INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

Department of Electrical and Electronics Engineering

COURSE DESCRIPTION FORMS

Course Title	**CONTROL SYSTEMS**			
Course Code	**A50211**			
Regulation	**R13**			
Course Structure	**Lectures**	**Tutorials**	**Practicals**	**Credits**
	4	**1**	**00**	**4**
Course Coordinator	Dr.S.Vathsal			
Team of Instructors	Dr.S.Vathsal			

I. COURSE OVERVIEW:

This course it is aimed to introduce the students the principles and applications of control systems in everyday life. The basic concepts of block diagram reduction, time analysis solutions to time invariant systems and also deals with the different aspects of stability analysis of systems in frequency domain and time domain

II. PREREQUISITES:

Level	Credits	Periods	Prerequisite
UG	4	4	Knowledge of systems, linear and non-linear control systems

III. COURSE ASSESSMENTMETHODS:

a. Marks distribution:

Session Marks	University End Exam Marks	Total Marks
There shall be two mid tem examinations. Each id term exam consists of subjective type and objective type test. The subjective test is for 10 marks, with duration of 1 hour. Subjective test of each semester shall contain four questions; the student has to answer two out of them. Each carrying 5marks The objective test paper Is prepared by JNTUH, which consists of 20 questions each carrying 0.5 marks and total of 10 marks. The student is assessed by giving two assignments, one, after completion of 1to 4 units and the second, after the completion of 4 to 8 units each carrying 5 marks. On the total the internal marks are 25. The average of two internal tests is the final internal marks. The external question paper is set by JNTUH consisting of 8 questions each carrying 15 marks out of which 5 questions are to be answered their by external examination is of total 75 mark	75	100

IV. EVALUATIONSCHEME:

S. No	Component	Duration	Marks
1	I Mid Examination	90 minutes	20
2	I Assignment	--	05
3	II Mid Examination	90 minutes	20
4	II Assignment	--	05
5	External Examination	3 hours	75

V. COURSEOBJECTIVE:

i. To analyze the principles and applications of control systems in day life.

ii. To define linear time–invariant system and to design simple control systems.

iii. The time domain approach is unified method for analyzing and designing systems modeled by either by modern or classical approach.

iv. To describe the degree or extent of the system stability. The steady state performance the transient response.

v. To compute bode plot for given open loop transfer function, defining the stability and gain margin and phase margin for given bode plot.

VI. COURSEOUTCOMES:

1. Gets Evaluate unstable open loop plants and processes and design specific compensators to provide closed loop stability.
2. Analyze transfer functions for electro-dynamic plants and machines, with electrical, electro- mechanical, electro-pneumatic, and electro-hydraulic elements from plant site collected data.
3. Use stability analysis in S –Domain.
4. To use frequency response in the analysis of control systems.
5. Solve problems relating to stability of control systems using various methods.

VII. HOW PROGRAM OUTCOMES AREASSESSED:

Program outcomes		Level	Proficiency Assessed by
PO1	An ability to apply the knowledge of mathematics, science and Engineering for solving multifaceted issues of Electrical Engineering.(General knowledge)	H	Assignments
PO2	An ability to communicate effectively and to prepare formal technical plans leading to solutions and detailed reports for electrical systems.(Problem Analysis)	S	Exercise
PO3	To develop Broad theoretical knowledge in Electrical Engineering and learn the methods of applying them to identify, formulate and solve practical problems involving electrical power.(Design/Development of solutions).	H	Assignments, discussion
PO4	An ability to apply the techniques of using appropriate technologies to investigate, analyze, design, simulate and/or fabricate/commission complete systems involving generation, transmission and distribution of electrical energy .(Conduct investigations of complex problems)	S	Exercise
PO5	An ability to model real life problems using different hardware and software platforms, both offline and real-time with the help of various tools along with upgraded versions. (Modern tool usage)	N	------

PO6	An Ability to design and fabricate modules, control systems and relevant processes to meet desired performance needs, within realistic constraints for social needs.(The engineer and society)	S	Exercise
PO7	An ability To estimate the feasibility, applicability, optimality and future scope of power networks and apparatus for design of eco-friendly with sustainability (Environment and sustainability)	H	Discussion, seminars
PO8	To Possess an appreciation of professional, societal, environmental and ethical issues and proper use of renewable resources.(Ethics)	N	-----
PO9	an Ability to design schemes involving signal sensing and processing leading to decision making for real time electrical engineering systems and processes at individual and team levels.**(**Individual and team work)	S	Discussions
PO10	an Ability to work in a team and comprehend his/her scope of work, deliverables , issues and be able to communicate both in verbal ,written for effective technical presentation.**(**Communication)	S	Discussion, seminars
P011	An ability to align with and upgrade to higher learning and research activities along with engaging in life-long learning.	S	Discussions, seminars
PO12	To be familiar with project management problems and basic financial principles for a multi-disciplinary work.**(**Project management and finance)	S	Prototype, discussions

