EMEC - Mechanical Engineering

EMEC 100. Introduction to Mechanical Engineering. 1 Credit. (1 Lec) F
COREQUISITE: M 151Q. The mechanical engineering profession, logical problem solving and design, professionalism, ethics.

EMEC 103. CAE I - Engineering Graphics Communications. 2 Credits. (2 Lab) F,S,Su
on demand PREREQUISITE: ME, MET, or I&E majors only. COREQUISITE: M 171Q for ME and ME majors; M 151Q for MET majors. Communication through engineering graphics. The course topics include drawing utilizing sketching, 2-D CAD and 3-D solid modeling software, drawing standards, fits, and tolerances.

EMEC 203. CAE II - Mechanical Engineering Computations. 2 Credits. (1 Lec, 1 Lab) F,S
PREREQUISITE: EMEC majors only, EMEC 103. COREQUISITE: M 172Q. Computer methodology, use of various computer software packages in mechanical engineering applications.

EMEC 250. Mechanical Engineering Materials. 3 Credits. (3 Lec) On Demand PREREQUISITE: WRIT 101W, and CHMY 121IN or CHMY 141. COREQUISITE: M 172Q for ME majors; M 166Q for MET majors. Properties of engineering materials and ceramics as related to their structures. Material selection for engineering applications.

EMEC 290R. Undergraduate Research. 1-6 Credits. (1-6 Ind) F,S
Su PREREQUISITE: Consent of instructor and approval of department head or director. Directed undergraduate research/creative activity which may culminate in a written work or other creative project. Course will address responsible conduct of research. May be repeated.

EMEC 291. Special Topics. 1-4 Credits. (1-4 cr.) On Demand PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

EMEC 292. Independent Study. 1-3 Credits. (1-3 Ind) F,S,Su
PREREQUISITE: Consent of instructor and approval of department head or director. Directed research and study on an individual basis.

EMEC 303. CAE III - Systems Analysis. 3 Credits. (3 Lec) F,S
PREREQUISITE: EMEC 203, M 273Q, M 274. COREQUISITE: EGEN 205. Course focuses on enhancing the appreciation of mathematics in ME and advancing the knowledge of mathematical methods in engineering analysis. Topics include introduction to mathematical modeling of engineering systems, linear algebra techniques, numerical methods, method of Laplace transformation, Fourier analysis, with classic and modern engineering applications.

EMEC 320. Thermodynamics I. 3 Credits. (3 Lec) F,S
PREREQUISITE: EGEN 201. Basic thermodynamic concepts, first and second laws, open and closed systems, properties of ideal and real substances, work, heat, irreversibility, and availability.

EMEC 321. Thermodynamics II. 3 Credits. (3 Lec) F,S
PREREQUISITE: EMEC 320. Vapor, gas power, and refrigeration cycles; mixtures and combustion.

EMEC 326. Fundamentals of Heat Transfer. 3 Credits. (3 Lec) F,S
PREREQUISITE: EGEN 335, EMEC 320. COREQUISITE: Concurrent enrollment in or prior completion of EMEC 303. Mechanisms of energy transport due to a temperature difference in materials. Conduction, convection, and radiation formulations.

EMEC 341. Adv Mechanics of Materials. 3 Credits. (3 Lec) F,S
PREREQUISITE: M 274 and EGEN 205. COREQUISITE: Concurrent enrollment in or prior completion of ETME 217 and EGEN 350. Static yield theories, introduction to fracture mechanics, analysis of fatigue, thick-walled pressure vessels, strain energy, Castigiano’s theorem, application to engineering design analysis problems.

EMEC 342. Mech Component Design. 3 Credits. (3 Lec) F,S
PREREQUISITE: EMEC 341. Requires completion of all 100-200 level courses (except core). Analysis of components used in mechanisms and machines. Topics include bolts, welds, springs, bearings, gears, belts, chains, motors, and hydraulic elements.

EMEC 360. Measurement & Instrumentation. 3 Credits. (3 Lec) F,S
PREREQUISITE: Requires completion of all 100-200 level courses (except Core), for ME majors. COREQUISITE: EGEN 350; EMEC 303 and EMEC 320 for ME majors; EGEN 324 for MET majors. Theory and application of engineering measurement concepts including: temperature, pressure, displacement and flow sensing; calibration; statistical and uncertainty analysis; sampling; signal conditioning; 1st and 2nd order dynamic response; emphasis of computerized data acquisition and feedback-based actuation and control.

