Department of Mechanical Engineering

Engineering Building, Room A103
(970) 491-6558; (970) 491-0924
engr.colostate.edu/me (http://www.engr.colostate.edu/me)

Professor Susan P. James, Head
Toni-Lee Viney, Undergraduate Program Coordinator
Star Garcia, Undergraduate Advisor
Tiara Marshall, Academic Support Coordinator
Megan Kosovski, Graduate Program Coordinator

Undergraduate

Majors

• Major in Mechanical Engineering
• Major in Biomedical Engineering and Mechanical Engineering

Graduate

Graduate Programs in Mechanical Engineering

Programs are offered leading to the Master of Science, Master of Engineering (Mechanical Engineering specialization), and Doctor of Philosophy. Students interested in graduate work should refer to the Graduate and Professional Bulletin and the Department of Mechanical Engineering (http://www.engr.colostate.edu/me).

Master Programs

• Master of Science in Mechanical Engineering, Plan A
• Master of Science in Mechanical Engineering, Plan B
• Master of Engineering, Plan C, Mechanical Engineering Specialization

Ph.D.

• Ph.D. in Mechanical Engineering

Courses

Mechanical Engineering (MECH)

MECH 101 Introduction to Mechanical Engineering Credits: 3 (3-0-0)
Course Description: The discipline of Mechanical Engineering as described in problems and problem solving methods—energy, materials, motion, fluids.
Prerequisite: None.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: Yes.

MECH 103 Introduction to Mechanical Engineering Credits: 3 (3-0-0)
Course Description: The discipline of Mechanical Engineering as described in problems and problem solving methods—energy, materials, motion, fluids.
Prerequisite: None.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

MECH 105 Mechanical Engineering Problem Solving Credits: 3 (3-0-0)
Course Description: Programming and engineering problem solving techniques, algorithms and processes from physics and calculus first principles.
Prerequisites: MECH 103 with a minimum grade of C and MATH 160 and PH 141, may be taken concurrently.
Registration Information: Credit not allowed for both MECH 105 and MECH 102.
Term Offered: Fall, Spring.
Grade Mode: Traditional.
Special Course Fee: No.

MECH 200 Introduction to Manufacturing Processes Credits: 3 (2-2-0)
Course Description: Engineering drawings, materials, manufacturing, and safety. Hand tools, cutting, drilling, the lathe, mill and numerical control.
Prerequisite: None.
Registration Information: Mechanical engineering and engineering science majors only. Must register for lecture and laboratory.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: Yes.

MECH 201 Engineering Design I Credits: 2 (1-2-0)
Course Description: Engineering design process and the roles of visual communication with emphasis on 3D physical solid modelers and Pro/ENGINEER.
Prerequisite: MECH 102 with a minimum grade of C or MECH 105 with a minimum grade of C.
Registration Information: Must register for lecture and laboratory.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<th>Term Offered</th>
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<tr>
<td>MECH 202</td>
<td>Engineering Design II</td>
<td>3 (2-2-0)</td>
<td>Spring</td>
<td>Must register for lecture and laboratory.</td>
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<tr>
<td>MECH 231</td>
<td>Engineering Experimentation</td>
<td>3 (2-2-0)</td>
<td>Fall, Spring</td>
<td>Must register for lecture and laboratory.</td>
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<tr>
<td>MECH 237</td>
<td>Introduction to Thermal Sciences</td>
<td>3 (3-0-0)</td>
<td>Fall, Spring</td>
<td>Must register for lecture and laboratory.</td>
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<tr>
<td>MECH 262</td>
<td>Engineering Mechanics</td>
<td>4 (4-0-0)</td>
<td>Fall, Spring</td>
<td>Must register for lecture and laboratory.</td>
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<tr>
<td>MECH 301</td>
<td>Engineering Design III</td>
<td>2 (1-2-0)</td>
<td>Spring</td>
<td>Must register for lecture and laboratory.</td>
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<tr>
<td>MECH 302</td>
<td>Engineering Design III</td>
<td>3 (3-0-0)</td>
<td>Fall, Spring</td>
<td>Must register for lecture and laboratory.</td>
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<tr>
<td>MECH 303</td>
<td>Energy Engineering</td>
<td>3 (3-0-0)</td>
<td>Fall, Spring</td>
<td>Must register for lecture and laboratory.</td>
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<tr>
<td>MECH 307</td>
<td>Mechatronics and Measurement Systems</td>
<td>4 (3-3-0)</td>
<td>Fall, Spring</td>
<td>Must register for lecture and laboratory.</td>
</tr>
<tr>
<td>MECH 324</td>
<td>Dynamics of Machines</td>
<td>4 (3-2-0)</td>
<td>Fall, Spring</td>
<td>Must register for lecture and laboratory.</td>
</tr>
<tr>
<td>MECH 325</td>
<td>Machine Design</td>
<td>3 (3-0-0)</td>
<td>Fall, Spring</td>
<td>Must register for lecture and laboratory.</td>
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<tr>
<td>MECH 331</td>
<td>Introduction to Engineering Materials</td>
<td>4 (3-2-0)</td>
<td>Fall, Spring</td>
<td>Must register for lecture and laboratory.</td>
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<tr>
<td>MECH 337</td>
<td>Thermodynamics</td>
<td>4 (3-0-1)</td>
<td>Fall, Spring</td>
<td>Must register for lecture and laboratory.</td>
</tr>
</tbody>
</table>

