

GUJARAT TECHNOLOGICAL UNIVERSITY

MECHATRONICS ENGINEERING

B. E. SEMESTER: VII

Subject Name: **Modern Control Systems (Department Elective –I)**

Subject Code: **172007**

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	University Exam (E)		Mid Sem Exam (Theory) (M)	Practical (Internal)
				Theory	Practical		
4	0	2	6	70	30	30	20

Sr. No	Course Content	Total Hrs.
1.	Basic Principles of Feedback Control: I Introduction to Block diagram of on-off control, proportional control, integral control, derivative control, PI, PD and PID control; Control Objective, Feedback Control Systems characteristics, Proportional Mode of Feedback Control, Integral Mode of Feedback Control, Derivative Mode of Feedback Control.	8
2.	Compensator Design Using Root-Locus Plots : Cascade Lead Compensation, Cascade Lag Compensation, Cascade Lag-Lead Compensation.	10
3.	Compensator Design Using Bode Plots : Reshaping the Bode Plot, Cascade Lead Compensation, Cascade lag Compensation, Cascade Lag-Lead Compensation.	10
4.	State Space Analysis of Continuous – time Control Systems: State Diagram, State Transition Matrix, Conversion of State Variable Models to Transfer Functions, Conversion of Transfer Functions to Canonical State Variable Models, Solution of State Variable Models, Solution of State Equations, State Transmission Matrix, Definition of Observability and Controllability.	10

5.	Design of State Feedback Controller : Introduction, Controller Design by Pole Placement.	2
6.	Discrete Time Systems : Introduction to discrete time systems; analog and digital controllers; the z-transformation; basic definition of z-transform; derivation of z-transform of standard functions; difference equation and its solution by the z-transform method; initial value and final value theorems; inverse z-transform by expanding $X(z)$ into (i) an infinite power series and (ii) partial fractions; pulse transfer functions; pulse transfer function of closed loop system using signal flow graph technique; stability analysis in z-plane.	10

Reference Books:

1. Control Systems : Principal and Design
Second Edition
M. Gopal
Mc Graw Hill Education
2. Modern Control Engineering
Fourth Edition
Katsuhiko Ogata
Prentice Hall of India
3. Digital Control and State Variable Methods
Second Edition
M. Gopal
Mc Graw Hill Education
4. Feedback Control Systems
S.G. Bhide, Satyanarayan, R.F. Barapate
Techmax Publishers, Pune