Summary of Graduate Courses Offered in Spring 2025 (1)

Course Number	Day	Time	Course Title	Concentration Area in the MSME program
MEGR5090-001	TR	0830-0945	Topics in Mech Engineering: Uncrewed Aerial Vehicles	Dynamics and Controls (need petition)
MEGR5090-002	MW	1730-1845	Topics in Mech Engineering: Aerospace Propulsion	
MEGR5092-001	TR	1600-1715	Topics in Motorsports Engineer: Advanced Road Vehicle Dynamics	Motorsports and Automotive Engineering (need petition)
MEGR5092-090	MW	1730-1845	Topics in Motorsports Engineer: Hybrid and Alternative Fuels Automotive Powerplants	Motorsports and Automotive Engineering (need petition)
MEGR5094-001	MWF	1325-1415	Topics in Energy Engineering: Renewable Energy Technologies and Applications	

Summary of Graduate Courses Offered in Spring 2025 (2)

Course Number	Day	Time	Course Title	Concentration Area in the MSME program
MEGR5098-001	TR	1430-1545	Topics in Precision Engineer: Geometric Specification and Verification	Metrology and Manufacturing (need petition)
MEGR5098-002	MWF	1010-1100	Topics in Precision Engineer: Virtual Machining for Part Quality	Metrology and Manufacturing (need petition)
MEGR5235-001	MW	1430-1545	Waves and Optics	
MEGR5242-001	TR	1430-1545	Applied Vehicle Aerodynamics	Motorsports and Automotive Engineering
MEGR5272-001	TR	1600-1715	Mechanics of the Human Locomotor System	Interdisciplinary Biomedical Engineering
MEGR5274-001	TR	1430-1545	Bioelectronic Medicine	Interdisciplinary Biomedical Engineering
MEGR5290-001	MW	1600-1715	Introduction to Electric Vehicles and Batteries	Motorsports and Automotive Engineering (need petition); *or* Battery Engineering

Summary of Graduate Courses Offered in Spring 2025 (3)

Course Number	Day	Time	Course Title	Concentration Area in the MSME program
MEGR7090/8090-001	MWF	0905-0955	Topics in Mechanical Engineer: Machine Learning in Manufacturing and Materials	Metrology and Manufacturing (need petition)
MEGR7090/8090-002	MW	1600-1715	Topics in Mechanical Engineer: Optical Metrology with Matlab	Metrology and Manufacturing (need petition)
MEGR7090/8090-003	TR	1300-1415	Topics in Mechanical Engineer: Failure of Materials	Solid Mechanics and Materials Science (need petition)
MEGR7090/8090-004	MWF	0800-0850	Topics in Mechanical Engineer: Additive Manufacturing Technology	Metrology and Manufacturing (need petition)
MEGR7090/8090-005	MWF	1325-1415	Topics in Mechanical Engineer: Multi-axis Machining	Metrology and Manufacturing (need petition)
MEGR7108/8108-001	TR	1600-1715	Finite Element Analysis & Applications	Solid Mechanics and Materials Science

Summary of Graduate Courses Offered in Spring 2025 (4)

Course Number	Day	Time	Course Title	Concentration Area in the MSME program
MEGR7117/8117-001	MWF	1220-1310	Statistical Thermodynamics	Fluid Mechanics and Thermal Science
MEGR7142/8142-001	MWF	1115-1205	Theory of Elasticity II	Solid Mechanics and Materials Science
MEGR7175/8175-001	MW	1730-1845	Engineering Analysis II	
MEGR7182/8182-001	MW	1430-1545	Machine Tool Metrology	Metrology and Manufacturing
MEGR7213/8213-001	TR	1000-1115	Introduction to Computational Fluid Dynamics	Fluid Mechanics and Thermal Science
MEGR7226/8226-001	TR	1000-1115	Optimal Control Theory	Dynamics and Controls
MEGR7283/8283-001	TR	1730-1845	Advanced Coordinate Metrology	Metrology and Manufacturing

Brief Description of Special Topics Courses (1)

Course No.	Course Title	Brief Course Description
MEGR5090-001	Topics in Mech Engineering: Uncrewed Aerial Vehicles	Fundamental concepts and technologies related to the dynamics, control, navigation, and guidance of fixed-wing uncrewed aerial vehicles (UAVs). Course offered annually in the Spring semester for 3 credit hours of graduate credit.
MEGR5090-002	Topics in Mech Engineering: Aerospace Propulsion	An overview of aerospace propulsion and turbomachinery systems, including fundamentals of aerothermodynamics, compressible fluid flows,combustion, propeller propulsion, air-breathing engines, and rocket propulsion.
MEGR5092-001	Topics in Motorsports Engineer: Advanced Road Vehicle Dynamics	Advanced topics related to road vehicle dynamics. Topics will include tire mechanics and behavior modeling, transient handling dynamics, and vehicle modeling and simulation. This course will build on the foundations established in road vehicle dynamics to develop a more comprehensive understanding of vehicle behavior. The course will include instruction on the use of Dymola simulation software, and this software will be used to illustrate and explore the concepts covered over the semester.
MEGR5092-090	Topics in Motorsports Engineer: Hybrid and Alternative Fuels Automotive Powerplants	Coverage of multiple power sources for vehicle propulsion. Topics will include traditional IC Engines with alternative fuels (e.g. hydrogen), hybrid drivetrains that incorporate an IC Engine with electric motors, plug-in hybrids, battery electric vehicles, and fuel cell vehicles. The challenges and opportunities for each system will be discussed including packaging, controls, thermal management, refueling, and total system efficiencies.
MEGR5094-001	Topics in Energy Engineering: Renewable Energy Technologies and Applications	This course introduces renewable energy systems that include solar, wind, geothermal, hydropower, biomass, and ocean energy. A primary focus will be on turbine technologies. Specifically, we will examine the energy conversion processes, system efficiency, performance analysis, and the design and operation of these systems. Technical aspects will explore fluid flow, drivetrain mechanics, and electrical energy production. Students will apply what they have learned from the class, especially the concepts of energy conversion, modeling systems, and efficiency, to a real-world project in renewable energy.

