

# GUJARAT TECHNOLOGICAL UNIVERSITY

## ELECTRICAL ENGINEERING (07)

ADAPTIVE CONTROL

SUBJECT CODE: 2720723

SEMESTER: II

**Type of course:** Adaptive Control

**Prerequisite:** NA

**Rationale:** NA

### Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P		Theory Marks		Practical Marks				
			ESE (E)	PA (M)	ESE (V)		PA (I)			
					ESE	OEP	PA	RP		
3	2#	0	4	70	30	20	10	10	10	150

### Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Introduction: Linear Feedback, Effects of process variation, Adaptive schemes, Adaptive control problem, Applications	04	05
2	Recursive parameter estimation: Least Square and Regression models, Estimating parameters in dynamical systems	08	15
3	Model reference adaptive control: The MIT rule, Determination of adaptation gain, Lyapunov theory, Design of MRAS using Lyapunov theory, Application to adaptive Control, Adaptive pole placement control	16	40
4	Gain Scheduling and Robust adaptive control schemes, Averaging-based analysis	08	20
5	Adaptive control of nonlinear systems	04	10
6	Various methods for Auto Tuning of PID controller	02	10

### Reference Books:

1. K. J. Astrom and B. Wittenmark, Adaptive Control, 2<sup>nd</sup> Edition, Addison-Wesley, 1995
2. P. A. Ioannou and J. Sun, Robust Adaptive Control, Prentice-Hall, 1995 (available now at [http://www-rcf.usc.edu/~ioannou/RobustAdaptiveBook95pdf/Robust\\_Adaptive\\_Control.pdf](http://www-rcf.usc.edu/~ioannou/RobustAdaptiveBook95pdf/Robust_Adaptive_Control.pdf))
3. K. S. Narendra and A. M. Annaswamy, Stable Adaptive Systems, Prentice-Hall, 1989
4. S. Sastry and M. Bodson, Adaptive Control, Prentice-Hall, 1989 (available now at <http://www.ece.utah.edu/~7Ebodson/acscr/index.html>)
5. M. Krstic, I. Kanellakopoulos, and P. Kokotovic, Nonlinear and Adaptive Control Design, Wiley-Interscience, 1995

**Course Outcomes:**

- The general principles of adaptive control and learning.
- The System identification (i.e. learning a model from empirical data)
- Analyze the behaviour of adaptive control schemes such as model reference adaptive control and self-tuning regulators.
- Issues of convergence, stability, and robustness.
- Various analytical methods i.e. Methods from averaging theory and singular perturbation.

**List of Open Source Software/learning website:** MATLAB, SCILAB, NPETEL Videos

**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