MEGR Technical Electives
Fall 2025 Offerings

Course No.	Course Name Note: Students that do not complete the required prerequisites prior to the fall semester need to drop the follow-on course(s) (or they may be dropped from courses without notice)	Prerequisites
MEGR 3090-001 **Joyee**	**Design and Analysis of Experiments in Engineering** Topics include: Simple comparative experiments, single factor experiment, randomized blocks, Latin squares, and related designs; factorial design, regression model, response surface method and other approaches to optimization; lectures and some labs that use Minitab.	*MEGR 2144 or MEGR 2180 with a grade of C or better*
MEGR 3092-090 **MEGR 3097-090** **Patalak**	**Motorsport Driver Crash Safety** ***(MEGR 3092: approved Motorsports elective; MEGR 3097: approved Biomedical technical elective)*** A class with a cross-disciplinary curriculum between Biomedical Engineering (Biomechanics) and Motorsport Mechanical Engineering used to introduce the tools and engineering principles of crash injury prevention and driver protection. The class will use examples from motorsport and passenger vehicle safety to introduce and teach occupant protection principles, which also have applicability to many modes of transportation, military vehicles, space travel and child restraint systems.	*MEGR 2141 with a grade of C or better*
MEGR 3225-001 **Tabarraei**	**Finite Element Analysis** ***(Aerospace, Motorsports, Biomedical, Precision and Energy technical elective)*** The basic concepts of FEA are introduced. Pertinent concepts from linear algebra are reviewed. Simple elements such as truss and beam elements are emphasized, with an introduction to continuum elements. Math software is used to illustrate theory fundamentals. A commercial finite element code is also introduced.	*MEGR 2144 and MEGR 2240, with a grade of C or better*
MEGR 3231-001 **Raquet**	**Advanced CAD/CAM (*approved Motorsports and Precision technical elective*)** An introduction to advanced CAD features and tools, CAM interface operations, design data management and reverse engineering; also application of the appropriate feature types to simplify the design process and increase the flexibility of the parametric model.	*ENGR 1202 and MEGR 2156 both with a C or better*
MEGR 3233-001 **El-Ghannam**	**Intro to Biomaterials** ***(approved Biomedical technical elective)*** The course will focus on classes of materials used for biomedical applications (i.e., metals, ceramics, polymers, and composites); including exposure to the multidisciplinary nature of biomaterials with aspects of materials science and life sciences; also design criteria relevant to biomedical implants.	*MEGR 3161 with a grade of C or better*
MEGR 3261-001 **Kumar**	**Sustainable Energy** ***(approved Energy technical elective)*** A treatment of global energy challenges, current energy usage, energy carriers, environmental impacts, future energy usage, transitions in energy usage and societal changes, and energy conversion technologies.	*MEGR 3112 as a pre- or co-requisite*
MEGR 3282-001 **Beaman**	**Statistical Process Control and Metrology** ***(approved Motorsports and Energy technical elective; required Precision elective)*** Introduction to metrology. Measurement of size, form and surface texture. Introduction to quality control, control charts for variables, acceptance sampling. Process capability estimation and process control.	*MEGR 2180 with a grade of C or better*
MEGR 3283-001 **Morse**	**Metrology and Precision Engineering** ***(approved Precision technical elective)*** Principles of precision design and their use in manufacturing and measurement; review of metrology and uncertainty, a case study of precision machine design, mechanical and optical methods of surface texture measurement, measurement of machine tool errors, coordinate metrology and its applications, and the role of vibration analysis in machine design.	*MEGR 2180 with a grade of C or above*
MEGR 3310-001 **Suresh Babu**	**Flight Mechanics** *(approved/required* ***Aerospace technical elective)*** This course is an introduction to the performance analysis and design of flight vehicles. Topics include: a) basic principles of flight-vehicle aerodynamics, b) performance of aircraft in gliding, climbing, level, and turning flight, c) estimation of take-off and landing distance distances as well as range and endurance, d) introduction to flight-vehicle design, and e) basics of space flight.	*MEGR 2141 with a grade of C or better*
MEGR 3452-090 **Lambert**	**Introduction to Nuclear Engineering (*approved Energy technical elective)*** An introduction to nuclear engineering and nuclear power generation. Topics include atomic and nuclear theory, radioactivity, radiation and matter, reactor theory, PWR and BWR, radiation protection, and non-power applications.	*MEGR 3112, 3114, 3116, all with a grade of C or better*
MEGR 4090-001 **MEGR 4091-001** **Grant**	**Design of High Temperature Materials** ***(4091: approved Aerospace technical elective)*** This course focuses on real-world material technologies engineered for resilience in extreme environmental applications. Students will become familiar with frameworks for selecting materials, processing methods for high temperature materials, mechanics of high temperature materials, and sources of failure, such as oxidation and corrosion, in extreme environment applications.	*MEGR 3161 with a grade of C or better*
MEGR 4090-002 **MEGR 4097-002** **Zhang**	**Microscopy for Engineering** ***(4097: approved Biomedical technical elective)*** Theory and practical experience in different microscopic techniques including optical microscopy, scanning electron microscopy, and atomic force microscopy; applications of microscopic techniques in engineering fields, such as morphological and topographic imaging of microstructures, compositional analysis, and sample preparation.	*MEGR 3161 with a grade of C or better*

