

MEGR Technical Electives
Spring 2020 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 (Schmid) CRN 21576	Advanced Manufacturing Processes Treatment and analysis of inter-relationships between manufacturing processes, material structures and properties, and product design and performance including real-world examples that relate to a diverse array of career interests.	<i>MEGR 2156, MEGR 2180, and MEGR 2144 with a C or better</i>
MEGR 3094-001 (Keanini) CRN 21751	Dynamics and Thermodynamics of Compressible Flow (<i>approved Energy technical elective</i>) Compressible flow equations, isentropic flow, normal shock waves, Fanno and Rayleigh line flows. Nonsteady one dimensional flow.	<i>MEGR 3121, MEGR 3112, and MEGR 3114 with a C or better</i>
MEGR 3097-001 (El-Ghannam) CRN 26159	Introduction to Bio-polymers and Composites (<i>approved Biomedical technical elective</i>) This course will address the 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.	<i>MEGR 3161 with a grade of C or better</i>
MEGR 3097-002 Beth Smith CRN 26160	Modeling Fluid Flows in Human Physiology (<i>approved Biomedical technical elective</i>) This course will introduce the application of engineering principles and modeling techniques to human physiology. The three main topics in the class will be: blood flow modeling, system modeling using the lumped parameter approach (including exposure to the BioGears Engine), and cardiovascular system modeling in Matlab.	<i>MEGR 2240 and MEGR 3114 with a C or better</i>
MEGR 3097-003 (Elliot) CRN 26161	Thermal Applications in Biomedical Engineering (<i>approved Biomedical technical elective</i>) Application of thermodynamic and heat transfer principles to the analysis of biomedical systems. Topics include: thermodynamic and transport properties of biological tissue, thermoregulation, design and use of cryosurgical probes, and numerical modeling methods.	<i>MEGR 3111 with a C or better as a prerequisite; MEGR 3116 as a pre- or co-requisite</i>
MEGR 3097-004 (Yang) CRN 26162	Bioelectronic Medicine (<i>approved Biomedical technical elective</i>) This course covers the basic principles of bioelectronic device application in nerve system, and the use of these principles in clinical neural engineering. Bioelectronic medicine is an interdisciplinary scientific fields to study implantable devices to control electrical signals in nerves to treat a range of debilitating chronic diseases.	<i>MEGR 2156, MEGR 2180, or MEGR 2279 with a C or better</i>
MEGR 3225-001 (Bobba) CRN 20631	Finite Element Analysis (<i>approved Motorsports, Biomedical and Energy technical elective</i>) The basic concepts of FEA are introduced. Necessary concepts from linear algebra are reviewed. 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.	<i>MEGR 2144 and MEGR 2240, both with a grade of C or better</i>
MEGR 3231-001 (Raquet) CRN 24747	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.	<i>ENGR 1202 and MEGR 2156 both with a C or better</i>
MEGR 3232-001 (Raquet) CRN 21513	Plastic Part Design (<i>approved Biomedical technical elective</i>) This course will be valuable to our students due partly to the strong emphasis we have on design and the great need for understanding in 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.	<i>MEGR 2156 with a grade of C or better</i>
MEGR 3234-001 (Zheng) CRN 21754	Introduction to Biodynamics (<i>approved Biomedical technical elective</i>) This course will introduce dynamic analysis of the human musculoskeletal system. Students will learn to develop lumped mass, planar and 3D rigid body models of human movement, and learn to calculate internal forces in muscles and joints during daily and sports activities.	<i>MEGR 2144 and 3121, both with a grade of C or better</i>
MEGR 3235-001 (Davies) CRN 26167	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.	<i>MATH 2171 and MEGR 3122 with a grade of C or better</i>
MEGR 3237-090 (Ghasemi) CRN 26168	Introduction to Control Systems (<i>approved Energy and Motorsports technical elective</i>) 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.	<i>MEGR 3122 with a grade of C or better</i>

MEGR 3240-090 (Garrett) CRN 26169	Advanced Automotive Powerplants (<i>approved Motorsports technical elective</i>) This is a follow-on course to Automotive Powerplants (MEGR 3210). Topics include combustion, thermodynamic efficiency, fuel efficiency, torque and power, emissions, etc.	<i>MEGR 3210 with a grade of C or better</i>
MEGR 3242-090 (Uddin) CRN 22463	Applied Vehicle Aerodynamics (<i>approved Motorsports technical elective</i>) The goal of this course is to provide the students with an in-depth knowledge of ground vehicle aerodynamics. Topics include: aerodynamic forces and moments; the effect of air viscosity; aerodynamic drag and drag reducing devices; aerodynamic lift and negative lift producing devices, spoiler and wings; rolling, pitching and yawing moments; effect of aerodynamic forces on speed, fuel consumption, acceleration, cornering, and braking; Wind tunnel testing and CFD.	<i>MEGR 2240, 3111, and MEGR 3114, all with a grade of C or better</i>
MEGR 3244-001 (Tkacik) CRN 26170	Tire Mechanics (<i>approved Motorsports technical elective</i>) In-depth analysis of the tire and its influence on vehicle performance, including: design, materials, construction, structural response, rolling resistance, force and moment generation, NVH, traction, wear, high speed limit, and standards. Tire models, their limitations, and their governing equations.	<i>MEGR 2144 and with a grade of C or better; MEGR 3121 as a pre- or co-requisite</i>
MEGR 3260-001 (Sarunac) CRN 26171	Introduction to Clean Coal Technology (<i>approved Energy technical elective</i>) This course will cover the basics of coal combustion, pollutant formation, measurement of emissions; emissions regulations, measurement of power plant performance, and options for performance improvement of existing and the newly-constructed power-generation fleet.	<i>MEGR 3112 and 3114 with a grade of C or better; pre- or co-requisite: MEGR 3116</i>
MEGR 3282-001 (Morse) CRN 20649	Statistical Process Control and Metrology (<i>approved Motorsports and Energy engineering elective</i>) 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.	<i>MEGR 2180 with a grade of C or better</i>
MEGR 3283-001 (Evans) CRN 26172	Metrology and Precision Engineering This course covers the principles of precision design and their use in manufacturing and measurement. Topics will include a 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.	<i>MEGR 2180 with a grade of C or better</i>

Approved non-MEGR Technical Electives

PHYS 3220-002 CRN 24437	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.	<i>PHYS 2102 and MATH 2241 with a grade of C or better, plus MEGR 3121 as a pre- or co-requisite</i>
PHYS 4242-001 CRN 23794	Quantum Mechanics II Continuation of PHYS 4241. Topics include: perturbation theory, atoms in external electric and magnetic fields, the Stark and Zeeman effects, the WKB approximation, selection rules for electromagnetic radiation, scattering theory, multi-electron atoms, electrons in solids, Bose-Einstein and Fermi-Dirac distributions.	<i>PHYS 4241 with a grade of C or above.</i>

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.**