Brief Description of Special Topics Courses (2)

Course No.	Course Title	Brief Course Description
MEGR5098-001	Topics in Precision Engineer: Geometric Specification and Verification	This course reconciles the engineering design process with manufacturing quality control. These two conceptual domains of geometric specification (a feature of the design process) and verification (a feature of quality control), often presented separately, are brought together in a comprehensive and integrated manner in this class. Students will learn to (i) develop and interpret rigorous engineering drawings, (ii) convey and recognize design intent via geometric specification, and (iii) anticipate and apply inspection and metrology techniques that verify manufactured components to meet specification. These goals will be met through coverage topics such as geometric dimensioning and tolerancing (GD&T), dimensional inspection techniques, and coordinate metrology. Recent developments and advancements in these areas will also be presented, including digital product definition/model-based definition, digital twins, 'Industry 4.0,' novel metrology techniques, and computational metrology.
MEGR5098-002	Topics in Precision Engineer: Virtual Machining for Part Quality	The goal of this course is to impart a detailed view of machining systems and processes. In one semester the course will cover mechanics and dynamics of machining processes such as turning and milling, analysis of machine tool dynamics through impact hammer tests and modal analysis, performing stability analysis for turning and milling processes, cutting force simulation, tool wear and surface integrity analysis. This course will be delivered in the virtual machining used for prediction and improvement of part quality context. The course will also include the relation of machining processes with computer aided manufacturing (CAM), and Computer Numerical Control (CNC). A good understanding of algebra, elementary calculus, mechanics and dynamics are required.

Brief Description of Special Topics Courses (3)

Course Number	Course Title	Brief Course Description
MEGR7090/8090-001	Topics in Mechanical Engineer: Machine Learning in Manufacturing and Materials	The main topic of this course is machine learning in manufacturing and materials. Machine learning is a subset of the broader topic of Artificial Intelligence (AI), and a discussion of manufacturing processes and materials intimately involves design. Therefore, this course serves as an introduction to the applications of AI in tackling mechanical engineering problems, especially in design, manufacturing, and materials. The topics cover different behaviors that make an agent intelligent, often a computer program that performs tasks like humans, e.g., representing knowledge, solving problems with reasoning, learning from observation or direct instruction, perceiving the world, and communicating through language.
MEGR7090/8090-002	Topics in Mechanical Engineer: Optical Metrology with Matlab	Course topics include various techniques that are used in optical metrology. Matlab will be used in this course. The objective of this course is to provide an overview of coherent optical measurement techniques that are commonly used in industrial applications.
MEGR7090/8090-003	Topics in Mechanical Engineer: Failure of Materials	This course focuses on the failure of structural materials such as metals and alloys. The goal is to understand and predict the materials failure in real service conditions, where they are subjected to high temperatures, cyclic loads, and other environments. ● Part 1: we will discuss elastic and plastic deformation, defects and microstructure, and their roles on mechanical properties. ● Part 2: we will discuss various types of failure modes, including creep, fracture, fatigue and radiation damage.

Brief Description of Special Topics Courses (4)

Course Number	Course Title	Brief Course Description
MEGR7090/8090-004	Topics in Mechanical Engineer: Additive Manufacturing Technology	3D printing or additive manufacturing (AM) is a class of technologies that build a 3D object directly from digital models. In recent years, with advances in material, energy, process and machine development, AM technologies are moving rapidly into the production end of manufacturing in creative and sometimes unexpected ways. AM technologies have been widely adopted in industries such as medical field, aerospace, education, arts, and architecture to name a few. Understanding the principles, advantages and limitations of AM technologies is important for future engineers in solving practical problems in a variety of working environments and bringing innovations to the industry. The objective of this course on 3D printing/AM is to provide students the opportunity to learn about various important aspects of AM technologies. The course will include an introduction to AM, computational aspects, physical modeling of part creation, process and quality control, feedstock materials, AM part properties, design for AM and applications of AM technologies and parts.
MEGR7090/8090-005	Topics in Mechanical Engineer: Multi-axis Machining	This course covers the advanced CAD/CAM applications, which are used in metal cutting processes. The theoretical and practical aspects for modelling, simulation and CNC Programming techniques will be discussed. The topics covered during the lectures will be applied through homework, lab sessions and a course project. Techniques for analytical surfaces representation and modeling, surface generation techniques in CAD environment, theoretical aspects of toolpath computation for 3 and 5 axis milling, machining strategies offered by commercial CAM packages, theoretical and practical aspects of post processing issues for 3 and 5 axis milling will be covered. Process modeling for simulation and verification of 3 and 5 axis milling processes will be covered. Machining systems such as CNC machines and robotic manufacturing systems will be focused.