DEPARTMENT OF INSTRUMENTATION & CONTROL ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

Course Title	**Modern Control Engineering**		
Course Code	**CL 653**	**Credits**	**3**
Department	**Chemical Engineering**	**Faculty**	**Dr. Ramakalyan Ayyagari**
Pre-requisites	--		
Other Course Teacher(s)/Tutor(s)	--	**Mobile No.** **Email**	**+919443923485** **rkalyn@nitt.edu**
Course Type	**PROGRAM CORE**		

COURSE OVERVIEW

This is a course on state variable modelling, analysis, and control of dynamical systems. The approach at a graduate level is to illustrate the deployment of mathematical analysis and design techniques on a given model, and interpret the results in terms of implications on the real, physical systems. The focus would be to build up a hierarchy of generalization that includes the classical transfer function for SISO systems as well as nonlinear MIMO systems.

COURSE OBJECTIVES

1. To introduce advanced medthods and techniques of linear system analysis nd design from modern and digital control theory, and emphasize their interrelation.
2. To introduce mathematical modeling, analysis, and design of a larger class of systems in a unified framework.

COURSE OUTCOMES (CO)

1.	In part I of the course, the student is exposed to an appropriate modern paradigm for the study of larger scale multi-input-multi-output systems.
	Alignment with the Program Outcomes: 1, 2, 3, 4, 5, 10, 12
2.	In part II, the student understands the importance of matrix theory in designing practical control systems.
	Alignment with the Program Outcomes: 1, 2, 3, 4, 5, 10, 12
3.	In part III, the student is motivated to study more general systems and their stability using Lyapunov's theory.
	Alignment with the Program Outcomes: 1, 2, 3, 4, 5, 10, 12
4.	In part IV, the student learns to design feedback controllers, in contrast to feed-forward controllers of classical control, with a good balance of intuiton and mathematical rigour.
	Alignment with the Program Outcomes: 1, 2, 3, 4, 5, 10, 12
5.	In part V, the student learns to implement modern control systems using a digital computer in the loop.
	Alignment with the Program Outcomes: 1, 2, 3, 4, 5, 10, 12

COURSE TEACHING AND LEARNING ACTIVITIES

Classes	Dates	Topic(s)	Mode of Delivery
1 – 6	Aug 7, 10, 17	Introduction to the course, Review of Signals & Systems	Board
7 – 12	Aug 21, 24, 28	Part I (State-space Models)	Board/PPT
August 31: ASSESSMENT 1: 1 hour test for 25% weight, covering Introdcution & Part I			

13 – 18	Sep 4, 7, 11	Part II (Analysis of State Eqns)	Board/PPT
19 – 24	Sep 14, 18, 21	Part III (Lyapunov Theory)	Board/PPT
September 25: ASSESSMENT 2: 1 hour test for 20% weight, covering Parts II & III			
25 – 34	Oct 5, 9, 12, 23, 26	Part IV (Controller Design)	Board/PPT
October 30: ASSESSMENT 3: 1 hour test for 20% weight, covering Part IV			
35 – 40	Nov 2, 6, 9,	Part V (Digital Control)	Board/PPT
November 23: ASSESSMENT 4: 2 hour test for 40% weight, covering all parts			

- **A detailed course calendar is attached herewith.**

COURSE ASSESSMENT METHODS

S.No.	Mode of Assessment	Date	Duration	% Weightage
1 – 3	3 Assessments @ 20% weightage	Aug 31, Sept 25, Oct 30	60 minutes each	60%
4	Compensatory Assessment	Nov 20	60 minutes	15%
5	End-term Assessment Covering the entire syllabus	Nov 23	120 minutes	40%
6	Re-assessment Covering the entire syllabus	Nov 27	180 minutes	100%

- **Evaluation will be completed by Nov 25 to facilitate Re-assessment on Nov 27 for students scoring < 35%.**
- **Students can access their answer scripts, for the unlikely event of re-grading, on Nov 25**

RESULTS WILL BE SUBMITTED TO THE PAC ON November 30, 2017

ESSENTIAL READINGS:

1. Brogan, W.L., Modern Control Theory, 3/e, Prentice Hall, 1990
2. Hespanha, J.P., Linear Systems Theory, Princeton Univ. Press, 2009
3. Sontag, E.D., Mathematical Control Theory, 2/e, Springer Verlag, 2014

COURSE EXIT SURVEY

Feedback from the students during the class committee meetings
Feedback before End-term examination through a questionnaire, for improvements in future.

COURSE POLICY (including attendance, grading, academic honesty, etc.)

ATTENDANCE

- 100% attendance, as on **November 6, 2017**, is mandatory, with an exemption up to 20% on genuine grounds; prior information and approval from the instructor is compulsory.
  - The only option for students with attendance < 80% is RE-DO. Please refer to the official rules for more details.

ASSESSMENTS AND GRADING POLICY

- A student can be, upon prior approval, absent from only one out of the the continuous assessments 1 – 3, for which he/she is allowed to take the compensatory assessment on November 20, 2017. Please note that compensatory assessment is not offered as an improvement test for everyone.
- A student is declared pass upon accumulating a minimum of 35% over all the 4 assessments; grading is done for those students declared passed based on the class average – average and above shall get S, A, and B grades, and below average shall get C, D, and E.

- In case one or more students fail to accumulate the stipulated minimum 35% (at the end of 4 assessments), they are permitted to take a one-time re-assessment for 100%; this is a 3-hour written examination on November 27, 2017, covering the entire syllabus.

ACADEMIC HONESTY

- Mid-term and End-term assessments in this course must be strictly individual work.
- However, collaboration by individuals is encouraged at the level of ideas.
    - Feel free to ask each other questions, or brainstorm on solutions, or work together on a board. However, be careful about copying the actual solution. This sort of collaboration at the level of artifacts is permitted if explicitly acknowledged, but this is usually self-defeating.
- The principle behind the collaboration rule is simple:
    - I want you to learn as much as possible; you may learn from me or from each other.
    - The goal of artifacts (programs) is simply to demonstrate what you have learned. So, I'm happy to have you share ideas, but if you want your own points you have to internalize the ideas and then craft them into an artifact by yourself, without any direct assistance from anyone else, and without relying on any idea taken from others (whether at this institute or from the web).

ACADEMIC DISHONESTY

For purposes of this class, academic dishonesty is defined as:

- Any attempt to pass off work on a test that didn't come straight out of your own head.
- Any collaboration on artifacts in which the collaborating parties do not clearly explain exactly who did what, at turn-in time.
- Any activity that has the effect of significantly impairing the ability of another student to learn. Examples here might include destroying the work of others, interfering with their access to resources, or deliberately providing them with misleading information.

ADDITIONAL COURSE INFORMATION

All the students are urged to be interactive during the classes. Further, the students are suggested to make a google group for faster dissemination of PPTs, discussions etc. They are free to interact with me over email any time, and if needed meet me in person with prior appointment.

Any changes in the proposed layout of the semester, due to unavoidable circumstances, shall be intimated immediately to the students and to the Chairperson, PAC

FOR SENATE'S CONSIDERATION

Course Faculty	CC-Chairperson	HOD
Dr. Ramakalyan Ayyagari	Dr. M. Perumalsamy	Dr. P. Sivashanmugam