B.P. PODDAR INSTITUTE OF MANAGEMENT AND TECHNOLOGY
137, VIP Road, Poddar Vihar,Kolkata-700052
Department of Electrical Engineering
Academic Year -2023-2024(Odd Semester)

LESSON PLAN

Program: Electrical Engineering **Credit: 3** **Contact: 3L+ 1T**
Course Name : Control System **Course Code: PC EE-503**
Course Coordinator: Dr. Sudipta Chakraborty

L.NO	Topics to be covered	Books (Text/Reference)	Teaching Aids	Teaching Methodology
L1	Objectives of Control System. Definition of linear and nonlinear systems. Concept of Feedback and Automatic control, examples of feedback control systems. Difference between feedback and feedforward.	T1, T2, T4	Green board PPT/PDF	Lecturing
L2	Transfer functions for LTI plants. Poles and Zeroes. Properties of Transfer function. Electrical analogy of Spring–Mass-Dashpot system.	T1, T3	Green board PPT/PDF	Lecturing Flip Classes
L3	Introduction to mathematical modelling of dynamic systems. Translational systems, Rotational systems, Mechanical coupling.	T2, T3	Green board PPT/PDF	Lecturing
T1	Numerical problems on derivation of transfer functions of common physical systems	T1,T2	Green board	Tutorial
L4	Block diagram representation of control systems.	T1, T2, T4	Green board PPT/PDF	Lecturing
L5	Techniques of reduction of block diagrams and computing the transfer function.	T1,T2,T3	Green board	Lecturing Flip Classes
L6	Signal Flow Graphs and Mason’s Gain Formula.	T1, T1	Green board PPT/PDF	Lecturing
T2	Problems	T2, T4	Green board PPT/PDF	Tutorial

L7	Analogous Systems. Introduction to Position Control System. D. C. Servo-Motor in Armature Control mode.	T2, T4, T5	Green board PPT/PDF	Lecturing
L8	D. C Servo Motor in Field Control Mode	T3,T2	Green board PPT/PDF	Lecturing Flip Classes
L9	AC Servo Motor	T2, T4	Green board PPT/PDF	Lecturing
T3	Numerical Problems on analogous systems	T2, T4	Green board PPT/PDF	Tutorial
L10	Elementary concepts of sensitivity and robustness	T2, T4	Green board PPT/PDF	Lecturing
L11	Elementary concepts of time domain analysis: recapitulation of idea of transient and steady state response, input types, plant types, weighting function, time constant and first-order step and impulse response.	T2, T5	Green board PPT/PDF	Lecturing
L12	Step and Impulse response of type-1, second order closed-loop plants..	T2, T4	Green board PPT/PDF	Lecturing Flip Classes
L13	Concept of damping ratio, peak overshoot, rise time and settling time. Performance indices describing transient response. Concept of dominant-pole pair.	T2, R1	Green board PPT/PDF	Lecturing Flip Classes
T4	Numerical problems	T4, R1	Green board PPT/PDF	Tutorial
L14	Concepts of system types and steady-state error constants for standard inputs.	T4, R1	Green board PPT/PDF	Lecturing
L15	Effects of addition of Pole and Zeros on system response.	T3, T4	Green board PPT/PDF	Lecturing
L16	Introduction to P,PI,PD and PID controllers.	R1, T4	Green board PPT/PDF	Lecturing Flip Classes

*L17	Introduction to Dynamic Error constants	T4	Green board	Lecturing
T5	Relevant Numerical problems.	T3, T4	Green board	Tutorial
L18	Concept of Stability: Asymptotic and BIBO, Concepts of absolute and relative stability.	T1, T4	Green board	Lecturing
L19	Stability by pole location and Routh-Hurwitz criteria.	T2, T4	Green board	Lecturing Quiz
L20	Introduction to Root-Locus and rules.	T4, R1	Green board PPT	Lecturing
L21	Rules of root-locus and their illustration with examples.	T1, T2,R1	Green board PPT	Lecturing Flip Classes
T6	Relevant problems	T1, T5	Green board	Tutorial
L22	Introduction to Frequency response. Concept of resonance frequency of peak magnification	T2, T4	Green board	Lecturing
L23	Familiarization with Semi-log Graph paper and Bode-plots.	T2, T4	Green board PPT/PDF	Lecturing
L24	Techniques for plotting the Gain and Phase plots	T2, T4	Green board	Lecturing
T7	Problems on Bode-plots	T, T4	Green board	Tutorial
L25	Polar Plots and Nyquist Stability Criterion	T1, T4	Green board	Lecturing
L26	Application of Nyquist Stability criterion	T1, T4	Green board	Lecturing
L27	Concept of State Variables. State Space Model.	T1,T3	Green board	Lecturing
L28	Physical Variable Models	T1, T2	Green board PPT/PDF	Lecturing
L29	Phase Variable Model	T1, T2	Green board PPT/PDF	Lecturing
T8	Problems.	T2, T4	Green board	Tutorial Flip class

L30	Eigen Values, Eigen Vectors.	T1, T2	Green board	Lecturing
L31	Diagonalization of State matrix	T2, T3,	Green board	Lecturing
L32	Solution of State Equation	T1, T5	Green board	Lecturing
T9	Problems.	T2, T4	Green board	Tutorial Flip class
L33	Controllability and Observability	T1, T2	Green board	Lecturing
L34	Pole placement by state feedback	T1, T5	Green Board	Lecturing
L35	Introduction to Discrete-time systems and Difference Equations	T2	Green Board	Lecturing

*** Gap within Syllabus**

Text Books:

T1 Modern Control Engineering, K. Ogata, 4th Edition, Pearson Education.
T2. Control System Engineering, I. J. Nagrath & M. Gopal. New Age International Publication.
T3. Control System Engineering, D. Roy Choudhury, PHI
T4. Control System Engineering, R. Anandanatarajan & R. Ramesh Babu, SCITECH
T5. Automatic Control Systems, B.C. Kuo & F. Golnaraghi, 8th Edition, PHI

Reference Books:

R1. Modern Control System, R.C. Dorf & R.H. Bishop, 11th Edition, PearsonEducation**.**

Web References:

W1. nptelhrd Control Engineering Lectures by Prof. Gopal
W2 Lecture Series by Prof. Ramkrishna Pasumarthy, Department of Electrical Engineering, IIT Madras

Teaching Modern Control System Analysis and Design
Robert H. Bishop, Richard C. Dorf
The University of Texas at Austin / The University of California, Davis

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Dr. Sudipta Chakraborty
Course Coordinator