MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

COURSE PLAN

Department	:	ICE
Course Name & code	:	LINEAR CONTROL THEORY & ICE 2203
Semester & branch	:	: IV Sem & ICE
Name of the faculty	:	: Dr. SHREESHA. C & Dr. Ravishankar Kamath
No of contact hours/week:		3 1 0 4

ASSESSMENT PLAN:

1. In Semester Assessments	50
• Written tests :	2*15=30
• Assignment/Quiz/Seminar :	4*5=20
2. End Semester Examination	50
• Click or tap here to enter text.	

Portions for Assignment/Quiz/Seminar etc.…	
Sl. no.	**Topics/Lessons**
1	1-12 Handwritten own materials may be allowed to be referred
2	17-28 Handwritten own materials may be allowed to be referred
3	32-44 Handwritten own materials may be allowed to be referred
4	1-36 Submission at the end of 10th week answers to a given set of questions covering whole syllabus, mostly self study topics
5	Click or tap here to enter text.
Portions for Sessional Test	
Test no.	**Topics/Lessons**
1	1-16
2	17-32

Course Outcomes (COs)

At the end of this course, the student should be able to:

		No. of Contact Hours	Program Outcomes (POs) addressed
CO1:	Representation of system using block diagram and signal flow graph to determine the transfer function	12	POs
CO2:	Perform time domain analysis of a linear systems	06	POs
CO3:	Perform frequency domain analysis of a linear system using graphical methods	22	POs
CO4:	Illustrate the working of compensator for linear systems	08	POs
CO5:	Click or tap here to enter text.	Hrs.	POs

Course Plan

L. No.	Topics	Course Outcome Addressed
L0	Introduction to control system – basic terminologies, open loop and closed loop systems, examples of control systems	C01
L1	Introduction to mathematical modeling - Concept of transfer function - Transfer function for electrical networks	C01
L2	Transfer function for mechanical systems (translational and rotational)	C01
L3	Tutorial – 1: Transfer function derivation for electrical and mechanical systems	C01
L4	Transfer function of armature controlled DC motor/ field controlled DC motor	C01
L5	Fundamentals of Analogous systems	C01
L6	Examples of Analogous systems	C01
L7	Block diagram representation of physical system	C01
L8	Block diagram reduction techniques	C01
L9	Block diagram reduction - examples	C01
L 10	Signal flow graph, Reduction method - Masons gain formulae	C01
L11	Tutorial – 2: Block diagram reduction and signal flow graph	C01

L12	Illustration of neative feedback on effect on disturbance rejection, plant parameter variation, time constant and integrating plant with simple feedback block diagram	C01
L. No.	**Topics**	**Course Outcome Addressed**
L 13	Time response, Standard test inputs – expressions, Order of a system, Response of first order system for step and impulse input, time constant, settling time, ss error	C02
L 14	Response of second order system for different test signals.	C02
L 15	Derivation of time domain specifications for second order systems	C02
L16	Tutorial – 3: Numerical on time response specifications	C02
L 17	Steady state errors – Type number of control system, Static error constants	C02
L18	teady state errors for unit step, ramp and parabolic inputs	C02
L19	Tutorial – 4: Numerical on steady state error and constants	C02
L 20	Introduction to frequency domain analysis, frequency domain specifications	C03
L 21	Frequency domain specifications for a second order system	C03
L 22	Correlation between time domain and frequency domain specifications	C03
L23	Tutorial – 5: Numerical on frequency response specifications	C03
L 24	Introduction to concept of stability – stable and unstable systems, BIBO stability	C03
L25	Location of roots on the S-Plane for stability	C03
L 26	Routh Hurwitz criterion for stability – construction of Routh array, different cases of Routh Hurwitz criterion	C03
L27	Tutorial – 6: Numerical on Routh Hurwitz criterion	C03
L 28	Root locus plot – Construction of root locus diagram	C03
L29	Breakaway points and Angle of departure	C03
L 30	Root locus plot - examples	C03
L31	Determining the limiting value of system gain, pole position impact	C03
L32	Tutorial – 7: Root locus - Numericals	C03
L33	Frequency response plots – Bode plot – magnitude and phase plot, Gain margin, Phase margin	C03
L 34	Bode plot – illustrated example, Gain adjustment in Bode plot	C03
L 35	Derivation of transfer function from bode plot	C03
L 36	Tutorial - 8: Bode plot numericals	C03
L 37	Polar plots, Determination of gain margin and phase margin from polar plots	C03
L38	Nyquist stability criterion, differentiation between s-plane contour and Nyquist	C03

	contour	
L39	Nyquist plot – Numericals	C03
L. No.	**Topics**	**Course Outcome Addressed**
L40	Tutorial – 9: Polar plot and Nyquist plot	C03
L41	Introduction to compensation, types of compensation – lag, lead and lag–lead	C04
L42	Characteristics of lead compensator – design procedure using bode diagram and root locus	C04
L43	Tutorial - 10: Design illustration of lead compensator	C04
L44	Characteristics of lag compensator – design procedure using bode diagram and root locus	C04
L45	Tutorial - 11: Design illustration of lag compensator	C04
L46	Characteristics of Lag-lead compensator – design procedure using bode diagram and root locus	C04
L47	Tutorial – 12: Design illustration of Lag-Lead compensator	C04
L48	Examples using PID controller	C04

References:

1. John J.D'Azzo and Constatine H. Houpis (2007) - Feedback control system analysis and synthesis, McGraw Hill, New-york
2. Nagrath and Gopal (2001) – Control systems Engineering, 2/e New Age International (P) Limited.
3. K. Ogata (2002) – Modern control engineering 3/e Prentice Hall.
4. Norman S. Nise (2003) – Control Systems Engineering 4/e, Wiley.
5. A Anand Kumar-Control Systems, PHI learning, New Delhi 2010
6. Click or tap here to enter text.
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Submitted by: DR. SHREESHA C

(Signature of the faculty)

Date: 08-01-2018

Approved by: DR. DAYANANDA NAYAK

(Signature of HOD)

Date: 08-01-2018

FACULTY MEMBERS TEACHING THE COURSE (IF MULTIPLE SECTIONS EXIST):

FACULTY	SECTION	FACULTY	SECTION
Dr. Ravishankar Kamath	A	Dr. Shreesha	B

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