

BEEE303L	Control Systems	L	T	P	C
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Pre-requisites	BEEE101L, BEEE101P, BMAT102L	Syllabus version			
		1.0			
Course Objectives					
1. Introduce the fundamentals of physical systems modelling and control of linear time invariant systems.					
2. Teach the practical control system design with realistic system specifications.					
3. Impart knowledge of state variable models and state feedback design.					
Course Outcome					
On the completion of this course, the student will be able to:					
1. Formulate mathematical models of the physical systems.					
2. Analyze the system performance in time and frequency domains.					
3. Determine the stability of linear time invariant system in time and frequency domains.					
4. Design compensators and controllers to meet the performance specifications.					
5. Perform state space analysis and design state feedback control.					
Module:1	Systems and their Representations	6 hours			
Basic elements in control systems: open loop and closed loop, transfer functions of mechanical, electrical and electro-mechanical systems, electrical analogous systems; Block diagram reduction, signal flow graphs.					
Module:2	Time Response Analysis	6 hours			
Standard test signals, time response of first and second order systems, time domain specifications; Steady state error, static error constants and system type.					
Module:3	Stability Analysis and Root Locus	6 hours			
Stability: concept and definition, characteristic equation, location of poles, Routh Hurwitz criterion; Root locus technique: construction, properties and applications.					
Module:4	Frequency Response Analysis	6 hours			
Frequency domain specifications; Bode plot, Polar plot; Correlation between frequency domain and time domain specifications.					
Module:5	Stability in Frequency Domain	5 hours			
Relative stability: gain margin, phase margin; stability analysis using frequency response methods; Nyquist stability criterion.					
Module:6	Compensators and Controllers	7 hours			
Realization of basic compensators, cascade compensation in time domain and frequency domain, feedback compensation, design of lag, lead, lag-lead series compensators using Bode plot; P, PI and PID controllers in frequency domain.					
Module:7	State Space Analysis	7 hours			
Concepts of state variable and state model, solution of state equation, state space to transfer function conversion, state space decomposition methods, controllability, observability, pole placement control, observer design.					
Module:8	Contemporary Issues	2 hours			
Total Lecture hours:					45 hours
Text Books					
1.	Norman S. Nise, Control System Engineering, 2019, 8 th Edition, John Wiley & Sons				
2.	Farid Galnaraghi, Benjamin C. Kuo, Automatic Control System, 2017, 9 th Edition, McGraw-Hill Education				
Reference Books					
1.	K. Ogata, Modern Control Engineering, 2016, 5 th Edition, Pearson				
2.	R.C. Dorf & R.H. Bishop, Modern Control Systems, 2017, 13 th Edition, Pearson				

	Education		
3.	M. Gopal, Control Systems- Principles and Design, 2016, 4 th Edition, Tata McGraw Hill		
4.	J. Nagrath and M. Gopal, Control System Engineering, 2018, 6 th Edition, New Age International Publishers		
Mode of Evaluation: CAT, Assignment, Quiz, FAT			
Recommended by Board of Studies		19-02-2022	
Approved by Academic Council		No. 65	Date 17-03-2022