

# UTKALMANI GOPABANDHU INSTITUTE OF ENGINEERING, ROURKELA



## LESSON PLAN

**SUBJECT- Th3.CONTROL SYSTEM ENGINEERING**

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**DEPARTMENT OF ELECTRICAL ENGINEERING  
(Session: 2022-23)**

WEEKS	TOPICS TO BE COVERED
1	Classification of Control system
	Open loop system & Closed loop system and its comparison
	Effects of Feed back
	Standard test Signals(Step, Ramp, Parabolic, Impulse Functions)
	Servomechanism
2	Transfer Function & Impulse response,
	Properties, Advantages & Disadvantages of Transfer Function modeling of Electrical Systems(R, L, C, Analogous systems)
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	Poles & Zeroes of transfer Function
	Simple problems of transfer function of network.Mathematical
3	Simple problems of transfer function of network.Mathematical
	Mathematical modeling of Electrical Systems(R, L, C, Analogous systems)
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	Components of Control System
	Gyroscope,
4	Synchros,
	Tachometer
	, DC servomotors,

	Ac Servomotors.
	Definition: Basic Elements of Block Diagram
5	Canonical Form of Closed loop Systems
	Rules for Block diagram reduction
	Procedure for of Reduction of Block Diagram
	Simple Problem for equivalent transfer function
	Basic Definition in Signal Flow Graph & properties
	Construction of Signal Flow graph from Block diagram
6	Mason's Gain formula 4.9. Simple problems in Signal flow graph for network
	Time response of control system. 5 . 2 Standard Test signal. 5.2.1. Step signal, 5.2.2. Ramp Signal 5.2.3. Parabolic Signal 5.2.4. Impulse Signa
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	Time Response of first order system with: 5.3.1. Unit step response 5.3.2. Unit impulse response
	Time Response of first order system with: 5.3.1. Unit step response 5.3.2. Unit impulse response
7	Time response of second order system to the unit step input.
	Time response of second order system to the unit step input. 5.4.1. Time response specification.
	5.4.2. Derivation of expression for rise time, peak time, peak overshoot, settling time and steady state error. . Steady state error and error constants
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	Types of control system.[ Steady state errors in Type-0, Type-1, Type-2 system]
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	Effect of adding poles and zero to transfer function.
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	Response with P, PI, PD and PID controller.
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10	Response with P, PI, PD and PID controller.
	6. ANALYSIS OF STABILITY BY ROOT LOCUS TECHNIQUE. 6 . 1 Root locus concept.
	6 . 2 Construction of root loci.
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11	6 . 3 Rules for construction of the root locus.
	6 . 3 Rules for construction of the root locus.
	6 . 4 Effect of adding poles and zeros to $G(s)$ and $H(s)$ .
	6 . 4 Effect of adding poles and zeros to $G(s)$ and $H(s)$ .
	7. FREQUENCY RESPONSE ANALYSIS. 7 . 1 Correlation between time response and frequency response.
12	7. FREQUENCY RESPONSE ANALYSIS. 7 . 1 Correlation between time response and frequency response.
	Polar plots.
	Polar plots.
	Bode plots.
	Bode plots.
13	All pass and minimum phase system.
	Computation of Gain margin and phase margin.
	Computation of Gain margin and phase margin.
	Log magnitude versus phase plot.
	Log magnitude versus phase plot.
14	Closed loop frequency response
	Closed loop frequency response
	Principle of argument.
	Nyquist stability criterion.
	Nyquist stability criterion applied to inverse polar plot.
15	Effect of addition of poles and zeros to $G(S)$ $H(S)$ on the shape of Niquist plot.
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	Assessment of relative stability.
	Constant M and N circle
	Nicholas chart.