

WPI SPECIAL TOPICS 2020-2021

Subj.	Course #	Title	Description	Term
BME	595	ST: COMMERCIAL ANALYSIS BME	This course partially fulfills the Clinical Competency requirement in Biomedical Engineering. The course will follow a seminar format, with faculty and industry experts serving as invited lecturers and case study presenters. The course is designed to introduce BME graduate students to the process and practices of evaluating the commercial potential of medical products and technologies.	Fall 2020

Subj.	Course #	Title	Description	Term
CS	525	SP TOP: SWARM INTELLIGENCE	<p>This course will cover a wide range of topics in swarm intelligence, including mathematical, computational, and biological aspects. The course is organized in three parts. In the first part, the students will learn about complex systems and the basic concepts of self-organization, such as positive and negative feedback, symmetry breaking, and emergence. The instructor will illustrate a diverse collection of self-organized systems in nature, finance, and technology that concretize these concepts. The second part covers optimization algorithms inspired by swarm intelligence, namely ant colony optimization and particle swarm optimization. The third and final part is dedicated to swarm robotics, and will cover common swarm algorithms for task allocation, collective motion, and collective decision-making. The course will blend theory and practice, challenging the students to learn by implementing the algorithms discussed in class. The final project will involve working on a research problem in swarm robotics, and the final deliverable will include a demo and a research paper.</p>	Spring 2021

Subj.	Course #	Title	Description	Term
ECE	579B	ST: Blockchain and Cryptocurrencies.	<p>Cryptocurrencies changed the way we look at money. It created significant impact on finance, socioeconomic and technology. The course will introduce the technical aspects of blockchain technologies, consensus protocols and cryptocurrencies. Students will learn the basics of the blockchain systems and how to engineer blockchain systems to create cryptocurrencies. They will learn the bottlenecks of the blockchain systems and study new blockchain design proposals to see if these bottlenecks are overcome. Further, the course will also cover the basics of Ethereum and smart contracts. Students will have the chance to learn programming smart contracts. In some occasions, the course might include class discussions and paper reading. Also, students are expected to give a presentation on a topic related to blockchain.</p>	Spring 2021
ECE	579N	ST: Optimal Control	<p>This course provides an introduction to the theory and practice of optimal control. The main emphasis of the course will be on linear quadratic methods. Topics covered will include static optimization, principles of MIMO systems and feedback control, calculus of variations, LQR/LQG control, and dynamic programming. Additional topics such as nonlinear and H-infinity control may be explored as time permits. Theoretical foundations will be reinforced with applications to state-of-the-art research areas such as autonomous vehicles and power systems.</p>	Spring 2021

Subj.	Course #	Title	Description	Term
ECE	579M	ST: Machine Learning Cybersecurity	<p>Machine Learning has proven immensely effective in a diverse set of applications. This trend has reached a new high with the application of Deep Learning virtually in any application domain. This course studies the applications of Machine Learning in the sub domain of Cybersecurity by introducing a plethora of case studies including anomaly detection in networks and computing, side-channel analysis, user authentication and biometrics etc. These case studies are discussed in detail in class, and further examples of potential applications of Machine Learning techniques including Deep Learning are outlined. The course has a strong hands-on component, i.e. students are given datasets of specific security applications and are required to perform simulations.</p> <p>Prerequisites: Basic understanding of principles of cybersecurity, familiarity with Machine Learning techniques and tools (Matlab or python, numpy, scikit-learn) will be useful but not required.</p>	Spring 2021
ETR	598	ST: ENGINEERING & BUSINESS: POWER OF COLLABORATION	<p>Technology-based project management and product designs benefit from collaboration between enabling technologies and the commercial opportunities they represent. The integration of the two disciplines can be utilized from inception to final delivery of the work products presented. This course is taught simultaneously with Engineering and Business School faculty. It features formal mid and final project reviews and collaborative teaching styles.</p>	Fall 2020

Subj.	Course #	Title	Description	Term
FP	580	ST: SPECIAL PROBLEMS	Individual or group studies on any topic relating to fire protection may be selected by the student and approved by the faculty member who supervises the work. Examples include: Individual or group studies on any topic relating to fire protection may be selected by the student and approved by the faculty member who supervises the work. Examples include: Business Practices, Combustion, People in Fires, Fire Dynamics II, Fire and Materials, Forensic Techniques, and Complex Decision Making.	Fall 2020 Spring 2021
MTE	594	ST: HEAT TREATMENT OF STEELS	Most cast, forged or powder metallurgy steel parts require heat treatment to obtain the specified properties. In this seminar the fundamentals of the heat treatment of steels will be addressed (i.e. normalizing, annealing, austempering, austforming, marquenching and hardening/quenching/tempering). In addition, the important surface engineering processes (carburizing, carbonitriding, nitriding, ferritic nitrocarburizing, boronizing and aluminizing) will be analyzed. Each process will be fully developed in terms of the thermodynamics, transformation and diffusion kinetics. Prerequisite: Introduction to Materials	Fall 2020

Subj.	Course #	Title	Description	Term
OIE	598	SP TOP: SUSTAINABLE SUPPLY CHAIN & OPERATIONS MANAGEMENT	<p>This course is intended to provide students with understanding the intra- and inter-organizational implications of environmental practices and policies. The role of organizational operational and supply chain management functions, activities, tools and methods and their relationship to the natural environment will be introduced and discussed. At the end of the course a successful student should be able to: grasp the scope of general operations and supply chain management and environmental sustainability as they relate to the firm, be able to relate to the manners in which management may respond and collaborate/cooperate with suppliers, customers, and various other stakeholders influencing and influenced by operational and supply chain activities from practical and theoretical case studies and able to evaluate various factors and understand tradeoffs in management decisions as they pertain to environmental operations and supply chain management.</p>	Spring 2021

Subj.	Course #	Title	Description	Term
RBE	595	ST: ROBOTIC MANIPULATION	This course covers both the fundamentals and recent advances of robotic manipulation research. Grasp taxonomies and stability measures will be examined, and grasp planning methods will be studied. Sensing strategies that are used for object manipulation will be covered along with various data processing methods. Soft manipulation techniques and the methods that exploits environmental constraints will be analyzed. In addition withIn-hand manipulation methods will be covered. Finally, learning-based manipulation strategies will be discussed.	A term 2020
SS	590	ST: LEARNING AND CREATIVITY	This course will cover selected topics related to learning and creativity— including memory, sleep, analogies, problem-solving, divergent thinking, and insight moments. Students will critically review journal articles and other forms of media to gain a better understanding of the processes involved in learning and creative cognition. Students will also learn about prominent theories of learning and creativity and identify ways to utilize these frameworks to improve education and student experiences in the classroom.	Spring 2021