Programme: B. Tech. (ECE)	Course Title: Control System and Engineering			Course Code: ECE327
Type of Course: Program Core	Prerequisites: Signal and Systems, Network Analysis and Synthesis			Total Contact Hours: 40
Year/Semester: 2/Even	Lecture Hrs/Week: 3	Tutorial Hrs/Week: 0	Practical Hrs/Week: 0	Credits: 3

Learning Objective:

The objective of the control system engineering course is to provide students with an in-depth understanding of control system concepts and its various engineering applications, with an ability to independently face mathematical modelling of the control system design challenges.

Course outcomes (COs):

On completion of this course, the students will have the ability to:		Bloom's Level
CO-1	Identify and analyse the physical and Electrical system and their Mathematical Models.	**1,2**
CO-2	Understand and analyse the block diagram representation of systems and the use of block diagram reduction methods.	**2,3,4**
CO-3	Understand the time and frequency domain representation of systems and their use to examine the performance and stability of systems.	**2,3,4**
CO-4	Identify and apply the concept of stability to design the compensators and PID controllers.	**2,3**
CO-5	Understand and acknowledge the state-space representation of systems.	**1,2**
CO-6	Apply the state-space approach for stability analysis and feedback controller design.	**3,4**

Course Topics		Lecture Hours
UNIT – I (Modelling of Physical Systems)		**10**
1.1 Definition of control system, Open loop and Closed loop, Feedback and Feed-forward control	**3**	
1.2 Mathematical modelling of a physical system: Differential equations of a physical system, Laplace transforms, System analogies, and concept of transfer function	**3**	
1.3 Block Diagram Algebra and reduction methods, Signal flow graph– Mason's Gain formula.	**4**	
UNIT – II (Time and Frequency Domain Analysis of Systems)		**10**
2.1 Standard test inputs, Time response of first order and second order systems.	**3**	

2.2 Steady state analysis: steady state error and error constants, transient response specifications.	**2**	
2.3 Stability analysis and design – Routh-Hurwitz criterion, Root Locus technique and design (Design of compensators using Root Locus).	**5**	
UNIT – III (Compensation and Controller Design)		**12**
3.1 Correlation between time and frequency response, frequency domain specifications	2	
3.2 Nyquist plots, Bode plots – gain margin, phase margin	6	
3.3 Compensator design: Proportional, PI and PID controllers, Lead-lag (i.e. phase-lag/ phase-lead) compensators using Bode plots	4	
UNIT – IV (Steady State Analysis of Systems)		**8**
4.1 Concept of state, state variables and state model, State models for continuous time systems (SISO, MIMO) – derivation of transfer function from state models and vice versa	2	
4.2 Solution of state equations – state transition matrix, Controllability and Observability	3	
4.3 State feedback controller using pole placement, Observers.	3	

Textbook References:

Textbook:

1. Nagrath I. J. and M. Gopal, *Control Systems Engineering*, 5th Ed, New Age International.

Reference books:

1. Ogata Katsuhiko, *Modern Control Engineering*, 5th Ed., Pearson Education Publishers, 2010.
2. Benjamin C. Kuo, *Automatic Control Systems*, 7th Ed., Prentice Hall, New Delhi, 2002.
3. Richard Dorf and Robert Bishop, *Modern Control Systems*, 12th Ed., PHI, 2010.
4. Norman S. Nise, *Control Systems Engineering*, 6th Ed.,Wiley India, 2011.

Additional Resources:

1. ***https://nptel.ac.in/courses/108/102/108102043/***

Evaluation Method*	
Item	**Weightage (%)**
Quiz1	10
Quiz2	10
Quiz3	10
Quiz4	10
Midterm	25
Final Examination	35

Note: **Due to the Covid-19 pandemic situation, evaluation components may change as directed by the academic office.*

**Please note, as per the existing institute's attendance policy the student should have a minimum of 75% attendance. Students who fail to attend a minimum of 75% lectures will be debarred from the End Term/Final/Comprehensive examination.

CO and PO Correlation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1					1	2		3	3	1	1
CO2	3	3	1	1	1				1	2		3	3	1	1
CO3	3	3	1	1	1				1	2		3	3	1	1
CO4	3	2	2	1					1	2		3	3	1	1
CO5	3	3	1	1	1				1	2		3	3	1	1
CO6	3	3	3	1					1	2		3	3	1	1

Last Updated On: DD-MM-YYYY

Updated By:

Approved By: