Birla Institute of Technology & Science, Pilani
Hyderabad Campus

FIRST SEMESTER 2020-2021
Course Handout Part II

Date: 17-08-2020

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : INSTR F343
Course Title : Industrial Instrumentation & Control
Instructor-in-charge : Balasubramanian M
Instructor : Balasubramanian M

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

5. **Course plan**

Lecture No.	Learning Objective	Topics to be covered	Chapter in the Text Book
1,2	To appreciate the needs, objectives of process control	Basic Control loop, variables, requirements,	T-CH1 R4(1.9)

		aims, parameters, dynamics of the process	
3	To understand the dynamics of processes	Terms, concepts used in process dynamics	T-CH2
4	To understand/review the concepts of Transfer function	Transfer functions, block diagram and signal flow representation	R5-CH4
5	To understand need and concept of mathematical modeling	Model of lumped and distributed parameter systems	T-CH2, R3 – CH11, R5-CH2,3&4
6,7	To understand steady state and transient analysis	Transient and steady state analysis of first order, second order and higher order systems and numerical to highlight concepts	R5-CH5
8	To understand different controller modes	On-off, on-off with neutral zone	T-CH3 , R4(9), R3 – CH1
9,10	To understand different controller modes	Proportional, Integral, derivative, PI, PD, PID	T-CH3, R4(9), R3 – CH1
11,12	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)
13	To learn about controller tuning	Ziegler, Cohen-Coon, Integral performance	T-CH4, R4
14	To learn about DDC loop	Sampling and reconstruction, DDC structure, position & velocity algorithm	T-CH5
15	To realize controller modes in pneumatic controllers	Controller modes in Pneumatic controllers	T-CH6, R5 (4.3)
16	To realize controller modes in hydraulic controllers	Controller modes in Hydraulic controllers	T-CH6, R5 (4.4)
17	To realize controller modes in electronic controllers	Controller modes in Electronic controllers	T- CH7, R1(10.3)
18,19	To learn the evolution, hardware of Programmable Logic Controllers	PLC vs relay Logic, PLC vs PCs, hardware components	T-CH13, R3(5),R2
20,21	To learn ladder diagram programming	Ladder diagram, selection of PLCs	T-CH13, R3(5),R2
22	To learn application of AI techniques in process control	Role of AI	T-CH14, R3(13),R2
23,24	To learn ES structure & Application	ES structure, Design & Applications	T-CH15, R3(13)
25,26	To ANN concepts	Neural networks – structure, applications	T-CH16, R3(18), R2

27,28	Learning algorithms	BPA, learning	T-CH16, R3, R2
29	Case studies	Examples, Matlab simulation	T-CH16
30,31	To learn concept & applications of FLC	Fuzzy controllers	T-CH17, R3(13),R2
32	To learn about different final control elements	Functions of control valves, Types of control valves, actuators	T-CH8, R3 – CH4
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)
37-38	To understand complex control schemes	Override, Auctioneering, Split Range	T1-CH11, R4(22)
39-40	To understand interaction and decoupling of control loops	Design of cross controllers and selection of loops using RGA	T-CH12, R4(24)
41-42	To understand distributed digital control systems	History, functional requirements, system architecture, configuration	T-CH18, R3(6),R2

6. Evaluation Scheme

Components	**Duration**	**Weightage**	**Marks**	**Date & Time**	**Nature of Component**
Test-1	30 min	10%	10	September 10 – September 20 (During scheduled class hour)	Open Book
Test-2	30 min	15%	15	October 09 – October 20 (During scheduled class hour)	
Test-3	30 min	15%	15	November 10 – November 20 (During scheduled class hour)	
Term Paper / Assignments	-	30%	30	Take Home	
Comprehensive	120 min	30%	30	TBA	
Total		100%	100		

7. **Chamber Consultation Hour** **:** To be announced in the class.
8. **Course Notices:** Notices will be displayed in CMS.

9. **Make-up Examination**: Make-up will be given on *extremely genuine* grounds only for those receiving prior approval.
10. **Academic Honesty and Integrity Policy:** Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Instructor-in-charge
INSTR F343