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SCHOOL OF ENGINEERING AND TECHNOLOGY	ELECTRICAL AND ELECTRONICS ENGINEERING DEPARTMENT	OPERATIONAL FROM (2013-2014)	FOR STUDENTS ADMITTED STARTING (2012-2013)

1	Course number	EEE310	
2	Course Title	**CONTROL SYSTEM THEORY (DC)**	
3	Credits	5	
4	Contact Hours (L-T-P)	3-1-2	
5	Course Objective	To provide students with: 1. An understanding of the methodology for modelling mechanical, electrical, and other types of dynamic systems using both time domain and frequency domain analysis. 2. An understanding of the fundamental analytical methods and tools used in control system design. 3. Ability to design feedback controllers and compensators to meet desired performance specifications	
6	Course Outcomes	On successful completion of this course students will be able to 1. identify the basic elements and structures of feedback control systems 2. analyze the methodology for modelling dynamic systems (electrical, mechanical, etc) 3. describe the working principles of different control system elements 4. estimate the transfer function to represent linear systems using Laplace transform 5. apply Block Diagram Reduction Technique and Signal Flow Graph to analyze a system 6. determine the fundamental characteristics and properties of feedback control systems 7. examine the different parameters of a system using time domain and frequency domain analysis 8. apply Routh-Hurwitz criterion to determine the domain of stability of linear time-invariant systems in the parameter space 9. design of Stable system by constructing Bode and polar plots for rational transfer functions 10. analyze and design the control systems using methods of Nyquist and root-locus 11. design feedback controllers and compensators to achieve desired performance specifications	
7	Outline syllabus:		
7.01	EEE310.A	Unit A	Basics of Control System
7.02	EEE310.A1	Unit A Topic 1	Basic elements of control system, open and closed loop systems.
7.03	EEE310.A2	Unit A Topic 2	Potentiometers, synchros, AC and DC servomotors, stepper motor, ac tacho- generator and gyros.

7.04	EEE310.A3	Unit A Topic 3	Electrical analogy of mechanical system, transfer function, block diagram reduction technique, signal flow graph.
7.05	EEE310.B	Unit B	Time Response
7.06	EEE310.B1	Unit B Topic 1	Time domain specifications, types of test input, First and second order system response.
7.07	EEE310.B2	Unit B Topic 2	Error coefficients, generalized error series, steady state error.
7.08	EEE310.B3	Unit B Topic 3	P, PI, PID modes of feedback control.
7.09	EEE310.C	Unit C	Frequency Response
7.10	EEE310.C1	Unit C Topic 1	Transfer functions of open loop and closed loop systems.
7.11	EEE310.C2	Unit C Topic 2	Bode plot and polar plot.
7.12	EEE310.C3	Unit C Topic 3	Correlation between frequency domain and time domain.
7.13	EEE310.D	Unit D	Stability of Control System
7.14	EEE310.D1	Unit D Topic 1	Characteristic equation, location of roots in s plane for stability , Routh Hurwitz criterion.
7.15	EEE310.D2	Unit D Topic 2	Root locus construction, effect of pole and zero additions.
7.16	EEE310.D3	Unit D Topic 3	Gain margin and phase margin, Nyquist stability criterion.
7.17	EEE310.E	Unit E	Modern Control System
7.18	EEE310.E1	Unit E Topic 1	Lag, lead, lag-lead compensator and their performance criteria.
7.19	EEE310.E2	Unit E Topic 2	State space analysis.
7.20	EEE310.E3	Unit E Topic 3	Controllability and observability.
7.21	EEE310.L01	Lab expt.1	To determine the speed-torque characteristics of an AC Servomotor
7.22	EEE310.L02	Lab expt.2	To study synchro transmitter and receiver pair and obtain output versus input characteristics
7.23	EEE310.L03	Lab expt.3	To control the speed of an AC motor using TRIAC
7.24	EEE310.L04	Lab expt.4	To determine the effect of feedback on DC motor.
7.25	EEE310.L05	Lab expt.5	To control the temperature using PID controller.
7.26	EEE310.L06	Lab expt.6	To examine the effect of P, PD, PI, PID controller on a second order system
7.27	EEE310.L07	Lab expt.7	To determine the transfer function of DC motor.
7.28	EEE310.L08	Lab expt.8	Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system using MATLAB
7.29	EEE310.L09	Lab expt.9	Time domain analysis and error analysis using MATLAB
7.30	EEE310.L10	Lab expt.10	Frequency domain analysis and error analysis using MATLAB
8	Course Evaluation		
8.1	Course work: 30 marks		
8.11	Attendance	None	
8.12	Homework	10 assignments, no weight	
8.13	Quizzes	7 best quizzes (based on assignments); 20 marks	
8.14	Labs	Evaluation of work done on each lab turn in the lab notebook and feedback from oral quiz about the work done that day. Zero, if the student is absent. 0.75N best marks out of N such evaluations: 10 marks	
8.15	Presentations	None	
8.16	Any other	None	
8.2	MTE	20 marks	
8.3	End-term examination: 50 marks		

9	References	
9.1	Text book	I J Nagrath& M Gopal, "Control System Engineering", New Age International Publishers.
9.2	Other references	1. B C Kuo, "Automatic Control Systems", PHI Publishers. 2. Katsuhiko Ogata, "Modern Control Engineering" , Prentice-Hall Engineering Publishers.
9.3	Software	MATLAB/Simulink.

Mapping of Outcomes vs. Topics

Outcome no. → Syllabus topic↓	1	2	3	4	5	6	7	8	9	10	11
EEE310.A1	X					X					
EEE310.A2			X								
EEE310.A3		X		X	X						
EEE310.B1				X			X				
EEE310.B2				X		X					
EEE310.B3	X	X		X							
EEE310.C1									X	X	
EEE310.C2						X	X				
EEE310.C3							X				
EEE310.D1								X			
EEE310.D2										X	
EEE310.D3									X		
EEE310.E1									X		
EEE310.E2											X
EEE310.E3											X