GUJARAT TECHNOLOGICAL UNIVERSITY

POWER ELECTRONICS (29)
CONTROL SYSTEM THEORY
SUBJECT CODE: 2712904
SEMESTER: I

Type of course: Control Engineering

Prerequisite: Higher Engineering Mathematics, Fundamental knowledge of signals and systems along with types, Transfer Function of System, Mathematical representation of signals and system modeling in time. Transforms especially like Laplacian and Z

Rationale: The course intends to provide foundations related to control engineering to graduate students. The course should enhance their ability to analyze and control multiple domain systems using techniques and tools related to control systems

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks		Practical Marks				
				ESE (E)	PA (M)	PA (V)		PA (I)		
						ESE	OEP	PA	RP	
3	2#	2	5	70	30	20	10	10	10	150

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	**Design And Analysis of Compensation Techniques** Performance specifications, design considerations in time and frequency domain, lead, lag and lead-lag compensation based on root locus and frequency response approaches, Effect of load disturbance upon control actions.	8	20
2	**Digital Control Systems** Control Actions (P, I , D, PD, PI, PID Controllers), Implementation of Digital Controllers with Application in Temperature & Position Control, Transfer Function Models, Jury Stability Criterion.	8	20
3	**State-Space Analysis of Control Systems** Limitations of conventional control theory, state-variables and state Model, state Models for Linear Continuous-Time Systems, solution of homogeneous and non-homogeneous state equations in time-domain and frequency-domain, Controllability and Observability , state-transition matrix, transfer matrix, Multivariable Systems.	10	24
4	**Liapunov's Stability Analysis & Variable Structure** Liapunov's Stability Analysis , Liapunov Functions for Non-linear & Linear Systems, Variable Structure Control and its applications.	8	18
5	**Optical Control Systems** Parameter Optimization, Optimal Control Problems, The State Regulator Problem, Infinite-time Regulator Problem	8	18

Reference Books:

1. Automatic Control System by B.C.Kuo, PHI.
2. Modern Control Engineering by K.Ogata, PHI.
3. Digital Control & State Variable Methods by M.Gopal, TMH.
4. Modern Control Design by Ashish Tewari, John Wiley

Course Outcome:

After learning the course the students should be able to:

1. Students will be able to develop mathematical models for controlling system behavior.
2. Students will be able to control the systems with nonlinear behaviors.
3. Students will learn fundamentals and applications of control theory for multi-disciplinary engineering problems.
4. Students will learn fundamentals of intelligent/smart control systems used in automation

List of Experiments:

1. To study about Phase-Lead Controller.
2. To study about Phase-Lag Controller.
3. To study about State Space Analysis.
4. To study about Pulse Transfer Function.
6. To study about P, I, D Controllers.
7. To study about Digital Controllers.
8. To Study about Liapunov's Stability Analysis & Variable Structure.
9. To Study about Optical Control Systems

Open Ended Problems:

Students may carry out analysis of specific application based intelligent control system with its mathematical analysis and feedback control system. Control system analysis may be of a linear, nonlinear or discrete category and can be carried out using any simulation software**.**

Major Equipments:

1. All these experimental study with Software Tool: MATLAB.
2. MATLAB contains Control Systems Toolbox, Digital Signal Processing Toolbox.
3. Control Experiment Equipment: PID Control, Non-linear Control Systems, Discrete-time Control Systems .

List of Open Source Software/learning website:

Matlab.

Learning website:

www.nptel.ac.in
ocw.mit.edu/