

COURSE CODE: 1151EE106	COURSE TITLE: <b>CONTROL SYSTEMS</b>	L	T	P	C
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**COURSE CATEGORY:**

Program Core

**PREAMBLE :**

This Course aims to provide knowledge in mathematical modelling with state space and transfer function models, time and frequency response analysis and stability studies of system.

**PREREQUISITE COURSES:**

Circuit Analysis

**RELATED COURSES:**

Analog Electronics, Signals Systems and Processing

**COURSE EDUCATIONAL OBJECTIVES :**

The objectives of the course are to make the students,

- To provide knowledge in mathematical modelling of various systems
- To perform time and frequency domain analysis and the check the stability
- To design controllers and compensators based on specifications given.
- To develop State model and appreciate its significance

**COURSE OUTCOMES :**

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	Develop mathematical Model for electrical, mechanical and Electro mechanical systems and Obtain transfer function using block diagram algebra and mason's gain formula	K2
CO2	Calculate various time domain specifications and describe their significance	K2
CO3	Analyze the Performance of The given System using frequency response plots and root locus	K3
CO4	Determine the stability of the given system using time and frequency domain approach	K3
CO5	Design a lag, lead, lag-lead compensators based on its specifications using root locus and bode plot approach and Explain the concept of P,PI and PID Controller .	K3
CO6	Develop state space models from transfer functions and vice versa	K3

**CORRELATION OF COs AND Pos**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					L						H	
CO2		H	L		H		H				H	
CO3	H		H	H	H		M					
CO4		H	M				L				L	
CO5	H		M		H		H				L	

<b>COURSE CONTENT:</b>		
<b>UNIT I</b>	<b>INTRODUCTION</b>	<b>9</b>
Introduction to control systems – open loop and closed loop systems – Mathematical modelling of various systems – analogies between Electrical and Mechanical Systems – Determination of transfer function using Block Diagram Reduction – Signal flow graph Method		
<b>UNIT II</b>	<b>TIME RESPONSE ANALYSIS</b>	<b>9</b>
Poles – Zeros - Effect of feed back – Standard Test Signals – Time Response of First order and Second order systems – Time response specifications – Effects of addition of Poles and Zeros - Steady State errors and error constants- P PI and PID Controllers an Introduction		
<b>UNIT III</b>	<b>FREQUENCY RESPONSE ANALYSIS</b>	<b>9</b>
Introduction to frequency response-Time and frequency response correlation (Excluding proof) – Polar plot – Bode plot – Frequency response specification -Gain margin and phase margin- Design of Lag and Lead compensators using frequency response specifications		
<b>UNIT IV</b>	<b>STABILITY ANALYSIS</b>	<b>9</b>
Stability concepts – Conditions for stability – Routh Hurwitz stability criteria - Root locus method – Stability in frequency domain – Nyquist stability criterion – Relative stability analysis		
<b>UNIT V</b>	<b>INTRODUCTION TO STATE SPACE MODEL</b>	<b>9</b>
Introduction to State space – State Equations – Conversion of State space model to transfer function and vice versa- Solution of State Equations-State Transition Matrix – Controllability and Observability.		
<b>TOTAL: 45 PERIODS</b>		
<b>TEXT BOOKS:</b>		
<ol style="list-style-type: none"> <li>1. Norman.S.Nise “Control Systems Engineering” , Wiley Student Edition, 5th edition 2012</li> <li>2. RicharD.C.Dorf and Robert.H.Bishop “Modern Control Sytems”, Pearson Education ,11th edition 2011</li> <li>3. IJ Nagrath and M.Gopal “Control Systems Engineering”, New Age International ,6th edition 2010</li> </ol>		
<b>REFERENCE BOOKS:</b>		
<ol style="list-style-type: none"> <li>1. Kaitshiko Ogata “Modern Control Engineering”Pearson Education “2010 edition</li> <li>2. John J Azzo and Constantine H.Houpis “Linear Control Systems analysis and Design with MATLAB , Marcel Dekker Inc, 6th Edition 2013</li> <li>3. Graham C. Goodwin, Stefen F. Grebe and Mario E.Salgado “Control System Design” , PHI,2002</li> </ol>		
<b>ONLINE RESOURCES</b>		
<ol style="list-style-type: none"> <li>a. <a href="https://www.facstaff.bucknell.edu/mastascu/eControlHTML/Intro/Intro1.html">https://www.facstaff.bucknell.edu/mastascu/eControlHTML/Intro/Intro1.html</a></li> <li>b. Lectures by Brian Douglas</li> </ol>		