# COURSES

**MENG-6003**

**Introductory Programming Methods for Data Science and Learning**

This graduate level course is designed for practicing engineers. Introduction to computer science concepts and basic programming skills that are specifically geared toward data science and machine learning, and forms a part of the introductory coursework for the MEng program. Course emphasizes writing programs that are capable of retrieving and manipulating large amount of data. The first half of the course focuses on Python as a first programming language, while the second half of the course covers selected advanced topics such as web scraping, database access and others.

**MENG-6013**

**Applications of Electrical and Computer Engineering in Mobility Systems**

This graduate level course is designed for practicing engineers. It is designed to introduce the fundamental principles of electrical and computer engineering that are required for application in mobility systems for students with non-ECE degrees. Topics include: passive circuit components, basic laws and analysis techniques; active electronic elements and circuits, digital logic circuits, digital & analog sensors and actuators, electrical machines; power electronics & batteries; digital systems; signal processing; microcomputers and interfacing; and basic mobility system networking and CAN concepts. Approximately one week is devoted to each topic illustrated in the context of specific applications in mobility systems. Case studies with specific applications of ECE in mobility systems will be assigned.

**MENG-6023**

**Applications of Industrial and Manufacturing Engineering in Mobility Systems**

This graduate level course is designed for practicing engineers. The course is designed to introduce the fundamental principles of industrial and manufacturing engineering that are required for application in mobility systems for students with non-IME degrees. Topics include: product and process design, work design, production systems, quality/six sigma, and management/leadership. Approximately two weeks are devoted to each topic illustrated in the context of specific applications in mobility systems. Case studies with specific applications of IME in mobility systems will be assigned.

**MENG-6033**

**Applications of ME in Mobility Systems**

This graduate level course is designed for practicing engineers. It introduces the basic principles of mechanical engineering that are required for application in mechanical automotive systems. Major topics include machine design, thermodynamics, fluid mechanics, heat transfer, and dynamic systems. Applications include chassis systems, suspension, steering, brakes, aerodynamics, powertrains, climate control, fuel cells, turbines, compressors, transmission systems, HVAC system, shafts, and safety systems.

**MENG-6093**

**Practical Technology Management**

This course instructs applied methods in the management of the technology domain of an enterprise. Leading the technological direction of an enterprise will include the processes of technology cycle evaluation, strategy formulation, development pipeline management, development process management, leading the development process, and the financial performance of innovation in an enterprise.

**MENG-6193**

**Practical Project Management**

This course instructs applied methods of managing projects utilizing standards of the Project Management Institute, including the processes related to initiating, planning, executing, controlling, reporting, and closing a project. Additionally, methods of Agile project management, as applied in recent business models, are introduced. Principles of the course are practiced in project-based learning activities as well as application experiences utilizing the tools and techniques of project management.

**MENG-6213**

**Introduction to Energy Storage Systems with EV Applications**

This graduate level course is designed for practicing engineers. The purpose of this course is to introduce the basics of energy storage systems. We will look at several competing energy storage concepts and management systems. The emphasis is on rechargeable Li-ion batteries for EV applications. The course will focus on the fundamentals of Li-ion batteries with respect to the physical principles of operation, design, manufacturing, modeling and state estimation. Students are required to complete research projects and independent review of research topics with approval of the instructor.

**MENG-6263**

**Power Electronics for Vehicle Electrification**

This graduate level course is designed for practicing engineers. It is an advanced class in power electronics. Advanced converter topologies, control methods, and analyses used in electric-vehicle and power-system domains will be discussed. topics include state-variable modeling of DC-DC converters for closed-loop control system design, isolated DC-DC converter topologies (half, full, and dual bridges) and resonant DC-DC converter topologies (series, parallel and series-parallel) for wireless power transfer and battery charging, soft-switching concepts and control methods for isolated DC-DC converters, single-phase and three-phase inverter design, inverter control methods including six-step, Sine PWM, Space Vector PWM, and Discontinuous PWM and the design and control of multilevel and modular multilevel inverters.

**MENG-6303**

**Applied Digital Signal Processing for Automotive Engineering**

This graduate level course is designed for practicing engineers. The course is designed to introduce critical digital signal/image processing principles/theories and techniques applied to a variety of automotive engineering applications. Special focus is given to autonomous driving and NVH analysis. Examples include, but not limited to, edge detection methods in traffic sign recognition and identification; Kalman filtering for vehicle state estimation; Modal analysis (frequency domain) and expansion to time-frequency domain analysis of dynamic response using techniques such as wavelets and Empirical Mode Decomposition (EMD). MATLAB will be heavily used for analysis and simulations.

**MENG-6323**

**Introduction to Automotive Control Systems**

This graduate level course is designed for practicing engineers. This class will focus on applying students' knowledge of fundamental principles of control systems to a variety of systems within automobiles. Specific topics will include the control of the air-fuel ratio, spark timing, idle speed, transmissions, cruise and headway, lane-keeping, and active suspensions. Other topics that may be included are antilock brakes, traction control, and vehicle stability control. Simulations will be used, and students will be using MATLAB/Simulink for many of the assignments.

**MENG-6423**

**Mobile Robotics**

This graduate level course is designed for practicing engineers. This course covers the fundamentals of robotics with an emphasis on mobile robots, which are intelligent integrated mechanical, electrical and computational systems functioning in the physical world. Topics include state-of-the-art technologies in mobile robotics, such as locomotion, sensing, control, communication, localization, mapping, navigation, etc. Advanced topics such as coordination of multiple mobile robots will also be explored. The course aims to provide both theoretical and practical experience to students through lectures and hands-on experience with real robots and simulation software. Students will also complete independent projects or research on current topics covering mobile robotics technologies and related fields.

