

Summary of Graduate Courses Offered in Fall 2025 (1)

Course Number	Day	Time	Course Title	Concentration Area in the MSME program
MEGR 5090-001	MWF	1010-1100	Topics in Mech Engineering: Design of High Temperature Materials	Solid Mechanics and Materials Science (need petition)
MEGR 5090-002	TR	1430-1545	Topics in Mech Engineering: Microscopy for Engineering	Solid Mechanics and Materials Science (need petition)
MEGR 5090-003	TR	1730-1845	Topics in Mech Engineering: Nonlinear Dynamics and Chaos	Dynamics and Control (need petition)
MEGR 5098-001	TR	1000-1115	Topics in Precision Engineer: Intelligent and Sustainable Machining Processes	Metrology and Manufacturing (need petition)
MEGR 5210-090	MW	1730-1845	Automotive Power Plants	Motorsports and Automotive Engineering
MEGR 5211-001	TR	1730-1845	Road Vehicle Dynamics	Motorsports and Automotive Engineering
MEGR 5271-001	MW	1430-1545	Orthopedic Biomechanics	Interdisciplinary Biomedical Engineering
MEGR 5273-001	TR	1300-1415	Regenerative Neural Engineering	Interdisciplinary Biomedical Engineering
MEGR 5291-001	TR	0830-0945	Battery Performance and Testing	Battery Engineering; <i>or</i> Motorsports and Automotive Engineering (need petition)
MEGR 5292-001	TR	1600-1715	Materials Science in Battery Technology	Battery Engineering; <i>or</i> Motorsports and Automotive Engineering (need petition); <i>or</i> Solid Mechanics and Materials Science (need petition)
MEGR 6141/8141-001	MWF	1115-1205	Theory of Elasticity	Solid Mechanics and Materials Science

Summary of Graduate Courses Offered in Fall 2025 (2)

Course Number	Day	Time	Course Title	Concentration Area in the MSME program
MEGR 6166/8166-001	MWF	1220-1310	Mechanical Behavior of Materials I	Solid Mechanics and Materials Science
MEGR 6181/8181-001	TR	1600-1715	Engineering Metrology	Metrology and Manufacturing
MEGR 7090/8090-001	MW	1600-1715	Topics in Mechanical Engineer: Data Driven Science and Scientific Computation	Metrology and Manufacturing (need petition)
MEGR 7090/8090-002	MW	1430-1545	Topics in Mechanical Engineer: Advanced Finite Element Analysis with Abaqus	Solid Mechanics and Materials Science (need petition)
MEGR 7090/8090-003	MW	1600-1715	Topics in Mechanical Engineer: Multiphase Flow	Thermal Science and Fluid Mechanics (need petition)
MEGR 7090/8090-004	TR	1430-1545	Topics in Mechanical Engineer: Digital Manufacturing	Metrology and Manufacturing (need petition)
MEGR 7090/8090-005	TR	1730-1845	Topics in Mechanical Engineer: Advanced Metrology and Applications	Metrology and Manufacturing (need petition)
MEGR 7114/8114-001	MWF	1325-1415	Advanced Fluid Mechanics	Thermal Science and Fluid Mechanics
MEGR 7172/8172-001	TR	0830-0945	Computational Methods in Engineering	Mathematics Requirement <i>or</i> capstone course
MEGR 7174/8174-001	MW	1730-1845	Engineering Analysis I	Mathematics Requirement
MEGR 7225/8225-001	TR	0830-0945	Linear Systems Theory	Dynamics and Control

Brief Description of Special Topics Courses (1)

Course Number	Course Title	Brief Course Description
MEGR 5090-001	Topics in Mech Engineering: Design of High Temperature Materials	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 5090-002	Topics in Mech Engineering: Microscopy for Engineering	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 5090-003	Topics in Mech Engineering: 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 5098-001	Topics in Precision Engineer: Intelligent and Sustainable Machining Processes	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).

Brief Description of Special Topics Courses (2)

Course Number	Course Title	Brief Course Description
MEGR7090/8090-001	Topics in Mechanical Engineer: Data Driven Science and Scientific Computation	This course provides an overview of mathematical tools used in data analysis to create "data-driven" surrogate models, such as digital twins, simplified physical process models, and preprocessing for machine learning. It emphasizes the mathematical principles of the Discrete Fourier Transform and linear algebra, including Eigenvectors and Singular Value Decomposition, applicable to Digital Signal Processing and Dimensionality Reduction. A substantial part of the course (50%) is dedicated to programming and problem-solving in Matlab, which requires prior knowledge of Matlab and programming.
MEGR7090/8090-002	Topics in Mechanical Engineer: Advanced Finite Element Analysis with Abaqus	This graduate-level course provides an in-depth study of the Nonlinear Finite Element Method (FEM), blending theory with hands-on computational lab sessions using Abaqus. Designed for students seeking to enhance their expertise in computational mechanics, this course covers nonlinear FEM, dynamic analysis, fracture mechanics, and topology optimization.
MEGR7090/8090-003	Topics in Mechanical Engineer: Multiphase Flow	The course will cover the following topics: (1) Thermodynamics of multiphase systems (equilibrium and stability of single phase and multiphase systems, Gibbs function, single-phase and multiphase multicomponent systems, etc.). (2) Governing equations of multiphase systems (Macroscopic equations for conservation of mass, momentum, and energy; differential form of conservation equations). (3) Modeling of multiphase flows (overview of averaging approach, homogeneous model, mixture model, numerical simulation of interfaces and free surfaces, modeling of fluid-solid system, Eulerian Lagrangian approach). (4) Condensation (dropwise condensation, filmwise condensation). (5) Evaporation (Liquid film on a wall, droplet evaporation in a gas). (6) Two-phase flow and heat transfer (vertical and horizontal tubes). (7) If time permits (Boiling: pool, nucleate, film boiling).

Brief Description of Special Topics Courses (3)

Course Number	Course Title	Brief Course Description
MEGR7090/8090-004	Topics in Mechanical Engineer: Digital Manufacturing	Digital manufacturing is an integrated manufacturing approach that leverages computer-based technologies to enhance the efficiency of manufacturing operations and to improve the quality of products and services. As an integrated approach it links systems and processes across all areas, from design to production and on the maintenance and support of the end products. Examples of such computer-based technologies are: Internet of Things (IoT), Big Data, Artificial Intelligence, Machine Learning, Augmented Reality, Cloud Computing, Advanced Robotics, Additive Manufacturing, and Digital Twin. Digital Manufacturing technologies contributes for the fourth industrial revolution also be called Industry 4.0. This course on Digital Manufacturing provides students with the opportunity to acquire the fundamental knowledge of computer-based technologies used in manufacturing, and to prepare them for the implementation of such technologies in the industry. Therefore, the students will be better prepared to address the present and future manufacturing challenges, thus to be succeed in today's competitive business market.
MEGR7090/8090-005	Topics in Mechanical Engineer: Advanced Metrology and Applications	This course explores advanced metrology principles and applications, focusing on uncertainty analysis, surface texture, form measurement, coordinate measuring machines (CMMs), laser trackers, 3D scanners, X-ray computed tomography (CT), and gears. Software and standards used for these topics will be reviewed and analyzed. Students will discuss real-world metrology challenges with industry experts and CPM graduate alumni in industry and government labs. If possible, they will also visit advanced metrology labs in the area. Through projects(one or two), students will develop case studies, solve industrial metrology problems, conduct comprehensive reviews of specialized metrology topics, and explore the development of AI agents/co-pilots using the RAG (Retrieval-Augmented Generation) technique, preparing them for research and professional applications in precision measurement.