MEGR Technical Electives, Spring 2026 Offerings

Course Number	Course Name Note: Students that do not complete the required prerequisites prior to the semester need to drop the follow-on course(s) (or they may be dropped from courses without notice)	Prerequisites
MEGR 3090-001 **(Brown)**	**Implicit and Field Driven Modeling for Additive Manufacturing** This course will explore the fundamental skills and applications of implicit and field driven modeling to design topologically complex parts for additive manufacturing. Topics covered will include: Meshing, Lattices, Light weighting, Textures and Ribbing, Simulation, Topology Optimization, and Design & Exporting for AM. Expected prerequisite knowledge includes: Computer aided design, Statics, and Solid Mechanics.	*MEGR 2156, MEGR 2144 and MEGR 2180 with a grade of C or better*
MEGR 3094-001 **(Kumar)**	**Energy and Decarbonization** *(approved Energy technical elective)* This course will be taught by industry experts and faculty engaged in energy-related research. The course will cover all energy sectors with focus on the impact of CO_2 emissions, the need for decarbonization, various strategies for reducing CO_2 emissions, and techno-socio-economic studies of the impact of decarbonization.	*MEGR 3111 with a grade of C or better*
MEGR 3097-001 **(Lee)**	**Biodesign: From Concept to Market** *(approved Biomedical technical elective)* Description: Working with Biology and Business students on a team to develop a bio- or biomedical device using set Biodesign principles. The devices will include Biological and Engineering concepts and the teams will develop Business Plans to bring devices to Market.	*MEGR 2279 with a grade of C or better*
MEGR 3225-001 **(Tabarraei)**	**Finite Element Analysis** *(approved Motorsports, Biomedical, Precision, Aerospace and Energy elective)* Basic concepts of FEA are introduced. Simple elements such as truss and beam elements are emphasized, with an introduction to continuum elements for structural analysis and heat transfer elements for heat transfer. Mathematics software is used to illustrate the finite element process. A commercially available finite element code is also introduced.	*MEGR 2144 and MEGR 2240, both with a grade of C or better*
MEGR 3232-001 **(Raquet)**	**Plastic Part Design** *(approved Biomedical technical elective)* This course treats the application of polymer science to contemporary design. There are two important components of this course: the science and technology of polymers (materials), and the implementation of these materials into engineering design.	*MEGR 2156 with a grade of C or better*
MEGR 3236-001 **(Zhang)**	**Introduction to Nanoscale Science and Engineering** *(approved Biomedical technical elective)* Introduction to nanoscale science and engineering. Topics include:nanomanufacturing, nanomaterials and nanostructures, properties and applications in biomedical and energy fields, experiments with nano-instruments, and related environmental issues.	*MEGR 3161 with a grade of C or better*
MEGR 3272-001 **(El-Ghanam)**	**Introduction to Bio-polymers and Composites** *(approved Biomedical technical elective)* Basics of polymer science and engineering and correlation between structural parameters and properties of the polymers including mechanical and biocompatibility properties. Examples of medical devices made of polymers and used to fix artificial joints or augment tissue will be discussed.	*MEGR 3161 with a grade of C or better*
MEGR 3282-001 **(Beaman)**	**Statistical Process Control and Metrology** *(approved Motorsports, Precision and Energy elective)* Introduction to metrology. Measurement of size, form and surface texture. Intro. to quality control, control charts for attributes and variables, acceptance sampling. Process capability estimation and process control.	*MEGR 2180 with a grade of C or better*
MEGR 4090-001 **(Schmid)**	**Design for Safety in Machines** Treatment of machinery and system safety. Emphasis is on identifying the appropriate context and applying critical thinking skills. The course relies on analysis of real-life case studies. Topics include professional codes of ethics, safety hierarchy, dependency hypothesis, safeguard classification, as well as systems issues such as computer security, safety-critical systems, intellectual property, and philosophical aspects of safety systems. Strategies for safety evaluation include failure mode and effects analysis and fault trees.	*MEGR 3221*
MEGR 4091-001 **(Wolek)**	**Astromechanics** (approved Aerospace technical elective) Introduction to astromechanics. Newton's law of gravitation. The two-body problem and types of orbits. Kepler's Laws. Orbital elements. Orbit determination. Orbit transfers (Hohmann, gravitational assist). Energy and time-of-flight relations. Interplanetary trajectories. Spacecraft mission design.	*MEGR 3121 and 2240 with grades of C or better*
MEGR 4092-001 **(Stover)**	**Advanced Road Vehicle Dynamics** *(approved Motorsports elective)* Advanced topics related to road vehicle dynamics. Topics will include tire mechanics and behavior modeling, transient handling dynamics, and vehicle modeling and simulation. This course will build on the foundations established in road vehicle dynamics to develop a more comprehensive understanding of vehicle behavior. The course will include instruction on the use of Dymola simulation software.	*MEGR 4211 with a grade of C or better*
MEGR 4092-090 **MEGR 4094-090** **(Garrett)**	**Hybrid and Alternative Fuels Automotive Powerplants** *(Motorsports elective [4092] and Energy [4094])* Coverage of multiple power sources for vehicle propulsion. Topics will include traditional IC Engines with alternative fuels, hybrid drivetrains, plug-in hybrids, battery electric vehicles, and fuel cell vehicles: packaging, controls, thermal management, refueling, and total system efficiencies of different powertrains.	*MEGR 2240, MEGR 3121 and ECGR 2161 all with a grade of C or better*
MEGR 4094-001 **(Hall)**	**Integrated Energy Systems** *(approved Energy technical elective)* This course treats energy production, transmission, distribution, and demand-side management that emphasizes subsystem interaction within larger infrastructures. Students complete applied projects—such as designing and building small-scale microgrids or solar-powered devices—to model real-world applications. The course advances Energy Engineering concentration by promoting system-level thinking and preparing students for careers in renewable integration, grid modernization, and energy system planning.	*MEGR 2156 and MEGR 2240 with a grade of C or better and MEGR 3111 or MEGR 3114 with a grade of C or better*

