EMEC - Mechanical Engineering

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

EMEC 103 CAE I-Engineering Graphics Communications: 2 Credits (2 Lab)
PREREQUISITE: ME, MET, EIMS majors or instructor consent
COREQUISITE: M 151Q or M 171Q or M 165Q. (F, Sp)
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
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EMEC 203 CAE II-Mechanical Engineering Computations: 2 Credits (1 Lec, 1 Lab)
PREREQUISITE: ME majors only, EMEC 103
COREQUISITE: M 172. (F, Sp) Computer methodology, use of various computer software packages in mechanical engineering applications
.

EMEC 250 Mechanical Engineering Materials: 3 Credits (3 Lec)
PREREQUISITE: WRIT 101W; CHMY 141 or CHMY 121IN
COREQUISITE: EMAT 252; M 172 or M 166. (F, Sp) 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 Other)
PREREQUISITE: Consent of instructor and approval of department head or director. (F, Sp, Su) 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
Repeatable up to 99 credits.

EMEC 291 Special Topics: 1-4 Credits (1 Lec)
PREREQUISITE: None required but some may be determined necessary by each offering department. On demand. 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
Repeatable up to 12 credits.

EMEC 292 Independent Study: 1-3 Credits (1-3 Other)
PREREQUISITE: Consent of instructor and approval of department head or director. (F, Sp, Su) Directed research and study on an individual basis
Repeatable up to 6 credits.

EMEC 303 CAE III-- Systems Analysis: 3 Credits (3 Lec)
PREREQUISITE: EMEC 203, M 273, M 274
COREQUISITE: EGEN 205. (F, Sp) 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)
PREREQUISITE: EGEN 201, M 273. (F, Sp) 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)
PREREQUISITE: EMEC 320. (F, Sp) Vapor, gas power, and refrigeration cycles; mixtures and combustion

EMEC 326 Fundamentals of Heat Transfer: 3 Credits (3 Lec)
PREREQUISITE: EGEN 335, EMEC 320
COREQUISITE: EMEC 303. (F, Sp) Mechanisms of energy transport due to a temperature difference in materials. Conduction, convection, and radiation formulations
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EMEC 341 Adv Mechanics of Materials: 3 Credits (3 Lec)
PREREQUISITE: M 274 and EGEN 205
COREQUISITE: EGEN 350 and ETME 216 or ETME 217. (F, Sp) Static yield theories, introduction to fracture mechanics, analysis of fatigue, thick-walled pressure vessels, strain energy, Castigliano's theorem, application to engineering design analysis problems
.

EMEC 342 Mechanical Component Design: 3 Credits (3 Lec)
PREREQUISITE: EGEN 350, EMEC 341. (F, Sp) 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)
PREREQUISITE: EELE 250
COREQUISITE: EGEN 350; EMEC 320 or EGEN 324; EMEC 303 or ETME 202. (F, Sp) 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 Credits (1 Lab)
COREQUISITE: EMEC 360. (F, Sp) 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)
PREREQUISITE: M 172 or M 165Q, PHSX 222 or PHSX 207. (F) 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)
PREREQUISITE: EMEC 103 or EMEC 303; or instructor's consent; junior standing. (F, Sp) 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: 3 Credits (3 Lec)
COREQUISITE: EMEC 342. (F, Sp) 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)
PREREQUISITE: College of Engineering students—completion of all required mathematics courses in the major; other students—permission of the instructor. (Sp) (S) 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, leukocyte, and cancer cell mechanotransduction

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

EMEC 426 Thermodynamics of Propulsion Systems: 3 Credits (3 Lec)
PREREQUISITE: EMEC 425. (Sp) An introduction to computer-aided thermodynamics calculations with applications to the mechanics and thermodynamics of aerospace propulsion systems. Includes computer-based chemical equilibrium applications and compressible fluid flow applications

EMEC 430 Introduction to Combustion: 3 Credits (3 Lec)
PREREQUISITE: EMEC 321 or ECHM 407
COREQUISITE: EMEC 326 or ECHM 322. (F) Study of combustion science based on chemistry, thermodynamics, fluid mechanics, and transport phenomenon. Stoichiometry, energetics of chemical reactions and flame temperature; combustion kinetics; momentum, heat and mass transport in combustion; combustion phenomena and applications
.

