BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
FIRST SEMESTER 2022-2023
Course Handout (Part II)

Date: 29/08/2022

In addition to part-I (General Handout for all courses appended to the timetable) this portion gives further specific details regarding the course.

Course No. **: EEE F422**
Course Title **: Modern Control Systems**
Instructor-in-charge **: Alivelu Manga Parimi**

1. Scope & Objective of the Course:

Feedback automatic control systems are indispensible in industrial processes, scientific instruments and even commercial, social and management situations. Most of these systems are non linear in nature. Analysis and design of these non linear systems is very important task that an engineer has to carry out. This course mainly focuses on various advanced control techniques.

2. **Text Book**: Nagrath I. J. and M. Gopal, Control Systems Engineering, New Age International (P) Ltd, 5th ed, 2007.

3. Reference Book:

M. Gopal, Modern Control System Theory, New Age International (P) Ltd, 2nd ed.

4. Course Plan:

Lect. No.	Topics to be covered	Learning object(s)	Chapter in the Text Book
1.	Introduction	General overview of the course	
2.	State variable analysis;	Understanding of concept of state, state variable and state model	12.1,12.2
3-6.	State model for LTC system	Determination of state model for LTC systems, state variable and linear discrete time systems	12.3,12.4
7.	Diagonalization	To understand the transformation of state model into a canonical form	12.5
8-9.	State equation, transition matrix	To solve state eqs and computation of transition matrix	12.6
10-11.	Controllability and observability	To understand the concept of controllable and observable system	12.7
12.	Pole placement	Understanding the effects of pole placement and pole zero cancellation	12.8
13-15.	Digital Control System; Spectrum analysis of sampling process ; signal reconstruction	Understanding of basics of digital control system	11.1,11.2,11.3
16-18.	Difference equations; Z Transform; Inverse Z Transform	Determination of Z, inverse Z transform and DE	11.4,11.5,11.7
19-20.	Z transform analysis of sampled data control system	Analysis of sampler and hold circuits	11.6,11.8
21-23	z and s domain relationship, stability analysis	Investigation of stability using various methods	11.9-11.10
24.	Compensation Techniques	Application of compensation techniques for	11.11

		Sampled data control systems.	
25-26.	Closed loop frequency response, Constant M and N circles	Investigation of closed loop system stability using their closed loop frequency plots.	9.5,9.6
27-29.	Liapunov's stability analysis	Understanding of Liapunov's method of stability analysis and its applications	13.1-13.4
30.	Nonlinear systems; common physical nonlinearities	Understanding of behavior of non linear systems	15.1, 15.2
31.	Phase Plane Method, singular points	Basic understanding Phase Plane Method, singular points	15.3,15.4
32.	Stability of nonlinear systems, Limit Cycles	Investigation of stability of non linear systems	15.5
33-34.	Phase Plane Trajectories	Construction of phase plane trajectories and its application to stability analysis	15.6
35-37.	Describing functions;	Derivations of describing functions and its application to stability analysis	15.7-15.9
38.	Adaptive control	Basics of Adaptive control	16.2, class notes
39-42.	Application of Modern Control Techniques	Intelligent Control using ANN, Fuzzy, Genetic Algorithm in various fields	Class notes

5. Evaluation Scheme:

Component	Duration	Weightage	Date & Time	Nature of Component
Midsem	90 min	90M, 30%	02/11 9.00 - 10.30AM	30% CB
Comprehensive exam	180 mnts	120 M 40%	22/12 FN	40% CB
Quizzes	30 min	30M, 10%	To be decided	10% CB
Assignment		45M, 15%		15% OB
Interaction in class	During class	15M, 5%		5%OB

6. Chamber Consultation Hours: to be announced in the class.

7. Notices: All notices will be displayed on CMS only.

8. Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

(Instructor In-Charge, EEE F422)