**Course Description:**
- **MECH 202:** Engineering design process with emphasis on teamwork, ideation, decision-making, project planning applied to a group design project.
- **MECH 231:** Measurement systems; experimental design; data acquisition and analysis techniques.
- **MECH 237:** First and second laws of thermodynamics, properties of materials, energy conversion, statistical aspects, heat transfer.
- **MECH 262:** Forces, static equilibrium, mass center, moments of inertia, kinematics and kinetics of particles and rigid bodies.
- **MECH 301:** Computer-aided engineering tools FEA and CFD for analysis and prediction of robustness and performance of mechanical components and assemblies.
- **MECH 302:** Design fundamentals, including design processes, project planning, creativity, manufacturing, and human factors.
- **MECH 303:** Energy generation (coal, oil, natural gas, solar, wind, geothermal, hydropower, tidal, biofuel, nuclear...), conversion, distribution, storage, efficiency.
- **MECH 307:** Mechatronic and measurement system analysis and design; applied electronics; data acquisition; microcontroller interfacing and programming.
- **MECH 324:** Analysis and synthesis of moving machinery. Stress analysis, failure theories, and specific mechanical components in design context.
- **MECH 325:** Design of mechanical components to avoid failure during operation. Stress analysis, failure theories, and specific mechanical components in design context.
- **MECH 331:** Characteristics of metallic, plastic, and ceramic material; basic principles which relate properties of materials to their atomic and microstructure.
- **MECH 337:** First and second laws, property relationships, characteristic functions, thermodynamics solver, various thermodynamics applications.
MECH 338 Thermal/Fluid Sciences Laboratory Credit: 1 (0-3-0)  
Course Description: Experimental methods in heat transfer, fluid flow, and thermodynamics.  
Prerequisites: MECH 337 with a minimum grade of C and MECH 342 with a minimum grade of C.  
Terms Offered: Fall, Spring.  
Grade Mode: Traditional.  
Special Course Fee: No.  

MECH 342 Mechanics and Thermodynamics of Flow Processes Credits: 3 (3-0-0)  
Course Description: Engineering details of viscous flow with losses, measurements, compressibility, turbomachinery, convective heat transfer.  
Prerequisites: MATH 340 with a minimum grade of C and PH 141 with a minimum grade of C and MECH 337 with a minimum grade of C, may be taken concurrently.  
Term Offered: Fall.  
Grade Mode: Traditional.  
Special Course Fee: No.  

MECH 344 Heat and Mass Transfer Credits: 3 (3-0-0)  
Course Description: Transport and rate processes, conduction, convection, and radiation.  
Prerequisite: MECH 342 with a minimum grade of C.  
Term Offered: Spring.  
Grade Mode: Traditional.  
Special Course Fee: No.  

MECH 392 Graduate Education and Research Seminar Credit: 1 (0-3-0)  
Course Description: Research in graduate school and industry as a career option for mechanical engineers.  
Prerequisites: MECH 231 with a minimum grade of C and MECH 237 with a minimum grade of C.  
Registration Information: Written consent of instructor.  
Terms Offered: Fall, Spring.  
Grade Mode: S/U Sat/Unsat Only.  
Special Course Fee: No.  

MECH 402 Mechanical Engineering Experimental Analysis Credits: 3 (2-2-0)  
Course Description: Analysis of large data sets associated with mechanical engineering experimentation; optimization; variability; design of experiments.  
Prerequisites: (MECH 307 with a minimum grade of C) and (MECH 324 with a minimum grade of C) and (MECH 331 with a minimum grade of C) and (MECH 338 with a minimum grade of C).  
Registration Information: Must register for lecture and laboratory.  
Term Offered: Fall.  
Grade Mode: Traditional.  
Special Course Fee: No.  

MECH 407 Laser Applications in Mechanical Engineering Credits: 3 (3-0-0)  
Course Description: Review of electromagnetic waves; applications of lasers and optics in engineering, e.g., position sensing, flowfield measurement, cutting and welding.  
Prerequisite: PH 142.  
Term Offered: Fall.  
Grade Mode: Traditional.  
Special Course Fee: No.  

MECH 408 Applied Engineering Economy Credits: 3 (2-0-1)  
Course Description: The basic principles and calculations of engineering economy with application to real problems, including energy and the environment.  
Prerequisite: MATH 161.  
Registration Information: Credit not allowed for both MECH 408 and MECH 410.  
Term Offered: Fall.  
Grade Mode: Traditional.  
Special Course Fee: No.  

MECH 410 Engineering Economy Principles/Calculations Credit: 1 (0-0-1)  
Course Description: Basic principles and calculation of engineering economy.  
Prerequisite: MATH 161.  
Registration Information: Credit not allowed for both MECH 410 and MECH 408. Offered as an online course only. Sections may be offered: Online.  
Terms Offered: Fall, Spring, Summer.  
Grade Mode: Traditional.  
Special Course Fee: No.  

MECH 411 Manufacturing Engineering Credits: 3 (3-0-0)  
Course Description: Casting, forming, machining, and welding processes used in manufacturing operations.  
Prerequisites: CIVE 360 and MECH 331.  
Term Offered: Spring.  
Grade Mode: Traditional.  
Special Course Fee: No.  

