MECHANICAL ENGINEERING (ME)

100 Level Courses

ME 151: *Practicum in Engineering.* 2 credits.
This course provides students with experiences in algorithmic thinking, visualization and communications. An essential component of this course is preparation of students for the National Academy of Engineering Grand Challenge Scholars Program. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Registration Restrictions:
Required Prerequisites: ((CS 109[C], 112[C], 112[XS] or ENGR 125T) and (ENGH 100[C], 100[XS], 101[C], 101[XS], HNRS 110[C] or 110[XS])).
[C] Requires minimum grade of C.
[XS] Requires minimum grade of XS.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Laboratory

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

200 Level Courses

ME 211: *Statics.* 3 credits.
An initial course in applied vector mechanics with emphasis on static equilibrium. Topics include forces, moments, couples, equivalent force-couple systems, centroids, distributed forces, and Coulomb friction. The application of the free body diagram in the analysis of static equilibrium of frames, machines and trusses is stressed. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts. Equivalent to CEIE 210.
Registration Restrictions:
Required Prerequisites: ((PHYS 160[C] or 160[XS]) and (MATH 114[C], 114[XS], 116[C] or 116[XS])).
[C] Requires minimum grade of C.
[XS] Requires minimum grade of XS.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Lecture, Recitation

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 212: *Solid Mechanics.* 3 credits.
A first course in mechanics of deformable bodies with emphasis on the engineering approach to the responses of these bodies to various types of loadings. Topics include stress-strain relationships, stress-strain analysis, stress and strain transformation (Mohr's circle), load-deflection, bending, torsion, buckling, and thermal effects. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts. Equivalent to CEIE 310.
Recommended Corequisite: MATH 214.

Registration Restrictions:
Required Prerequisites: (ENGR 210[C], CEIE 210[C], 210[XS], ME 211[C] or 211[XS]).
[C] Requires minimum grade of C.
[XS] Requires minimum grade of XS.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Lecture, Recitation

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 221: *Thermodynamics.* 3 credits.
A basic thermodynamics course in which the first and second laws of thermodynamics are studied primarily from the classical macroscopic viewpoint and applied to both closed and open systems. Working substances include perfect gases, real gases and vapors in addition to solids and liquids. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Registration Restrictions:
Required Prerequisites: ((PHYS 160[C] or 160[XS]) and (PHYS 161[C] or 161[XS]) and (MATH 114[C], 114[XS], 116[C] or 116[XS])).
[C] Requires minimum grade of C.
[XS] Requires minimum grade of XS.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Lecture, Recitation

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 231: *Dynamics.* 3 credits.
A course in classical vector dynamics. Topics include vector algebra and calculus, kinematics and kinetics of particles and rigid bodies, as well as energy and momentum methods. Extensive problem solving involving particle and rigid body motion is required. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Recommended Corequisite: MATH 214.

Registration Restrictions:
Required Prerequisites: (ME 211[C], 211[XS], CEIE 210[C] or 210[XS]).
[C] Requires minimum grade of C.
[XS] Requires minimum grade of XS.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Lecture, Recitation

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

300 Level Courses

ME 311: *Mechanical Experimentation I.* 1 credit.
Experimental measurements in solid mechanics and materials science. Involves technical report writing. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Recommended Corequisite: ME 313.

Registration Restrictions:
Required Prerequisites: ME 212[C] or 212[XS].
[C] Requires minimum grade of C.
[XS] Requires minimum grade of XS.

Enrollment is limited to students with a major in Mechanical Engineering.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Laboratory

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 313: *Material Science.* 3 credits.
An introductory course in physical and mechanical properties of engineering design materials, ceramics and plastics, their structures, use in engineering applications and failure phenomena. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Registration Restrictions:
Required Prerequisites: ((((CHEM 211[C] or 211[XS]) and (CHEM 213[C] or 213[XS])) or (CHEM 251[C] or 251[XS]) or ((CHEM 271[C] or 271[XS]) and (CHEM 272[C] or 272[XS]))) and (ME 212[C], 212[XS], BENG 230[C], 230[XS], CEIE 310[C] or L310)).
[C] Requires minimum grade of C.
[XS] Requires minimum grade of XS.

Enrollment is limited to students with a major, minor, or concentration in Bioengineering or Mechanical Engineering.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 321: *Mechanical Experimentation II.* 1 credit.
Experimental measurements in fluid mechanics and heat transfer. Involves technical report writing. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Recommended Corequisite: ME 323.

Registration Restrictions:
Required Prerequisites: (ME 322[C] or 322[XS]).
[C] Requires minimum grade of C.
[XS] Requires minimum grade of XS.

Enrollment is limited to students with a major in Mechanical Engineering.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Laboratory

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 322: *Fluid Mechanics.* 3 credits.
An introductory course in fluid dynamics stressing both the integral and differential forms of the conservation laws of fluid flow. Engineering applications are made to hydrostatics and to ideal and real fluid flows. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Registration Restrictions:
Required Prerequisites: (ME 221[C] or 221[XS]) and (ME 231[C] or 231[XS]) and (MATH 214[C] or 216[C]).
[C] Requires minimum grade of C.
[XS] Requires minimum grade of XS.

Enrollment is limited to students with a major, minor, or concentration in Mechanical Engineering.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 323: *Heat Transfer.* 3 credits.
Study of thermal radiation, steady and transient conduction, laminar and turbulent convection, internal and external flow, boundary layers and empirical correlations. Applications address fins, nuclear reactor cooling, heat exchangers and interactive computing. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Registration Restrictions:
Required Prerequisites: (ME 322[C] or 322[XS]).
[C] Requires minimum grade of C.
[XS] Requires minimum grade of XS.

