Electrical Engineering: Control Systems

**EECS 5375 (BMEN 5375)** Introduction to Robotics (3 semester credit hours) Fundamentals of robotics, rigid motions, homogeneous transformations, forward and inverse kinematics, velocity kinematics, motion planning, trajectory generation, sensing, vision, and control. Prerequisites: **ENGR 2300** and (EE 4310 or BMEN 4310) or equivalent. (2-3) Y

**EECS 6302 (BMEN 6302) and MECH 6317 and SYSM 6302** Dynamics of Complex Networks and Systems (3 semester credit hours) Design and analysis of complex interconnected networks and systems. Basic concepts in graph theory; Eulerian and Hamiltonian graphs; traveling salesman problems; random graphs; power laws; small world networks; clustering; introduction to dynamical systems; stability; chaos and fractals. (3-0) Y

**EECS 6323 (MECH 6323) and SYSE 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

**EECS 6324 (BMEN 6324) and MECH 6324 and SYSE 6326** 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

**EECS 6331 (MECH 6300 and SYSM 6307)** Linear Systems (3 semester credit hours) State space methods of analysis and design for linear dynamical systems. Coordinate transformations and tools from advanced linear algebra. Controllability and observability. Lyapunov stability analysis. Pole assignment, stabilizability, detectability. State estimation for deterministic models, observers. Introduction to the optimal linear quadratic regulator problem. Prerequisites: **ENGR 2300** and **EE 4310** or **MECH 4310** or equivalent. (3-0) Y

**EECS 6336 (BMEN 6388 and MECH 6313 and SYSE 6324)** 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

**EECS 7V90** Special Topics in Control Systems (1-6 semester credit hours) May be repeated for credit as topics vary (9 semester credit hours maximum). ([1-6]-0) R