EMEC 361. Measurement & Instrument Lab. 1 Credit. (1 Lab) F,S
COREQUISITE: EMEC 360. Application of engineering measurement concepts including: temperature, pressure, displacement and flow sensing; calibration; statistical and uncertainty analysis; sampling; signal conditioning; 1st and 2nd order dynamic response.

EMEC 368. Introduction to Aerospace. 3 Credits. (3 Lec) F
PREREQUISITE: M 172, PHSX 222. Introductory course on topics relevant to aerospace engineering and science. Required for the Aerospace Minor. Topics include history, atmospheric and space vehicles, propulsion, flight vehicle performance, materials and structures, and stability and control.

EMEC 403. CAE IV - Design Integration. 3 Credits. (1 Lec, 2 Lab) F,S
on demand; PREREQUISITE: EMEC 103 or EMEC 303; or instructor’s consent; junior standing. Develop the ability to use solid and parametric modeling to design and document machine parts. Geometric dimensioning and tolerancing, auxiliary views, analysis of models, advanced modeling techniques and customization are covered through hands-on experiences.

EMEC 405. Finite Element Analysis. 4 Credits. (3 Lec, 1 Rct) F,S
COREQUISITE: Concurrent enrollment in or prior completion of EMEC 342. Introduction to the finite element method emphasizing the fundamental principles of FEA. Various finite element formulations for applications to structural analysis, thermal/fluids analysis, and design. Practical computational experience using a commercial finite element computer code.

EMEC 424. Cellular Mechanotransduction. 3 Credits. (3 Lec) F
PREREQUISITE: College of Engineering students—completion of all required mathematics courses in the major; other students—permission of the instructor. Solid and fluid mechanics and relationships to cell biology. This interdisciplinary course brings together topics from both engineering and molecular biology to understand the mechanisms by which cells respond to loading. Topics selected from: musculoskeletal, circulatory, lymphatic, chondrocyte, leucocyte, and cancer cell mechanotransduction.

EMEC 425. Advanced Thermal Systems. 3 Credits. (3 Lec) F,S
PREREQUISITE: EMEC 321, EMEC 326. Study of thermodynamics, heat transfer, and fluid mechanics analysis for applications to thermal systems.

EMEC 444. Mech Behavior of Materials. 3 Credits. (3 Lec) F,
even years
PREREQUISITE: EMAT 251. Professional elective standing, or consent of instructor. Theory, analysis, and application of mechanical behavior of materials. Constitutive behavior. Topics selected from: plasticity, fracture mechanics, visco elasticity, high temperature behavior, and material symmetry. Engineering behavior of materials such as metals, polymers, ceramics, composites, and biomaterials. Structure-function relationships such as stress-based growth, toughening mechanisms, fatigue, and damage-tolerant design with modern engineering materials are emphasized.

EMEC 445. Mechanical Vibrations. 3 Credits. (3 Lec) F,S
PREREQUISITE: EMEC 303. Requires completion of all 100-200 level courses (except Core). Vibration problems of single and multiple degree of freedom systems. Introduction to vibration of continuous bodies. Analysis of free and forced vibration problems. Effects of damping.

EMEC 447. Aircraft Structures. 4 Credits. (3 Lec, 1 Rct) On Demand PREREQUISITE: EMEC 341 or instructor approval. An introduction to the current practices in the design and analysis of aircraft metallic and composite structures. Overview of aircraft design, analysis, testing, and certification with examples. Static and dynamic load condition analysis.

EMEC 465. Bio-inspired Engineering. 3 Credits. (3 Lec) F
on demand PREREQUISITE: EGEN 355, EMEC 320, EGEN 310 for ME majors; EGEN 310 for MET majors. Corequisites listed for non-majors. Addresses design in nature and resultant solutions as inspiration for solving engineering design problems. Structural, thermal, and fluid concepts in nature will be applied to engineering. Smart structures, self-healing materials, and robotics will be introduced.