Enrollment is limited to students with a major, minor, or concentration in Mechanical Engineering.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 331: *Mechatronics.* 3 credits.
Study of electromechanical systems, utilizing the fundamentals of circuit theory to design, build, and control mechanical devices. Topics include electrical devices, sensors, microcontrollers, data acquisition, instrumentation and interfaces. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Registration Restrictions:
Required Prerequisites: (ECE 330[C], 330[XS] or 286[C]).
[C] Requires minimum grade of C.
[XS] Requires minimum grade of XS.

Enrollment is limited to students with a major in Mechanical Engineering.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 341: *Design of Mechanical Elements.* 3 credits.
Fundamentals of mechanical design. Introduction to the fundamentals of static and fatigue failure theories, design of basic machine elements such as fasteners, bearings, gearing and shafts. Builds on the fundamentals of design introduced in earlier courses by introducing the concepts of customer requirements, specification development, reverse engineering, functional decomposition, and design for manufacturing. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Registration Restrictions:
Required Prerequisites: (ME 212[C], 212[XS], CEIE 310[C] or L310[C]).
[C] Requires minimum grade of C.
[XS] Requires minimum grade of XS.

Enrollment is limited to students with a major, minor, or concentration in Mechanical Engineering.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 342: *Design of Thermal Systems.* 3 credits.
Study of equipment which operates on principles of thermodynamics. Applications include gas and vapor power cycles, refrigeration and air conditioning systems, propulsion systems, combustion, energy conversion and compressible flow. Systems will be will be designed and optimized using economic constraints. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Registration Restrictions:
Required Prerequisites: (ME 221[C] or 221[XS]).
[C] Requires minimum grade of C.
[XS] Requires minimum grade of XS.

Enrollment is limited to students with a major, minor, or concentration in Mechanical Engineering.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 351: *Analytical Methods in Engineering.* 3 credits.
Survey of advanced mathematics topics needed in the study of engineering. Topics include vector differential and integral calculus, matrix analysis, partial differential equations, complex variables, numerical methods, data analysis using statistics and probability theory. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Registration Restrictions:
Required Prerequisites: (ME 151[C] or 151[XS]) and (MATH 214[C], 214[XS], 216[C], 216[XS] or U214[C]) and (ME 231[C]).
[C] Requires minimum grade of C.
[XS] Requires minimum grade of XS.

Enrollment is limited to students with a major, minor, or concentration in Mechanical Engineering.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 352: *Entrepreneurship in Engineering.* 3 credits.
Introduces students to the concept of entrepreneurship and how to translate technical skill sets to commercial success. Topics include creating a business plan, pitching ideas, risk mitigation, and selecting investment alternatives. Emerging technology related to Mechanical Engineering will be analyzed in this context. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Recommended Prerequisite: Completion of at least 15 credits hours in major courses.

Registration Restrictions:
Enrollment limited to students with a class of Junior, Senior Plus or Senior.

Enrollment is limited to students with a major, minor, or concentration in Mechanical Engineering.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 395: *Mechanical Engineering Internship.* 0-3 credits.
Students will participate in experiential learning in an industrial setting. Students must identify work opportunity and seek approval from the internship coordinator prior to registering. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May be repeated within the degree for a maximum 6 credits.
Registration Restrictions:
Required Prerequisites: ((ME 212[C] or 212[XS]) and (ME 221[C] or 221[XS]) and (ME 231[C] or 231[XS])).
[C] Requires minimum grade of C.
[XS] Requires minimum grade of XS.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Internship

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

400 Level Courses

ME 409: *Data Center Engineering.* 3 credits.
This course is an introduction to Data Center Engineering (infrastructure side design, construction, and daily operations). Emphasis is on understanding and applying design techniques and construction processes which will result in a decarbonized data center. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/

engineering-computing/engineering/mechanical/). Limited to two attempts.
Registration Restrictions:
Enrollment limited to students with a class of Senior Plus or Senior.

Enrollment is limited to students with a major, minor, or concentration in Computer Engineering, Electrical and Computer Engr, Electrical Engineering or Mechanical Engineering.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 410: *Biosafety Laboratories.* 3 credits.
This course is intended to train students in the design, operation, and maintenance of biosafety laboratories of critical importance for public health, safety, and welfare. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Recommended Prerequisite: ME 342

Registration Restrictions:
Required Prerequisites: ME 323[C] or BENG 230[C].
[C] Requires minimum grade of C.

Enrollment limited to students with a class of Junior Plus, Junior, Senior Plus or Senior.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 413: *A Seat at the Table.* 3 credits.
In this interactive, discussion-based course we delve into engineering history, societal impact, and case studies to better understand engineering innovation in the present and the future. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Specialized Designation: Mason Impact.

Registration Restrictions:
Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 414: *Fatigue Analysis.* 3 credits.
This course is an introduction to some of the main concepts of deformation processes leading to fracture; linear elastic fracture mechanics and fatigue crack propagation. Fatigue and fracture of a wide variety of materials including metals, composites, and biomaterials will be covered. Particular attention will be given to fatigue analysis of metals and composites used in aerospace structures, natural biomaterials such as bone and additively manufactured metals (metal 3D printing)ina and laminated materials. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Registration Restrictions:
Required Prerequisites: (ME 313[C] or 313[XS]).
[C] Requires minimum grade of C.
[XS] Requires minimum grade of XS.

Enrollment limited to students with a class of Senior Plus or Senior.

