NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	Minor in Industrial Automation (Inter-disciplinary) Offered by B.Tech. in Electronics and Instrumentation Engineering
Semester:	V
Course Code:	3EI104IC24
Course Title:	Industrial Control System
Course Type:	Core Course- II under Minor (Interdisciplinary)
Year of Introduction:	2024-25

L	T	Practical component				C
		LPW	PW	W	S	
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Course Learning Outcomes (CLOs):

At the end of the course, the students will be able to –

1. develop mathematical model of the given process **(BL3)**
2. design proper controller as per the system requirements **(BL3)**
3. apply the tuning rules to achieve optimum performance **(BL3)**
4. select advanced control strategy to achieve the objectives of control system **(BL4)**

Unit	Contents	Teaching hours (Total 45)
Unit- I	**Mathematical modelling** Transfer function, Signal Flow diagram, Analogy between mechanical and electrical systems, interacting and noninteracting systems, second order systems, system with transportation lag	**08**
Unit- II	**Time response analysis** Time response of first order and seconder order system and related time domain specifications, need of time domain compensation	**04**
Unit- III	**Conventional controllers** Concept of compensator design in time domain, Introduction to various controller modes, response of different controller for various errors, selection criteria for controllers. Proportional controller response for set point and load change, proportional-integral and proportional-integral-derivative response for set point and load change. State feedback controllers	**15**
Unit- IV	**Tuning of controllers** Need of controller tuning, criteria for good control, tuning methods – Ziegler-Nichols and Choen-Coon, error based performance criteria, process identification for controller tuning	**08**
Unit- V	**Advanced control algorithms** Need of advanced control strategies, cascade control, feedforward-feedback control, ratio control, dead time compensator, compensator for inverse response system, split range control, selective control, inferential control, reset windup, adaptive control, applications of advanced control strategies in various unit operations	**10**

Self Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:
This shall consist of at least 10 practicals based on the above syllabus.

Suggested Reading:

1. Donald R Coughanowr and S.E.leBlanc, Process Systems Analysis and Control, McGraw Hill Publication.
2. I.J. Nagrath and M. Gopal, Control System Engineering, New Age Publishers
3. Curtis Johnson, Process Control Instrumentation Technology, Prentice Hall of India Publication
4. Seborg, Edgar, Millichamp and Doyle, Process Dynamics and Control, Wiley Student Edition
5. Bela G. Liptak, Instrument Engineers Handbook, Process Control, Elsevier

Suggested List of Experiments (not restricted to the following):
(Only for Information)

1.	To develop mathematical model for mechanical and electrical system	**(02 Hrs)**
2.	To develop mathematical model using signal flow graph	**(02 Hrs)**
3.	To Evaluate the dynamic behavior of first order and second order system	**(02 Hrs)**
4.	To Measure time response parameters of the system	**(02 Hrs)**
5.	To Check continuous cycling method for controller tuning	**(02 Hrs)**
6.	To implement state feedback controllers	**(02 Hrs)**
7.	To implement conventional control algorithm	**(04 Hrs)**
8.	To Perform the cascade control scheme	**(02 Hrs)**
9.	To study Ratio Control scheme	**(02 Hrs)**
10.	To check the performance of Split Range Control scheme using PROSIM software	**(04 Hrs)**

L = Lecture, T = Tutorial, P = Practical, C = Credit

w.e.f. the academic year 2024 - 25 and onwards