4219 – BASIC CONTROL ENGINEERING

Teaching Schedule Per Week			Progressive Assessment		Examination Schedule (Marks)			
					Theory		Practical Ex.	Total
Lectures	Practical	Credits						
3	2	5	25	25	3 Hrs	100	-	150

Pre-requisite	Source	Semester	Theory	Test	Total	TW	PR	Gr Total
Nil	INC		75	25	100	25	–	125

Rationale: All modern engineering systems include certain aspects of control systems at some point which makes it possible for a system to behave in a desired manner. The subject orients students to the basic concept of control systems. Components of servo systems, transfer functions & block diagram representations of systems & typical applications of control systems in practical fields.

COURSE CONTENTS	Hrs.	Mks.
1. INTRODUCTION TO FEEDBACK CONTROL SYSTEMS	6	15
Control System – Definition & terminology, Classification of control systems, The needs for control systems, Effects of feedback on control systems, Practical examples of open loop & closed loop control systems, Reset Windup.		

2. SERVO COMPONENTS Working principle, characteristics & typical applications in control systems of the following components:-Potentiometer, Synchros, D.C. Generator, D.C. Motor, A.C. Servo motor, D.C. Servomotor, Tachometer, D.C. stepper motor, Shaft encoder, Solenoid.	10	
3. TRANSFER FUNCTION & BLOCK DIAGRAM ALGEBRA Laplace transforms pairs commonly used in control systems and their applications. Transfer functions of potentiometer, tachometer, D.C. motor (no derivations), Block diagram representations of the above, General block diagram representation of a feedback control system & terminology, Block diagram reduction techniques.	10	20
4. TYPES OF FEEDBACK CONTROL SYSTEMS Order, class & class number of system, Standard test signals, Analysis of a second order servo system (positional servomechanism), Transfer function & block diagram of a positional servomechanism system, Transient & steady state response of the above system to step input damped natural frequency & error coefficients and comparison of steady state errors for type 0, type 1 and type 2 systems.	10	20
5. STABILITY Concept of stability, S-Plane, Poles and Zeros and their significance, Routh stability criterion, Nyquist stability criterion, Frequency response testing, Bode plots and polar plots of standard transfer functions, effect of addition of poles and zeros on polar plots, relative stability, definitions of gain margin and phase margin.	12	2
Total	48	100

LIST OF PRACTICALS:

1. To plot speed torque characteristics of a servomotor.	(1 Turn)
2. Study of a stepper motor.	(2 Turns)
3. Study of synchros.	(3 Turns)
4. To find response of type 0, type 1, type 2 systems to step input.	(3 Turns)
5. Study of standard test signals.	(1 Turn)
6. Study of A. C. & D.C. Position control systems.	(2 Turns)
7. Study of On-Off Temp. Control system.	(1 Turn)
8. To find out characteristics of the Tachogenerator.	
9. To find out characteristics of D.C. motor.	
10. To find out characteristics of a voltage regulator.	
11. Study of DC Solenoid.	
12. Study of Encoders.	

Notes: Simple numerical problems to be solved in Laplace Transforms, error coefficients, time response parameters, etc.

TEXT BOOKS:

Introduction to feedback control systems by Pericles Emanuels and Edward Leff.

REFERENCE BOOKS:

1. Basic control engineering by B. Yousefzadeh
2. Control system Engineering by I. J. Nagarath & M.Gopal.