Enrollment is limited to students with a major, minor, or concentration in Mechanical Engineering.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 415: *Composite Materials.* 3 credits.
This course will develop an understanding of the structural mechanics of composite materials and applications in aerospace, civil, and mechanical engineering. Students will identify fundamental relationships for predicting the mechanical response of multi layered materials and structures and micromechanical and macromechanical relationships for lamina and laminated materials. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Registration Restrictions:
Required Prerequisites: (ME 313[C] or 313[XS]).
[C] Requires minimum grade of C.
[XS] Requires minimum grade of XS.

Enrollment limited to students with a class of Senior Plus or Senior.

Enrollment is limited to students with a major, minor, or concentration in Mechanical Engineering.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 421: *HVAC Design.* 3 credits.
Included in this course is an introduction to thermodynamics, fluid mechanics and heat transfer as they apply to Heating, Ventilation, and Air Conditioning (HVAC). Emphasis is on understanding the refrigeration cycle, psychrometrics, building heating, cooling, and ventilation load estimation, duct design including insulation material selection, vibration and noise control, building energy efficiency concepts, building system controls, and system component selection. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Recommended Prerequisite: ME 342

Registration Restrictions:
Required Prerequisites: (ME 323[C] or 323[XS]).
[C] Requires minimum grade of C.
[XS] Requires minimum grade of XS.

Enrollment limited to students with a class of Senior Plus or Senior.

Enrollment is limited to students with a major, minor, or concentration in Mechanical Engineering.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 422: *Computational Fluid Dynamics (CFD) for Mechanical Engineers.* 3 credits.
This class provides an introduction to the principles and applications of CFD. The foundational theory and governing equations of fluid flow and heat transfer will be presented and applied using commercial software. Students will develop the ability to set up, run, and interpret the results of CFD simulations of primarily mechanical engineering problems. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Recommended Prerequisite: ME 351

Registration Restrictions:
Required Prerequisites: (CS 112[C], 109[C] or ENGR 125T) and ME 322[C].
[C] Requires minimum grade of C.

Enrollment limited to students with a class of Junior Plus, Junior, Senior Plus or Senior.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 423: *Microfluidics.* 3 credits.
This course focuses on the physics of transport of mass, momentum, and energy in micro- and nanofluidic devices. At the core of the subject is fluid mechanics at the micrometer scale, where liquids behave quite differently than they do in our daily lives. These behaviors include pumping fluid with electricity and without moving parts (known as “electro-osmosis”), or flows that require no external driving force at all, but instead are driven by capillary action (the driving force behind paper microfluidics, a burgeoning subfield). Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Registration Restrictions:
Required Prerequisites: ME 322[C] or BENG 230[C].
[C] Requires minimum grade of C.

Enrollment limited to students with a class of Junior Plus, Junior, Senior Plus or Senior.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 425: *Renewable Energy Engineering.* 3 credits.
Study of renewable resources and the technology used to convert these to usable forms of energy. Solar PV, Solar Thermal, Wind, Hydro, Tidal, Geothermal, Biomass and the economics driving the system design process will be discussed. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Specialized Designation: Green Leaf Related Course

Recommended Prerequisite: ME 352 or CEIE 301

Registration Restrictions:
Required Prerequisites: (PHYS 260[C] or 260[XS]).
[C] Requires minimum grade of C.
[XS] Requires minimum grade of XS.

Enrollment limited to students with a class of Senior Plus or Senior.

Enrollment is limited to students with a major, minor, or concentration in Civil and Infrastructure Engr, Environmental Engineering, Electrical Engineering or Mechanical Engineering.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 432: *System Dynamics and Controls.* 4 credits.
Covers modeling and analysis of a wide range of mechanical and electrical systems. Topics include: derivation of transfer functions using Laplace transform; system analysis in both time domain and frequency domain; state-variable models; assessment of system stability; introduction to feedback controls; and use of computer tools (Matlab). Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Registration Restrictions:
Required Prerequisites: (ME 351[C] or 351[XS]) and (ECE 286[C], 286[XS], 330[C] or 330[XS]).
[C] Requires minimum grade of C.
[XS] Requires minimum grade of XS.

Enrollment is limited to students with a major, minor, or concentration in Mechanical Engineering.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Laboratory, Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 443: *Mechanical Design I.* 3 credits.
The first course in a two-semester capstone design sequence. Topics include the engineering design process, project management, codes and standards, engineering ethics, and computer-aided design. Students form design teams, select a capstone design project and progress through the proposal and preliminary design stages of the project. The capstone design project continues in ME 444. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.

Registration Restrictions:
Required Prerequisites: (ME 212[C], 313[C] and 323[C] and (((ME 341[C] or 342[C]) and ME 351[C]) or CS 367[C])).
[C] Requires minimum grade of C.

Enrollment is limited to students with a major in Applied Computer Science or Mechanical Engineering.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 444: *Mechanical Design II.* 3 credits.
The second of the two-semester capstone design course sequence. Students continue with concept selection, detail design, prototyping and evaluation of their major design projects. Formal presentations and reports are prepared to review and document the designs. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Mason Core: Mason Core, Mason Apex, Writing Intensive in Major (https://catalog.gmu.edu/mason-core/)

Registration Restrictions:
Required Prerequisites: ME 443[C] or 443[XS].
[C] Requires minimum grade of C.
[XS] Requires minimum grade of XS.

Enrollment is limited to students with a major in Mechanical Engineering.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 445: *Finite Element Analysis.* 3 credits.
This course will develop an understanding of how finite element analysis (FEA) can be applied to mechanics and thermal fluids problems. Students will apply the mathematics of FEA to solve engineering problems and utilize software packages to aid in analysis. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Registration Restrictions:
Required Prerequisites: (ME 351[C] or 351[XS]).
[C] Requires minimum grade of C.
[XS] Requires minimum grade of XS.