MEGR 4090-003 Kelly	**Nonlinear Dynamics and Chaos** The course will treat the analysis of systems governed by nonlinear ordinary differential equations as well as nonlinear difference equations.	*MEGR 3122 with a grade of C or better*
MEGR 4098-001 Outeiro	**Intelligent and Sustainable Machining Processes** ***(approved Precision technical elective)*** This course is designed to introduce students to the fundamental skills and knowledge on machining system approach, machining technology, and programming of CNC machining tools. Topics include machine tool architecture, cutting tool technology and inspection, Computer Numerical Control (CNC)	*MEGR 2156 with a grade of B or better*
MEGR 4127-001 Conrad	**Introduction to Robotics** Modeling of industrial robots including homogeneous transformations, kinematics, velocities, static forces, dynamics, computer animation of dynamic models, motion trajectory planning, and introduction to vision, sensors, and actuators.	*MEGR 3171 and 3171L with a grade of C or better*
MEGR 4210-090 Garrett	**Automotive Power Plants** ***(approved Motorsports and Energy technical elective)*** Energy analysis of internal and external combustion engines for vehicular propulsion. Thermodynamic principles for combustion efficient use of fuel combustion, different types of fuel uses, and pollutant control.	*MEGR 3112 with a grade of C or better*
MEGR 4211-001 Stover	**Road Vehicle Dynamics** ***(approved Motorsports technical elective)*** An introduction to road vehicle Dynamics; acceleration and braking, road loads, steady-state cornering, suspension, steering system and tire behavior.	*MEGR 3122 with a grade of C or better*
MEGR 4271-001 Zheng	**Orthopedic Biomechanics** ***(approved Biomedical technical elective)*** This course will introduce mechanical properties of the human body's hard tissues and soft tissues. This course will focus on mechanical and biological considerations for treatment of orthopedic diseases and sports injuries, such as fracture, ACL injury, and osteoarthritis. Students will learn how to solve medical problems using their engineering knowledge, such as finite element analysis and inverse dynamics.	*MEGR 2144 with a grade of C or better*
MEGR 4273-001 Yang	**Regenerative Neural Engineering** ***(approved Biomedical technical elective)*** This course covers the basic principles of neuroscience and biomedical engineering, and the use of these principles in Regenerative Neural Engineering – advanced 3D bioprinting, stem cells, conductive materials, nanomaterials, and brain interfaces that relate to clinical issues and neurology.	*MEGR 2156, MEGR 2180, or MEGR 2279 with a C or better*
MEGR 4291-001 Bombik	**Battery Performance and Testing (*approved Motorsports and Energy technical elective)*** This course will present the cutting-edge advances in the materials used in batteries, such as Li-ion batteries and Li metal batteries. Discussions will include component materials (electrodes, electrolytes, separator) and full devices.	*MEGR 3152 as a prerequisite or corequisite*

Approved non-MEGR Technical Electives

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*
PHYS 4232-001	**Electromagnetic Theory II** Continuation of PHYS 4231. Topics covered include magnetostatics, electrodynamics, electromagnetic waves, potentials and fields. Three lecture hours each week.	*PHYS 4231 with a grade of C or better*
MATH 3171	**Applied Math** *(Approved ME Technical Elective but **NOT** for Motorsports, Biomedical, Precision, Aerospace or Energy concentrations; does NOT simultaneously count as a math elective)* Separation of variables techniques for the classical partial differential equations of mathematical physics; Fourier series; Sturm-Liouville theory.	*MATH 2241 and 2171, with a grade of C or better*

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.