

# MECHANICAL ENGINEERING (MECH)

## MECH 139 - Foundations of Academic Discovery

Foundations of Academic Discovery serves as the entry point to the Rock Integrated Studies Program. With its strong faculty-student interaction, the course promotes intellectual inquiry, critical and creative thinking, and academic excellence. Through varied content, the course introduces students to academic discourse and information literacy while exploring topics such as diversity and inclusion and global awareness. This course will set students along the path to becoming engaged with issues and scholarship important to a 21st century education while they learn about themselves and their place in the world.

Credits: 3

Term(s) Typically Offered: Offered as Needed

Enrollment limited to students with a semester level of Freshman 1 or Freshman 2.

Enrollment limited to students with the ROCK STUDIES 2 STUDENT or ROCK STUDIES STUDENT attributes.

## MECH 190 - Experimental

A unique and specifically focused course within the general purview of a department which intends to offer it on a "one time only" basis and not as a permanent part of the department's curriculum.

Credits: 1-3

Term(s) Typically Offered: Offered as Needed

## MECH 195 - Workshop

A workshop is a program which is usually of short duration, narrow in scope, often non-traditional in content and format, and on a timely topic.

Credits: 1-6

Term(s) Typically Offered: Offered as Needed

## MECH 198 - Selected Topics

A Selected Topics course is a normal, departmental offering which is directly related to the discipline, but because of its specialized nature, may not be able to be offered on a yearly basis by the department.

Credits: 1-3

Term(s) Typically Offered: Offered as Needed

## MECH 290 - Experimental

A unique and specifically focused course within the general purview of a department which intends to offer it on a "one time only" basis and not as a permanent part of the department's curriculum.

Credits: 1-3

Term(s) Typically Offered: Offered as Needed

## MECH 295 - Workshop

A workshop is a program which is usually of short duration, narrow in scope, often non-traditional in content and format, and on a timely topic.

Credits: 1-6

Term(s) Typically Offered: Offered as Needed

## MECH 298 - Selected Topics

A Selected Topics course is a normal, departmental offering which is directly related to the discipline, but because of its specialized nature, may not be able to be offered on a yearly basis by the department.

Credits: 1-3

Term(s) Typically Offered: Offered as Needed

## MECH 310 - Machines and Mechanisms

Analysis of motion and forces in linkages and mechanisms. Synthesis of plane mechanisms, analysis of cams, gears and gear trains. Fundamentals of vibrations in machines. Analysis techniques include graphical, analytical and computational methods.

Prerequisite: ENGR 240<sup>D</sup>

<sup>D</sup> Requires minimum grade of D.

Credits: 4

Term(s) Typically Offered: Offered Fall Terms

Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

## MECH 320 - Manufacturing Processes

Introduction to properties and uses of engineering materials. Introduction to mechanical testing methods, metrology, tolerances, testing and inspection; semi-finished product manufacturing; macro-processing (forming, casting, powder metallurgy, metal working, composite fabrication); joining; nontraditional manufacturing processes; and surface processing.

Prerequisites: ENGR 220<sup>D</sup> and ENGR 230<sup>D</sup>

<sup>D</sup> Requires minimum grade of D.

Credits: 3

Term(s) Typically Offered: Offered Fall Terms

Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

## MECH 330 - Introduction to Mechatronics

Selection of mechanical and electronic components and integration of these components into complex systems. Hands-on laboratory and design experiments with components and measurement equipment used in the design of mechatronic products.

Prerequisite: ENGR 310<sup>D</sup>

<sup>D</sup> Requires minimum grade of D.

Credits: 4

Term(s) Typically Offered: Offered Fall Terms

Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

## MECH 340 - Heat Transfer

One-, two-, three-dimensional steady state conduction; transient conduction; free and forced convection; radiation; heat exchangers; heat and mass transfer by analytical, numerical analogical and experimental methods; design of thermal systems.

Prerequisites: ENGR 320<sup>D</sup> and MATH 301<sup>D</sup>

<sup>D</sup> Requires minimum grade of D.

Credits: 4

Term(s) Typically Offered: Offered Spring Terms

Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

**MECH 390 - Experimental**

A unique and specifically focused course within the general purview of a department which intends to offer it on a "one time only" basis and not as a permanent part of the department's curriculum.

Credits: 1-3

Term(s) Typically Offered: Offered as Needed

Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

**MECH 395 - Workshop**

A workshop is a program which is usually of short duration, narrow in scope, often non-traditional in content and format, and on a timely topic.

Credits: 1-6

Term(s) Typically Offered: Offered as Needed

Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

**MECH 398 - Selected Topics**

A Selected Topics course is a normal, departmental offering which is directly related to the discipline, but because of its specialized nature, may not be able to be offered on a yearly basis by the department.

Credits: 1-3

Term(s) Typically Offered: Offered as Needed

Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

**MECH 410 - Machine Design**

Application of fundamental engineering principles to the design of various elements found in machines. Elements include connections, shafts, keys, couplings, springs, gears, belts, chains, bearings, clutches, brakes, screws, etc.

Prerequisite: MECH 310<sup>D</sup>

<sup>D</sup> Requires minimum grade of D.

Credits: 4

Term(s) Typically Offered: Offered Spring Terms

Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

**MECH 411 - Mechanical Control Systems**

Introduction to theory of feedback and control. Performance and stability of linear systems. Design of feedback control systems. Practical application and introduction to state-space methods.

Prerequisites: ENGR 310<sup>D</sup> and MECH 410<sup>D</sup>

<sup>D</sup> Requires minimum grade of D.

