

**COURSE HANDOUT**  
**Second Semester 2015-16**

**Course No. INSTR F343**

**Course Title Industrial Instrumentation & Control**

**Instructor-in-charge SUREKHA BHANOT**

**1. Scope and Objective of the course**

This course offers study of various aspects of automatic control for industrial processes, including some recent developments in the field of process control

**2. Course Description :**

Introduction to process control; Elements of process loop; Controller principle; Hydraulic, pneumatic, electronic controllers; Controller tuning; Final control elements; Control loop characteristics; Complex control systems; Intelligent controllers; Programmable logic controllers; Distributed control systems; Digital control principles;

**3. Text Book :**

Surekha Bhanot, *Process Control : Principles and Applications*, Oxford University press, Fourth Impression 2010

**4. Reference Book :**

R1 C.D. Johnson, *Process Control Instrumentation Technology*, Prentice Hall of India, New Delhi , 1993

R2 Liptak B.G., *Process Control : Instrument Engineer's handbook*, Butterworth Heinemann

R3 Krishan Kant, *Computer Based Industrial Control*, Prentice Hall of India, New Delhi, 1997

R4 Stephanopoulos George, *Chemical Process Control*, Prentice Hall of India

R5 Ogata K., *Modern Control Engineering*, Pearson Education Asia

#### 4. Course plan

Lecture No.	Learning Objective	Topics to be covered	Reference
1,2	To appreciate the needs, objectives of process control	Basic Control loop, variables, requirements, aims, parameters, dynamics of the process	T-CH1 R4(1.9)
3	To understand the dynamics of processes	Terms, concepts used in process dynamics	T-CH2
4	To understand need and concept of mathematical modeling	Model of lumped and distributed parameter systems	T-CH2
5	To understand different controller modes	On-off, on-off with neutral zone	T-CH3 , R4(9)
6,7	To understand different controller modes	Proportional, Integral, derivative, PI, PD, PID	T-CH3, R4(9)
8,9,10	To learn dynamic behavior of feedback controlled systems	Effect on dynamic behavior of process with different controller modes in closed loop with	T-CH4, R4(14)
11	To learn about controller tuning	Ziegler, Cohen-Coon, Integral performance	T-CH4, R4
12	To learn about DDC loop	Sampling and reconstruction, DDC structure, position & velocity algorithm	T-CH5
13	To realize controller modes in pneumatic controllers	Controller modes in Pneumatic controllers	T-CH6, R5 (4.3)
14	To realize controller modes in hydraulic controllers	Controller modes in Hydraulic controllers	T-CH6, R5 (4.4)
15	To realize controller modes in electronic controllers	Controller modes in Electronic controllers	T- CH7, R1(10.3)
16,17	To learn the evolution, hardware of Programmable Logic Controllers	PLC vs relay Logic, PLC vs PCs, hardware components	T-CH13, R3(5),R2
18,19,20	To learn ladder diagram programming	Ladder diagram, selection of PLCs	T-CH13, R3(5),R2
21	To learn application of AI techniques in process control	Role of AI	T-CH14, R3(13),R2
22,23	To learn ES structure & Application	ES structure, Design & Applications	T-CH15, R3(13)
24,25	To ANN concepts	Neural networks – structure, applications	T-CH16, R3(18), R2
26,27	Learning algorithms	BPA, learning	T-CH16, R3, R2
28	Case studies	Examples, Matlab simulation	T-CH16
29,30,31	To learn concept &	Fuzzy controllers	T-CH17,

	applications of FLC		R3(13),R2
32	To learn about different final control elements	Functions of control valves, Types of control valves, actuators	T-CH8
33	To understand P&I diagrams	Draw P&I diagrams	T-CH9
34,35	To understand complex control schemes	Cascade control , Ratio control,	T-CH10, R4(20, 21)
36	To understand complex control schemes	Feedforward, Adaptive control, Inferential, Model reference adaptive control, Self tuning regulator	T-CH10, R4 (21)
37	To understand complex control schemes	Override, Auctioneering, Split Range	T1-CH11, R4(22)
38,39	To understand interaction and decoupling of control loops	Design of cross controllers and selection of loops using RGA	T-CH12, R4(24)
40	To understand distributed digital control systems	History, functional requirements, system architecture, configuration	T-CH18, R3(6),R2

### 5. Evaluation Scheme

Component No.	Evaluation Component	Duration	Marks	Date, Time & Venue	Nature of component
1	Mid Test	90 min March 19, 2-3:30 PM	90	19/3 2:00 -3:30 PM	Closed +Open book
2	QUIZES(5 Surprise+2 announced) each of 10 M		50		Closed book
4	Assignments		40		
5	Comp. Exam	3 hrs MAY 16, 2016	120	16/5 FN	Closed book + Open Book

6. **Chamber Consultation Hour** : Tue: 5 PM

9. **Course Notices** : Notices will be displayed on the Notice board of Instrumentation and on CMT

10 **Make-up Examination** : Make-up will be given on extremely genuine grounds only . Prior application and approval should be made for seeking the make-up examination

Instructor-in-charge  
INSTR F343