ROBOTICS & AUTONOMOUS SYSTEMS GRAD COURSE OFFERINGS SPRING 2026 **Subject to Change**			
COURSE	**SECTION**	**DESCRIPTION**	**NOTES**
ENG ME 500 A1: Recent Application Advantages of Quantum Dots	A1 - Eytan Barouch Monday, Wednesday 12:20-2:05	Elements of QM theory, foundations of QM in crystals and applications, classical and modern diodes, Transistors and their applications, QUANTUM DOTS (QD), applications of QD to electronics, applications of QD to vaccine developments, applications of QD to cancer surgery by humans as well as robots.	
ENG ME 500 A2: Advanced Manufacturing	A2 - Will Boley Tuesday, Thursday 1:30-2:15	This course introduces students to advanced and emerging concepts in the complementary fields of functional materials and automated manufacturing. It will introduce students to 1) Fundamental concepts of functional materials, which are materials that can have any combination of outstanding properties (e.g.'s, electrical, mechanical, optical, and adaptive); 2) Myriad applications of advanced functional materials (e.g.'s sensors, actuators, hierarchical and meta-materials, wearables and implantables, adaptive and autonomous architectures, and energy and sustainability); and 3) State-of-the art automated manufacturing systems concepts and techniques that are used to fabricate advanced functional materials (e.g.'s, subtractive, additive, and hybrid manufacturing). The students will learn the fundamental materials and processing science that govern their properties and how to design, manufacture, and integrate them into a functional product. The course will have a significant lab component throughout the semester. Labs will take place in the Automated Design and Manufacturing Laboratory (ADML, link here), a flexible manufacturing cell (FMC), and in the Materials Science Lab Room, both in EPIC. Four of the labs will focus on training the students on how to use the system, one of the labs will focus on the process of making a 3D printable electrically conductive ink, and the final lab will focus on using the FMC in the ADML to automatically machine and print a simple functional circuit. The students will have another hands-on component in the form of a semester-long team project. Each team will have the opportunity to select a project from a list of available projects, or propose their own project that either advance the capabilities of the ADML or use the ADML for a novel advanced manufacturing application. Proposed Masters or PhD thesis projects are also welcome, provided they are aligned with the themes of the course project.	
ENG ME 500 A3: Introduction to Biological Feedback Control	A2 - Elise Morgan Tuesday, Thursday 9:00-10:45	Examination of the basic concepts of feedback control from different perspectives in natural sciences and engineering. Discussion of the fundamentals of current understanding of how biological systems use feedback control, foundational analytical principles of feedback control from mechanical and electrical engineering, and juxtaposition of the biological and engineering bodies of knowledge. Course goals are: 1) to connect each student's prior, discipline-specific understanding of feedback control to a common framework; 2) to expose students to the concept of mathematical modeling of feedback in systems, including biological examples of feedback control; and 3) to provide instruction in and experience working in multi-disciplinary teams. Same as BE500 A3 and MS 500 A3. Students may not receive credit for both.	
ENG ME 503: Kinetic Processes in Materials	A1 - Soumendra Basu Monday, Wednesday 10:10-11:55	Kinetics of mass transport, continuum and atomistic approaches, chemical diffusion; kinetics of chemical reactions, kinetics of adsorption and evaporation; nucleation and growth; solidification; spinodal decomposition; coarsening; martensitic transformations; order-disorder reactions; point defects and their relation to transport kinetics. Meets with ENGMS503; students may not receive credit for both.	
ENG ME 515: Vibration of Complex Mechanical Systems	A1/DL - Greg McDaniel Tuesday, Thursday 3:30-5:15	Analysis of free and forced vibration of multidegree-of-freedom systems. Analysis of free and forced vibration of continuous systems such as strings, bars, beams, and membranes. Introduction to vibration control, vibration isolation, and vibration absorbers. Introduction to vibration sensors. Analysis of free and forced vibration of systems and structures modeled with the finite element method. Students learn computational implementation of all analyses.	
