DEPARTMENT OF Instrumentation and Control Engineering

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE PLAN – PART I			
Name of the programme and specialization	B.Tech Instrumentation and Control Engineering		
Course Title	Control System –I		
Course Code	ICPC21	No. of Credits	4
Course Code of Pre-requisite subject(s)	nil		
Session	July 2018	Section (if, applicable)	B
Name of Faculty	Dr. S. Narayanan	Department	ICE
Email	narayanan@nitt.edu	Telephone No.	0431-2503364
Name of Course Coordinator(s) (if, applicable)	Not applicable		
E-mail	------	Telephone No.	
Course Type	[√] Core course	[ ] Elective course	

Syllabus (approved in BoS)

Review of Systems, Mathematical Models – Differential Equations, Linear Approximations and Transfer Functions, Block Diagrams and Signal Flow Graphs Feedback Control System Characteristics, and Performance Specifications on transients and steady - state, Stability of Linear Feedback Systems – Routh - Hurwitz criterion.

The Root Locus Method, Feedback Control System Analysis & Performance Specifications in Time - Domain, Design of Lead, Lag, and PID Controllers using Root Locus.

Frequency Response Methods, Nyquist's Stability Criterion, Bode plots, Performance Specifications in Frequency - Domain, Stability Margins.

Design of Lag and PID controllers in Frequency Domain, Design of Lag - Lead Controllers using time - domain and frequency - domain methods.

COURSE OBJECTIVES

1. To introduce the concept of feedback control system.
2. To impart knowledge in mathematical modeling of physical systems.
3. To impart knowledge in characteristics and performance of feedback control system.
4. To teach a variety of classical methods and techniques for analysis and design of control systems.

COURSE OUTCOMES (CO)	
Course Outcomes	**Aligned Programme Outcomes (PO)**
On completion of this course, the students will be able to	
1. generate mathematical models of dynamic control system by applying differential equations.	1,2,3,4,5,6,7
2. analyze and characterize the behavior of a control system in terms of different system and performance parameters.	1,2,3,4,5,6,7
3. compute and assess system stability.	1,2,3,4,5,6,7
4. evaluate and analyses system performance using frequency and transient response analysis.	1,2,3,4,5,6,7
5. design and simulate control systems (linear feedback control systems, PID controller, and multivariable control systems), using control software, to achieve required stability, performance and robustness.	1,2,3,4,5,6,7
6. critically analyses and outline the dynamic response of closed loop systems.	1,2,3,4,5,6,7

COURSE PLAN – PART II

COURSE OVERVIEW

To introduce the concepts of modeling, analysis of simple linear and non-linear dynamic systems.

To teach a variety of classical methods and techniques for designing control systems

1. The student understands translating physical phenomena into corresponding mathematical descriptions, and applies appropriate tools to analyze the behavior of systems.
2. The student learns to deploy classical graphical tools to analyze and design control systems in time-domain.
3. The student understands that the frequency domain is a complementary point of view, and learns to design control systems in frequency-domain.
4. The student is exposed to the PID controllers prevalent in the Industry.

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	Week/Contact Hours	Topic	Mode of Delivery
1	I , II , III & IV	Control problem, steady state calculation, performance specifications, introduction to Modelling and Identification of Dynamical Systems (Control mathematics, such as matrix algebra, Laplace transform, z-transform, differential equations, and difference equations for control system modelling, analysis and design)	Chalk and talk, demonstrations

2	V& VI	Open loop control and closed loop control design using analytical method, introduction to modern control theory	Chalk and talk, demonstrations
3.	VI & VII	Analysis of Graphical tools	Chalk and talk, demonstrations
4.	VIII& IX	Analysis of Various compensator structures	Chalk and talk, demonstrations
5.	X &XI XII	Control system design using graphical tools	Chalk and talk, demonstrations

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Test-1	5th Week	1 hour	20%
2	Test-2	8th Week	1 hour	20%
3	Assignment test	11th Week	1 hour	15%
CPA	Compensation Assessment*	One week before end sem	1 hour	20%
4	Final Assessment *	Last week	3 hours	45%

***mandatory; refer to guidelines on page 4**

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

COURSE POLICY (preferred mode of correspondence with students, compensation assessment policy to be specified)

MODE OF CORRESPONDENCE (email/ phone etc) email

COMPENSATION ASSESSMENT POLICY

Students who have missed the first or second cycle test can register with the consent of faculty for the Re-Test examination which shall be conducted soon after the completion of the second cycle test.

ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)

- **At least 75% attendance in each course is mandatory.**
- **A maximum of 10% shall be allowed under On Duty (OD) category.**
- Students with **less than 65% of attendance** shall be prevented from writing the final assessment and **shall be awarded 'V' grade.**

ACADEMIC DISHONESTY & PLAGIARISM

- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.

  The above policy against academic dishonesty shall be applicable for all the programmes.

ADDITIONAL INFORMATION

The module will be delivered using a combination of lectures and tutorials/lab demonstrations involving example exercises. Concepts and the scope of a topic will be introduced in lectures. These will be supported by directed reading and experimental simulation laboratory based work. The lab sessions will enhance the understanding of students of real-world applications of the material delivered in the module. The students will learn through applying a variety of analysis methods, mathematical and simulation tools to real system models. Matlab will be incorporated into the module as an integral part of teaching and learning.
In the teaching-learning process, the students will have opportunities to exercise both team work and independent effort.

FOR APPROVAL

S. Narayanan.

Course Faculty _____ **CC-Chairperson** _____ 9/7/18 **HOD** _____ 13/7/18