SRM UNIVERSITY
Faculty of Engineering and Technology

DEPARTMENT OF ICE

Course Code : EC0303
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
S.Stella Jenifer	ECE A	Tech Park	8.30-4 pm	Stella.s@ ktr.srmuniv.ac.in
P.K.Senthilkumar	ECE B	Tech Park	8.30-4 pm	senthilkumar.p@ktr.srmuniv.ac.in
B.Hemalatha	ECE C,D	Tech Park	8.30-4 pm	hema.b@ktr.srmuniv.ac.in
A.Dominic Savio	ECE E	Tech Park	8.30-4 pm	dominicsavio.a@ktr.srmuniv.ac.in
E.Paul Braineard	ECE F	Tech Park	8.30-4 pm	Paulbraineard.e@ ktr.srmuniv.ac.in
C.Likith Kumar	ECE G	Tech Park	8.30-4 pm	likithkumar.c@ktr.srmuniv.ac.in
P.Anitha Saraswathi	ECE H, I	Tech Park	8.30-4 pm	anitha.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

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Tentative test details and portions:

Cycle Test - I:	01.08.14	Unit I
Cycle Test –II:	15.08.14	Unit III
Model Exam:	20.10.14	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 III:** Transient and steady state response definitions	Nagoor kani(chapter 3)
DAY 12	Mathematical expression of standard test signals, Type & order of systems	Nagoor kani
DAY 13	Step, ramp and impulse response of first order systems	Nagoor kani
DAY 14	Step, ramp and impulse response of second order systems	Nagoor kani
DAY 15	Step response of second order critically damped systems	Nagoor kani
DAY 16	Step response of second order Over damped systems	Nagoor kani
DAY 17	Time domain specifications of second order under damped systems	Nagoor kani
DAY 18	Steady state error analysis	Nagoor kani
DAY 19	Related problems	
DAY 20	**UNIT IV:** Stability analysis & characteristic equation	Benjamin.C.Kuo
DAY 21	Location of roots in S-plane for stability	Benjamin.C.Kuo
DAY 22	Routh's stability criterion	Benjamin.C.Kuo
DAY 23	Relative stability analysis	Benjamin.C.Kuo
DAY 24	Root locus technique	Benjamin.C.Kuo
DAY 25	Construction of root loci for negative feed back systems	Benjamin.C.Kuo
DAY 26	Related Problems	
DAY 27	Surprise Test -III	
DAY 28	**UNIT V:** Frequency response analysis	Katsuhiko ogata(chapter 8)
DAY 29	Frequency domain specifications of second order systems	Katsuhiko ogata
DAY 30	Bode plots and stability (gain and phase) margins	Katsuhiko ogata

DAY 31	Need for compensation -Introduction to lead, lag, lead-lag compensating networks	Katsuhiko ogata
DAY 32	Minimum phase& non-minimum phase systems	Katsuhiko ogata
DAY 33	Construction of Polar plots	Katsuhiko ogata
DAY 34	Construction of constant M and N circles	Katsuhiko ogata
DAY 35	Construction of Nichols chart	Katsuhiko ogata
DAY 36	Construction of Nyquist stability criterion	Katsuhiko ogata
DAY 37	Discussion of 2 marks	
DAY 38	**UNIT II:** Transfer function of potentiometers	Nagrath & Gopal
DAY 39	Transfer function of armature controlled DC motor	Nagrath & Gopal
DAY 40	Transfer function of field controlled DC motor	Nagrath & Gopal
DAY 41	Transfer function of tachogenerators	Nagrath & Gopal
DAY 42	Transfer function of gear trains	Nagrath & Gopal
DAY 43	Transfer function of P,PI,PD controller	Nagrath & Gopal
DAY 44	Transfer function of PID controller	Nagrath & Gopal
DAY 45	Surprise Test-II	