ENG ME 518: Product Quality	A1 - James Perkins Monday, Wednesday 6:30-8:15	Introduction to statistical methods for design, control and improvement of quality. Includes Statistical Process and Quality Control (SPC & SQC) and Acceptance Sampling. Extensive coverage of Design of Experiments (DOE) with applications to designing quality into products and to process and product performance improvement. Also covers Robust Design and Taguchi's method. Introduction to modern approaches to management of quality (TQM, Six Sigma).	

ENG ME 533: Energy Conversion	A1 - Sean Lubner Monday, Wednesday 12:20-2:05	Thermodynamic and mechanical aspects of modern conventional energy conversion systems, including steam electric power plants, gas turbine and internal combustion engines, and refrigeration systems. Combined cycle and cogeneration are also considered, as well as economic and environmental aspects of energy conversion. Includes design project.	
ENG ME 535: Green Manufacturing	A1 - Uday Pal Tuesday, Wednesday 1:30-3:15	Provides a systems view of the manufacturing process that aims to efficiently use energy, water, and raw materials to minimize air and water pollution and generation of waste per unit of the manufactured product. Specifically, the course will discuss methods to maximize yield and minimize waste effluents in processes, ways to devise treatment strategies for handling manufacturing wastes, innovative ways to decrease energy consumption in manufacturing, by-product use and product recycling, and policies that encourage green manufacturing. Same as ENG MS 535. Students may not receive credits for both.	
ENG ME 537: Product Realization	A1 - Stephen Chomyszak Tuesday, Thursday 9:00-10:45	This course focuses on the essential and challenging process of getting a design from the drawing board into the hands of a customer. Cases are drawn from a range of industries, technologies and development speeds (everything from hardware startups to aircraft). It includes topics such as Design for Manufacturing, validation testing, cash flow modeling, in vs outsourcing, setting up a factory, selecting supplier partners, distribution, and ongoing product support. There will be a semester long project to build and prototype a small production line.	**This class has a required LAB component either on Tuesday, 11:15am-12:05pm OR Thursday, 11:15am-12:05pm**
ENG ME 543: Sustainable Power Systems: Planning, Operation and Markets	A1/DL - Michael Caramanis Monday, Wednesday 4:30-6:15	Breakthroughs in clean energy generation technologies and the advantage of exploiting efficiently the available work in fossil fuels will render electricity the dominant energy form in a sustainable environment future. We review the key characteristics of Electric Power Transmission and Distribution (T&D) networks and the associated planning and operation requirements that ensure supply adequacy, system security and stability. Capital asset investment and operation cost minimization is discussed in a systems engineering context where the assets as well as the dynamic behavior of generators, T&D networks, and loads interact. Recent developments in the formation of competitive wholesale markets at the High Voltage Transmission system level, the associated market participation and clearing rules and the market clearing optimization algorithms are presented and analyzed in terms of their effectiveness in fostering cost reflective price signals and competitive conditions that encourage optimal distributed/not-centralized investment and operating decisions. Finally, we present T&D congestion and supply-demand imbalance related barriers to the widespread adoption of environmentally friendly and economically efficient technological breakthroughs, and propose a systems engineering and real-time retail-market based coordination of centralized as well as decentralized generation, storage and load management resources that is able to achieve desirable synergies and mitigate these barriers. Same as ENG EC 543 and ENG SE 543. Students may not receive credits for both.	
ENG ME 545: Electrochemistry of Fuel Cells and Batteries	A1 - Jörg Werner Tuesday, Thursday 3:30-5:15	Topics covered include Fundamental Electrochemistry of solid-state materials as well as aqueous and non-aqueous systems including molten salts. Thermodynamics and kinetics of electrode reactions and associated mass transport in electrochemical systems. Measurements techniques (dc polarization, ac impedance spectroscopy, blocking electrodes, etc.) used in characterizing electrochemical systems. Design of devices including fuel cells, batteries, and sensors. Electrochemical processes including membrane separation and electrolysis. Same as ENG MS 545. Students may not receive credits for both.	