MECH 417 Control Systems Credits: 3 (2-2-0)  
Course Description: Feedback and forward loop control design and simulation; discrete time and frequency domain methods with implementation considerations.  
Prerequisites: MATH 340 and MECH 307.  
Registration Information: Must register for lecture and laboratory.  
Term Offered: Fall.  
Grade Mode: Traditional.  
Special Course Fee: Yes.  

MECH 424 Advanced Dynamics Credits: 3 (3-0-0)  
Course Description: Kinematics and dynamics of rigid bodies. Hamilton's principle and Lagrange's equations for lumped parameter extended bodies and distributed systems.  
Prerequisite: MECH 324.  
Term Offered: Spring.  
Grade Mode: Traditional.  
Special Course Fee: No.  

MECH 425 Mechanical Engineering Vibrations Credits: 4 (3-2-0)  
Course Description: Vibrations applied to rotating machinery and structures. SDOF and MDOF systems, mode shapes, vibration measurements and control. Hands-on lab.  
Prerequisite: MECH 324.  
Registration Information: Must register for lecture and laboratory.  
Term Offered: Spring.  
Grade Mode: Traditional.  
Special Course Fee: No.
MECH 431 Metals and Alloys Credits: 3 (3-0-0)
Course Description: Engineering metals and alloys, modification of properties by alloying, plastic deformation, and heat treatment. Fundamentals of physical metallurgy.
Prerequisite: MECH 331.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

MECH 432 Engineering of Nanomaterials Credits: 3 (3-0-0)
Course Description: Structure, properties, and processing of extremely small (10 to the minus 9 m) synthetic and natural materials.
Prerequisite: MECH 331.
Term Offered: Fall (even years).
Grade Mode: Traditional.
Special Course Fee: No.

MECH 437 Internal Combustion Engines Credits: 3 (2-0-1)
Course Description: Application of thermodynamics, heat transfer, and fluid mechanics to internal combustion engines.
Prerequisite: MECH 344.
Registration Information: Must register for lecture and recitation.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

MECH 460 Aeronautics Credits: 3 (3-0-0)
Course Description: Thermodynamics and fluid mechanics principles applied to the mechanics, aerodynamics, performance, stability, and control of airplanes.
Prerequisite: MECH 342.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

MECH 463 Building Energy Systems Credits: 3 (3-0-0)
Course Description: Comfort, psychrometrics, loads, solar radiation, heating and cooling system design, transport, solar system design, economics.
Prerequisite: MECH 344.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

MECH 468 Space Propulsion and Power Engineering Credits: 3 (3-0-0)
Course Description: Orbital mechanics and space missions; chemical, nuclear, and electric rockets; nuclear heat sources; thermoelectric and photovoltaic devices.
Prerequisites: ECE 204 and MECH 337 and MECH 342.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

MECH 470 Biomedical Engineering Credits: 3 (3-0-0)
Also Offered As: BIOM 470.
Course Description: Engineering application in human/animal physiology, diagnosis of disease, treatment, rehabilitation, human genome manipulation.
Prerequisites: (MATH 155 or MATH 160) and (PH 141).
Registration Information: Credit not allowed for both MECH 470 and BIOM 470.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

MECH 486A Engineering Design Practicum I Credits: 4 (1-12-0)
Course Description: Capstone engineering design project; transition experience to the mechanical engineering profession in industry and graduate education.
Prerequisites: MECH 301 with a minimum grade of C and MECH 325 with a minimum grade of C and MECH 344 with a minimum grade of C and MECH 402 with a minimum grade of C, may be taken concurrently.
Registration Information: Must register for lecture and laboratory.
Term Offered: Fall, Spring, Summer.
Grade Mode: Traditional.
Special Course Fee: Yes.

MECH 486B Engineering Design Practicum II Credits: 4 (1-12-0)
Course Description: Capstone engineering design project; transition experience to the mechanical engineering profession in industry and graduate education.
Prerequisites: MECH 338 with a minimum grade of C and MECH 486A with a minimum grade of C.
Registration Information: Must register for lecture and laboratory.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: Yes.

MECH 495 Independent Study Credits: Var[1-18]
Course Description:
Prerequisite: None.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

MECH 498A Engineering Research Practicum: Fall Credits: 4 (1-12-0)
Course Description: Capstone engineering research project; transition experience to graduate research and education.
Prerequisites: MECH 301 with a minimum grade of C and MECH 325 with a minimum grade of C and MECH 402 with a minimum grade of C, may be taken concurrently.
Registration Information: Must register for lecture and laboratory.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

MECH 498B Engineering Research Practicum: Spring Credits: 4 (1-12-0)
Course Description: Capstone engineering research project; transition experience to graduate research and education.
Prerequisites: MECH 338 with a minimum grade of C and MECH 498A with a minimum grade of C.
Registration Information: Must register for lecture and laboratory.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

MECH 501 Engineering Project and Program Management Credits: 3 (0-0-3)
Course Description: Engineering program management fundamentals, program planning and control strategies, risk assessment, work breakdown structures and costing options.
Prerequisite: None.
Registration Information: Admission to the M.E. program. Offered as an online course only.
Term Offered: Summer.
Grade Mode: Traditional.
Special Course Fee: No.
MECH 502  Advanced/Additive Manufacturing  
**Engineering Credits:** 3 (3-0-0)  
**Course Description:** Materials, controls, and mechanics applied to additive manufacturing; rapid prototyping; direct digital manufacturing.  
**Prerequisites:** MECH 202 and MECH 331.  
**Registration Information:** Sections may be offered: Online.  
**Term Offered:** Spring.  
**Grade Mode:** Traditional.  
**Special Course Fee:** No.

