computers, Computer interfacing for data acquisition and control, Data acquisition and control by using std. add-on-cards
3.	**The Control of Chemical Process:** Characteristics and Associated Problems, Incentives for chemical process control, Design aspects and Hardware for a process control system.
4.	**Distributed Digital Control Systems:** Advantages of DCC, Process control requirements of computers, Computer network - multi-mini computer architecture, peer-to-peer and server based networks, network topology, network adapter card, software; Selection of a suitable DICS, Interconnection of networks, Communication in distributed control systems, Logical topology, Ethernet card, Selection of operator interface, ERP and process control
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 molding processes, On-line optimizing control of a distillation column.
6.	**Control System:** Dynamic Behaviour First Order Control Systems, Multicapacity Control Systems, Analysis of Dynamic Behaviour of Second Order Control Systems.
7.	**Mechanism of Control System and Controllers:** Block Diagram Algebra, Mechanism of Controllers and Control Valve, Dynamic Behaviour of Controllers.
8.	**Stability Analysis of Control Systems:** Stability for linear system, Routh-Hurwitz stability criterion, Limitations of the Routh test

	for stability, Root Locus diagram, Method of plotting the Root Locus diagram for negative feedback system.
9.	**Design of Control Systems Using Frequency Response:** Frequency response of a first order system, Bode diagram, Bode diagram of first order system, First order systems in series, Bode diagram of second order system, Proportional controller; Bode diagrams for proportional derivative controller, proportional integral controller, proportional- integral-derivative controller & transportation lag parameter; The stability criterion, Phase and gain margins, Ziegler- Nichols optimum controller settings, Limitations of the Ziegler-Nichols method.
10.	Introduction to digital control, sampling, signal construction, z-transforms, On descrete model development form continuous models.
11.	**Measurement and Measuring Instruments:** Introduction, System configuration, Problem analysis, Basic characteristics of measuring devices, Calibration, Transducers and various Measuring Instruments for Process Control, Chromatography, Spectrophotometry, Flame photometry.

Reference Books:

1. Process Control Instrumentation Technology : Curtis Johnson, Prentice Hall India Pvt. Ltd.
2. Process Control and Instrumentation : Prof. R. P. Vyas, Central Techno Publications, Nagpur
3. Chemical Process Control: George Stephanopoulos, Prentice Hall India Pvt. Ltd.
4. Instrumentation Devices and Systems : C S Rangan, G R Sarma, V S V Mani; Tata McGrawhill
5. Computer Control of Processes : M. Chidambaram, Narosa Publishing House
6. Process Instrumentation and Control : A. P. Kulkarni, Nirali Prakashan
7. Industrial Instrumentation : Donald P. Ekman