ENG ME 546: Introduction to Micro/Nanofluidics	A1 - Chunhua Duan Tuesday, Thursday 9:00-10:45	This course is an introductory graduate course in mechanical engineering. It is aiming to introduce unique transport phenomena and major applications of micro/nanofluidics to senior undergraduates and new graduate students. Topics include overview of micro/nanofluidics, scaling laws, intermolecular forces, lubrication theory, surface tension and Marangoni flow, chaotic mixing, electrowetting, electrokinetics, dielectrophoresis, chemical reaction in confined space, micro/nano fabrication, etc. Special emphasis will be focused on understanding fundamental mechanism of transport phenomena at the micro/nanoscale.	

ENG ME 547: Introduction to Computational Fluid Dynamics	A1 - Sheryl Grace Tuesday, Thursday 11:00-12:45	This course will prepare students in the fundamentals of the computational approach to study fluid flow problems, and will provide a deeper understanding of the physical models and governing equations of fluid dynamics. It will also present an opportunity to learn the basic skills of programming solutions to differential equations, and present an overview of essential numerical techniques. Students will develop finite difference based computer models as part of the "12 Steps" to numerically solving the laminar Navier-Stokes equations. Consistency, stability and convergence of the numerical methods will be discussed. Extensions to turbulent flows will be considered. The students will be introduced to an open source CFD code and will explore numerical solutions to problems in fluid mechanics using the code.	
ENG ME 549: Structures and Function of the Extracellular Matrix	A1 - Instructor TBD Monday, Wednesday 10:10-11:55	This is an introductory course dealing with the detailed structure of the basic units of the extracellular matrix including collagen, elastin, microfibrils, and proteoglycans as well as the functional properties such as elasticity at different scales from molecule to fibrils to organ level behavior. The biological role of these components and their interaction with cells is also covered. Interaction of enzymes and the matrix in the presence of mechanical forces is discussed. Mathematical modeling is applied at various length scales of the extracellular matrix that provides quantitative understanding of the structure and function relationship. Special topics include how diseases affect extracellular matrix in the lung, cartilage, and vasculature. The relevance of the properties of native extracellular matrix for tissue engineering is also discussed. Same as ENG BE 549 and ENG MS 549. Students may not receive credit for both.	
ENG ME 555: MEMS: Fabrication and Materials	A1 - Xin Zhang Monday, Wednesday 12:20-2:05	This course will explore the world of microelectromechanical systems (MEMS) and NEMS. This requires an awareness of design, fabrication, and materials issues involved in micro/nanosystems. We will go over this through a combination of lectures, case studies, and individual homework assignments. The course will cover fabrication technologies, material properties, structural mechanics, basic sensing and actuation principles, packaging, and MEMS markets and applications. The course will emphasize the fabrication and materials of micro/nanosystems. This is not because the other parts aren't important. Instead, it is because with fabrication and materials expertise there is something concrete you can do that will always help. When we exam special topics and case studies, a lot of these other pieces will be put together. Same as ENG MS 555. Students may not receive credit for both.	
ENG ME 566: Advanced Engineering Mathematics	A1 - Eytan Barouch Monday, Wednesday 4:30-6:15	Introduces students of engineering to various mathematical techniques which are necessary in order to solve practical problems. Topics covered include a review of calculus methods, elements of probability and statistics, linear algebra, transform methods, difference and differential equations, numerical techniques, and mathematical techniques in optimization theory. Examples and case studies focus on applications to several engineering disciplines. The intended audience for this course is advanced seniors and entering MS engineering students who desire strengthening of their fundamental mathematical skills in preparation for advanced studies and research.	