MECH 503  Engineering Maintenance Process Credits: 3 (0-0-3)  
**Course Description:** Design for engineering maintainability development and management of effective maintenance programs applicable to typical industrial environments.  
**Prerequisite:** None.  
**Registration Information:** Admission to the M.E. program. Offered as an online course only.  
**Term Offered:** Summer.  
**Grade Mode:** Traditional.  
**Special Course Fee:** No.

MECH 504  Specification and Procurement of Engr Systems Credits: 3 (0-0-3)  
**Course Description:** Specification and procurement of engineering systems, including contracts, legal, ethics and Statement of Work development.  
**Prerequisite:** None.  
**Registration Information:** Admission to the M.E. program. Offered as an online course only.  
**Term Offered:** Summer.  
**Grade Mode:** Traditional.  
**Special Course Fee:** No.

MECH 507  Laser Diagnostics for Thermosciences Credits: 3 (3-0-0)  
**Course Description:** Basics of optics, spectroscopy, and lasers. Physics and applications of laser diagnostic techniques used in thermosciences.  
**Prerequisite:** PH 142.  
**Registration Information:** Sections may be offered: Online.  
**Term Offered:** Spring (odd years).  
**Grade Mode:** Traditional.  
**Special Course Fee:** No.

MECH 509  Design and Analysis in Engineering Research Credits: 3 (3-0-0)  
**Course Description:** Design, model building, analysis and reporting in engineering and manufacturing research and experimentation.  
**Prerequisites:** MATH 340 and STAT 315.  
**Registration Information:** Sections may be offered: Online.  
**Term Offered:** Spring.  
**Grade Mode:** Traditional.  
**Special Course Fee:** No.

MECH 511  Engineering Decision Making Under Uncertainty Credits: 3 (3-0-0)  
**Course Description:** Systems engineering and engineering economic methodologies for evaluating interdependent capital expenditure proposals under incomplete information.  
**Prerequisites:** MECH 410 and STAT 315.  
**Registration Information:** Sections may be offered: Online.  
**Term Offered:** Spring.  
**Grade Mode:** Traditional.  
**Special Course Fee:** No.

MECH 512  Reliability Engineering Credits: 3 (3-0-0)  
**Course Description:** Models to predict time to failure of mechanical or electronic devices, reliability data analysis and case studies.  
**Prerequisites:** STAT 315 and MECH 513.  
**Registration Information:** Sections may be offered: Online.  
**Term Offered:** Fall (even years).  
**Grade Mode:** Traditional.  
**Special Course Fee:** No.

MECH 513  Simulation Modeling and Experimentation Credits: 3 (3-0-0)  
**Course Description:** Logic/analytic modeling in simulations. Event and transient entity-based simulation languages. Simulation design, experimentation and analysis.  
**Prerequisite:** STAT 315.  
**Registration Information:** Sections may be offered: Online.  
**Term Offered:** Spring.  
**Grade Mode:** Traditional.  
**Special Course Fee:** No.

MECH 514  Manufacturing and Robotic Systems Credits: 3 (2-2-0)  
**Course Description:** Examination of electromechanical systems of manufacturing applications and robotics.  
**Prerequisite:** MECH 417.  
**Registration Information:** Must register for lecture and laboratory.  
**Term Offered:** Spring (odd years).  
**Grade Mode:** Traditional.  
**Special Course Fee:** No.

MECH 520  Finite Element Analysis in Mechanical Engr Credits: 3 (3-0-0)  
**Course Description:** Application of FEA as a tool to analyze mechanical engineering problems.  
**Prerequisites:** (CIVE 360) and (MATH 340 or MATH 530).  
**Term Offered:** Spring.  
**Grade Mode:** Traditional.  
**Special Course Fee:** No.

MECH 523  Vehicle Energy Storage System Design Credits: 3 (3-0-0)  
**Course Description:** Develop vehicle system designs utilizing electrochemical energy storage systems such as batteries and capacitors.  
**Prerequisite:** MECH 331.  
**Term Offered:** Spring.  
**Grade Mode:** Traditional.  
**Special Course Fee:** No.

MECH 524  Principles of Dynamics Credits: 3 (3-0-0)  
**Course Description:** Kinematics and dynamics of rigid body motion; Lagrangian and Hamiltonian formulations of mechanics; applications to engineering problems.  
**Prerequisite:** MECH 324.  
**Term Offered:** Fall.  
**Grade Mode:** Traditional.  
**Special Course Fee:** No.
MECH 525  Cell and Tissue Engineering  Credits: 3 (3-0-0)
Also Offered As: BIOM 525.
Course Description: Cell and tissue engineering concepts and techniques with emphasis on cellular response, cell adhesion kinetics, and tissue engineering design.
Prerequisite: BC 351 or BMS 300 or BMS 500 or BZ 310 or NB 501.
Registration Information: Credit only allowed for one of the following: MECH 525, BIOM 525, and CBE 525. Sections may be offered: Online.
Term Offered: Spring (even years).
Grade Mode: Traditional.
Special Course Fee: Yes.

