ECE5703 Control Systems		L	T	P	J	C
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Prerequisite:	Nil					

Course Objectives:

- To impart knowledge on performance specification, limitations and structure of controllers
- To impart knowledge on design of controllers using root-locus and frequency domain techniques
- To introduce the techniques of extending the theory on continuous systems to discrete time systems

Expected Outcomes:

The student will be able

- To know how to use neural networks for solving different problems related to pattern recognition, function approximation, data visualization, and so on
- To apply the rules of fuzzy logic for solving engineering problems.

Student Learning Outcomes (SLO):	**1,2,6,9,13 and 17**

Module:1	**Introduction to Control System**	**1**	**hour**	**SLO: 1,2**

Control system configuration – open loop, closed loop, analysis and design objectives; design process, LabVIEW and MATLAB/Simulink for control system design and simulation.

Module:2	**Time Domain Analysis and Design**	**2**	**hours**	**SLO: 1,2**

First order, Second order control system response for step, ramp and impulse inputs. characteristic equation -Poles and Zeroes concept- stability and Routh criterion

Module:3	**Root Locus Techniques**	**2**	**hours**	**SLO:1,2**

Review of root locus construction – Lead/ Lag compensator design using root locus.

Module:4	**Frequency Response Techniques**	**2**	**hours**	**SLO: 1,2**

Bode plots and stability- gain and phase margins- Lead/ Lag compensator design using Bode plots.

Module:5	**Three-Term Controllers**	**2**	**hours**	**SLO: 1,2**

P, PI, PD, PID Controller- Basic control action - Effects of Derivative, Integral control actions-Design of P, PI, PID controllers – Tunable PID Controllers – Ziegler – Nichols Methods for Controller Tuning.

Module:6	**Introduction to Digital Control System**	**2**	**hours**	**SLO:1,2**

Discrete Time systems, Sampling, time response of discrete data system, characteristics -Jury's stability test. Pulse transfer function, Digital PID controller

Module:7	**Programmable Logic Controller**	**3**	**hours**	**SLO: 1,2**

Evolution of PLC – Sequential and Programmable controllers – Architecture – Programming of PLC – Relay logic and Ladder logic – Functional blocks – Communication Networks for PLC.

Module:8	**Contemporary Issues**	**1**	**hours**	**SLO: 1,2,6,9,13,17**

	Total Lecture:	**15**	**hours**	

Reference Books:				
1.	Katsuhiko Ogata, Modern Control Engineering, Prentice Hall, 4th Ed., 2001			
2.	M. Gopal “Modern Control System Theory” New Age International, 2005.			
3.	Programmable Logic Controller - Principles and Applications, Webb &Reis, PHI, 2002			
4.	M.Gopal,"Digital control and state variable methods", Tata McGraw Hill, 3rd ed., 2003.			
5.	I.J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International(p) Limited, 4th Ed., 2006			
List of Challenging Tasks:				**SLO: 6 and 13**
1 Design of compensator in frequency domain for the given plant model. Possible compensator types include phase lead, phase lag, lead-lag, PID, PD or PI. 2 Design of compensator for the given plant model in time domain. 3 State variable analysis- state equation and solution 4 State feedback controller design 5 Design of observer based state feedback control. 6 Design of digital controller for position control				
List of Projects for J Component :				**SLO: 6 and 13**
1 Smart traffic control using PLC 2 Home automation using PLC. 3 Automatic railway gate control 4 Automatic irrigation system using soil moisture sensing. 5 Control system for sun tracking solar panel 6 Automatic steering control for hybrid electric vehicle 7 Automotive active suspension system 8 Hardware-in-loop simulation 9 PID control of speed and torque of electric vehicle				