ENG ME 571: Medical Robotics	A2 - Shelia Russo Monday, Wednesday 12:20-2:05	**Graduate Prerequisites**: Mechanical Design (CAD), Experience in Fabrication, Experience with Pr ogramming/Automation, Technical Communication (e.g. writing and presen tation). Consent of Instructor This course will be composed of lectures, tutorials, and group work. We will study the design, mechanics, materials, manufacturing, and control of robots and associated technologies for medical applications. We will cover theory, on medical robotics and case studies, including examples from medical companies and research groups.This class is aimed toward graduate students in engineering; no medical background is required. We will study and explore design principles of different mechatronic components and systems for medical robots. We will cover in-depth especially the meso-scale actuators, sensors, and body construction methods.	**Area: Design**

ENG ME 576: Nanomanufacturing and Hierarchical Materials	A1 - Keith Brown Monday, Wednesday 10:10-11:55	Nanoscale materials are often celebrated as having unique properties that exceed their bulk counterparts. However, leveraging such nanoscale materials as components in bulk materials is challenging as it requires (1) making enough material to be relevant on bulk scales and (2) incorporating nanomaterials at a bulk scale in amannerso as to maximize their effect. The structural ordering of these nanomaterials can range from disordered, as in the case of nanocomposites, to highly ordered, as is generally the case in metamaterials. This course is designed to communicate he state-of-the-art, challenges, and opportunities of constructing hierarchical materials with nanoscale constituents. Same as ENG MS 576. Students may not receive credits for both.	
ENG ME 584: Manufacturing Strategy	A1 - Jim Perkins Monday, Wednesday 4:30-6:15	Strategic decision-making for technical people in manufacturing companies. Provides practice in applying financial, organizational, and operational concepts through analysis and discussion of case situations. Topics include process alternatives and their implications; interactions among product design, process design, worker skill and worker motivation; supplier relationships; interfaces with marketing and finance; introduction of new technology; capacity planning; and competitive analysis. Taught principally by in-class discussion plus guest lectures.	
ENG ME 692: Advanced Product Design and Engineering	A1 - Stephen Chomyszak Monday, Wednesday 2:30-4:15	**Graduate Prerequisites**: Graduate standing in an an engineering discipline. Previous courses in materials science, CAD, FEA, structures. Basic programming and electrical engineering. Spring Semester; part of a two-term sequence with ENG ME 691. Advanced Product Design and Engineering is focused on the tools and skills enabling smart, practical product engineering choices. A "proactive" mechanical engineer creates products and systems that are functional, manufacturable, and economically successful, even as user expectations and technologies evolve. Students are expected to perform original research on design and engineering trends, apply advanced engineering methods to specific examples, justify their conclusions in design reviews, and ultimately create a manufacturable design prototype. Grading based on a mix of team and individual assignments.	
ENG ME 701: Optimal and Robust Control	A1 - Sean Andersson Monday, Wednesday 4:30-6:15	This course is aimed at an introduction (with rigorous treatment) to the fundamentals of optimal and robust control. It will be divided roughly into two parts. The first will cover aspects of robust control including model reduction, H_2 and H_ infinity control, and feedback control of uncertain systems. The second will delve into optimal control including topics such as the linear quadratic regulator, the calculus of variations, the maximum principle, and the Hamilton-Jacobi-Bellman equation. Same as ENG EC 701 and ENG SE 701. Students may not receive credits for both.	**Area: Control**
ENG ME 710: Dynamic Programming and Reinforcement Learning	A1 - Michael Caramanis Monday, Wednesday 10:10-11:55	Introduction to sequential decision making via dynamic programming. The principle of optimality as a unified approach to optimal control of dynamic systems and Markovian decision problems. Applications from control theory and operations research include linear-quadratic problems, the discrete Kalman Filter, inventory control, network, investment, and resource allocation models. Adaptive control and numerical solutions through successive approximation and policy iteration, suboptimal control, and neural network applications involving functional approximations and learning. Same as ENGEC 710 and ENGSE 710. Students may not receive credits for both.	
ENG ME 714: Advanced Stochastic Modeling and Simulation	A1 - Jim Perkins Monday, Wednesday 2:30-4:15	Introduction to Markov chains, point processes, diffusion processes as models of stochastic systems of practical interest. The course focuses on numerical and simulation methods for performance evaluation, optimization, and control of such systems. Same as ENG SE 714. Students may not receive credits for both.	