MECH 526  Fundamentals of Vehicle Dynamics  Credits: 3 (3-0-0)
Course Description: Kinetics of vehicle suspensions, steady-state and transient stability and control, tires, wheel and suspension geometry and loads, dampers, steering.
Prerequisite: MECH 324.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

MECH 527  Hybrid Electric Vehicle Powertrains  Credits: 3 (3-0-0)
Course Description: Hybrid powertrains and modeling including vehicle dynamics, internal combustion engine, electric motor, energy storage, and control.
Prerequisite: MECH 307.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

MECH 529  Advanced Mechanical Systems  Credits: 3 (3-0-0)
Course Description: Modeling, analysis, and synthesis of practical mechanical devices in which dynamic response is dominant consideration.
Prerequisite: MECH 307.
Term Offered: Spring (odd years).
Grade Mode: Traditional.
Special Course Fee: No.

MECH 530  Advanced Composite Materials  Credits: 3 (3-0-0)
Course Description: Materials aspects of advanced composite constituents and how their combination yields synergistic results.
Prerequisites: CIVE 360 and MECH 337.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

MECH 531  Materials Engineering  Credits: 3 (3-0-0)
Also Offered As: BIOM 531.
Course Description: Selection of structural engineering materials by properties, processing, and economics; materials for biomedical and biotechnology applications.
Prerequisite: MECH 331 or MECH 431.
Registration Information: Credit not allowed for both MECH 531 and BIOM 531. Sections may be offered: Online.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

MECH 532  Materials Issues in Mechanical Design  Credits: 3 (3-0-0)
Also Offered As: BIOM 532.
Course Description: Failure mechanisms from materials viewpoint with emphasis on use in design. Fracture, creep, fatigue, and corrosion.
Prerequisite: MECH 331.
Registration Information: Credit not allowed for both MECH 532 and BIOM 532. Sections may be offered: Online.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

MECH 536  Materials Applications in Renewable Energy  Credits: 3 (3-0-0)
Course Description: Materials science applied to renewable energy, transmission and storage; study of solar cells, fuel cells, Li-ion batteries and related technologies.
Prerequisite: MECH 331.
Registration Information: Required field trips.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

MECH 538  Mechanical Engineering Thermodynamics  Credits: 3 (3-0-0)
Course Description: First and second laws of thermodynamics applied to engineering devices and systems. Introduction to availability, energy, and lost work analysis.
Prerequisite: MECH 337.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

MECH 539  Advanced Fluid Mechanics  Credits: 3 (3-0-0)
Course Description: Properties, kinematics; vorticity; exact solutions; instability; boundary layers; turbulence; wakes; compressible flow; supersonic flow; shockwaves.
Prerequisite: CIVE 300 or MECH 342.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

MECH 543  Biofluid Mechanics  Credits: 3 (3-0-0)
Course Description: Fluid dynamic concepts for understanding fluid motion in living organs/organisms; advanced research applications.
Prerequisites: MECH 342 or CIVE 300 or BMS 300 and PH 121 or BMS 300 and PH 141 or BMS 420.
Term Offered: Spring (odd years).
Grade Mode: Traditional.
Special Course Fee: No.

MECH 544  Advanced Heat Transfer  Credits: 3 (3-0-0)
Course Description: Fundamentals and engineering applications of heat transfer including conduction, convection, and radiation.
Prerequisite: MECH 344.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.
MECH 551 Physical Gas Dynamics I Credits: 3 (3-0-0)
Course Description: Characteristics of real gases in reacting and nonequilibrium systems; equilibrium air; statistical mechanics, chemical thermodynamics.
Prerequisite: MECH 342.
Term Offered: Fall (odd years).
Grade Mode: Traditional.
Special Course Fee: No.

MECH 552 Applied Computational Fluid Dynamics Credits: 3 (3-0-0)
Course Description: Introductory theory of CFD, formulation of engineering problems for CFD analyses, mesh generation, solver settings, and postprocessing.
Prerequisite: CIVE 300 or CBE 331 or MECH 342.
Term Offered: Fall (odd years).
Grade Mode: Traditional.
Special Course Fee: No.

MECH 555 Ceramic Materials Engineering Credits: 3 (3-0-0)
Course Description: Ceramic materials engineering and its application to materials technologies.
Prerequisite: MECH 331.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

MECH 557 Turbomachinery Credits: 3 (3-0-0)
Course Description: Application of fundamental principles of thermodynamics and fluid mechanics to turbomachinery.
Prerequisites: MECH 337 and MECH 342.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

MECH 558 Combustion Credits: 3 (3-0-0)
Course Description: Combustion processes: explosions, detonations, flame propagation, ignition, generation of pollutants in moving and stationary energy conversion systems.
Prerequisite: MECH 342.
Term Offered: Fall (even years).
Grade Mode: Traditional.
Special Course Fee: No.

MECH 561 Space Propulsion and Mission Analysis Credits: 4 (4-0-0)
Course Description: Analysis of space flight missions and propulsion systems.
Prerequisite: MATH 340.
Term Offered: Spring (even years).
Grade Mode: Traditional.
Special Course Fee: No.

MECH 564 Fundamentals of Robot Mechanics and Controls Credits: 3 (3-0-0)
Course Description: Kinematics of robots, controls for robots.
Prerequisite: MECH 417.
Term Offered: Spring (even years).
Grade Mode: Traditional.
Special Course Fee: No.

