

MEGR Technical Electives

Fall 2017 Offerings

Course No.	Course Name	Prerequisites
	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)	
MEGR 3090-001 (Zhang) CRN 13360	Microscopy for Engineering (<i>approved Biomedical engineering technical elective</i>) This course is designed for undergraduate students to learn basic theory and gain practical experience in microscopic techniques including optical microscopy, scanning electron microscopy (SEM), and transmission electron microscopy (TEM). Students will learn applications of microscopic techniques in engineering fields, such as morphology of microstructures, analysis of compositions, crystal structure determination, and sample preparation. Lab sessions will introduce the use of optical microscopes, SEMs, and TEMs.	<i>MEGR 3161 with a grade of C or above</i>
MEGR 3090-002 (Tkacik) CRN 13361	Advanced Motorsports Testing Methods (<i>approved Motorsports technical elective</i>) This course will incorporate lectures, research and experimental labs relating to jet propulsion, rockets, underwater propulsion, high-speed vehicles, etc. Labs will involve configuring instrumentation and data acquisition as well as analysis of data collected during experiments.	<i>ECGR 2161 with a grade of C or above</i>
MEGR 3090-003 (Cho) CRN 13362	Biomedical Microfluidics (<i>approved Biomedical Eng. elective</i>) Microfluidics is the study of flow phenomena at small length scales with characteristic channel dimensions typically less than the diameter of human hair. Miniaturization of fluid handling systems allows the development of micro Total Analysis Systems (microTAS) or so called "lab-on-a chip" which combines biological and chemical sample preparation, separation and analysis in a single device. This course covers the principles of fluid flow in microchannels, microfabrication techniques, applications, and hands-on lab activities to make and test microfluidic devices.	<i>MEGR 3111 and 3114, with a grade of C or better</i>
MEGR 3090-004 (Elliott) CRN 14430	Biological Thermodynamics (<i>approved Biomedical Engineering elective</i>) This course will explore the energy transductions that occur in and between living organisms, structures, and cells, and the thermodynamic principles that underlay these transductions. The first third of the course will cover aqueous solution thermodynamics, then explore the fundamentals of biomolecule and cell thermodynamics and their application to problems in Biological and Biomedical Engineering. Biological/Biomedical Engineering applications that will be explored include cell cryopreservation, stabilization of protein therapeutics, and the design of drug delivery constructs.	<i>MEGR 3111 with a grade of C or better</i>
MEGR 3092-001 (McAlpine) CRN 15444	Advanced Instrumentation for Motorsports (<i>approved Motorsports technical elective</i>) 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.	<i>MEGR 3171 with a grade of C or better</i>
MEGR 3094-090 CRN 16798	Turbomachinery (<i>approved Energy technical elective</i>) Fundamentals of turbo machines with emphasis on steam, gas, and wind turbines. The principles of fluid mechanics, thermodynamics and aerodynamics will be utilized to the design and analysis of turbines, pumps and compressors. Types and classification of turbo machines, principle of operation, Euler's equation, components of energy transfer, concept of impulse and reaction, efficiency, and other performance parameters of turbo machines	<i>MEGR 3112 and MEGR 3114, both with a grade of C or above</i>
MEGR 3094-001 CRN 12910	Sustainable Energy (<i>approved Energy elective</i>) This course is designed to give students an understanding of the design and operation of sustainable energy systems.	<i>MEGR 3112 with a grade of C or above</i>
MEGR 3210-090 (Garrett) CRN 11182	Automotive Power Plants (<i>approved Motorsports technical elective</i>) 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.	<i>MEGR 3112 with a grade of C or above</i>
MEGR 3211-001 (Replogle) CRN 13368	Road Vehicle Dynamics (<i>approved Motorsports technical elective</i>) An introduction to road vehicle Dynamics; acceleration and braking, road loads, steady-state cornering, suspension, steering system and tire behavior.	<i>MEGR 3122 with a grade of C or above</i>
MEGR 3225-001 (TBA) CRN 11185	Finite Element Analysis (<i>approved Motorsports, Biomedical and Energy elective</i>) 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.	<i>MEGR 2144 and MEGR 2240, both with a grade of C or above</i>

MEGR 3231-001 (Raquet) CRN 12311	Advanced CAD/CAM (<i>approved Motorsports technical elective</i>) 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 above
MEGR 3233-001 (El-Ghannam) CRN 12435	Intro to Biomaterials (<i>approved Biomedical engineering technical elective</i>) 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 above
MEGR 3235-001 (Davies) CRN 13369	Waves and Optics 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 above
MEGR 3452-090 (Lambert) CRN 12436	Introduction to Nuclear Engineering (<i>approved Energy technical elective</i>) 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, MEGR 3114, and MEGR 3116, all with a grade of C or above
MEGR 4143-001 (Schmitz) CRN 13127	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 above.

Approved non-MEGR Technical Electives

PHYS 3220-001 CRN 10176	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 above, plus MEGR 3121 as a pre- or co-requisite
PHYS 4232-001 CRN 10217	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 above
PHYS 4271-001 CRN 10179	Waves and Optics Topics include ray analysis of common optical elements, wave properties of light, the superposition of periodic and non-periodic waves, and selected topics from geometrical and physical optics. *Students cannot earn credit for both this course and MEGR 3235.	MATH 2171 with a grade of C or above; Pre- or co-requisite: MEGR 2144)
MATH 3171 CRN 11611 or 14774	Applied Math (<i>Approved ME Technical Elective but NOT for Motorsports, Biomedical or Energy concentrations; does NOT simultaneously count as a math elective</i>) Separation of variables techniques for the classical partial differential equations of mathematical physics; Fourier series; Sturm-Liouville theory. (FALL ONLY)	MATH 2241 and 2171, with a grade of C or above

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 the Department of Mechanical Engineering 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.