JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

II Year-II Semester		L	T	P	C
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	LINEAR CONTROL SYSTEMS				

Course objectives:

- To introduce the concepts of open loop and closed loop systems, mathematical models of mechanical and electrical systems, and concepts offeedback
- To study the characteristics of the given system in terms of the transfer function and introducing various approaches to reduce the overall system fornecessaryanalysis
- To develop the acquaintance in analyzing the system response in time-domain and frequency domain in terms of variousperformanceindices
- To analyze the system in terms of absolute stability and relative stability by differentapproaches
- To design different control systems for different applications as pergivenspecifications
- To introduce the concepts of state variable analysis, design and also the concepts of controllability andobservability.

UNIT I
INTRODUCTION
Concepts of System,Control Systems: Open Loop and closed loop control systems and their differences. Different examples of control systems, Feed-Back Characteristics, Effects of feedback.Mathematical models, Differential equations, Impulse Response andtransfer functions.Translational and Rotational mechanicalsystems

UNIT II
TRANSFER FUNCTION REPRESENTATION
Transfer Function of DC Servo motor - AC Servo motor- Synchro-transmitter and Receiver, Block diagram representation of systemsconsidering electrical systems as examples -Block diagram algebra– Representation by Signal flow graph - Reduction using mason'sgain formula.
TIME RESPONSEANALYSIS
Standard test signals - Time response of first order systems – CharacteristicEquation of Feedback control systems, Transient response of second ordersystems - Time domain specifications – Steady state response - Steady stateerrors and error constants.

UNIT III
STABILITY ANALYSIS IN S-DOMAIN
The concept of stability – Routh's stability criterion – qualitative stabilityand conditional stability – limitations of Routh's stability100
Root Locus Technique:
The root locus concept - construction of root loci-effects of adding polesand zeros to G(s)H(s) on the root loci.

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UNIT IV
Frequency response analysis: Introduction, Correlation between time and frequency response, Polar Plots, Bode Plots, Nyquist StabilityCriterion

UNIT V
CLASSICAL CONTROL DESIGN TECHNIQUES
Compensation techniques – Lag, Lead, Lead-Lag Controllers design infrequency Domain, PID Controllers. State Space Analysis of ContinuousSystems Concepts of state, state variables and state model, derivation ofstate models from block diagrams, Diagonalization- Solving the Timeinvariant state Equations- State Transition Matrix and it's Properties –Concepts of Controllability and Observability.

TEXT BOOKS:
1. Automatic Control Systems 8th edition– by B. C. Kuo–John wiley andson's,2003.
2. Control Systems Engineering – by I. J. Nagrath and M. Gopal,New Age International(P) Limited, Publishers, 2nd edition,2007
3. Modern Control Engineering–by Katsuhiko Ogata – Pearson Publications, 5th edition,2015.

REFERENCE BOOKS:
1. Control Systems by A.Nagoorkani, RBA publications,3 edition,2017.
2. Control Systems by A.Anandkumar, PHI, 2 Edition,2014.

Course Outcomes:
- This course introduces the concepts of feedback and its advantages to various controlsystems
- The performance metrics to design the control system in time-domain and frequency domain areintroduced.
- Control systems for various applications can be designed using time-domain and frequency domainanalysis.
- In addition to the conventional approach, the state space approach for the analysis of control systems isalsointroduced.