Lesson plan

Name of the faculty : Er. Gaurav Kumar

Discipline : Electronics & Communication Engineering

Semester : 6th

Subject : Control system (Paper Code: PCC-EE-305-G)

Lesson Plan Duration : 15 weeks (From May 2021 to Sep 2021)

Work Load (Lecture/ Practical) per week (in hours): Lecture-03, Practical-01

Week	**Theory**		**Practical**	
	Lecture day	**Topic(Including assignment/test)**	**Practical Day**	**Topic**
1st	1st	**Introduction to control problem (4 hours)** Industrial Control examples Mathematical models of physical systems	1st	To study speed Torque characteristics of a) A.C. servo motor b) DC servo motor
	2nd	Control hardware and their models. Transfer function models of linear time-invariant systems		
2nd	1st	Feedback Control: Open-Loop and Closed-loop systems	2nd	(a) To demonstrate simple motor driven closed loop DC position control system
	2nd	Benefits of Feedback. Block diagram algebra.		
3rd	1st	**Time Response Analysis (10 hours)** Standard test signals	3rd	To study and demonstrate simple closed loop speed control system
	2nd	Time response of first and second order systems for standard test inputs		
4th	1st	Application of initial and final value theorem	4th	To study the lead, lag, lead-lag compensators and to draw their magnitude and phase plots.
	2nd	Design specifications for second-order systems based on the time-response.		
5th	1st	Concept of Stability. Routh-Hurwitz Criteria	5th	To study a stepper motor & to execute microprocessor or computer-based control of

	2nd	Relative Stability analysis		the same by changing number of steps, direction of rotation & speed.
6th	1st	Root-Locus technique	6th	To implement a PID controller for temperature control of a pilot plant
	2nd	Construction of Root-loci.		
7th	**Sessional -I Examination+Activity**			
8th	1st	**Frequency-response analysis (6 hours)** Relationship between time and frequency response	8th	To study behavior of 1 order,2 order type 0, type 1 system.
	2nd	Polar plots		
9th	1st	Bode plots	9th	To study control action of light control device
	2nd	Bode plots continue……		
10th	1st	Nyquist stability criterion	10th	To study water level control using a industrial PLC
	2nd	Relative stability using Nyquist criterion – gain and phase margin		
11th	1st	Closed-loop frequency response	11th	To study motion control of a conveyor belt using a industrial PLC
	2nd	**Introduction to Controller Design (10 hours)** Stability		
12th	1st	steady-state accuracy, transient accuracy	12th	**MATLAB BASED (ANY FOUR EXPT.)** 10. Introduction to MATLAB (Control System Toolbox), Implement at least any
	2nd	disturbance rejection, insensitivity and robustness of control systems		

				Different Toolboxes in MATLAB, Introduction to Control Systems Toolbox
13th	1st	Root-loci method of feedback controller design	13th	Determine transpose, inverse values of given matrix. Plot the pole-zero configuration in s-plane for the given transfer function. Plot unit step response of given transfer function and find peak overshoot, peak time
	2nd	Design specifications in frequency-domain		
14th	1st	Frequency-domain methods of design. Application of Proportional, Integral and Derivative Controllers	14th	Plot unit step response and to find rise time and delay time
	2nd	Lead and Lag compensation in designs		
15th	1st	Analog and Digital implementation of controllers	15th	Plot locus of given transfer function, locate closed loop poles for different values of k.
	2nd	**State variable Analysis (6 hours)** Concepts of state variables		
16th		State space model. Diagonalization of State Matrix. Solution of state equations		Plot root locus of given transfer function and to find out S, Wd, Wn at given root & to discuss stability.
		Eigen values and Stability Analysis. Concept of controllability and observability		Plot bode plot of given transfer function and find gain and phase margins Plot the Nyquist plot for given transfer function and to discuss closed loop stability, gain and phase margin.
17th	**Sessional -II Examination+Activity**			