MEGR Technical Electives
Fall 2022 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 Suresh Babu CRN: 11636	**Flight Dynamics** This course covers the principles of steady, quasi-steady, and dynamic flight, including the forces and moments acting on flight vehicles, along with their underlying aerodynamics.	*MEGR 3114 and MEGR 3122, with a grade of C or better*
MEGR 3225-001 (Fang) CRN: 10608	**Finite Element Analysis** *(approved Motorsports, Biomedical 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 (Raquet) CRN: 11193 CRN: 12636	**Advanced CAD/CAM** *(approved Motorsports 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) CRN: 11248	**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 3238-001 (Zhang) CRN: 15990	**Microscopy for Engineering** *(approved Biomedical technical elective)* 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: 13187	**Advanced Instrumentation for Motorsports** *(approved Motorsports technical elective)* 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 (TBA) CRN: 14774	**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) CRN: 12916	**Statistical Process Control and Metrology** *(approved Motorsports and Energy technical elective)* 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 (TBA) CRN:15991	**Metrology and Precision Engineering** 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: 11249	**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 (TBA) CRN: 16479	**Materials Science in Battery Technology** *(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 3161 with a grade of C or better*

MEGR 4090-002 CRN: 17172	**Electric Vehicle Battery Modeling and Estimation** *(approved Motorsports and Energy technical elective)* Automotive drive cycle analysis and range estimation for conventional vehicles, hybrid vehicles and electric vehicles. Fuel efficiency, carbon emissions, and power requirements of all three types of vehicles will be discussed. Electrochemical modeling of battery charge/discharge cycles and degradation aging using Kalman Filter and other state estimation techniques.	*MEGR 3112, MEGR 3122, MEGR 3171 all with a grade of C or better*
MEGR 4143-001 (Smith) CRN: 14775	**Discrete Mechanical Vibrating Systems** Free and forced vibrations of lumped parameter systems with multi-degrees of freedom. Topics include transient and steady state response, determination of natural frequencies and mode shapes with and without damping.	*MEGR 3122 with a grade of C or better*
MEGR 4210-090 (TBA) CRN: 16123	**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 (TBA) CRN: 16124	**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 4237-001 (Ghasemi) CRN: 16125	**Introduction to Control Systems** *(approved Energy and Motorsports technical 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 4271-001 (Zheng) CRN: 16126	**Orthopedic Biomechanics** *(approved Biomedical technical elective)* This course will introduce mechanical properties of 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: 16127	**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 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*

Approved non-MEGR Technical Electives

PHYS 3220-001 CRN: 10099	**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 CRN: 10121	**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 CRN: 10823 CRN: 12047	**Applied Math** *(Approved ME Technical Elective but **NOT** for Motorsports, Biomedical 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:

Students must take at least three of the four required technical electives from MEGR-designated courses.

Students who wish to take a technical elective course outside of those listed above must receive approval from the Director of Undergraduate Programs **before** registering for such courses. Students will not receive credit otherwise.

Students pursuing concentrations must complete technical electives that are approved for their concentration.

Students are responsible for meeting all required prerequisites for elective courses.