EMEC 436 Computational Fluid Dynamics: 3 Credits (3 Lec)
PREREQUISITE: EMEC 303, EGEN 335, M 274. (F, Sp) Introduction to computational methods used for the solution of advanced fluid dynamics problems. Emphasis on finite difference methods as applied to various ordinary and partial differential model equations in fluid mechanics, fundamentals of spatial discretization, numerical integration, and numerical linear algebra. A focus on the engineering and scientific computing environment. Other topics may include waves, advanced numerical methods (like spectral, finite element, finite volume), non-uniform grids, turbulence modeling, and methods for complex boundary conditions

EMEC 440 Biomechanics of Human Movement: 3 Credits (3 Lec)
PREREQUISITE: EGEN 202, EGEN 205, EMEC 203, M 274 or consent of instructor. (Sp) Applications of mechanics to the human body. Overview of key problems and challenges in musculoskeletal biomechanics. Topics include: biological tissue form and function, generation of movement, kinematics, and inverse dynamics

EMEC 444 Mech Behavior of Materials: 3 Credits (3 Lec)
PREREQUISITE: EMEC 341 or ETME 341. (F) 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)
PREREQUISITE: EMEC 303. (F, Sp) 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 Other)
PREREQUISITE: EMEC 341 or instructor approval. (Sp) 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 462 System Dynamics and Control: 3 Credits (3 Lec)
PREREQUISITE: EMEC 203, EMEC 303, EMEC 360, EMEC 361. (F) Fundamental principles of system dynamics and control with emphasis on mechanical systems. Modeling and analysis of multi-physical domain systems, including state-space representation and transfer/frequency response functions. Basic concepts of stability, system response and SISO controller design

EMEC 465 Bio-inspired Engineering: 3 Credits (3 Lec)
PREREQUISITE: EGEN 335, EMEC 320, EGEN 310R or consent of instructor. (Sp) Address evolution in nature as paradigms for engineering design problem solutions. Structural, mechanical, and modeling concepts in nature applied to engineering. Advanced applications include smart structures, optimization, biology, and robotics

EMEC 466 Acoustics, Engineering and the Environment: 3 Credits (3 Lec)
PREREQUISITE: PHSX 222, PHSX 207 or EELE 217. (Sp) This course will give students exposure to engineering acoustics and noise and vibration control. Learn about sub-disciplines within acoustical engineering. Environmental (interior and exterior) acoustics, human perception, designing sound absorbers, diffusers and isolation assemblies, acoustics within spaces, noise and vibration prediction (modeling) and mitigation, impact on wildlife and specifically-acoustic measurements. OSHA & EPA noise limits, various noise metrics as they apply to industry, HVAC, automotive and aerospace

EMEC 467 Micro-Electromechanical Systems: 3 Credits (3 Lec)
PREREQUISITE: EELE 250 and EGEN 205 and Junior Standing; or consent of instructor. (Sp) 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. MEMS case studies using FEM in Comsol in an extended project work

EMEC 489R Mechanical Engineering Design Capstone I: 2 Credits (1 Lec, 1 Other)
PREREQUISITE: EGEN 310R, ME majors only
COREQUISITE: EMEC 321, EMEC 326, EMEC 342, EMEC 360, EMEC 361. (F, Sp) Senior capstone design experience in Mechanical Engineering. Students, under the guidance of a faculty supervisor, solve real-world design problems
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EMEC 490R Undergraduate Research: 1-6 Credits (1-6 Other)
(F, Sp, Su) 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. Repeatable up to 12 credits.

EMEC 491 Special Topics: 1-4 Credits (1 Lec)
Repeatable up to 12 credits.

EMEC 492 Independent Study: 1-3 Credits (1-3 Other)
(F, Sp, Su) Directed research and study on an individual basis. Repeatable up to 6 credits.

EMEC 495 Student Teaching: ME Consult: 1-3 Credits (1-3 Other)
(F, Sp, Su) Students enrolled in this class will provide technical support for selected ME/MET courses.
Repeatable up to 3 credits.

EMEC 498 Internship: 1-3 Credits (1-3 Other)
PREREQUISITE: EMEC 303, EMEC 320, EMEC 341, and consent of internship coordinator. (F, Sp, Su) An individualized assignment arranged with an agency, business, or other organization to provide guided experience in the field

EMEC 499R Mechanical Engineering Design Capstone II: 3 Credits (1 Lec, 1 Lab, 1 Other)
PREREQUISITE: EMEC 489R, ME majors only. (F, Sp) 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)
PREREQUISITE: College of Engineering students—completion of all required mathematics courses in the major; other students—permission of the instructor. (Sp) Graduate students: good standing within graduate program. NOTE: this course will co-convene undergraduate and graduate versions with additional work and depth required of graduate students. 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, leukocyte, and cancer cell mechanotransduction

EMEC 525 Conduction Heat Transfer: 3 Credits (3 Lec)
PREREQUISITE: EMEC 326
COREQUISITE: EGEN 505. (F) (F) 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)
PREREQUISITE: EGEN 335 or ECHM 321
COREQUISITE: EM 525 or consent of instructor. () Offered Spring, even years. Review of conservation equations, laminar and turbulent internal flows, potential flows, and Stokes flow
.