EMEC 467. Micro-Electromechanical Systems. 3 Credits. (2 Lec, 1 Lab) On Demand PREREQUISITE: Senior standing; ELEF 250 and EGEN 205; or consent of instructor. Introduction to sensors and actuators and their working principles. MEMS (microelectromechanical systems) fabrication procedures. MEMS materials and their mechanical properties. Mechanical behavior of microsystems. MEMS packaging and thermal-mechanical stresses in MEMS packages. Reliability issues in MEMS.

Montana State University

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EMEC 489R. Mechanical Engineering Design Capstone I. 2 Credits. (1 Lec, 1 Rec) F
PREREQUISITE: EGEN 310R, ME majors only. COREQUISITE: Concurrent enrollment in or prior completion of EMEC 321, EMEC 326, EMEC 342, EMEC 360, EMEC 361, EMEC 445. Senior capstone design experience in Mechanical Engineering. Students, under the guidance of a faculty supervisor, solve real-world design problems.

EMEC 490R. Undergraduate Research. 1-6 Credits. (1-6 Ind) F,S,Su
PREREQUISITE: Junior standing, consent of instructor, and approval of certifying officer. Directed undergraduate research/creative activity which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.

EMEC 491. Special Topics. 1-4 Credits. (1-4 cr.)
PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

EMEC 492. Independent Study. 1-3 Credits. (1-3 Ind) F,S,Su
PREREQUISITE: Junior standing, consent of instructor, and approval of department head or director. Directed research and study on an individual basis.

EMEC 495. Student Teaching: ME Consult. 1-3 Credits. (1-3 Ind; 3 cr. max) F,S,Su
PREREQUISITE: Sophomore standing in ME/MET curriculum and consent of supervising faculty. Students enrolled in this class will provide technical support for selected ME/MET courses.

EMEC 498. Internship. 1-12 Credits. (1 Ind) F,S,Su
PREREQUISITE: Junior standing and consent of internship coordinator. An individualized assignment arranged with an agency, business, or other organization to provide guided experience in the field.

EMEC 499R. Mech Eng Design Capstone II. 3 Credits. (1 Lec, 1 Rct, 1 Lab) F,S
PREREQUISITE: EMEC 489R or consent of instructor. ME majors only. Senior capstone design experience in Mechanical Engineering. Students implement and test the function of design prototypes, under the guidance of a faculty supervisor.

EMEC 524. Cellular Mechanotransduction. 3 Credits. (3 Lec) F
PREREQUISITE: College of Engineering students-completion of all required mathematics courses in the major, or graduate standing. Topics include: musclekeletal, circulatory, lymphatic, chondrocyte, leukocyte, and cancer cell mechanotransduction.

EMEC 525. Conduction Heat Transfer. 3 Credits. (3 Lec) F
PREREQUISITE: EMEC 362. COREQUISITE: EMEC 510. Advanced topics in conduction heat transfer with emphasis on analytical techniques including separation of variables, Duhamel’s theorem, two-phase problems, and numerical techniques.

EMEC 530. Advanced Fluid Mechanics I. 3 Credits. (3 Lec) S alternate years, to be offered odd years.
PREREQUISITE: EGEN 335 or ECHM 322. COREQUISITE: EM 525 or consent of instructor. Review of conservation equations, laminar and turbulent internal flows, potential flows, and Stokes flow.

EMEC 531. Advanced Fluid Mechanics II. 3 Credits. (3 Lec) S alternate years, to be offered even years.
PREREQUISITE: EGEN 335 or ECHM 322. COREQUISITE: EM 525. Laminar boundary layer and free shear flows, internal and external compressible flows.

EMEC 533. Transport Phenomena. 3 Credits. (3 Lec) S alternate years, to be offered even years.
PREREQUISITE: EGEN 335 or instructor approval. Numerical solutions of fluid flows, discretization methods, solution algorithms, aspects of turbulent flows.

EMEC 545. Advanced Mechanical Vibrations. 3 Credits. (3 Lec) S alternate years, to be offered even years.
PREREQUISITE: EGEN 335 or EMEC 342. Advanced topics in mechanical vibrations. Multidegree of freedom systems, continuous systems, generalized coordinates. Introduction to nonlinear vibrations.

EMEC 565. Smart Structures. 3 Credits. (3 Lec) S alternate years, to be offered even years.
PREREQUISITE: EGEN 335 or EMEC 342. Analysis and design of intelligent structures for aerospace, mechanical, and civil applications. Topics include piezoelectricity, shape memory effects, magnetorheology, and biomimicking.