Faculty of Engineering and Technology

DEPARTMENT OF ICE

Course Code	:	IC0305
Course Title	:	CONTROL SYSTEMS
Year& Semester	:	III & V semester
Course duration	:	Odd semester (July-Nov 2014)

Faculty Details:

Name of the staff	Section	Office	Office Hours	Mail ID
P.K.Senthilkumar	ICE A	Tech Park	8.30-4 pm	Senthilkumar.p@ktr.srmuniv.ac.in

Required Text Books:
1. Katsuhiko Ogata, Modern Control Engineering, Prentice Hall of India
2. I.J.Nagrath & M.Gopal, Control Systems Engineering, Wiley & Sons Ltd
3. Benjamin.C.Kuo, Automatic Control Systems, Prentice Hall of India
4. Nagoor kani, Control Systems, RBA Publications

Web Resource:
- www.mathworks.com
- www.wiley.com
- www.nist.edu/academ/eie/ele-501.htm
- www.answers.com
- www.infibeam.com
- www.vitastapublishing.com

Prerequisite   : Electric circuits & Networks
Objective:
1. To Understand the fundamentals of mathematical modeling
2. To derive transfer function of control system components
3. To analyze the transient and steady state response of first and second order systems
4. To analyze the stability of systems from transfer function forms
5. To understand the frequency domain tools for analysis and design of linear control systems

Tentative test details and portions:
 Cycle Test - I: 30.07.14   Unit I & II
 Cycle Test –II: 30.08.14   Unit III & IV
  Model Exam: 10.10.14   All five units

Assessment details

Cycle test I	10 points

Cycle test II	10 points
Model test	20 points
Surprise test (3* 5 Points)	05 points
Attendance	05 points
TOTAL	50 Points

Outcomes

Students who have successfully completed this course

Course outcome	Program outcome
• Mathematical modeling of linear control systems • Transfer function of control system components • Transient and steady state response of first and second order systems • Stability analysis of systems from transfer function • Frequency domain analysis	**A:** The student will be able to obtain the mathematical model of mechanical and electrical systems. **B:** The student will have a broad knowledge in developing the transfer function of potentiometers, tachogenerators, motor, gear trains & controllers **C.** Student will be able analyze transient and steady state response of system for step, ramp and impulse inputs **D.** Student will be able analyze the stability of higher order systems using routh array. **E.** Student will be able to determine the frequency domain specification from various plots like Bode, nyquist, Polar and M&N circles

Detailed Session Plan

Day	Name of the topics	Reference
DAY 1	**UNIT-I:** Introduction and classification of control systems	Nagrath & Gopal
DAY 2	Linear, nonlinear, time varying, time in-variant, continuous, discrete, SISO and MIMO systems – definitions.	Nagrath & Gopal
DAY 3	Introduction to Mathematical modeling of systems	Nagrath & Gopal
DAY 4	Mathematical modeling of mechanical translational systems	Nagrath & Gopal
DAY 5	Mathematical modeling of mechanical rotational systems	Nagrath & Gopal
DAY 6	Mathematical modeling of electrical systems	Nagrath & Gopal
DAY 7	Mechanical-electrical analogies	Nagrath & Gopal
DAY 8	Block Diagram reduction technique	Nagrath & Gopal
DAY 9	Signal flow graphs	Nagrath & Gopal
DAY 10	Surprise Test- I	
DAY 11	**UNIT II:** Transfer function of potentiometers	Nagrath & Gopal
DAY 12	Transfer function of armature controlled DC motor	Nagrath & Gopal

DAY 13	Transfer function of field controlled DC motor	Nagrath & Gopal
DAY 14	Transfer function of tachogenerators	Nagrath & Gopal
DAY 15	Transfer function of gear trains	Nagrath & Gopal
DAY 16	Transfer function of P,PI,PD controller	Nagrath & Gopal
DAY 17	Transfer function of PID controller	Nagrath & Gopal
DAY 18	Surprise Test-II	
DAY 19	**UNIT III:** Transient and steady state response definitions	Nagoor kani(chapter 3)
DAY 20	Mathematical expression of standard test signals, Type & order of systems	Nagoor kani
DAY 21	Step, ramp and impulse response of first order systems	Nagoor kani
DAY 22	Step, ramp and impulse response of second order systems	Nagoor kani
DAY 23	Step response of second order critically damped systems	Nagoor kani
DAY 24	Step response of second order Over damped systems	Nagoor kani
DAY 25	Time domain specifications of second order under damped systems	Nagoor kani
DAY 26	Steady state error analysis	Nagoor kani
DAY 27	Related problems	
DAY 28	**UNIT IV:** Stability analysis & characteristic equation	Benjamin.C.Kuo
DAY 29	Location of roots in S-plane for stability	Benjamin.C.Kuo
DAY 30	Routh's stability criterion	Benjamin.C.Kuo
DAY 31	Relative stability analysis	Benjamin.C.Kuo
DAY 32	Root locus technique	Benjamin.C.Kuo
DAY 33	Construction of root loci for negative feed back systems	Benjamin.C.Kuo
DAY 34	Related Problems	
DAY 35	Surprise Test -III	
DAY 36	**UNIT V:** Frequency response analysis	Katsuhiko ogata(chapter 8)
DAY 37	Frequency domain specifications of second order systems	Katsuhiko ogata
DAY 38	Bode plots and stability (gain and phase) margins	Katsuhiko ogata
DAY 39	Need for compensation -Introduction to lead, lag, lead-lag compensating networks	Katsuhiko ogata
DAY 40	Minimum phase& non-minimum phase systems	Katsuhiko ogata
DAY 41	Construction of Polar plots	Katsuhiko ogata
DAY 42	Construction of constant M and N circles	Katsuhiko ogata
DAY 43	Construction of Nichols chart	Katsuhiko ogata
DAY 44	Construction of Nyquist stability criterion	Katsuhiko ogata
DAY 45	Discussion of 2 marks	