Department of Instrumentation and Control Engineering

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE OUTLINE TEMPLATE			
Course Title	CONTROL SYSTEM – II		
Course Code	IC PC 24	No. of Credits	3
Department	ICE	Faculty	Section A: Dr. M. Umapathy
Pre-requisites Course Code	NIL		
Course Coordinator(s) (if, applicable)	Not Applicable		
Other Course Teacher(s)/Tutor(s) E-mail	umapathy@nitt.edu	Telephone No.	04312503353
Course Type	Programme Core		

COURSE OVERVIEW

This course will introduce the students to state space methods and solutions to state equations, modeling via energy approach and deriving state models for dynamical systems, design of controllers using states, design of state estimators, etc.,. This course will also expose the students to Lyapunov's theory and stability analysis using the same. The basics of Digital control system and design concepts will also be introduced in this course. .

COURSE OBJECTIVES

1. To introduce about the system states and state space; System representation in states space form.
2. To teach the advanced methods and techniques of linear system analysis and Lyapunov stability.
3. To impart knowledge in the control techniques for design of a larger scale of systems.

COURSE OUTCOMES (CO)

Course Outcomes	Aligned Programme Outcomes(PO)
On completion of this course, the students will be able to,	
1. Exposed to an appropriate modern paradigm for the study of larger scale multi-input-multi-output systems.	1, 3, 4, 5, 6
2. Able to use linear algebra and matrix theory in the analysis and design of practical control systems.	1, 3, 4, 5, 6
3. Able to determine the stability of systems using Lyapunov's theory.	1, 3, 4, 5, 6
4. Motivated to implement modern control systems using a digital computer.	1, 3, 4, 5, 6

COURSE TEACHING AND LEARNING ACTIVITIES			
S. No	**Week**	**Topic**	**Mode of Delivery**
1	1-3	State-space Models – Review of vectors and matrices, Canonical Models from Differential Equations and Transfer Functions, Interconnection of subsystems. Modelling via energy approach.	Lecture and power point presentation. Problem solving in Tutorial classes
2.	4-5	Analysis of Linear State Equations – First order scalar differential equations, System modes and modal decomposition, State Transition Matrix, Time-varying matrix case.	Lecture and power point presentation. Problem solving in Tutorial classes
3	6-8	Controllability & Observability –Definitions, Controllability/Observability Criteria, Design of state feedback control systems, Full-order and Reduced-order Observer Design, Kalman canonical forms, Stabilizability & Detectability	Lecture and power point presentation. Problem solving in Tutorial classes Invited talk by an expert
4	9-10	Lyapunov's stability theory for Linear Systems – Equilibrium points and stability concepts, Stability definitions, Linear system stability, The Direct method of Lyapunov, Use of Lyapunov's method in feedback design.	Lecture and power point presentation. Problem solving in Tutorial classes Invited talk by an expert
5	11-12	Digital Control Systems, Closed-loop Feedback Sampled-Data Systems, Stability Analysis, Implementation of Digital Controllers. One detailed case study of modern control theory.	Lecture and power point presentation. Problem solving in Tutorial classes

COURSE ASSESSMENT METHODS				
S. No	**Mode of Assessment**	**Week/Date**	**Duration**	**% Weightage**
1.	Unit Test I	5th week	1 hour	20%
2.	Unit Test II	10th week	1 hour	20%
3.	Final Assestment	12th week	3 hour	40%
4..	Tutorials, Participation in regular and invited lectures.			20%

ESSENTIAL READINGS : Textbooks, reference books Website addresses, journals, etc

1. Katsuhiko Ogata, "Modern Control Engineering", PHI Learning Private Ltd, 5th Edition, 2010.

2. Franklin, G.F., David Powell, J., Emami-Naeini, A., Feedback Control of Dynamic Systems, Prentice Hall, 7th edition, 2014.

3. Dorf, R.C., Bishop, R.H., Modern Control Systems, Prentice Hall, 13th edition, 2016.

4. Brogan, W.L., Modern Control Theory, Prentice Hall, 3rd edition, 1990.

Reference Books:

1. John J.D., Azzo Constantine, H. and Houpis Sttuart, N Sheldon, Linear Control System Analysis and Design with MATLAB, CRC Taylor& Francis Reprint 2009.

2. I.J. Nagrath and M. Gopal, Control Systems Engineering, New Age International Publishers, 4th Edition, 2012.

COURSE EXIT SURVEY

Feedback from students will be obtained during the course

Students' performance in tutorials and their participation in the regular and expert lectures will be used to assess the understanding level.

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

1. 75% of attendance is must inclusive of on duty on any grounds. 5% of relaxation can be considered on medical grounds.
2. Relative grading with passing minimum of 35 % or clustering will be followed, on seeing the overall performance of the students at the end of the semester.
3. For the students missing the unit tests for medical reasons, one compensation assessment will be conducted during the end of the semester one week before the final assessment for a weightage, equal to that of the missed assessments. But students are advised not to miss assessments.
4. Students securing less than 35% of marks will be given a reassessment exam after two of the final assessment for a weightage of 40% and marks obtained will be added to the internal assessment and appropriate grades will be awarded.
5. For the students not passing the course even after, one final reassessment will be given during the first week of next semester for a weightage of 100% and the grades will be given on absolute grading policy. Students failing in the same have to take up redo or formative assessment.

ADDITIONAL COURSE INFORMATION: NIL

FOR SENATE'S CONSIDERATION

Course Faculty _____ **CC-Chairperson** _____ **HOD** _____