Enrollment is limited to students with a major, minor, or concentration in Mechanical Engineering.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 446: *Energetics.* 3 credits.
This course will develop an understanding of the basic science of energetic systems. Basic properties of explosives, propellants, and pyrotechnics will be discussed; as well as basics systems and safety engineering using energetic materials. Application of energetic materials in different industries (i.e. automotive air bags as well as oil/gas industries) will be discussed. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Recommended Prerequisite: ME 313

Registration Restrictions:
Enrollment limited to students with a class of Senior Plus or Senior.

Enrollment is limited to students with a major, minor, or concentration in Mechanical Engineering.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 447: *Computer-Aided Design.* 3 credits.
This is an advanced course exploring tools used in computer-aided design. Students will explore the role of computer-aided design in mechanical component and system design by creating geometric models, assemblies and engineering drawings. Students will enter the course familiar with CAD tools and basic part modelling and upon completion be able to create parametric designs, moving assemblies, and presentation quality documents. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Registration Restrictions:
Required Prerequisites: (ME 151[C] and 212[C]).
[C] Requires minimum grade of C.

Enrollment is limited to students with a major, minor, or concentration in Mechanical Engineering.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 453: *Developing the Societal Engineer.* 2 credits.
A course which highlights, through speakers, discussions and workshops, the professional responsibility of a being a mechanical engineer. Additional topics that will be covered include ethical issues, current events and trends in the profession. Engineering case studies will be explored. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Registration Restrictions:
Required Prerequisites: ME 443[*C] or 443[*XS].
[*] May be taken concurrently.
[C] Requires minimum grade of C.
[XS] Requires minimum grade of XS.

Enrollment is limited to students with a major in Mechanical Engineering.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 454: *Project Mgmt for Engineers.* 3 credits.
Introduction to the fundamentals of project management. Students will understand the proposal process, apply decision-making and analysis tools to select a winning proposal, perform network scheduling techniques to identify the critical path for a project, and understand and apply the interpersonal skills to lead and manage highly effective project teams. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Registration Restrictions:
Enrollment limited to students with a class of Junior Plus, Junior, Senior Plus or Senior.

Enrollment is limited to students with a major, minor, or concentration in Bioengineering, Civil and Infrastructure Engr or Mechanical Engineering.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 466: *Advanced Materials Engineering.* 3 credits.
Introduction to advanced materials design, manufacturing methods, characterization and their applications in energy, environmental, biology, and so on. General discussions of advanced materials, from multidisciplinary fundamental research to consumer products, suitable for all levels and specializations. This course provides an opportunity for students to learn the superior properties of advanced materials, which lies at the interfaces of chemistry, physics and biology, and their broader impact nowadays. The associated lab sessions include advanced manufacturing, materials characterization, and cleanroom section. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Registration Restrictions:
Required Prerequisite: ME 313[C].
[C] Requires minimum grade of C.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 467: *Nanosensors.* 3 credits.
This course discusses a wide range of sensing mechanisms, including fluorescent sensing, nanocantilever oscillators, electrochemical detection, optical and plasmonic sensing, and magnetic detection. This course discusses types of nanomaterials, such as gold nanoparticles, quantum dots, graphene, graphene oxides, magnetic nanoparticles, carbon nanotubes, inorganic nanowires/nanorods, plasmonic nanostructures, photonic crystals, carbon nanotubes, fullerenes, fluorescent and biological molecules, and nanostructured silicon. This course explains how to utilize the unique properties of nanomaterials to develop high performance Nanosensors. This course also introduces various types of nano sensors including temperature, strain, light, spectrophotometric, pulse oximeter, optical fiber probes, fluorescence, pH, ion-selective electrodes, piezoelectric, glucose, DNA and immunosensors, microfluidic and paper-based lab-on-a-chip devices. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Registration Restrictions:
Required Prerequisites: (CHEM 211[XS], 211[C], 271[XS] or 271[C]).
[XS] Requires minimum grade of XS.
[C] Requires minimum grade of C.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 471: *Introduction to Astronautics.* 3 credits.
Astronautics is the study of space and its uses. This course will introduce the student to multiple aspects of space and space sciences, such as orbital mechanics, satellite subsystems, space systems engineering, launch, and re-entry. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Registration Restrictions:
Required Prerequisites: (ME 231[C] or 231[XS]).
[C] Requires minimum grade of C.
[XS] Requires minimum grade of XS.

Enrollment is limited to students with a major, minor, or concentration in Computer Engineering, Electrical Engineering or Mechanical Engineering.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 472: *Spacecraft Subsystems.* 3 credits.
Spacecraft are complex systems of systems made up of many separate subsystems. In this course we shall study the various types of subsystems, learn their functions and major components, and understand the interaction between them to make a functional spacecraft. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Recommended Corequisite: ME 471

Registration Restrictions:
Required Prerequisites: (ME 231[C] or 231[XS]).
[C] Requires minimum grade of C.
[XS] Requires minimum grade of XS.

Enrollment is limited to students with a major, minor, or concentration in Computer Engineering, Electrical Engineering or Mechanical Engineering.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 473: *Space Systems Propulsion.* 3 credits.
Analysis of launch vehicle and in-space propulsion systems; fundamentals and engineering of rocket engines. Introduction to advanced propulsion systems including combined cycle, pressure-gain combustion, nuclear, and physics-based. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Recommended Prerequisite: ME 471

Registration Restrictions:
Required Prerequisites: (ME 221[C] or 221[XS]).
[C] Requires minimum grade of C.
[XS] Requires minimum grade of XS.

