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, history and examples

Unit 2: Mathematical Modeling
Modeling of mechanical systems, electrical systems, liquid level system and thermal system, force voltage and force current analogy of mechanical systems, armature control and field control of dc motors, modeling of gears and transformer, modeling of sensors, encoders and generators

Unit 3: System Reduction Techniques
Transfer functions, block diagram representations, signal flow graph

Unit 4: Time Response Analysis
Standard test signals, Response of First order systems to test signals, Response of second order systems, Time response specifications, Steady state errors

Unit 5: Stability Analysis
Definitions based on impulse response, Routh's criterion, Root locus

Unit 6: Frequency Response Analysis
Definitions, Bode plot, stability criterion for Bode plot

Unit 7: Stability in Frequency Domain
Definitions, Polar plots, Nyquist's stability criterion, Nichols' chart, Stability margins

Unit 8: Design of Linear Control Systems
Specifications, PID-controllers, phase lead and lag compensation, internal feedback, feed forward control

Unit 9: State Space Analysis
Definition of multivariable systems, Matrix representation of differential equations, Transfer matrix, Introduction to multivariable feedback

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