N=None **S=Supportive** **H=highly related**

VIII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED

Program Specific Outcomes		Level	Proficiency Assessed By
PSO1	**Professional Skills:** Able to utilize the knowledge of high voltage engineering in collaboration with power systems in innovative, dynamic and challenging environment, for the research based team work.	S	Lectures, Assignments
PSO2	**Problem-Solving Skills:** Can explore the scientific theories, ideas, methodologies and the new cutting edge technologies in renewable energy engineering, and use this erudition in their professional development and gain sufficient competence to solve the current and future energy problems universally.	N	------
PSO3	**Successful Career and Entrepreneurship:** The understanding of technologies like PLC, PMC, process controllers, transducers and HMI one can analyze, design electrical and electronics principles to install, test , maintain power system and applications	S	Guest Lectures

N – None **S – Supportive** **H-Highly Related**

IX. SYLLABUS:

UNIT - I

Concept of Control Systems - Open Loop and closed loop and their differences-Different examples of control systems –classification of control systems, feed –back characteristics, Effects of feedback. Mathematical models – Differential equations, Impulse Response and transfer function –translational and rotational mechanical system

UNIT - II

Transfer Function of DC Servo motor - AC Servo motor- Synchro transmitter and Receiver. Block diagram representation of systems considering electrical systems as examples. Block diagram algebra – Representation by Signal flow graph - Reduction using Mason's gain formula.

UNIT - III

Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants – Effects of proportional derivative, proportional integral systems.

UNIT - IV

The concept of stability – Routh's stability criterion – qualitative stability and conditional stability – limitations of Routh's stability.

Root locus Technique: The root locus concept - construction of root loci-effects of adding poles and zeros to G(s) H(s) on the root loci.

UNIT - V

Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Phase margin and Gain margin stability Analysis from Bode Plots.

X. TEXT BOOKS:

1. Modern control theory by M.Gopal, newage.
2. Modern control engineering by K. Ogata, prenticehall

XI. REFERENCES:

1. Control system engineering by I.J.nagarath and M.Gopal,newage
2. Advanced control systems bynagoorkani

XII. COURSEPLAN:

The course plan is meant as a guideline. There may be probably being changes.

Lecture No.	Learning Objectives	Topic To Be Covered	Reference
1	Introduction	Introduction of control system	T1
2-3	Introduction to system and control systems	Concepts of Control Systems Open Loop and Closed loop control systems and their differences	T1
4	Differences of control system	Differences of control system	T1
5	Different examples of control systems	Different examples	T1
6	classification of control systems	classification of control systems	T1
7-8	feed –back characteristics ,Effects of feedback	feed –back characteristics ,Effects of feedback	T1
9	Differential equations, Impulse Response and transfer function	Differential equations, Impulse Response and transfer function	T1, R2
10-13	translational and rotational mechanical system	Introduction of translational and rotational mechanical system	T1
14-15	Transfer Function of DC Servo motor	Introduction and Transfer Function of DC Servo motor	T1, R2
16-17	AC Servo motor-	Introduction of AC Servo motor-	T1, R2
18	Synchro transmitter and Receiver	Introduction of Synchro transmitter and Receiver	T1
19-20	Block diagram representation of systems considering electrical systems as examples	Introduction and explanation	T1
21-23	Block diagram algebra	Problems	T1
24-26	Representation by Signal flow graph - Reduction using Mason's gain formula.	Masons gain formula	T1
27	Introduction	Introduction of Time response analysis	T1, R2
28	Time response of first order systems	Time response of first order systems	T1, R2
29-30	Characteristic Equation of Feedback control systems	Characteristic Equation of Feedback control systems	T1
31-34	Transient response of second order systems - Time domain specifications	Time response	T1, R1
35-36	Steady state response - Steady state errors and error constants	Steady state response	T1, R2

37-39	Effects of proportional derivative, proportional integral systems.	PID controller	T1, R2
40	Introduction	The concept of stability	T1, R2
41- 44	Routh's stability criterion – qualitative stability and conditional stability	Routh's stability criterion	T1, R1
45	limitations of Routh's stability	limitation	T1, R2
46	Introduction	The root locus concept	T1
47-52	Construction of root loci- effects of adding poles and zeros to G(s) H(s) on the root loci.	Root locus and problems	T1
53	Introduction	Introduction of frequency response	T1
54	Frequency domain specifications	Frequency domain specifications expressions	T1, R1
55- 65	Determination of Frequency domain specifications and transfer function from the Bode Diagram-Phase margin and Gain margin stability Analysis from Bode Plots.	Different problems	T1

XIII. MAPPING COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OF HEPROGRAM OUTCOMES:

Course Objectives	Program outcomes											
	a	b	c	d	e	f	g	h	i	j	k	l
I	S		H	S		S	S		S	S		H
II	H		H	H		H	S		S	S		H
III	S		H	H		H	S		S	S		H
IV	S		H	H		S	S		S	S		H
V	H		H	S		H	S		S	S		H

S=Supportive H=highly related

XIV. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF THEPROGRAM OUTCOMES:

Course Objectives	Program outcomes											
	a	b	c	d	e	f	g	h	i	j	k	l
I	S	N	H	S	N	S	S	N	S	S	N	S
II	H	N	H	H	N	H	S	N	S	S	N	S
III	S	N	H	H	N	H	S	N	S	S	N	S
IV	S	N	H	H	N	S	S	N	S	S	N	S
V	H	N	H	S	N	H	S	N	S	S	N	S

S=Supportive H=highly related

Prepared by: Dr.S.Vathsal

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