Subject: **System Dynamics and Control**

Summary: This exam requires that the student have a mature understanding of system dynamics and control. The material is based on material at the undergraduate and junior graduate levels. The student is expected to have an in-depth understanding of system modeling and the time response and frequency response of linear systems. The student should understand the relationship between the frequency response and the time response and also the relationship and transformation between continuous and discrete time models of dynamic systems. The exam covers methods of classical controller design and introductory methods of modern (state space) control.

Keywords

- Modeling of lumped parameter systems.
- Convolution.
- Laplace Transforms.
- Dynamics of first and second-order systems.
- Time response of higher order systems (i.e., greater than 2nd order).
- Simulation diagrams, block diagrams, and signal flow graphs.
- Bode diagrams and frequency response.
- System types.
- The root locus method of control systems design.
- Nyquist and polar plots.
- Nyquist stability criteria.
- The Nichols chart.
- Lead, Lag, and Lead-Lag compensator design.
- The state space formulation of system dynamics.
- The transfer function matrix.
- Eigenvalues and eigenvectors.
- Transformation to companion and diagonal forms.
- Full state feedback and full state observers.
- Controllability, observability.
- The discrete form of system dynamics.
- The Z-transform and Z-transform matrix.
- Deadbeat controllers and observers.
- The linear quadratic regulator.
- The regulator/observer combination.