Course Title: Control Systems Design
Course Code: COEG 401
Credit Hours: 3

Course Description:
This course extends the design methods from control engineering, to learn using control system design tools, and to introduce equipment for realisation of control systems.

Course Contents

Unit 1: Introduction
The control problem; System specification: Demands and desires; System realisation: Analog and digital systems, design tools and approaches

Unit 2: System Description and Analysis
Single-Input-Single-Output (SISO) systems; Multi-Input-Multi-Output (MIMO) systems; Linearization; Block-diagrams, Transfer functions (matrices), State space methods; Controllability and observability

Unit 3: Computer Simulation and Realization
Introduction to computer tools for analysis and design; Bock diagrams and op-amp circuits; Realisation of transfer functions and state space models

Unit 4: Design Criteria and Constraints
Performance criteria in time domain: steady state and transient performance; Noise and disturbances; Frequency domain criteria; Relative stability: robustness; Non-linear devices: relays, Saturation, hysteresis

Unit 5: Control System Structures
Feedback control: dynamic response, Effect of disturbances; Feedforward control: from disturbance and reference, Frequency analysis and design; Cascaded control systems: Internal feedback

Unit 6: System Design Methods
Criteria and specification; Transfer function specification: Frequency response, Pole-zero cancellations; State-space methods: Pole placement and root locus; Digital control system design; Simulations and system identification

Unit 7: PID-Controllers
Control actions and automatic controllers; Sensors, controllers and actuators; Device analysis; Documentation

References:
1. C. T. Chen, *Analog and Digital Control System Design*, Saunders, College Publishing 1993
2. K. Ogata, *Modern Control Engineering*, 2nd Ed., PHI 1990

3. W. Wolovich, *Automatic Control Systems: Basic Analysis and Design*, Saunders College Publishing 1994
4. S. Thompson, *Control Systems Engineering and Design*, ELBS (Longman) 1990
5. Gene F. *Franklin*. J. David Powell. Abbas Emami-Naeini, *Feedback Control of Dynamic system*, 3rd Ed, Addison-Wesley 1994
6. K. J. Astrom and B. Wittenmark, *Computer Controlled Systems: Theory and Design*, 2nd Ed., PHI 1994
7. B. Friedland, *Control System Design*, McGraw-Hill
8. J. A. Borrie, *Modern Control Systems: A Manual of Design Methods*, PHI
9. B.C. Kuo, *Automatic Control Systems*, 7th Ed., PHI 1995
10. Raymond T. Stefani, Bahram Shahian, Clement J. Savant, Gene H. Hostetter, *Design of Feedback Control Systems*, 4th Ed. Oxford 2002