MECH 565 Broad-Beam Ion Sources Credits: 3 (3-0-0)
Course Description: Physical processes in broad-beam electron-bombardment ion sources for space propulsion and ion machining applications.
Prerequisite: MATH 340.
Term Offered: Spring (odd years).
Grade Mode: Traditional.
Special Course Fee: No.

MECH 569 Micro-Electro-Mechanical Devices Credits: 3 (3-0-0)
Also Offered As: ECE 569.
Course Description: Micro-electro-mechanical processes and applications in sensors, optics, and structures.
Prerequisite: MECH 344 or ECE 331 with a minimum grade of C.
Registration Information: Credit not allowed for both MECH 569 and ECE 569. Sections may be offered: Online.
Term Offered: Spring (even years).
Grade Mode: Traditional.
Special Course Fee: No.

MECH 570 Bioengineering Credits: 3 (3-0-0)
Also Offered As: BIOM 570.
Course Description: Physiological and medical systems analysis using engineering methods including mechanics, fluid dynamics, control, electronics, and signal processing.
Prerequisites: MECH 307 and MECH 324.
Registration Information: Credit not allowed for both MECH 570 and BIOM 570. Sections may be offered: Online.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

MECH 573 Structure and Function of Biomaterials Credits: 3 (3-0-0)
Also Offered As: BIOM 573.
Course Description: Structure-function relationships of natural biomaterials; application to analysis of biomimetic materials and biomaterials used in medical devices.
Prerequisite: MECH 331.
Registration Information: Credit not allowed for both MECH 573 and BIOM 573. Sections may be offered: Online.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

MECH 574 Bio-Inspired Surfaces Credits: 3 (3-0-0)
Also Offered As: BIOM 574.
Course Description: Analysis of surface functionalities of various biological species; identification of design principles.
Prerequisites: MECH 342 and CHEM 111.
Registration Information: Credit not allowed for both MECH 574 and BIOM 574.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

MECH 575 Solar and Alternative Energies Credits: 3 (3-0-0)
Course Description: Solar radiation, flat-plate collectors, energy storage, space heating and cooling, power generation, applications, simulation.
Prerequisites: MECH 337 and MECH 342 and MECH 344.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.
MECH 576  Quantitative Systems Physiology  Credits: 4 (4-0-0)
Also Offered As: BIOM 576.
Course Description: Quantitative, model-oriented approach to cellular and systems physiology with design examples from biomedical engineering.
Prerequisites: BMS 300 and CHEM 113 and MATH 340 and PH 142.
Registration Information: Credit not allowed for both BIOM 576 and MECH 576. Sections may be offered: Online.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

MECH 576. Sections may be offered: Online.

MECH 609  Experimental Optimization  Credits: 3 (1-0-2)
Course Description: Application of design of experiments, response surface and optimization methods to experimental investigations.
Prerequisite: STAT 315.
Restriction: Must be a: Graduate, Professional.
Registration Information: Must register for lecture and recitation. Sections may be offered: Online.
Term Offered: Summer (odd years).
Grade Mode: Traditional.
Special Course Fee: No.

MECH 609. No.

MECH 626  Race Car Vehicle Dynamics  Credits: 3 (3-0-0)
Course Description: Quasi-static, steady-state and transient analyses of racing suspensions including modal analysis in roll, pitch, heave, yaw and warp.
Prerequisites: CIVE 562 and MECH 524 and MECH 526.
Restriction: Must be a: Graduate, Professional.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

MECH 626. No.

MECH 628  Applied Fracture Mechanics  Credits: 3 (3-0-0)
Course Description: Stress distribution near cracks; energy criteria for fracture; design criteria; fracture toughness testing.
Prerequisite: CIVE 560.
Restriction: Must be a: Graduate, Professional.
Term Offered: Spring (even years).
Grade Mode: Traditional.
Special Course Fee: No.

MECH 628. No.

MECH 644  Conduction Heat Transfer  Credits: 3 (3-0-0)
Course Description: Linear and nonlinear, isotropic and anisotropic conduction; analytical, numerical techniques, inverse methods.
Prerequisite: MECH 344.
Restriction: Must be a: Graduate, Professional.
Term Offered: Fall (odd years).
Grade Mode: Traditional.
Special Course Fee: No.

MECH 644. No.

MECH 645  Radiation Heat Transfer  Credits: 3 (3-0-0)
Course Description: Radiation fundamentals; properties; spectral, directional variations; transfer between surfaces; participating media; numerical Monte Carlo methods.
Prerequisite: MECH 344.
Restriction: Must be a: Graduate, Professional.
Term Offered: Spring (even years).
Grade Mode: Traditional.
Special Course Fee: No.

MECH 645. No.

MECH 646  Convection Heat Transfer  Credits: 3 (3-0-0)
Course Description: Fundamentals; conservation, constitutive equations; second law; forced, free convection; internal, external flows; laminar, turbulent flows.
Prerequisite: MECH 344.
Restriction: Must be a: Graduate, Professional.
Term Offered: Spring (odd years).
Grade Mode: Traditional.
Special Course Fee: No.

MECH 646. No.

MECH 650  Computational Materials from First Principles  Credits: 3 (3-0-0)
Course Description: Ab initio calculations for molecules, clusters, solutions and solid state materials, ab initio and classical molecular dynamics simulations.
Prerequisites: (CHEM 461 or MECH 331) and (CHEM 474 or MECH 337 or PH 361) and (MATH 340).
Restriction: Must be a: Graduate, Professional.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

MECH 650. No.

