Systems Engineering

**SYSE 6322** (MECH 6316) Digital Control of Automotive Powertrain Systems (3 semester credit hours) Digital control systems, discretization and design by equivalents. Input-output design and discrete-time state variable estimation and control. Introduction to various control problems in automotive powertrains. Application of digital control principles to automotive powertrains for internal combustion engine idle speed control and air-to-fuel ratio control. Prerequisite: A basic course in control systems at the undergraduate level. (3-0) T

**SYSE 6323** (EECS 6323 and MECH 6323) Robust Control Systems (3 semester credit hours) Theory, methodology, and software tools for the analysis and design of model-based control systems with multiple actuators and multiple sensors. Control oriented model parameterizations and modeling errors. Definitions and criteria for robust stability and performance. Optimal synthesis of linear controllers. The loop shaping design method. Methods to simplify the control law. Mechatronic design examples. Prerequisite: MECH 4310 or equivalent and MECH 6300 or EECS 6331 or SYSM 6307 or equivalent. (3-0) T

**SYSE 6324** (BMEN 6388 and EECS 6336 and MECH 6313) Nonlinear Systems (3 semester credit hours) Equilibria, phase portraits, linearization of nonlinear systems; periodic solutions; Poincare-Bendixson theorem; fundamental existence and uniqueness theorem for ODEs; Lyapunov stability theory; Invariance principle and LaSalle's theorem; converse theorems; singular perturbations; center manifold theorem; differential geometric tools, feedback linearization, input-output linearization, output injection, output tracking, passivity-based control; backstepping. Prerequisite: EECS 6331 or MECH 6300 or SYSM 6307 or equivalent. (3-0) T

**SYSE 6325** (MECH 6325) Optimal Estimation and Kalman Filter (3 semester credit hours) Theory, analysis, design, and implementation of Kalman filters are covered in this course together with real-world applications of the theory. Topics include a review of probability and random variables; random signals and random processes; response of linear systems to random signals; the Wiener filter; the discrete-time Kalman filter; continuous-time Kalman filter; prediction and smoothing; the extended Kalman filter; the ensemble Kalman filter; the unscented Kalman filter; case studies in GPS and GPS-aided inertial navigation, simultaneous localization and mapping (SLAM), and amplitude and phase estimation in dynamic mode atomic force microscopy (AFM). Prerequisite: MECH 6300 or SYSM 6307. (3-0) R

**SYSE 6326** (BMEN 6324 and EECS 6324 and MECH 6324) Robot Control (3 semester credit hours) Dynamics of robots; methods of control; force control; robust and adaptive control; feedback linearization; Lyapunov design methods; passivity and network control; control of multiple and redundant robots; teleoperation. Prerequisite: EECS 6331 or MECH 6300 or SYSM 6307. (3-0) T

**SYSE 6V80** Special Topics (1-3 semester credit hours) This course focuses on special topics related to systems and control engineering typically not found in other courses. The course is generally open to all engineering students with graduate level standing particularly in electrical, mechanical, systems, computer science, and bioengineering. Department consent required. May be repeated for credit (6 semester credit hours maximum). ([1-3]-0) Y