Credits: 3

Term(s) Typically Offered: Offered as Needed

Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

**MECH 412 - Finite Element Analysis**

Modern analysis techniques used to investigate a variety of systems in engineering and science. Computational models of problems are developed using energy concepts, structural mechanics, and matrix operations. The methods used are implemented using a general finite element program and the accuracy of the results is evaluated. The learned theoretical approach is applied to common structural elements such as trusses, beams, frames, and plates.

Prerequisite: ENGR 230<sup>D</sup>

<sup>D</sup> Requires minimum grade of D.

Credits: 3

Term(s) Typically Offered: Offered as Needed

Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

**MECH 420 - Design and Manufacturing**

Manufacturing methods and operations. The interaction between design and manufacturing stressed in terms of drawing specifications versus process capability and tolerances, including standards applications and 1redesign for producibility.

Prerequisite: MECH 320<sup>D</sup>

<sup>D</sup> Requires minimum grade of D.

Credits: 3

Term(s) Typically Offered: Offered Spring Terms

Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

**MECH 421 - Mechanical Vibrations**

Introduction to mechanical vibrations: single and multi-degree of freedom systems, free and forced vibrations, impedance and modal analysis including applications.

Prerequisites: MECH 410<sup>D</sup> and ENGR 240<sup>D</sup>

<sup>D</sup> Requires minimum grade of D.

Credits: 3

Term(s) Typically Offered: Offered as Needed

Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

**MECH 422 - Thermal System Design**

Device design and system design of compressors, turbines, heat exchangers, piping systems, internal combustion engines, and other component equipment. Optimization including thermo-economic evaluation and energy analysis.

Prerequisite: MECH 340<sup>D</sup>

<sup>D</sup> Requires minimum grade of D.

Credits: 3

Term(s) Typically Offered: Offered as Needed

Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

**MECH 423 - Additive Manufacturing**

Introduction to technologies and processes used to translate virtual solid model data into physical models for prototyping and end-use manufacturing applications. Discussion of design tools and design considerations for additively manufactured components.

Prerequisite: MECH 320<sup>D</sup>

<sup>D</sup> Requires minimum grade of D.

Credits: 3

Term(s) Typically Offered: Offered as Needed

Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

**MECH 430 - Mechatronics**

Instrumentation and measurements emphasizing systems that combine electronics and mechanical components with modern controls and microprocessors. First and second order behavior, transducers and intermediate devices, measurement of rapidly changing engineering parameters, microcontrollers and actuators.

Prerequisite: MECH 330<sup>D</sup>

<sup>D</sup> Requires minimum grade of D.

Credits: 3

Term(s) Typically Offered: Offered as Needed

Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

**MECH 431 - Introduction to Robotics**

Introduction to robots and their types. Homogeneous transformations. Kinematic equations and their solutions. Motion trajectories, statics, dynamics, and control of robots. Robot programming. Actuators, sensors and vision systems.

Prerequisites: ENGR 310<sup>D</sup> and MECH 330<sup>D</sup>

<sup>D</sup> Requires minimum grade of D.

Credits: 3

Term(s) Typically Offered: Offered as Needed

Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

**MECH 440 - HVAC Systems**

The analysis and design of heating air conditioning systems. Topics include: psychometrics, comfort & health, heating and cooling loads, solar radiation, air distribution systems and refrigeration.

Prerequisites: MECH 340<sup>D</sup> and ENGR 301<sup>D</sup>

<sup>D</sup> Requires minimum grade of D.

Credits: 3

Term(s) Typically Offered: Offered as Needed

Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

**MECH 441 - Sustainable Energy**

The technical, economic, environmental and physical resources constraints of energy sources are discussed in terms of both national and global development needs. The current states of both non-renewable and renewable technologies are presented in terms of their potential contribution to sustainable energy resources required for continued viable economic development.

Prerequisite: ENGR 320<sup>D</sup>

<sup>D</sup> Requires minimum grade of D.

Credits: 3

Term(s) Typically Offered: Offered as Needed

Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

**MECH 460 - Capstone Design I**

Capstone Design course is the culmination of the educational experience in Mechanical Engineering. The courses require students to draw upon all previous coursework and cultivate new skills in order to solve complex design problems associated with an assigned group project. This is the first course of a year-long design experience.

Credits: 3

Term(s) Typically Offered: Offered Spring Terms

Enrollment limited to students with a semester level of Senior 1 or Senior 2.

Enrollment limited to students with department of Physics and Engineering.

**MECH 461 - Capstone Design II**

Capstone Design course is the culmination of the educational experience in Mechanical Engineering. The courses require students to draw upon all previous coursework and cultivate new skills in order to solve complex design problems associated with an assigned group project. This is the second course of a year-long design experience.

Prerequisite: MECH 460<sup>D</sup>

<sup>D</sup> Requires minimum grade of D.

Credits: 3

Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

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

Enrollment limited to students in the College of Engineering & Science college.

**MECH 490 - Independent Study**

Independent Study courses give students the opportunity to pursue research and/or studies that are not part of the university's traditional course offerings. Students work one on one or in small groups with faculty guidance and are typically required to submit a final paper or project as determined by the supervising professor.

Credits: 1-3

Term(s) Typically Offered: Offered as Needed

Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

**MECH 495 - Workshop**

A workshop is a program which is usually of short duration, narrow in scope, often non-traditional in content and format, and on a timely topic.

Credits: 1-6

Term(s) Typically Offered: Offered as Needed

Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.

**MECH 498 - Selected Topics**

A Selected Topics course is a normal, departmental offering which is directly related to the discipline, but because of its specialized nature, may not be able to be offered on a yearly basis by the department.

Credits: 1-3

Term(s) Typically Offered: Offered as Needed

Students with a semester level of Freshman 1, Freshman 2 or Sophomore 1 may **not** enroll.