MECH 651  Computational Gas Dynamics  Credits: 3 (3-0-0)
Course Description: Numerical methods for inviscid and viscous compressible flow.
Prerequisite: MECH 530.
Registration Information: Written consent of instructor.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

MECH 651. No.

MECH 657  Advanced Computational Gas Dynamics  Credits: 4 (3-2-0)
Course Description: Advanced computational algorithms for gas dynamics.
Prerequisite: MECH 651.
Restriction: Must be a: Graduate, Professional.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

MECH 657. No.

MECH 658  Advanced Combustion Theory and Modeling  Credits: 3 (3-0-0)
Course Description: Asymptotic structure of flames, limit phenomena and multi-phase combustion.
Prerequisite: MECH 558.
Restriction: Must be a: Graduate, Professional.
Term Offered: Spring (odd years).
Grade Mode: Traditional.
Special Course Fee: No.

MECH 658. No.

MECH 661  Theory/Control of Internal Combustion Engines  Credits: 3 (3-0-0)
Course Description: Theory and applications of internal combustion engines. Alternative fuels, engine control, and pollution prevention.
Prerequisite: MECH 437.
Restriction: Must be a: Graduate, Professional.
Term Offered: Spring (odd years).
Grade Mode: Traditional.
Special Course Fee: No.
MECH 671 Orthopedic Tissue Biomechanics  Credits: 3 (3-0-0)
Course Description: Linear elastic, finite deformation, and viscoelastic theories applied to the mechanical behavior of orthopedic tissues (bone, tendon, cartilage).
Prerequisite: CIVE 560.
Restriction: Must be a: Graduate, Professional.
Registration Information: Credit not allowed for both MECH 671 and BIOM 671 or for MECH 671/BIOM 671 and MECH 571/BIOM 571.
Term Offered: Fall (odd years).
Grade Mode: Traditional.
Special Course Fee: No.

MECH 676 Building Energy Design  Credits: 3 (2-2-0)
Course Description: Design of space heating and cooling systems. Solar thermal electric power systems, industrial and agricultural process heat.
Prerequisite: MECH 575.
Restriction: Must be a: Graduate, Professional.
Registration Information: Must register for lecture and laboratory. Credit not allowed for both MECH 676 and MECH 463.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

MECH 684 Supervised College Teaching  Credits: Var[1-18]
Course Description: 
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: S/U Sat/Unsat Only.
Special Course Fee: No.

MECH 692 Seminar  Credits: Var[1-18]
Course Description: 
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring.
Grade Mode: Instructor Option.
Special Course Fee: No.

MECH 695A Independent Study: Bioengineering  Credits: Var[1-18]
Course Description: 
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

MECH 695B Independent Study: Energy Conversion  Credits: Var[1-18]
Course Description: 
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

MECH 695C Independent Study: Environmental Engineering  Credits: Var[1-18]
Course Description: 
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

MECH 695D Independent Study: Heat and Mass Transfer  Credits: Var[1-18]
Course Description: 
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

MECH 695E Independent Study: Industrial and Systems Engineering  Credits: Var[1-18]
Course Description: 
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

MECH 695F Independent Study: Mechanics and Design  Credits: Var[1-18]
Course Description: 
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

MECH 695G Independent Study-Computer: Assisted Engineering  Credits: Var[1-18]
Course Description: 
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

MECH 695H Independent Study: Robotics  Credits: Var[1-18]
Course Description: 
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

