GUJARAT TECHNOLOGICAL UNIVERSITY

ELECTRICAL ENGINEERING (07)
ROBUST & OPTIMAL CONTROL
SUBJECT CODE: 2740706
M.E. 4TH SEMESTER

Type of course: NA

Prerequisite: Modern Control System, Linear Algebra, Calculusand Nonlinear Control

Rationale: After completing this course student will be able to

- Design H_∞ and H_2
- Carry out frequency domain based system
- Simulate the State-Space concept in optimal control

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks		Practical Marks				
L	T	P	C	ESE (E)	PA (M)	ESE (V)		PA (I)		
						ESE	OEP	PA	RP	
3	2#	0	4	70	30	30	0	10	10	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Introduction to Linear Algebra and Linear Dynamical System Linear subspace, Eigenvalue and Eigenvector, Matrix Inversion, Subspace, Vector norms, Controllability and Observability, various canonical structures and pole placement problems, Multivariable systems with pole-zero realization	03	10
2	Performance Specification Hardy Space, Hilbert Space, H_∞ and L_∞ norms, Power and Spectrum signals, Well Posedness of loop structure, Concept of loop shaping and weighted computation of H_∞ and H_2 gains	06	18
3	Model Uncertainty and Robustness Model uncertainty, Small Gain Theorem, Unstructured Robust Performance, Gain Margin and Phase Margin, Existence of Stabilizing Controller, Duality and Special Problems	08	18
4	Algebraic Riccati Equation All solution of Riccati Equation, Riccati operator, Spectral Factorization, Positive real Function, Inner function	07	12
5	H_2 Optimal Control Introduction to regulator problem, Standard and Extended LQR problem, Standard H_2 problem	06	18
6	H_∞ Optimal Control: Special and General Case Motivation for special problem, information control, full control ,	12	24

	disturbance feed forward, output estimation, separation theory, optimal controller, loop shifting, relaxing assumption, state feedback and parameterization of state feedback		

Reference Books:

1. Robust and Optimal Control by John C. Doyle and Kemin Zhou

Course Outcome:
After learning the course the students should be able to:

1. Design Robust system out of any linear and non-linear system
2. Design MIMO system for optimal case
3. Implement state-space in broader way to classical approach design

List of Tutorials:

1. MATLAB Programme for Algebra
2. MATLAB based programe for Lyapunov function for stability
3. MATLAB programe for LQR system
4. MATLAB programe for H_∞ and H_2
5. MATLAB programe for LOOP shaping in feedback sytem

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.