

## MEGR Technical Electives

Fall 2023 Offerings

Course No.	Course Name <b>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)</b>	Prerequisites
MEGR 3090-001 Suresh Babu CRN:	<b>Flight Mechanics</b> 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 3092-090 MEGR 3097-090 Patalak	<b>Driver Crash Safety in Motorsports (MEGR 3092: approved Motorsports elective; MEGR 3097: approved Biomedical technical elective)</b> A class with 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 3214-090 Williams CRN:	<b>Refrigeration and Air Conditioning (approved Energy technical elective)</b> Thermodynamics and heat transfer applied to analysis, design of cooling/heating systems.	MEGR 3112 and MEGR 3116, with a grade of C or better
MEGR 3225-001 Tabarraei CRN:	<b>Finite Element Analysis (Motorsports, Biomedical, Precision and Energy technical elective)</b> 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 Raquet CRN: CRN:	<b>Advanced CAD/CAM (approved Motorsports and Precision technical elective)</b> 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 CRN:	<b>Intro to Biomaterials (approved Biomedical technical elective)</b> 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 3238-001 Zhang CRN:	<b>Microscopy for Engineering (approved Biomedical technical elective)</b> Theory and practical experience in microscopic techniques including optical microscopy and SEM; applications of microscopic techniques in engineering fields, such as morphology of microstructures, analysis of compositions, crystal structure determination, and sample preparation.	MEGR 3161 with a grade of C or above
MEGR 3241-001 McAlpine CRN:	<b>Advanced Instrumentation for Motorsports (approved Motorsports technical elective)</b> A discussion of motorsports related data acquisition, implementation, sensors, analysis techniques and challenges thereof. Students will get hands-on experience with current motorsports acquisition software, hardware and actual recorded data.	MEGR 3171 with a grade of C or better
MEGR 3261-001 Kumar CRN:	<b>Sustainable Energy (approved Energy technical elective)</b> 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 CRN:	<b>Statistical Process Control and Metrology (approved Motorsports and Energy technical elective; required Precision elective)</b> Introduction to metrology. Measurement of size, form and surface texture. Introduction 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 3283-001 CRN:	<b>Metrology and Precision Engineering (approved Precision technical elective)</b> 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 3452-090 Lambert CRN:	<b>Introduction to Nuclear Engineering (approved Energy technical elective)</b> 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 4092-001 MEGR 4094-001 Ma CRN:	<b>Materials Science in Battery Technology (MEGR 4092: approved Motorsports elective; MEGR 4094: approved Energy technical elective)</b> 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 3161 with a grade of C or better
MEGR 4090-001 MEGR 4098-001 Stuart Smith CRN: CRN:	<b>Mechatronics (MEGR 4098: approved Precision technical elective)</b> This course will introduce the development of modern engineering processes. Today's 'bricks' of process development are: mechanical, electrical, computing, and instrumentation components. These bricks must be evaluated for function and fabricated into a system to satisfy specific performance requirements. Students will use software tools to design, assemble and control electro-mechanical systems both in the laboratory and as individual hardware-based exercises.	MEGR 3171 with a grade of C or better
MEGR 4210-090 Garrett CRN:	<b>Automotive Power Plants (approved Motorsports and Energy technical elective)</b> 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 CRN:	<b>Road Vehicle Dynamics (approved Motorsports technical elective)</b> 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 4237-001 Ghasemi CRN:	<b>Introduction to Control Systems (approved Energy, Precision and Motorsports technical elective)</b> 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 4271-001 Zheng CRN:	<b>Orthopedic Biomechanics (approved Biomedical technical elective)</b> 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 CRN:	<b>Regenerative Neural Engineering (approved Biomedical technical elective)</b> This course covers the basic principles of neuroscience and biomedical engineering, and the use of these principles in Regenerative Neural Engineering – advanced 3D bio-printing, 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 3216-001 Lessani CRN:	<b>Thermal/Fluid Design (IF MEGR 3221 is completed as the Design Elective, MEGR 3216 is approved to count as a technical/Motorsports/Biomedical/Energy/Precision elective. MEGR 3216 can be used to satisfy only one requirement.)</b> Design of systems utilizing thermodynamic, heat transfer, and fluid flow principles. Topics include: thermal system design, thermodynamic modeling, design applications with heat transfer, thermo-economic optimization of simple and complex systems.	MEGR 3122, 3114 and 3116, all with a grade of C or better

### Approved non-MEGR Technical Electives

PHYS 3220-001 CRN:	<b>Mathematical Methods in Physics</b> 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 CRN:	<b>Electromagnetic Theory II</b> 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 CRN: CRN:	<b>Applied Math (Approved ME Technical Elective but NOT for Motorsports, Biomedical, Precision or Energy concentrations; does NOT simultaneously count as a math elective)</b> 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.