ENG ME 724: Advanced Optimization Theory and Methods	A1 - Alexander Olshevsky Monday, Wednesday 4:30-6:15	**Graduate Prerequisites:** ENG EC 524 or consent of instructor. Complements ENGEC524 by introducing advanced optimization techniques. Emphasis on nonlinear optimization and recent developments in the field. Topics include: unconstrained optimization methods such as gradient and incremental gradient, conjugate direction, Newton and quasi-Newton methods; constrained optimization methods such as projection, feasible directions, barrier and interior point methods; duality; and stochastic approximation algorithms. Introduction to modern convex optimization including semi-definite programming, conic programming, and robust optimization. Applications drawn from control, production and capacity planning, resource allocation, communication and sensor networks, and bioinformatics. Meets with ENG EC 724 and ENG SE7 24. Students may not receive credits for both.	
ENG ME 727: Principles and Applications of Tissues	A1 - Wilson Wong Monday, Wednesday 8:00-9:45	Provides the chemistry and engineering skills needed to solve challenges in the biomaterials and tissue engineering area, concentrating on cell-biomaterial interactions, soft tissue mechanics and specific research topics. Students will write a NIH-style grant proposal on a specific research topic. Note that the laboratory portion is not offered in ENG ME 727. Same as ENG BE 527, ENG BE 727, ENG ME 727, ENG MS 727. Students may not receive credit for both.	
ENG ME 740: Vision, Robotics, and Planning	A1 - John Baillieul Tuesday, Thursday 9:00-10:45	Methodologies required for constructing and operating intelligent mechanisms. Comprehensive introduction to robot kinematics for motion planning. Dynamics and control of mechanical systems. Formal treatment of differential relationships for understanding the control of forces and torques at the end effector. Discussion of robot vision and sensing and advanced topics in robot mechanics, including elastic effects and kinematic redundancy. Same as ENG SE 740. Students may not receive credits for both.	**Areas: Control, Perception**
ENG ME 762: Nonlinear Systems and Control	A1 - Hua Wang Tuesday, Thursday 11:00-12:45	**Graduate Prerequisites: (ENGME501) or ENG EC 501 or consent of instructor** Introduction to the theory and design methods of non-linear control systems. Application to robotics, vibration and noise control, fluid control, manufacturing processes, and biomedical systems. Mathematical methods based on the theory of differentiable manifolds; non-linear control techniques include feedback linearization, back-stepping, forwarding, and sliding mode control. Additional course topics will include controllability and observability, Lyapunov stability and its applications, limit cycles, input-output stability, zero dynamics, center manifold theory, perturbation theory, and averaging. Same as ENG SE 762. Students may not receive credits for both.	**Area: Control**
ENG ME 788: Soft Tissue Biomechanics	A1 - Katherine Zhang Tuesday, Thursday 11:00-12:45	This course will introduce students to the mechanics of soft biological tissue. In particular, the response of the heart, vasculature, and tissue scaffolds to mechanical loads from the perspective of nonlinear solid mechanics will be studied. Constitutive models for hyperelastic materials will be adapted to biomaterials to handle mechanical characteristics such as nonlinearity, viscoelasticity, and orthotropy. Basic experimental methods, and anatomy and physiology of particular tissue types will also be introduced. Emphasis is placed on integrating the basic analytical, experimental, and computational methods for a more complete understanding of the underlying mechanobiology. Meets with ENG BE 788. Students may not receive credit for both.	

NON-ME COURSES (R&AS-RELATED) SPRING 2026 *Subject to Change* Please check MyBU for most up-to-date information			
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ENG EC 720: Digital Video Processing	A1 - Janusz Jonrad Tuesday, Thursday 3:30-5:15	Review of sampling/filtering in multiple dimensions, human visual system, fundamentals of information theory. Motion analysis: detection, estimation, segmentation, tracking. Image sequence segmentation. Spectral analysis of image sequences. Video enhancement: noise reduction, super-resolution. Video compression: transformation, quantization, entropy coding, error resilience. Video compression standards (H.26X and MPEG families). Future trends in image sequence compression and analysis. Homework and project will require MATLAB programming.	**Area: Perception**