Enrollment is limited to students with a major, minor, or concentration in Mechanical Engineering.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 475: *Aeronautics I.* 3 credits.
Aeronautics I will expose students to the applied science of atmospheric flight. The course focuses on aircraft and introduces elements that are incorporated into design, manufacture and performance of flight-capable, air-breathing machines operating within the troposphere Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Registration Restrictions:
Required Prerequisites: ((ME 212[C] or 212[XS]) and (ME 322[C] or 322[XS])).
[C] Requires minimum grade of C.
[XS] Requires minimum grade of XS.

Enrollment is limited to students with a major, minor, or concentration in Mechanical Engineering.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 476: *Aeronautics II.* 3 credits.
Aeronautics II is the second course of the two course sequence and extends the principles and topics covered in Aeronautics I. The course reviews multiple topics related to aerodynamics and various principles of aircraft flight. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Registration Restrictions:
Required Prerequisites: (ME 475[C] or 475[XS]).
[C] Requires minimum grade of C.
[XS] Requires minimum grade of XS.

Enrollment is limited to students with a major, minor, or concentration in Mechanical Engineering.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 477: *Aircraft Propulsion.* 3 credits.
Analysis of aircraft propulsion systems; fundamentals of jet propulsion including air breathing engines and turbomachinery used for atmospheric flight. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Recommended Prerequisite: ME 342

Registration Restrictions:
Required Prerequisites: (ME 221[C] or 221[XS]).
[C] Requires minimum grade of C.
[XS] Requires minimum grade of XS.

Enrollment is limited to students with a major, minor, or concentration in Mechanical Engineering.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 480: *Machine Learning for Mechanical Engineers.* 3 credits.
This course provides a hands-on introduction to machine learning (ML) as applied to physical and mechanical systems. Students will gain experience in applied machine learning concepts, building an understanding of how such algorithms can support real-world systems. The students will learn to use industry-standard tools and libraries to apply ML in computer vision, anomaly detection, robotics/autonomy, among other areas. Additionally, students will gain an understanding of key factors relating to the application of ML in real-world systems, including the conditions under which ML is an appropriate tool to use, human-machine interaction considerations, and sociological and ethical considerations. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Recommended Corequisite: ME 432

Registration Restrictions:
Required Prerequisites: (CS 112[C] or SYST 130[C]) and (ME 351[C] or MATH 344[C]).
[C] Requires minimum grade of C.

Enrollment limited to students with a class of Junior Plus, Junior, Senior Plus or Senior.

Schedule Type: Lecture

Grading:

This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 498: *Independent Study in Mechanical Engineering.* 0-4 credits.
Directed self-study of topics of special interest. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May be repeated within the term for a maximum 6 credits.
Specialized Designation: Topic Varies

Registration Restrictions:
Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Independent Study

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 499: *Special Topics in Mechanical Engineering.* 0-4 credits.
Topics of special interest to undergraduates. Notes: May be repeated for credit when topic is different. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May be repeated within the term for a maximum 24 credits.
Specialized Designation: Topic Varies

Registration Restrictions:
Enrollment limited to students with a class of Senior Plus or Senior.

Enrollment is limited to students with a major, minor, or concentration in Mechanical Engineering.

Students with the terminated from CEC major attribute may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

500 Level Courses

ME 500: *Mechanical Engineering Seminar.* 0-4 credits.
This course will acquaint graduate students with the state of the art in mechanical engineering research. Students will attend seminars and provide a final written report summarizing what they learned over the term. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May be repeated within the degree for a maximum 6 credits.
Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Seminar

Grading:
This course is graded on the Graduate Special scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 521: *Energy Transfer.* 3 credits.
Study of thermal fluid sciences related to energy systems. Provides foundations in thermodynamics, mass transfer, fluid mechanics, and heat transfer in steady systems. Covers modelling and analysis of engineering devices such as pumps, heat exchangers, turbines, and airfoils which constitute energy systems. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May not be repeated for credit.
Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the College of Science, Engineering Computing or Schar School of Policy and Gov colleges.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 531: *Energy Transmission.* 3 credits.
Introduces analysis of local and national electrical grids used for power transmission and develops understanding of economic constraints on energy systems. Students will model energy transmission systems with dynamic loads ensuring energy security and optimal performance. Advanced topics such as forecasting for renewable energy integration, smart grid implementation, and utilization of emerging energy storage technology are covered. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May not be repeated for credit.
Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the College of Science, Engineering Computing or Schar School of Policy and Gov colleges.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 541: *Power Generation.* 3 credits.
Study of traditional and advanced power generation technology. Builds upon conservation principles of mass, energy, and momentum to analyze, model and optimize energy systems based on physical principles. Specific attention will be paid to site specific conditions for generation. Advanced cycles will be covered which utilize fossil fuel, renewable, and nuclear energy. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May not be repeated for credit.
Recommended Prerequisite: ME 521.

Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the College of Science, Engineering Computing or Schar School of Policy and Gov colleges.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 542: *Energy Utilization.* 3 credits.
Covers energy utilization by end users. Technology and system integration are covered for applications such as combined heat power units and transportation. Students will use energy audit techniques to identify and minimize energy losses from the demand side. Investment, payback, and subsidies for purchasing energy system updates will be evaluated. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May not be repeated for credit.
Recommended Prerequisite: ME 521.

Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the College of Science, Engineering Computing or Schar School of Policy and Gov colleges.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 551: *Naval Engineering.* 3 credits.
This course will provide learners exposure to specific needs of naval vessels. Through understanding a design's concept of operations and mission, students will learn how to identify needed vessel capabilities and integration, such as radar and sonar, combat systems, damage control, and special mission systems to support unmanned and manned air, surface, sub-surface vessels and other payloads. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May not be repeated for credit.
Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 552: *Fundamentals of Naval Architecture.* 3 credits.
Students learn the fundamentals of naval architecture including ship geometry and definitions, intact, damaged, and submarine stability and trim, structural fundamentals, resistance and propulsion, seakeeping, maneuverability, and control. Case studies are utilized to provide a real-world grounding to the academic work in this class. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May not be repeated for credit.
Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 553: *Ship Design Process and Tools.* 3 credits.
Students are taught the theory and practice of ship design. Topics will include the development of requirements, the design spiral, set-based design, application of computational tools to efficient evaluation of the design space, ship classification, and cost. The class culminates in a ship design project. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May not be repeated for credit.
Recommended Prerequisite: ME 551 ME 552

Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 554: *Naval Project Management.* 3 credits.
Students will be taught key concepts in program and project management for defense acquisition, maintenance, and modernization efforts. Through lectures, case studies, and practical exercises, learners will better understand how to bring a design from the drafting table to the fleet. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May not be repeated for credit.
Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 575: *AI Design and Deployment Risks.* 3 credits.
This course will explore the fundamental issues that underpin risk inherent in systems that utilize AI. Students will learn how to measure these risks, assess the impacts and harms that could results from AI, and formulate plans for managing risks including testing, maintenance, governance and legal interventions. Topics will include AI robustness, generalizability, validity, reliability, safety, and security and students will develop risk assessment plans for a domain of their choice. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May not be repeated for credit.
Recommended Corequisite: (CS 480 or 580) or (ECE 427, 527 or 554)

Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 576: *AI: Ethics, Policy, and Society.* 3 credits.
Artificial intelligence (AI) technologies are rapidly expanding across multiple domains, leading to significant debate about its ethical and societal impacts. Still a matter of debate is what appropriate legal and governance structures should be created to ensure the ethical design, development, deployment, and use of AI. Further complicating the debate is the question of which parties and stakeholders should contribute to creating AI governance structures and mechanisms. The course will explore pressing issues in ethics and policy, including transparency, privacy and surveillance, misinformation and disinformation, fairness, algorithmic bias (from both underlying data and modeling choices), justice, equity, trust, and labor practices and supply chains. These topics will be grounded in specific use cases often drawn from cutting edge topics in the news. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May not be repeated for credit.
Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 577: *Emerging AI & Robotics Tech Seminar.* 1 credit.
This seminar focuses on student-led critical analyses of emerging AI issues in the news across all domains. Speakers from industry and government will also participate. May be repeated within the certificate, BS degree, MS degree, and PhD degree for a maximum 2, 3, 3, and 6 credits respectively. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May be repeated within the degree for a maximum 6 credits.
Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Seminar

Grading:
This course is graded on the Satisfactory/No Credit scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 585: *Human Robot Interaction.* 3 credits.
Introduction to the theory, principles, and methods used to model, design and test automated, autonomous or robotic systems that require or support human interaction. Focus areas include understanding the theory and mechanics of both human and robot perception and cognition, the design of interaction architectures such as teleoperation and human supervisory control, and how to conduct principled tests and experiments of human-robot systems. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

600 Level Courses

ME 620: *Mechanical Engineering Decision Making.* 3 credits.
Fundamentals of decision making with applications to mechanical engineering product and systems design, system reliability, and system operation and maintenance; product/system evaluation and optimization; design and systems theory; and social choice theory. This course takes the view that engineers are decision makers and presents the fundamentals of good decision making in the context of mechanical engineering. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May not be repeated for credit.
Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 621: *Foundations of Fluid Mechanics.* 3 credits.
Derivation of the fundamental equations of fluid mechanics, including the Navier-Stokes equations, conservation of mass, and the vorticity transport equations. Vector and Cartesian tensor notation are used throughout. Equations of motion are applied to incompressible viscous and inviscid flows. Some aspects of turbulence are discussed. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May not be repeated for credit.

Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the College of Science, Engineering Computing or Schar School of Policy and Gov colleges.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 631: *Advanced Dynamics of Mechanical Systems.* 3 credits.
This course introduces the principles and methods for formulating and analyzing mathematical models of mechanical and robotic systems using Newtonian, Lagrangian, and Hamiltonian formulations of particle and rigid body dynamics. Additional topics include geometric mechanics, symmetry and reduction, and application to some basic problems in mechatronics, robotics, and autonomy. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May not be repeated for credit.
Recommended Prerequisite: Dynamics (ME231) or equivalent

Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 641: *Robot System Integration.* 3 credits.
Building complex systems such as robots requires knowledge and expertise across many different fields, as well as the ability to integrate them. The aim of this course is for the students to gain hands-on experience in building a robot system by integrating different components of the system. The lectures will cover fundamental topics in robotics including microcontroller, circuits, mechanical systems, modeling, perception and control. Towards the end of the course, the lectures will focus on topics focused on system integration. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). Limited to two attempts.
Registration Restrictions:
Required Prerequisites: ME 631[B-], ECE 521[B-], CS 580[B-] and CYSE 550[B-].
[B-] Requires minimum grade of B-.

