GOVT. POLYTECHNIC BALANGIR
Department of Electrical Engineering

LESSON PLAN: 2025-26

Name of the Faculty: Saiswarup Patel (Guest Faculty)

Subject: CONTROL SYSTEM ENGINEERING (Th. 3)
Program: Diploma in Electrical Engineering Semester: 6th
Total Contact Hours: 60 Total Marks: 100
Assessment: Progressive –20, End Term – 80
Credits: 5

COURSE OBJECTIVES:
At the end of the course the students will be able to
1. Acquire knowledge about Mathematical modeling, Block diagram algebra, signal flow graphs and control system components.
2. Ability to deal with time response analysis of various systems.
3. Finding out steady state error and error constants.
4. Acquire knowledge about the analysis of stability in Root locus technique.
5. Learning about frequency response analysis of control system.
6. To use Bode plot and Nyquist plot for judgments about stability of a system.

Unit 1: Fundamental of control system (Total Classes: 04)

Class No.	Topic	Subtopic	Teaching Aids/Activities	Course Objective
1	Control System	Classification of Control system, Open loop system & Closed loop system and its comparison	Chalkboard definition writing	CO1
2	Effects of Feed back in control system	Effects of Feed back	PPT with basic information about control system.	CO1
3	Standard test Signals	Step, Ramp, Parabolic, Impulse Functions	Chalkboard definition writing & showing video on different type of signal	CO1
4	Servomechanism	Servomechanism	Showing a short video clip about Servomechanism	CO1

Unit 2: Mathematical model of a system (Total Classes: 04)

Class No.	Topic	Subtopic	Teaching Aids/Activities	Course Objective
5	Transfer Function of control system	Transfer Function & Impulse response	PPT slides & short video clip about transfer function in control system	CO1

6	Transfer Function of control system	Properties, Advantages & Disadvantages of Transfer Function	PPT slides & short video clip about transfer function in control system	CO1
7	Transfer Function of control system	Poles & Zeroes of transfer Function, Simple problems of transfer function of network.	Whiteboard problem-solving	CO1
8	Mathematical modeling of Electrical Systems	Mathematical modeling of Electrical Systems(R, L, C, Analogous systems)	Whiteboard problem-solving	CO1

Unit 3: Control system components (Total Classes: 04)

Class No.	Topic	Subtopic	Teaching Aids/Activities	Course Objective
9	Components of Control System	Components of Control System	Chalkboard definition writing	CO1
10	Components of Control System	Gyroscope, Synchros	PPT slides & short video clip	CO1
11	Components of Control System	Tachometer, Ac Servomotors	PPT slides & short video clip	CO1
12	Components of Control System	DC servomotors	PPT slides & short video clip with derivation.	CO1

Unit 4: Block diagram algebra & signal flow graphs (Total Classes: 08)

Class No.	Topic	Subtopic	Teaching Aids/Activities	Course Objective
13	Block Diagram Algebra	Basic Elements of Block Diagram	Chalkboard definition writing	CO1
14	Block Diagram Algebra	Canonical Form of Closed loop Systems	PPT slides & short video clip	CO1
15	Block Diagram Algebra	Rules for Block diagram reduction	Chalk diagram on board	CO1
16	Block Diagram Algebra	Procedure for of Reduction of Block Diagram	Chalk diagram on board	CO1
17	Block Diagram Algebra	Simple Problem for equivalent transfer function	Chalk diagram on board	CO1

Class No.	Topic	Subtopic	Teaching Aids/Activities	Course Objective
18	Signal Flow Graph	Basic Definition in Signal Flow Graph & properties	Graph represention on board	CO1
19	Signal Flow Graph	Construction of Signal Flow graph from Block diagram	Graph represention on board	CO1
20	Signal Flow Graph	Mason's Gain formula, Simple problems in Signal flow graph for network	Numerical worksheet; Whiteboard solving	CO1

Unit 5: Time response analysis (Total Classes: 10)

Class No.	Topic	Subtopic	Teaching Aids/Activities	Course Objective
21	Time response analysis	Time response of control system.	short video	CO2
22	Standard Test signal	Step signal, Ramp Signal, Parabolic Signal, Impulse Signal	Chalk diagram and graph represention on board	CO2
23	Time Response of first order system	Unit step response, Unit impulse response	Chalkboard definition writing and it's derivation	CO2
24	Time response of second order system to the unit step input	Time response specification	PPT slides & short video clip	CO2
25	Time response of second order system to the unit step input	Derivation of expression for rise time, peak time, peak overshoot, Settling time and steady state error	PPT slides & short video clip	CO2
26	Time response of second order system to the unit step input	Steady state error and error constants	Chalkboard definition writing	CO3
27	Types of control system	Steady state errors in Type-0, Type-1 and Type-2 system	Chalkboard definition writing & derive the steady state error.	CO3
28	Types of control system	Effect of adding poles and zero to transfer function.	Derivation on board, numerical examples	CO3
29	Controller	Response with P and PI controller	PPT slides & short video clip	CO3