**MENG-6453**

**Introduction to Electrified Vehicle Propulsion**

This graduate level course is designed for practicing engineers. It introduces students to electrified propulsion systems for automotive applications. Topics in the course include the fundamentals of chassis energy requirements, combustion engines, electrical motors, electrical motor controls, and electrical energy storage systems. With this background, the integration of these hybrid electric components into the hybrid electric vehicle powertrain system will be studied, including electric energy storage (batteries, flywheels, ultra-capacitors) and electrical energy production-fuel cells. Relevant codes and standards will be emphasized.

**MENG-6463**

**Introduction to Vector Control of AC Electric Machines**

This graduate level course is designed for practicing engineers. Methods of controlling electric machines and their applications in electric vehicles are discussed. Topics include theory of permanent-magnet and induction machines; coordinate-frame transformations; analysis and tuning of torque and speed control systems; modeling and dynamics of electric drives and vehicles; power-electronic devices, power-electronic circuits and switching schemes; rotor-flux-oriented vector control; regenerative braking; and rotor-flux position-sensing methods. Machine and vehicle models will be developed using MATLAB Simulink. A low-voltage permanent-magnet machine and power-electronic inverter will be analyzed and tested. Students are also required to complete a research project, to be determined and assigned with approval of the instructor.

**MENG-6523**

**Introduction to Artificial Intelligence for Autonomous Driving**

This graduate level course is designed for practicing engineers. This course will provide introductory theories and technologies in artificial intelligence focusing on machine learning, covering a wide range of machine learning methods, concepts and applications. Machine learning studies algorithms that learn from large quantities of data, identify patterns and make predictions on new data. The major list of machine learning fields are computer vision, robotics, autonomous driving, voice/gesture recognition, and automated planning & scheduling, etc. Student will study the concepts that underlie intelligent systems and investigate advanced topics in intelligent system through the course project.

**MENG-6543**

**Introduction Computer Vision for Autonomous Driving**

This graduate level course is designed for practicing engineers. The course will cover introductory theories and modern technologies in computer vision systems for autonomous driving. Data from visual sensors play crucial roles in many fields such as autonomous driving, surveillance camera, and robotics. The computer vision system seeks to automate tasks that the human visual system can do. The goal of this course is to learn technologies that enable a computer automatically to understand the content of visual sensors for autonomous driving. The first half of this course will focus on fundamental models and algorithms in computer vision and in the second half of the course students can learn about computer vision applications and programming skills to accomplish computer vision tasks. Graduate students taking this course are also required to complete independent review or survey of cutting edge research topics in computer vision systems, such as object-detection methods for autonomous driving, Deep Neural Network for environmental perception, and innovative applications, etc., selected by the students with approval of the instructor. The survey or research report must be presented in a conference paper format that is ready for submission to a conference.

**MENG-6653**

**Introduction to Information Retrieval and Data Mining**

This graduate level course is designed for practicing engineers. Information retrieval and data mining topics, including information storage and retrieval, file structures, precision and recall, probabilistic retrieval, search strategies, automatic classification, automatic text analysis, decision trees, nearest neighbor method, and rule induction. Graduate students will create and analyze additional material about Mining of Massive Datasets.

**MENG-6813**

**Introduction to Artificial Intelligence**

This graduate level course is designed for practicing engineers. The course covers types of intelligence, knowledge representation, cognitive models. Heuristic and algorithmic techniques in problem solving, knowledge representation. Selected topics from natural language processing, vision processing, game playing, pattern recognition, speech recognition, robots, and other current topics in artificial intelligence.

**MENG-6823**

**Introduction to Machine Learning**

This graduate level course is designed for practicing engineers. This course provides an introduction to machine learning. Topics include: supervised learning including generative, discriminative learning, parametric and non-parametric learning, neural networks, support vector machines; unsupervised learning including clustering, dimensionality reduction, kernel methods, learning theory bias/variance trade-offs, VC theory, large margins.

**MENG-6843**

**Introduction to Internet of Things (IoT)**

This graduate level course is designed for practicing engineers. The most important topics of the Internet of Things and its applications will be addressed. Topics include an introduction to network stacks and embedded operating systems, IoT architecture models, smart devices, connection and access technologies, the IoT network layer, application layer protocols relevant to IoT, and IoT security practices. Various IoT application areas will be discussed, such as industrial, home automation, manufacturing, energy, utilities, vehicles, smart cities, agriculture, and health care. Students complete a term project to develop a complete IoT application. Students are also required to complete a research project, to be determined and assigned with approval of the instructor.

**MENG-6953**

**Mobility Systems Seminar I**

Students in the professionally-oriented Master of Engineering General program may receive credit for taking seminars either through Kettering University's Professional Development Program or SAE International's Professional Development Program. To receive credit students must complete a total of four Continuing Education Units (CEU), equivalent to 40 hours of instruction, which have been reviewed and approved by a faculty review committee, consistent with Graduate academic policy. The transfer of credit must be supported by documentation from the provider for each individual applicant seeking such transfer.

**MENG-6963**

**Mobility Systems Seminar II**

Students in the professionally-oriented Master of Engineering General program may receive credit for taking seminars either through Kettering University's Professional Development Program or SAE International's Professional Development Program. To receive credit students must complete a total of four Continuing Education Units (CEU), equivalent to 40 hours of instruction, which have been reviewed and approved by a faculty review committee, consistent with Graduate academic policy. The transfer of credit must be supported by documentation from the provider for each individual applicant seeking such transfer.