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 698: *Research Study in Selected Mechanical Engineering Topics.* 3 credits.
This is a research based course that allows graduate students to work on a special research topic. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May be repeated within the degree for a maximum 6 credits.
Recommended Prerequisite: Graduate Student Standing and Permission of the Instructor

Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Independent Study

Grading:
This course is graded on the Graduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 699: *Advanced Special Topics in Mechanical Engineering.* 3 credits.
Advanced topics in mechanical engineering will be taught in this course. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May be repeated within the term for a maximum 6 credits.
Recommended Prerequisite: Permission of the Instructor

Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

700 Level Courses

ME 714: *Fracture Mechanics.* 3 credits.
Investigation of linear elastic and elastic-plastic fracture mechanics. Topics include: theory of elasticity and plasticity, energy and stress approach to fracture mechanics, methods to determine the stress intensity factor, fracture mechanics testing, fatigue crack growth. Develop a basic understanding of how crack-like defects impact performance in structures and learn how to select materials to ensure damage tolerance. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May not be repeated for credit.
Recommended Prerequisite: Introductory graduate level course in advanced strength of materials or theory of elasticity, or consent of the instructor.

Registration Restrictions:
Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the College of Science, Engineering Computing or Schar School of Policy and Gov colleges.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 715: *Impact Dynamics.* 3 credits.
Includes advanced dynamics of impact, impact biomechanics, as well as vehicle crashworthiness standards and accident data analysis. Students will learn about FMVSS and NCAP crash tests. FARS and NASS real world accident databases, and methods to analyze crash and accident data. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May not be repeated for credit.
Recommended Prerequisite: ME 231, ME 212 or equivalent courses.

Registration Restrictions:
Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the College of Science, Engineering Computing or Schar School of Policy and Gov colleges.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 721: *Advanced Fluid Mechanics.* 3 credits.
The course is intended to provide engineering students with the opportunity to apply theoretical ideas developed in ME 621 to specific problems in inviscid and viscous flows, including turbulence. We will be exclusively concerned with incompressible flows. Although this is not a CFD course, a full understanding of theoretical aspects of fluid mechanics is a prerequisite for understanding and using CFD-simulations. Models used in CFD such as k-epsilon, Reynolds-averaged Navier-Stokes (RANS), Large-eddy (LES), and Direct (DNS) will be discussed. Specially designed projects are intended to enable students to apply what they have learned to different flow situations. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May not be repeated for credit.
Recommended Prerequisite: ME 621

Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate or Non-Degree.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 722: *Introduction to Turbulence.* 3 credits.
Introduces beginning graduate students to the theory of turbulence. The theory of homogeneous-isotropic turbulence is introduced, followed by a discussion of sheared and wall-bounded turbulence. Some aspects of coherent structures in turbulence will be introduced as well as models used in computing turbulence. Specially designed projects are intended to enable students to apply what they have learned to different flow situations. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May not be repeated for credit.
Recommended Prerequisite: ME 621.

Registration Restrictions:
Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the College of Science, Engineering Computing or Schar School of Policy and Gov colleges.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 723: *Compressible Flow.* 3 credits.
This course is intended to provide engineering students with the opportunity to study the fluid mechanics of a compressible gas. Topics of interest include one-dimensional gas flows, flow of gas in convergent-divergent ducts, choked flows, high speed flows, physical acoustics, and shock waves. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May not be repeated for credit.
Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate or Non-Degree.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 724: *Viscoelastic Flow.* 3 credits.
Many flows in nature behave very differently than air or water. Such flows may possess elasticity, or may have complex viscosities. Examples include blood, corn starch solutions, and solutions of high molecular weight polymers. This course will introduce the students to the theoretical methods that are needed to model the behavior of such viscoelastic fluids. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May not be repeated for credit.
Recommended Prerequisite: ME 621

Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate or Non-Degree.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 728: *Foundations of Heat Transfer.* 3 credits.
This course provides an introduction to the mechanisms of heat transfer. The course first covers the fundamentals of conduction, natural and forced convection, radiation, and phase-change heat transfer. Modeling of thermal systems, such as thermosyphons or heat exchangers, will be emphasized. The semester concludes with important and emerging application areas, including heat transfer in biological systems, sustainable power generation, and nanoscale heat transfer. Grades are determined by performance on homework, journal article review, final project, and take-home midterm and final examinations. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May not be repeated for credit.
Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate or Non-Degree.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 732: *Advanced Thermodynamics.* 3 credits.
An advanced thermodynamics course for graduate students in engineering, incorporating both classical and statistical thermodynamics. Explores the origins of thermodynamic parameters and equations such as equations of state, heat capacities, and Maxwell Relations. Students develop the ability to apply these principles to challenges in modern engineering research in fields such as molecular simulation, materials, biotechnology, and mechanics. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May not be repeated for credit.
Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate or Non-Degree.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 740: *Introduction to Continuum Mechanics.* 3 credits.
This course covers tensor analysis, state of stress, material and spatial descriptions of motion of a continuous medium, kinematics of deformation, general principles of solid mechanics, fluid mechanics and thermomechanics and balance principles: mass, momentum, and energy. Constitutive equations of large-deformation elasticity, and an introduction to inelasticity are also covered. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May not be repeated for credit.
Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate or Non-Degree.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 741: *Theory of Elasticity.* 3 credits.
This course is intended to introduce graduate students to the field of linear elasticity. The governing equations of linear elasticity are developed before solving the problems of plane elasticity. The course also covers boundary value problems and the Airy stress function method associated with plane elasticity. Specialized topics may include: three-dimensional problems, energy and numerical methods. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May not be repeated for credit.
Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate or Non-Degree.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 742: *Finite Element Analysis for Solids.* 3 credits.
This course focuses on numerical solutions of elasticity/inelasticity and heat transfer. Strong and weak forms as general solution processes for differential equations are presented. Formulation of finite elements and interpolation functions and overall solution processes with the finite element method are covered. MATLAB programing is used for coding and in addition a modern (commercial) finite element code is discussed. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May not be repeated for credit.
Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate or Non-Degree.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 745: *Mechanics and Properties of Materials.* 3 credits.
This course is intended to introduce graduate students to the field of solid mechanics. The theories of elastic stress and strain are covered before moving on to inelastic behavior. Torsion and bending of solid and thin-walled bars are covered. Specialized topics include: buckling, fatigue and fracture mechanics. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May not be repeated for credit.
Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate or Non-Degree.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:

