

EE3001 – Control Systems I

Subject Code	EE3001	Subject Title	Control Systems I			
Credits	2.0	Total Hours	Lectures	24 h	Pre-Requisites	MA 2001
GPA/NGPA	GPA		Lab/Tutorial/Assignment	12 h		
Aims: To introduce the fundamental in control systems						
Learning Outcomes On successful completion of this module, students are able to:						
<ol style="list-style-type: none"> 1. Demonstrate understanding of basic concepts of control engineering 2. Demonstrate understanding of feedback theory of control systems 3. Perform calculations on time response analysis 4. Demonstrate understanding of the concepts of stability in control engineering 5. Perform calculations on frequency domain analysis 						
LO 1.	Demonstrate understanding of basic concepts of control engineering [6 h] Basic concepts of control systems:- Open loop and closed loop systems, Difference between open loop and closed loop systems; Block diagram algebra, signal flow graph (SFG); Definition of transfer function; Electrical analogue to mechanical, hydraulic, thermal and pneumatic systems; Mathematical model of physical systems, transfer function; Examples of Armature control DC motor, Field Control DC Motor, Position Control Systems					
LO 2.	Demonstrate understanding of feedback theory of control systems [4 h] Types of feedbacks; effect of degenerative feedback on control systems; regenerative feedback; Components:- AC Servo Motors, DC servo motors					
LO 3.	Perform calculations on time response analysis [5 h] Standard test signals:- Step, ramp, parabolic and impulse signals; Time response of 1 st order systems to unit step and unit ramp inputs; Time response of 2 nd order to unit step input; Steady state errors and error constants of different types of control systems; Time domain design specifications					
LO 4.	Demonstrate understanding of the concepts of stability in control engineering [6 h] Definition of Characteristic equation and its roots; Necessary conditions of stability using standards transfer functions; Routh's Hurwitz stability criterion and its application for stability and relative stability; Root locus techniques, Root locus concepts, rules for construction of root loci, determination of root locus, root contours, Example problems of demonstrating root loci of different order, different type systems					
LO 5.	Perform calculations on frequency domain analysis [6 h] Frequency domain analysis:- Introduction to polar plots, determination of stability from polar plots, Nyquist stability criterion, Applications of Nyquist to the linear feedback system, Relative stability and definition of phase margin and gain margin using polar plot; Bode plot and determination of stability using Bode plot; Relative stability using bode plot Gain adjustment; Phase adjustment for achieve a stable system					
Practical Work: [2×3 h]						
Tutorials: [3×1 h]						
Assignment: [3 h]						
Assessment						
	a	Practical work				15%
	b	Assignment				15%
	c	End of semester Written examination: 2 h test				70%
Rec. Bks.	<ol style="list-style-type: none"> 1. Modern Control Engineering : D.Roy Choudhury, PHI (ISBN 10-8120321960) 2. Modern Control Engineering : K. Ogata , PHI (ISBN-10: 0136156738) 3. Control Systems Engineering : L.J. Nagrath, M. Gopal, Third Edition, New Age International Publishers. (ISBN-10: 8122417752) 4. Control System, Theory & Applications : Samarjit Ghosh, Pearson Education (ISBN-10: 8131708284) 5. System Dynamic and Control : Eroni Umez Erani., PWS Publishing, International Thompson Publishing Company (ISBN-10: 8131708284) 6. H.K.P Neubert "Instrument Transducers Oxford Herman University Press Eighth Impression 2008.(ISBN-13: 9780198563204) 7 Ramon Pallas-Arenyand Johan G. Webster "Sensor And Signal Conditioning" John Wiley, New York 1991.(ISBN 0-471-33232-1) 8 "Transducer Interfacing Handbook", A guide to Analog Signal Conditioning (ISBN 10: 0916550052) 					