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

Course Title	**Computational Techniques in Control Engineering (II Semester)**		
Course Code	**CL 652**	**Credits**	**3**
Department	**Chemical Engg. & ICE**	**Faculty**	**Dr. Ramakalyan Ayyagari**
Pre-requisites	--		
Course Coordinator	**Dr. K. Dhanalakshmi, Chairperson, PAC**		
Other Course Teacher(s)/Tutor(s)	--	**Mobile No.** **Email**	**9443923485** **rkalyn@nitt.edu**
Course Type	**CORE**		

COURSE OVERVIEW

This course is an adaptation of numerical methods pertaining to control engineering problems, particularly of very high order. The algorithms for control system analysis & design are set in a numerical algebraic framework and are designed and analyzed in a formal way.

COURSE OBJECTIVES

Upon completing this course, the student would be competent enough to develop software exclusively for control theoretic problems.

COURSE OUTCOMES (CO)

1.	In unit I, core mathematical ideas from Linear Algebra and Probability will be reinforced with a bent on computations
2.	In unit II, students will be exposed to algorithms for computing the state transition matrix will be explored. There are several (nearly 20) such algorithms, but 4 major algorithmic ideas will be discussed in detail.
3.	In unit III, algorithms for numerically determining the stability of systems via Lyapunov theory will be learnt.
4.	In unit IV, students are taken up to higher levels of computationally hard problems and algorithmic design through the static state feedback control design problem.
5.	In unit V, case studies will be shown, and commercial algorithms shall be learnt. The course concludes with an overview of advanced algorithms for nonlinear systems and stochastic systems.

COURSE TEACHING AND LEARNING ACTIVITIES

Classes	Dates	Topic(s)	Mode of Delivery
1	Janunary 6	Introduction to the course	Board
2 – 6	Jan 18, 20, 25, Feb 1, 3	Review of Linear Algebra & Probability Theory	Board
7 – 10	Feb 8, 10, 22, 24	Computing State Transition Matrix	Board/PPT
11 – 14	Mar 1, 3, 8, 10	Algorithms for computing the Lyapunov matrix	Board/PPT
15 – 18	Mar 15, 17, 29, 31	Algorithms for computing the state feedback matrix	Board/PPT
19 – 21	Apr 5, 7, 12	Discussion on commercial algorithms, Algorithms for nonlinear systems etc.	Board/PPT

Classes will be held on Wednesdays 10.30 to 12.10 & Fridays 8.30 to 10.10. Hence, at least 38 classes (accommodating ad-hoc classwork suspension for NITT-FEST) shall be conducted

COURSE ASSESSMENT METHODS				
S.No.	**Mode of Assessment**	**Date**	**Duration**	**% Weightage**
1.	Mid-term exam (written)	March 7	90 minutes	30%
2.	Individual Programming Projects	Submission before March 31 Presentation before April 19		40%
3.	End-term exam (written)	April 18	90 minutes	30%
RESULTS WILL BE SUBMITTED TO THE PAC ON APRIL 21, 2017				

ESSENTIAL READINGS:

1. G. Strang, Introduction to Linear Algebra, 5/e, SIAM, 2016
2. B.N. Datta, Numerical Methods for Linear Control Systems, Elsevier Academic Press, 2005.
3. G.H. Golub & C.F. Van Loan, Matrix Computations, 4/e, John Hopkins University Press, 2012.
4. Get MATLAB 2016b installed (from the CSG) on your laptops and visit National Institute of Technology MATLAB Academy access portal.

COURSE EXIT SURVEY

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

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

- At least 75% attendance during the class-work is mandatory.
  - No re-test will be conducted if absent for the written examinations
- Grading would be relative, with class-average (out of 100) shall be the benchmark – average and above shall get S, A, and B grades, and below average shall get C, D, E, and F.

Academic Honesty:

- Mid-term and End-term exams and the programming project 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 on projects etc. They are free to interact with me over email any time, and if needed meet me in person with prior appointment.
FOR SENATE'S CONSIDERATION

Course Faculty	CC-Chairperson	HOD
Dr. Ramakalyan Ayyagari	Dr. K. Dhanalakshmi	Dr. P. Sivashanmugam