MEGR 4094-002 **()**	**Energy Storage Systems** *(approved Energy technical elective)* TBA	*MEGR 3111 with a grade of C or better*
MEGR 4098-001 **(Berez)**	**Geometric Specification and Verification** *(approved Precision technical elective)* Students who complete this course will be proficient in the interpretation and application of geometric dimensioning and tolerancing practices that define geometric product specifications and capture design intent. Students will also be able to select and apply dimensional inspection and coordinate metrology techniques that verify against specifications.	*MEGR 2180 and 2240 with a grade of C or better*
MEGR 4098-002 **(Tunc/Outeiro)**	**Virtual Machining for Part Quality** *(approved Precision technical elective)* The goal of this course is to impart a detailed view of machining systems and processes. Coverage of mechanics and dynamics of machining processes such as turning and milling, analysis of machine tool dynamics, performing stability analysis for turning and milling processes, cutting force simulation, tool wear and surface integrity analysis. Virtual machining used for prediction and improvement of part quality. The relation of machining processes with computer aided manufacturing (CAM), and Computer Numerical Control (CNC). A good understanding of algebra, elementary calculus, mechanics and dynamics is required.	*MEGR 2156, 2180 and 3121 all with a grade of C or better*
MEGR 4235-001 **(Boreman)**	**Waves and Optics** *(approved Precision elective)* Ray analysis of optical elements (mirrors, lenses and systems of lenses, prisms). Reflection and refraction at plane and spherical surfaces, thin and thick lenses, lens maker's equation, field of view, and numerical aperture. Wave properties of light, superposition of waves, diffraction, interference, polarization, and coherence. **Students cannot earn credit for both this course and PHYS 4271.**	*MATH 2171 and MEGR 3122 with a grade of C or better*
MEGR 4237-001 **Ghasemi**	**Introduction to Control Systems** *(approved Energy, Precision, Aerospace and Motorsports elective)* This course will address both the theoretical and practical foundations for the design of automatic control systems. The course will cover control-oriented modeling, idealized time-domain control design and real-world frequency-domain design techniques that can be used to address practical issues of environmental disturbances, model uncertainty, sensor imperfections, communication delays, and actuator dynamics.	*MEGR 3122 with a grade of C or better*
MEGR 4242-001 **(Uddin)**	**Applied Vehicle Aerodynamics** *(approved Motorsports and Aerospace technical elective)* Flow of air around streamlined and bluff bodies, aerodynamic forces, flow separation and reattachments, aerodynamic tools, introduction to computational fluid dynamics, use of commercial CFD packages to solve fluid flow problems, computer simulation and analysis of flow around bluff bodies and road vehicles including race cars.	*MEGR 2240 and MEGR 3114, with a grade of C or better*
MEGR 4272-001 **(Zheng)**	**Mechanics of the Human Locomotor System** *(approved Biomedical technical elective)* Introduces dynamic analysis of the human musculoskeletal system. Students learn to develop 3‑D rigid body models of human movement, and how to calculate internal forces in muscles and joints during daily and sports activities. Students also learn to use motion capture systems and simulation software of human locomotion.	*MEGR 2144 with a grade of C or better*
MEGR 4274-001 **(Yang)**	**Bioelectronic Medicine** *(approved Biomedical technical elective)* The basic principles of neuroscience and neural engineering, and the use of engineering principles in bioelectronic medicine. Topics include: the use of optogenetics, electrical stimulation, electromagnetic stimulation, and brain machine Interfaces as applied to solving prevalent clinical issues related to neurology and neural engineering.	*MEGR 2156, MEGR 2180, or MEGR 2279 with a C or better*
MEGR 4312-001 **(Suresh Babu)**	**Aerospace Propulsion** *(approved Aerospace technical elective)* An overview of aerospace propulsion and turbomachinery systems, including fundamentals of aerothermodynamics, compressible fluid flows, combustion, propeller propulsion, air-breathing engines, and rocket propulsion.	*MEGR 3111 and 3114 with grades of C or better*

Approved non-MEGR Technical Electives

BIOL 3161-001	**Introduction to Biotechnology** *(approved Biomedical technical elective)* An overview of basic molecular biology, techniques, and uses of biotechnology tools in environmental and biomedical fields.	*BIOL 1110 or BIOL 2120 with a C or above*
PHYS 3220-001	**Mathematical Methods in Physics** Topics include: distribution functions, solutions to ordinary and partial differential equations, boundary value problems, Fourier analysis, vectors and matrices, vector calculus, and complex variables.	*PHYS 2102 and MATH 2241 with a grade of C or better, plus MEGR 3121 as a pre- or co-requisite*

Important Notes:
- At least three of the four required technical electives must be MEGR courses.
- Students pursuing concentrations are required to complete technical electives that are approved for their concentration.
- Students with interest in a course that is outside of those listed above are required to seek approval from the Director of Undergraduate Programs before registering for such a course. Students will not receive credit otherwise.
- Students are responsible for meeting all required prerequisites for courses.