MECH 695I Independent Study: Solar Engineering  Credits: Var[1-18]
Course Description: 
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.
<table>
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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits:</th>
<th>Prerequisite:</th>
<th>Restriction:</th>
<th>Terms Offered:</th>
<th>Grade Mode:</th>
<th>Special Course Fee:</th>
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<td>MECH 695J</td>
<td>Independent Study: Computational Fluids</td>
<td>Var[1-18]</td>
<td>None</td>
<td>Must be a: Graduate, Professional</td>
<td>Fall, Spring, Summer</td>
<td>Instructor Option</td>
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<td>MECH 695K</td>
<td>Independent Study: Materials</td>
<td>Var[1-18]</td>
<td>None</td>
<td>Must be a: Graduate, Professional</td>
<td>Fall, Spring, Summer</td>
<td>Instructor Option</td>
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<td>MECH 695L</td>
<td>Independent Study: Plasma Engineering</td>
<td>Var[1-18]</td>
<td>None</td>
<td>Must be a: Graduate, Professional</td>
<td>Fall, Spring, Summer</td>
<td>Instructor Option</td>
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<tr>
<td>MECH 695M</td>
<td>Independent Study: Motorsport Engineering</td>
<td>Var[1-18]</td>
<td>None</td>
<td>Must be a: Graduate, Professional</td>
<td>Fall, Spring, Summer</td>
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<td>MECH 699A</td>
<td>Thesis: Bioengineering</td>
<td>Var[1-18]</td>
<td>None</td>
<td>Must be a: Graduate, Professional</td>
<td>Fall, Spring, Summer</td>
<td>S/U Sat/Unsat Only</td>
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<td>MECH 699B</td>
<td>Thesis: Energy Conversion</td>
<td>Var[1-18]</td>
<td>None</td>
<td>Must be a: Graduate, Professional</td>
<td>Fall, Spring, Summer</td>
<td>S/U Sat/Unsat Only</td>
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<td>MECH 699C</td>
<td>Thesis: Environmental Engineering</td>
<td>Var[1-18]</td>
<td>None</td>
<td>Must be a: Graduate, Professional</td>
<td>Fall, Spring, Summer</td>
<td>S/U Sat/Unsat Only</td>
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<tr>
<td>MECH 699E</td>
<td>Thesis: Industrial and Systems Engineering</td>
<td>Var[1-18]</td>
<td>None</td>
<td>Must be a: Graduate, Professional</td>
<td>Fall, Spring, Summer</td>
<td>S/U Sat/Unsat Only</td>
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<td>MECH 699F</td>
<td>Thesis: Mechanics and Design</td>
<td>Var[1-18]</td>
<td>None</td>
<td>Must be a: Graduate, Professional</td>
<td>Fall, Spring, Summer</td>
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<td>MECH 699G</td>
<td>Thesis: Computer-Assisted Engineering</td>
<td>Var[1-18]</td>
<td>None</td>
<td>Must be a: Graduate, Professional</td>
<td>Fall, Spring, Summer</td>
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<td>MECH 699H</td>
<td>Thesis: Robotics</td>
<td>Var[1-18]</td>
<td>None</td>
<td>Must be a: Graduate, Professional</td>
<td>Fall, Spring, Summer</td>
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<td>MECH 699I</td>
<td>Thesis: Solar Engineering</td>
<td>Var[1-18]</td>
<td>None</td>
<td>Must be a: Graduate, Professional</td>
<td>Fall, Spring, Summer</td>
<td>S/U Sat/Unsat Only</td>
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<td>MECH 699J</td>
<td>Thesis: Computational Fluids</td>
<td>Var[1-18]</td>
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<td>Must be a: Graduate, Professional</td>
<td>Fall, Spring, Summer</td>
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<td>MECH 699K</td>
<td>Thesis: Materials</td>
<td>Var[1-18]</td>
<td>None</td>
<td>Must be a: Graduate, Professional</td>
<td>Fall, Spring, Summer</td>
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<td>MECH 699L</td>
<td>Thesis: Plasma Engineering</td>
<td>Var[1-18]</td>
<td>None</td>
<td>Must be a: Graduate, Professional</td>
<td>Fall, Spring, Summer</td>
<td>Instructor Option</td>
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MECH 699M Thesis: Motorsport Engineering Credits: Var[1-18]
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

MECH 721 Special Topics in Design and Manufacturing Credits: Var[1-18]
Course Description: Special topics in engineering design and manufacturing.
Prerequisite: MECH 514 or MECH 620.
Restriction: Must be a: Graduate, Professional.
Term Offered: Spring (odd years).
Grade Mode: Traditional.
Special Course Fee: No.

MECH 722 Continuum Mechanics Credits: 3 (3-0-0)
Course Description: Mechanics of continuous media; cartesian tensors, vector analysis, kinematics of deformation, balance of momentum, mass and energy, constitutive equations.
Prerequisite: CIVE 502.
Restriction: Must be a: Graduate, Professional.
Term Offered: Spring (even years).
Grade Mode: Traditional.
Special Course Fee: No.

MECH 729 Special Topics in Mechanics and Materials Credits: 3 (3-0-0)
Course Description: Advanced topics in discipline of engineering mechanics and materials; associated analysis and manufacturing techniques.
Prerequisite: MECH 524 or MECH 530.
Restriction: Must be a: Graduate, Professional.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

MECH 784 Supervised College Teaching Credits: Var[1-18]
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: S/U Sat/Unsat Only.
Special Course Fee: No.

MECH 799A Dissertation: Bioengineering Credits: Var[1-18]
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: S/U Sat/Unsat Only.
Special Course Fee: No.

MECH 799B Dissertation: Energy Conversion Credits: Var[1-18]
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: S/U Sat/Unsat Only.
Special Course Fee: No.

MECH 799C Dissertation: Environmental Engineering Credits: Var[1-18]
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: S/U Sat/Unsat Only.
Special Course Fee: No.

Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: S/U Sat/Unsat Only.
Special Course Fee: No.

MECH 799E Dissertation: Industrial and Systems Engineering Credits: Var[1-18]
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: S/U Sat/Unsat Only.
Special Course Fee: No.

MECH 799F Dissertation: Mechanics and Design Credits: Var[1-18]
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: S/U Sat/Unsat Only.
Special Course Fee: No.

Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: S/U Sat/Unsat Only.
Special Course Fee: No.

MECH 799H Dissertation: Robotics Credits: Var[1-18]
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: S/U Sat/Unsat Only.
Special Course Fee: No.

MECH 799I Dissertation: Solar Engineering Credits: Var[1-18]
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: S/U Sat/Unsat Only.
Special Course Fee: No.
MECH 799J Dissertation: Computational Fluids Credits: Var[1-18]
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: S/U Sat/Unsat Only.
Special Course Fee: No.

MECH 799K Dissertation: Materials Credits: Var[1-18]
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: S/U Sat/Unsat Only.
Special Course Fee: No.

MECH 799L Dissertation: Plasma Credits: Var[1-18]
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

MECH 799M Dissertation: Motorsport Engineering Credits: Var[1-18]
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.