CONTROL SYSTEMS

Paper Code: ETEE- 212   **L**   **T/P**   **C**
Paper: Control Systems   **3**   **1**   **4**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: To teach the fundamental concepts of Control systems and mathematical modeling of the system. To study the concept of time response and frequency response of the system. To teach the basics of stability analysis of the system

UNIT I : Control Systems -- Basics & Components
Introduction to basic terms, classifications & types of Control Systems, block diagrams & signal flow graphs. Transfer function, determination of transfer function using block diagram reduction techniques and Mason's Gain formula. Control system components: Electrical/ Mechanical/Electronic/A.C./D.C. Servo Motors, Stepper Motors, Tacho Generators, Synchros, Magnetic Amplifiers, Servo Amplifiers,

[T1,T2][No. of Hrs. : 11]

UNIT II : Time – Domain Analysis
Time domain performance specifications, transient response of first & second order systems, steady state errors and static error constants in unity feedback control systems, response with P, PI and PID controllers, limitations of time domain analysis.

[T1,T2][No. of Hrs. : 10]

UNIT III : Frequency Domain Analysis
Polar and inverse polar plots, frequency domain specifications and performance of LTI systems, Logarithmic plots (Bode plots), gain and phase margins, relative stability. Correlation with time domain performance closes loop frequency responses from open loop response. Limitations of frequency domain analysis, minimum/non-minimum phase systems.

[T1,T2][No. of Hrs. : 10]

UNIT IV : Stability & Compensation Techniques
Concepts, absolute, asymptotic, conditional and marginal stability, Routh–Hurwitz and Nyquist stability criterion, Root locus technique and its application.
Concepts of compensation, series/parallel/ series-parallel/feedback compensation, Lag/Lead/Lag-Lead networks for compensation, compensation using P, PI, PID controllers.

[T1,T2][No. of Hrs. : 11]

Text Books:
[T1]   B. C. Kuo, "Automatic control system", Prentice Hall of India, 7th edition 2001.
[T2]   Nagraath Gopal "Control Systems Engineering -Principles and Design" New Age Publishers

Reference Books:
[R1]   Norman S. Nise, "Control systems engineering" John Wiley & Sons (Asia) Singapore.
[R2]   Raymond T. Stefani, Design of Feedback Control System, Oxford University Press.
[R3]   K. Ogata, "Modern control engineering", Pearson 2002.
[R4]   S. P.Eugene Xavier, "Modern control systems", S. Chand & Company.
[R5]   M. Gopal "Control Systems-Principles and Design" TMH 4th Edition 2012