Class No.	Topic	Subtopic	Teaching Aids/Activities	Course Objective
30	Controller	Response with PD and PID controller	PPT slides & short video clip	CO3

Unit 6: Analysis of stability by root locus technique (Total Classes: 10)

Class No.	Topic	Subtopic	Teaching Aids/Activities	Course Objective
31	Root locus technique	Basic of Root locus	Chalkboard definition writing & explain different properties of Root locus.	CO4
32	Root locus technique	Basic of Root locus	Chalkboard definition writing & explain different properties of Root locus.	CO4
33	Root locus technique	Construction of root loci.	PPT slides & short video clip	CO4
34	Root locus technique	Construction of root loci.	PPT slides & short video clip	CO4
35	Root locus technique	Rules for construction of the root locus.	PPT slides & short video clip	CO4
36	Root locus technique	Rules for construction of the root locus.	PPT slides & short video clip	CO4
37	Root locus technique	Numerical of root locus.	Numerical worksheet; Whiteboard solving	CO4
38	Root locus technique	Numerical of root locus.	Numerical worksheet; Whiteboard solving	CO4
39	Root locus technique	Effect of adding poles to $G(s)$ and $H(s)$.	PPT slides & short video clip	CO4
40	Root locus technique	Effect of adding zeros to $G(s)$ and $H(s)$.	PPT slides & short video clip	CO4

Unit 7: Frequency response of system (Total Classes: 10)

Class No.	Topic	Subtopic	Teaching Aids/Activities	Course Objective

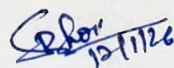| Class No.	Topic	Subtopic	Teaching Aids/Activities	Course Objective
41	Frequency Response Analysis	Correlation between time response and frequency response.	PPT slides & short video clip	CO5
42	Frequency Response Analysis	Correlation between time response and frequency response.	PPT slides & short video clip	CO5
43	Frequency Response Analysis	Polar plots.	Numerical worksheet; Whiteboard solving	CO5
44	Frequency Response Analysis	Polar plots.	Numerical worksheet; Whiteboard solving	CO5
45	Frequency Response Analysis	Bode plots.	Numerical worksheet; Whiteboard solving	CO5
46	Frequency Response Analysis	Bode plots.	Numerical worksheet; Whiteboard solving	CO5
47	Frequency Response Analysis	All pass and minimum phase system.	PPT slides & short video clip	CO5
48	Frequency Response Analysis	Computation of Gain margin and phase margin.	PPT slides & short video clip	CO5
49	Frequency Response Analysis	Log magnitude versus phase plot.	PPT slides & short video clip	CO5
50	Frequency Response Analysis	Closed loop frequency response.	PPT slides & short video clip	CO5
Unit 8: Nyquist plot (Total Classes: 10)				
Class No.	Topic	Subtopic	Teaching Aids/Activities	Course Objective
51	Nyquist Plot	Principle of argument.	Chalkboard definition writing of Nyquist plot	CO6
52	Nyquist Plot	Nyquist stability criterion.	PPT slides & short video clip	CO6

53	Nyquist Plot	Niquist stability criterion applied to inverse polar plot.	Numerical worksheet; Whiteboard solving	CO6
54	Nyquist Plot	Niquist stability criterion applied to inverse polar plot.	Numerical worksheet; Whiteboard solving	CO6
55	Nyquist Plot	Effect of addition of poles to G(S) H(S) on the shape of Niquist plot.	PPT slides & short video clip	CO6
56	Nyquist Plot	Effect of addition of zeros to G(S) H(S) on the shape of Niquist plot.	PPT slides & short video clip	CO6
57	Nyquist Plot	Assessment of relative stability.	PPT slides & short video clip	CO6
58	Nyquist Plot	Constant M circle	Chalkboard writing and derivation of M circle	CO6
59	Nyquist Plot	Constant N circle	Chalkboard writing and derivation of N circle	CO6
60	Nyquist Plot	Nicholas chart.	Numerical worksheet; Whiteboard solving	CO6

SaiSwarup Patel
Signature of the Faculty

12/11/26
Signature of the HOD
Electrical Engg. Branch

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