ME 598  **Special Topics**  credit: 1 to 4 hours.

Subject offerings of new and developing areas of knowledge in mechanical engineering intended to augment the existing curriculum. See Class Schedule or departmental course information for topics and prerequisites. May be repeated in the same or separate terms if topics vary.

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<th>CRN</th>
<th>Type</th>
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<td>68952</td>
<td>Lecture</td>
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Credit Hours: 2 hours
Fun with Mechanics
Restricted to students in the Mechanical Sci & Engineering department.
Restricted to Graduate - Urbana-Champaign.
This course is being offered to give graduate students an opportunity to participate in a creative design project course that is of a competitive nature. In the first semester (2 credit hours) small student teams of 3 - 5 persons will design a device to meet the specified technical requirements of the competition and provide an engineering analysis that shows that their design is likely to be successful. The device will be fabricated in the second semester (2 credit hours). The Fall 2017 project will be to build a walking machine that is powered by a cordless drill that carries a human rider. A competition consisting of racing around the Engineering Quad will be held at the end of the second semester in the spring of 2018. This course has no lectures or exams, grades are based solely on the project.

| 45639 | Discussion/Recitation    | JB      | 03:00 PM - 04:50 PM | TR   | 106B1 - Engineering Hall | Bentsman, J Chen, Z |

Credit Hours: 4 hours
Advanced Computer Control
This course provides foundation for modern computer control through progression from basic discrete time control theory to the more advanced control algorithms, enhanced by the elements of machine learning, which have been highly successful in applications. Exposure to the implementation of these algorithms on modern computing platforms will also be provided. The topics will include: state space and input-output models of discrete time systems; current computer control thinking and platforms; system-theoretic properties of discrete time systems; discrete time control fundamentals: pole placement design, observer design, output feedback, disturbance rejection, servo design; linear discrete time optimal control; robust discrete time (H#) control for linear and nonlinear systems; discrete time polynomial design; discrete-time nonlinear filtering and control; model-predictive control with constraints; discrete time robust adaptive control (L1 and others); enhancement of discrete time controllers with computationally intensive elements of machine learning/artificial intelligence; introduction to field-programmable gate arrays (FPGAs) and graphical processing units (GPUs) for solving computationally intensive control problems through individual projects. Prerequisite: ME360 or equivalent is required. ME460 or ECE 486 is desirable.

| 66713 | Lecture-Discussion        | KCS     | 10:00 AM - 11:50 AM | TR   | 1020 - Lincoln Hall  | Smith, K   |

Credit Hours: 4 hours
Physicochemical Hydrodynamics
This course introduces basic concepts of molecular diffusion in liquids with interactions due to stationary or flowing fluid. Uncharged and charged solutions/dispersions/suspensions of molecules, macromolecules, and particles are considered in enclosed and porous-media flows. Particular emphasis is placed on analysis using the equations that govern concentration, velocity, and electric-potential fields, flux/flow driving forces and their constitutive relations, and transport properties/parameters. Applications are discussed in energy, environmental, chemical, and biological systems. Prerequisites: Courses in heat/mass transfer and fluid mechanics.

| 70404 | Lecture-Discussion        | MEK     | 11:00 AM - 12:20 PM | TR   | 105 - Talbot Laboratory | Kersh, M   |

Credit Hours: 4 hours
Orthopedic Biomechanics
Principles of musculoskeletal joint biomechanical function and modeling; design rationale and manufacturing of orthopedic implants; computational modeling of bone and orthopedic tissue adaptation; experimental and computational methods used to obtain physiological boundary conditions. Pre-requisites: ME 481 and ME 170 (or equivalent). Solid mechanics and Matlab proficiency is recommended.

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<th>70405</th>
<th>Lecture</th>
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<th>1022 - Lincoln Hall</th>
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Credit Hours: 4 hours

Reinforcement Learning
Theory and practice of reinforcement learning as a tool for machine learning and artificial intelligence, applied to control, dynamics, and robotics, with a particular emphasis on computation. Topics will include reinforcement learning algorithms (temporal difference, Q-learning, policy gradient, actor-critic), function approximation and the use of deep neural networks, and efficient implementation on parallel architectures. Restrictions and prerequisites: CS 446 or equivalent; experience with TensorFlow, PyTorch, or equivalent.