

Typical PhD Screening Exam Topics: Control Systems

Input Output Models: Laplace Transforms, Transfer Functions, Frequency Response, Bode Plots, Open Loop Stability, Closed Loop Stability.

State Space Models: State Equations, Controllability, Observability, Multi Input Multi Output (MIMO) Systems, Response to External Inputs and Initial Conditions.

Compensator Design: Tracking of Steps and Ramps using Integrators, Lag/Lead Compensators by Bode Plot, Root Locus and Nyquist Plots.

State Feedback Control: Pole Placement, Observers.

Stochastic Models: State Space Models of Dynamic Systems, White and Colored Disturbances.

Linear Least Squares Estimation: Estimation of Random Vectors by Minimum Mean Squared Error Criterion.

Optimal Recursive Linear Estimation: Discrete Time Kalman Filter, Recursion for Estimated State and Error Covariance Matrix, Relation with Deterministic Observers, Innovation Sequence.

Steady State Optimal Filter: Algebraic Riccati equation (ARE) and Conditions for the Solution to Exist.

Performance Measures for Dynamic Systems: Quadratic and General Criteria.

Optimal Control for General Dynamic Systems by Calculus of Variations.

Optimal Quadratic Control for Linear Systems: Linear Time Varying, Steady State Time Invariant Control, Dynamic Programming.

Optimal Linear Quadratic Gaussian (LQG) Regulator.

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Note: This list is provided only as a guideline to the student and may not be completely comprehensive. Examiners reserve the right to determine specific areas of concentration, and students may be examined on any topic that broadly relates to the area.