EMEC 531 Advanced Fluid Mechanics II: 3 Credits (3 Lec)
PREREQUISITE: EGEN 335 or ECHM 321
COREQUISITE: EM 525. () Offered Spring, odd years. Laminar boundary layer and free shear flows, internal and external compressible flows
.

EMEC 536 Computational Fluid Mechanics: 3 Credits (3 Lec)
PREREQUISITE: EGEN 335 or Instructor Approval. (F) Numerical solutions of fluid flows, discretization methods, solution algorithms, aspects of turbulent flows

EMEC 540 Biomechanics of Human Movement: 3 Credits (3 Lec)
PREREQUISITE: Graduate student in good academic standing. (Sp) Applications of mechanics to the human body. Overview of key problems and challenges in musculoskeletal biomechanics. Topics include: biological tissue form and function, generation of movement, kinematics, and inverse dynamics. Department of Mechanical & Industrial Engineering

EMEC 545 Advanced Mechanical Vibrations: 3 Credits (3 Lec)
PREREQUISITE: EMEC 445. (Sp) Advanced topics in mechanical vibrations. Multidegree of freedom systems, continuous systems, generalized coordinates. Introduction to nonlinear vibrations

EMEC 555 Current Topics in Orthopaedic Biomechanics: 1 Credits (1 Lec)
PREREQUISITE: Undergraduate students: Junior or senior status (e.g. completion of at least 69 credits) within a STEM major Graduate students: good standing within your graduate program. (F, Sp) This course covers current topics from the orthopaedic biomechanics literature. Special attention will be paid to the structural tissues including bone and cartilage, as well as to the pathologies of the structural tissues that occur with injury, disease, and aging including osteoporosis and osteoarthritis. Weekly meetings will include student presentations of primary literature, discussion of experimental methods, and interpretation of results within the broader picture of the musculoskeletal literature
Repeatable up to 3 credits.

EMEC 565 Smart Structures: 3 Credits (3 Lec)
PREREQUISITE: EMEC 303 and EMEC 342 and EMEC 445, or equivalent. () Offered on demand. Analysis and design of intelligent structures for aerospace, mechanical, and civil applications. Topics include piezoelectricity, shape memory effects, magnetorheology, and biomimicking

EMEC 575 Research or Prof Paper/Project: 1-6 Credits (1-6 Other)
PREREQUISITE: Graduate standing. (F, Sp, Su) A research or professional paper or project dealing with a topic in the field. The topic must have been mutually agreed upon by the student and his or her major advisor and graduate committee. This course can be used toward fulfilling the requirements for the Master of Science in Mechanical Engineering for non-thesis option students
Repeatable up to 6 credits.

EMEC 589 Graduate Consultation: 1-3 Credits (1-3 Other)
PREREQUISITE: Master's standing and approval of the Dean of Graduate Studies. (F, Sp, Su) This course may be used only by students who have completed all of their coursework (and thesis, if on a thesis plan) but who need additional faculty or staff time
Repeatable up to 3 credits.

EMEC 590 Master's Thesis: 1-10 Credits (1-10 Other)
PREREQUISITE: Master's standing; consent of instructor. (F, Sp, Su) Master's Thesis
Repeatable up to 99 credits.

EMEC 591 Special Topics: 1-4 Credits (1-4 Lec)
PREREQUISITE: Upper division courses and others as determined for each offering. On demand. 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
Repeatable up to 12 credits.

EMEC 592 Independent Study: 1-3 Credits (1 Other)
PREREQUISITE: Graduate standing, consent of instructor, approval of department head or director. (F, Sp, Su) Directed research and study on an individual basis
Repeatable up to 6 credits.

EMEC 594 Seminar: 1 Credits (1 Other)
PREREQUISITE: Graduate standing or seniors by petition. (F, Sp) Course prerequisites as determined for each offering. Topics offered at the graduate level which are not covered in regular courses. Students participate in preparing and presenting the discussion material
Repeatable up to 1 credits.

EMEC 598 Internship: 1-12 Credits (1-12 Other)
PREREQUISITE: Graduate standing, consent of instructor and approval of graduate program coordinator. (F, Sp, Su) An individualized assignment arranged with an agency, business or other organization to provide guided experience in the field
Repeatable up to 12 credits.

EMEC 690 Doctoral Thesis: 1-10 Credits (1-10 Other)
PREREQUISITE: Doctoral standing; consent of instructor. (F, Sp, Su) Doctoral Thesis
Repeatable up to 99 credits.