Course Title: Control Engineering
Course Code: COEG 301
Credit Hours: 3

Course Description:
This course introduces the principles of automatic control systems and their applications to engineering processes.

Course Contents:

Unit 1: Introduction
Definition of control systems, Open loop and closed loop systems, classification and examples of control system, history of control system

Unit 2: Mathematical Modeling
Introduction to Mathematical Modeling, Modeling Mechanical systems, Modeling of Electrical circuits, Transfer function, Modeling of liquid level systems, Modeling of thermal systems, Force-Voltage and Force-Current Analogous system, Modeling of gear and transformers, Modeling of sensors and encoders, generators, Modeling of electromechanical system, Modeling of mixed system

Unit 3: State Space Analysis
Definitions, Matrix representation of differential equations, Transfer matrix Relation between state space and transfer function, Examples of electrical and mechanical system

Unit 4: System Reduction Techniques
Block diagram representation, Rules for block diagram reduction, block diagram reduction examples, Definitions of Signal Flow Graph, Rules for construction of Signal Flow Graph, Block diagram to Signal Flow Graph, Signal Flow Graph to block diagram reduction conversion, mixed system its block diagram and Signal Flow Graph

Unit 5: Time Response Analysis
Introduction of time response, Standard test signals, Response of first order systems to test signals, Response of second order systems to test signals, Time response specifications, Steady state errors

Unit 6: Stability Analysis
Definitions of stability and stable systems, Routh Hurwitz criterion, Root locus plot-Introduction, Rules for constructing root locus

Unit 7: Frequency Response Analysis
Frequency response methods, Bode plot introduction, Bode plot for different factors of transfer function, Stability criterion for Bode plot, Polar plots, Nyquist's stability criterion, Nichols' chart, Stability margins, Frequency response specifications

Unit 8: Design of Linear Control Systems

Specification for control system design, phase lead and lag compensation, Design of Control System by root locus method, Design of control system by Bode plot

References:

1. Nise S. N., *Control System and Engineering*, John Wiley and Sons, 2011
2. Golnaraghi F., Kuo B. C, *Automatic Control Systems*, 7th Ed., John Wiley and Sons, 2010
3. Ogata K, *Modern Control Engineering*, 2nd *Ed*, PHI 2002
4. Dorf C. R., Bishop H. R., *Modern Control System*, Prentice Hall, 2011

Evaluation:

In-Semester Evaluation: 50%
End-Semester Evaluation: 50%