Kadi Sarva Vishwavidyalaya

Faculty of Engineering & Technology

Master of Engineering Semester I

(Electrical Power System)

(With effect from Academic Year 2017-18 (CBCS))

Subject Code: MEEE-102-N	Subject Title: Modern Control System
Pre-requisite	

A. **Course Objectives:**

The educational objectives of this course are

- To understand the basic concepts of modern control theory in relation to the stability of a system.
- To co relate the concepts of control theory with the field of electrical engineering.

Teaching scheme				Total Credit	Evaluation Scheme					Total Marks
L	T	P	Total		Theory		IE Marks	CIA Marks	Pract. Marks	
Hrs	Hrs	Hrs	Hrs		Hrs	Marks				
04	00	02	06	05	03	70	30	20	30	150

B. **Outline of the Course:**

Sr. No	Title of the Unit	Minimum Hours
1	**Mathematical background**	8
2	**State Variable Analysis**	20
3	**Controllability and Observalibitly**	10
4	**Models of Digital control devices and systems**	12
5	**Nonlinear systems**	10

Total Hours (Theory): 60
Total Hours (Lab): 30
Total Hours: 90

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Detailed Syllabus

Sr. No.	Topic	Lecture Hours	Weightage(%)
1	**Mathematical background**: Matrices: Definition of Matrices; Matrix Algebra; Matrix Multiplication and Inversion; Rank of a Matrix; Differentiation and Integration of Matrices.	8	10%
2	**State Variable Analysis:** Introduction, concepts of state, state variables and state model, state-space representation for linear continuous-time systems and discrete-time systems. Time, domain solution of state equations: Solution of homogeneous state equations, state transition matrix, evaluation of matrix exponential (e^{At}), solution of non- homogeneous state	20	30%
3	**Controllability and Observalibitly:** Concept of Controllability and Observability; Controllability and Observability tests for continuous time system; Controllability and Observability of discrete time system; Controllability and Observability of state model in Jordan canonical form; Loss of Controllability and Observability for sampling	10	15%
4	**Models of Digital control devices and systems** Introduction to z-transform, ROC in z-transform, basic discrete time signals, time domain models of discrete time systems, transfer function models, stability on z-plane and jury stability criteria, z-domain description of sampled continuous time plants, , z-domain description of systems with dead time, Implementation of digital controllers, Tunable PID controllers, Methods of tuning industrial PI, PID controllers	12	25%
5	**Nonlinear systems:** Introduction, common physical nonlinearities-saturation, dead-zone, relay, relay with dead zone, hysteresis, backlash, etc, jump resonance, limit cycle. Phase-plane analysis-phase plane and phase trajectory, singular points, construction of phase trajectory, evaluation of time, stability analysis.	10	20%
	Total	60	100

C. Instructional Methods

- At the start of course, the course delivery pattern , prerequisite of the subject will be discussed
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory, which may carries five marks in overall evaluation.
- Two internal exams may be conducted and average of the same may be converted to equivalent of 15 marks as a part of internal theory evaluation.
- Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry an importance of five marks in the overall internal evaluation.
- Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overall internal evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concept being taught in lectures.
- Experiments shall be performed in the laboratory related to course contents.

D. Student Learning outcomes:

- After completion of the course, students will be able to apply concepts of modern control theory in power system control.

E. Text Books & Reference Books:

- *'Digital control and state variable methods'*, M. Gopal, TATA McGraw Hill Company
- *'Discrete time control systems',* Katsushiko Ogata, Prentice Hall Publication,©1995.
- *'Modern Control Systems',* M.Gopal, TATA McGraw Hill Company
- '*Digital control systems*', Benjamin C. Kuo, Oxford University Press, USA, ©1995.