GOVT. POLYTECHNIC BALANGIR
Department of Electrical Engineering

LESSON PLAN: 2025-26

Name of the Faculty: Saiswarup Patel (Guest Faculty)

Subject: LINEAR CONTROL SYSTEM **(Th. 4b)**

Program: Diploma in Electrical Engineering Semester: 4th

Total Contact Hours: 45 Total Marks: 100

Assessment: Progressive –30, End Term – 70

Credits: 3

COURSE OBJECTIVES:

At the end of the course the students will be able to

1. Express the basic elements and structures of feedback control systems
2. Correlate the pole-zero configurations of transfer functions and their time-domain response
3. Determine the steady-state response, errors of stable control systems
4. Apply Routh-Hurwitz criterion, Root Locus, Bode Plot and Nyquist Plot to determine the stability of LTI systems
5. Design compensators to achieve the desired performance

Unit 1: Introduction to Laplace Transform (Total Classes: 09)

Class No.	Topic	Subtopic	Teaching Aids/Activities	Course Objective
1	Open loop and closed loop control systems	Classification of Control system, Open loop system & Closed loop system and its comparison	Chalkboard definition writing	CO1
2	Open loop and closed loop control systems	Feedback principle, Transfer function of LTI systems	PPT slides & short video clip about transfer function in control system	CO1
3	Mathematical model of control system	Mechanical and Electromechanical system	Chalkboard definition writing & numerical problem solving	CO1
4	Mathematical model of control system	Force voltage and force current analogy	Chalkboard definition writing	CO1
5	Block diagram reprsentation	Rules of Block diagram reduction technique	PPT slides & short video clip	CO1
6	Block diagram reprsentation	Numerical problem of block diagram reduction technique	Whiteboard problem-solving	CO1
7	Block diagram reprsentation	Numerical problem of block diagram reduction technique	Whiteboard problem-solving	CO1

8	Signal flow graph	Mason's gain formula - characteristic equation	Chalkboard definition writing	CO1
9	Signal flow graph	numerical problem of signal flow graph	Whiteboard problem-solving	CO1
Unit 2: Control system components (Total Classes: 09)				
Class No.	**Topic**	**Subtopic**	**Teaching Aids/Activities**	**Course Objective**
10	Control System Components	DC servomotors	Chalkboard definition writing and it's derivation	CO2
11	Control System Components	AC servomotors	Chalkboard definition writing and it's derivation	CO2
12	Control System Components	synchro and gyroscope	PPT slides & short video clip	CO2
13	Control System Components	Stepper motor	PPT slides & short video clip	CO2
14	Control System Components	Tacho generator	PPT slides & short video clip	CO2
15	Time domain analysis of control system	Transient state response	PPT slides & short video clip	CO2
16	Time domain analysis of control system	Steady state response	Graph represention on board	CO2
17	Time domain analysis of control system	step responses of first order systems	PPT slides & short video clip	CO2
18	Time domain analysis of control system	step responses of second order systems	PPT slides & short video clip	CO2
Unit 3: Error analysi (Total Classes: 09)				
Class No.	**Topic**	**Subtopic**	**Teaching Aids/Activities**	**Course Objective**

19	Error analysis	Steady-state error analysis	Chalkboard writing	CO3
20	Static error coefficient	static error coefficient of type 0 systems	Chalkboard definition writing and it's derivation	CO3
21	Static error coefficient	static error coefficient of type 1 systems	Chalkboard definition writing and it's derivation	CO3
22	Static error coefficient	static error coefficient of type 2 systems	Chalkboard definition writing and it's derivation	CO3
23	Dynamic error coefficients	Dynamic error coefficients	PPT slides & short video clip	CO3
24	Stability concept	Time response for various pole location	Chalkboard definition writing and represented with the help of graph	CO3
25	Stability concept	stability of feedback system	PPT slides & short video clip	CO3
26	Stability concept	Routh's stability criterion	Derivation on board, numerical examples	CO3
27	Stability concept	Routh's stability criterion	Derivation on board, numerical examples	CO3
Unit 4: Root locus and Polar plot (Total Classes: 10)				
Class No.	**Topic**	**Subtopic**	**Teaching Aids/Activities**	**Course Objective**
28	Root locus	General rules for constructing Root loci	Chalkboard definition writing & explain different properties of Root locus.	CO4
29	Root locus	General rules for constructing Root loci	Chalkboard definition writing & explain different properties of Root locus.	CO4

30	Root locus	stability from root loci	PPT slides & short video clip	CO4
31	Root locus	Construction of root loci.	PPT slides & short video clip	CO4
32	Root locus	Effect of addition of poles and zeros.	PPT slides & short video clip	CO4
33	Root locus	Numerical of root locus.	Numerical worksheet; Whiteboard solving	CO4
34	Polar plot	Lag, Lead and Lead-Lag compensators	Chalkboard definition writing & explain different properties of Bode plot.	CO4
35	Nyquist plot	Nyquist stability criterion	Chalkboard defination writing with Numerical worksheet solving	CO4
36	Nichols chart	Non-minimum phase system	PPT slides & short video clip	CO4
37	Nichols chart	Transportation lag	PPT slides & short video clip	CO4
Unit 5: Frequency domain analysis (Total Classes: 08)				
Class No.	**Topic**	**Subtopic**	**Teaching Aids/Activities**	**Course Objective**
38	Frequency Domain Analysis	Frequency domain specifications	PPT slides & short video clip	CO5
39	Frequency Domain Analysis	Bode plot	Chalkboard definition writing & explain different properties of Bode plot.	CO5
40	Frequency Domain Analysis	Analysis based on Bode plot - Log magnitude vs. phase plot	Numerical worksheet; Whiteboard solving	CO5
41	Frequency Domain Analysis	Analysis based on Bode plot - Log magnitude vs. phase plot	Numerical worksheet; Whiteboard solving	CO5

42	Frequency Domain Analysis	State space model	PPT slides & short video clip	CO5
43	Frequency Domain Analysis	State space model	PPT slides & short video clip	CO5
44	Frequency Domain Analysis	State Transition matrix	Chalkboard writing	CO5
45	Frequency Domain Analysis	State Transition matrix	Chalkboard writing	CO5

Saiswarup Patel
Signature of the Faculty

12/1/26
Signature of the HOD
Electrical Engg. Branch

H.O.D.
Deptt. of Electrical Engg.
Govt. Polytechnic
Bolangir