This course is graded on the Graduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 750: *Nanomaterials Enabled Renewable Energy.* 3 credits.
This course is intended to introduce beginning graduate students to the advanced nanomaterials, as well as their applications in renewable energy, i.e. photovoltaics and energy storage devices. Students will investigate how nano-materials can be used to harness renewable energy. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May not be repeated for credit.
Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate or Non-Degree.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 751: *Advanced Materials for Water Treatment.* 3 credits.
This course is intended to introduce graduate students to the specific advanced materials which play an important role in the water treatment. In particular, the course will focus on water desalination and water purification. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May not be repeated for credit.
Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate or Non-Degree.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 753: *Tribology and Surface Engineering.* 3 credits.
The course covers essential topics in tribology and surface mechanics as well as advanced surface engineering techniques. By definition, tribology is the science and engineering of interacting surfaces under relative motion. It is an interdisciplinary area involving the multiscale study and application of the friction, lubrication and wear principles in engineering and design. This course, in particular, covers nano/micro/macro-contact of surfaces, mechanics of friction and adhesion, surface failures, boundary and thin film lubrication, and an introduction to emerging tribology (e.g., micro/nanotribology, biotribology and harsh environment tribology). Also covered are topics on advanced surface manufacturing and engineering techniques for improving functionality of several material systems. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May not be repeated for credit.
Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate or Non-Degree.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 754: *Introduction to Nano-Materials.* 3 credits.
Introduction to the properties of nanomaterials, nanotechnology and their applications in energy, environmental, biology, and medicine. General discussion of nanotechnology, from multidisciplinary fundamental research to consumer products, suitable for all levels and specializations. This course provides an opportunity for students to learn the superior properties of nanomaterials, the evolving nanotechnology which lies at the interfaces of chemistry, physics and biology, and their broader impact nowadays. This course includes sessions providing hands-on training on a scanning electron microscope (SEM), atomic force microscopy (AFM), advanced manufacturing and cleanroom usage. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May not be repeated for credit.
Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate or Non-Degree.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 755: *Optofluidics.* 3 credits.
Optofluidics is an emerging field which seeks to understand fluids and optics at micro and nanoscale. This course provides an overview of the fundamental physics of optics and fluid mechanics (e.g. the Maxwell equations and the Navier-Stokes equations) and discusses how they interact at small scales to create many new applications. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May not be repeated for credit.
Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate or Non-Degree.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 762: *Nano Bio Sensors.* 3 credits.
This course discusses a wide range of sensor transduction mechanisms, including resistive, capacitive, piezoelectric, inductive, magnetic, optical, chemical, and many other types of sensor transduction mechanisms used in different applications. This course also discusses types of nanomaterials, such as nanoparticles, quantum dots, nanowires and nanorods, nanotubes, nanocomposites, and graphene, as well as their unique properties. This course also introduces various types of nanosensors and biosensors, including physical monitoring sensors, mechanical sensors, optical sensors, chemical sensors, and biosensors. ME 762 will include hands-on lab sessions that aim to develop flexible potentiometric sensors based on graphene. Students will explore the design, fabrication, and characterization methods. They will learn how to synthesize graphene using laser manufacturing and use a thermal

evaporator to make interconnects and contact electrodes with metals to fabricate devices. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May not be repeated for credit.
Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate or Non-Degree.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (https://catalog.gmu.edu/policies/academic/grading/)

900 Level Courses

ME 990: *Dissertation Topic Presentation.* 1 credit.
Students put together a professional presentation of a research proposal and present it for critique to fellow students and interested faculty. Notes: May be repeated with change of research topic, but credit toward doctoral degree is given once. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May not be repeated for credit.
Recommended Prerequisite: Completion of all coursework for the PhD in Mechanical Engineering, or permission of instructor.

Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy or Graduate.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Research

Grading:
This course is graded on the Satisfactory/No Credit scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 998: *Doctoral Dissertation Proposal.* 1-12 credits.
Work on research proposal that forms basis for doctoral dissertation. Notes: No more than 24 credits of ME 998 and 999 may be applied to doctoral degree requirements. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May be repeated within the degree for a maximum 12 credits.
Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy or Graduate.

Schedule Type: Dissertation

Grading:
This course is graded on the Satisfactory/No Credit scale. (https://catalog.gmu.edu/policies/academic/grading/)

ME 999: *Doctoral Dissertation.* 1-12 credits.
Admission to Doctoral candidacy. Students must submit the Doctoral proposal and have it approved prior to registering for this course. Students may not take ME 998 and 999 at the same time. NOTE: Students must contact the department to receive approval and CRN to register. Offered by Mechanical Engineering (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/). May be repeated within the degree for a maximum 12 credits.
Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy or Graduate.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Dissertation

Grading:
This course is graded on the Satisfactory/No Credit scale. (https://catalog.gmu.edu/policies/academic/grading/)