MECHANICAL SCIENCE AND
ENGINEERING

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• Bachelor of Science in Mechanical Engineering (http://
catalog.illinois.edu/undergraduate/engineer/departments/mech-
engin/bs-mechanical-engineering)
• Bachelor of Science in Engineering Mechanics (http://
catalog.illinois.edu/undergraduate/engineer/departments/mech-
engin/engin-mech)

ME Class Schedule (https://courses.illinois.edu/schedule/DEFAULT/DEFAULT/ME)

Mechanical Engineering Courses

ME 170 Computer-Aided Design credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ME/170)
Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; ISO and ANSI standards for coordinate dimensioning and tolerancing; geometric dimensioning and tolerancing. Use of solid-modeling software for creating associative models at the component and assembly levels with automatic blueprint creation, interference checking, and linked bill of materials. Credit is not given for both ME 170 and GE 101 or SE 101.

ME 199 Undergraduate Open Seminar credit: 1 to 5 Hours. (https://courses.illinois.edu/schedule/terms/ME/199)
May be repeated.

ME 200 Thermodynamics credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ME/200)
Classical thermodynamics through the second law; system and control-volume analyses of thermodynamic processes; irreversibility and availability; relations for ideal gas mixtures. Prerequisite: MATH 241.

ME 270 Design for Manufacturability credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ME/270)
Introduction to DFM methodologies and tools; material selection (new and traditional materials); designing for primary manufacturing processes (cutting fundamentals, casting, forming, and shaping); designing with plastics (snap-fits, integral hinges, etc.); design for assembly (DFA); geometric dimensioning and tolerancing (GD&T). Same as TAM 270. Prerequisite: ME 170. ME and EM majors only.

ME 290 Seminar credit: 0 Hours. (https://courses.illinois.edu/schedule/terms/ME/290)
Lectures by faculty and invited authorities, concerning the ethics and practices of mechanical engineering/engineering mechanics, as well as its relationship to other fields of engineering, to economics, and to society. Offered fall term only. Approved for S/U grading only.

ME 297 Introductory Independent Study credit: 1 to 3 Hours. (https://courses.illinois.edu/schedule/terms/ME/297)
Independent study and/or individual projects related to mechanical engineering. Approved for Letter and S/U grading. May be repeated to a maximum of 6 credit hours for letter grade; no limit for S/U grade mode. Prerequisite: Consent of Instructor.

ME 310 Fundamentals of Fluid Dynamics credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ME/310)
Fundamentals of fluid mechanics with coverage of theory and applications of incompressible viscous and inviscid flows, and compressible high speed flows. Credit is not given for both ME 310 and TAM 335. Prerequisite: MATH 285 OR MATH 286 OR MATH 441; credit or concurrent registration in ME 200.

ME 320 Heat Transfer credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ME/320)
Fundamentals of fluid mechanics with coverage of theory and applications of incompressible viscous and inviscid flows, and compressible high speed flows. Credit is not given for both ME 310 and TAM 335. Prerequisite: MATH 285 OR MATH 286 OR MATH 441; credit or concurrent registration in ME 200.

ME 330 Engineering Materials credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ME/330)
Structures of polymers, metals, and ceramics as the basis for their mechanical behavior. Manipulation of structure through such processes as heat treatment and solidification. Mechanisms of material failure in service (yielding, fracture, fatigue, creep, corrosion, and wear) and simple design techniques to avoid these failures. Strategies for materials selection in design. Credit is not given for both ME 330 and either CEE 300 or MSE 280. Prerequisite: CHEM 102 and TAM 251.

ME 340 Dynamics of Mechanical Systems credit: 3.5 Hours. (https://courses.illinois.edu/schedule/terms/ME/340)
Dynamic modeling of mechanical components and systems; time-domain and frequency-domain analyses of linear time-invariant systems; multi-degree-of-freedom systems; linearization of nonlinear systems. Credit is not given for both ME 340 and either GE 320 or AE 353. Prerequisite: MATH 285 OR MATH 286 OR MATH 441; TAM 212; credit or concurrent registration in ECE 205 and MATH 415.

ME 351 Analysis of Mfg Processes credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ME/351)
Mechanistic and empirical modeling of manufacturing processes including metal cutting theory, casting analysis, forging analysis, sheet metal forming, plastics molding, welding and mechanical joining assembly analysis. Also, hands-on exposure to manufacturing processes, CAD/CAM software (MasterCam), 5 axis machining (ShopBot), Wire EDM machining, statistical process control (SPC), and geometric dimensioning and tolerancing (GD&T) metrology principles using CMM. Prerequisite: ME 270.

ME 360 Signal Processing credit: 3.5 Hours. (https://courses.illinois.edu/schedule/terms/ME/360)
Basic electromechanical techniques used in modern instrumentation and control systems. Use of transducers and actuators. Signal conditioning, grounding, and shielding. Analog and digital signal processing and feedback control methods with emphasis on frequency domain techniques. Frequency response of continuous and discrete systems. Credit is not given for both ME 360 and ABE 425. Prerequisite: ME 340.

Information listed in this catalog is current as of 10/2018
ME 370 Mechanical Design I credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ME/370)
Kinematics and dynamics of machinery, including introduction to user-centered design and design thinking, analytical and computer-aided design of kinematics, dynamic force analysis, principle of virtual work, cam and gear design, and balancing. Project-based learning of multi-mechanism system design, analysis, fabrication, and evaluation. Prerequisite: ME 270, TAM 212, and TAM 251.

ME 371 Mechanical Design II credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ME/371)
Design and analysis of machinery for load-bearing and power transmission. Consideration of material failure modes, including yielding, fracture, and fatigue. Design and selection of machine elements: threaded fasteners, springs, rolling-element bearings, fluid film lubrication, gears and friction drives. Prerequisite: ME 200.

ME 400 Energy Conversion Systems credit: 3 or 4 Hours. (https://courses.illinois.edu/schedule/terms/ME/400)
Processes and systems for energy conversion, including power and refrigeration cycles, air conditioning, thermoelctrics and fuel cells; ideal-gas mixtures and psychrometrics. 3 undergraduate hours. 4 graduate hours. Prerequisite: ME 300 OR CEE 300; ME 370.

ME 401 Refrigeration and Cryogenics credit: 3 or 4 Hours. (https://courses.illinois.edu/schedule/terms/ME/401)
Theory of operation and design of equipment for production of low temperatures, from below ambient to near absolute zero; industrial, consumer, aerospace, medical, and research applications. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: Credit or concurrent registration in ME 320.

ME 402 Design of Thermal Systems credit: 3 or 4 Hours. (https://courses.illinois.edu/schedule/terms/ME/402)
Selection of components in fluid- and energy-processing systems to meet system-performance requirements; computer-aided design; system simulation; optimization techniques; investment economics and statistical combinations of operating conditions. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: Credit or concurrent registration in ME 320.

ME 403 Internal Combustion Engines credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ME/403)
Theory and analysis of reciprocating internal-combustion engines; fuels, carburetion, combustion, exhaust emissions, detonation, fuel injection, and factors affecting performance; laboratory work on variables that affect performance. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: Credit or concurrent registration in ME 400 or ABE 466.

ME 404 Intermediate Thermodynamics credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ME/404)
Classical thermodynamics, including the TdS equations and the Maxwell relations; development of thermodynamic property relations, behavior of real gases, thermodynamics of mixtures, phase equilibrium and chemical reactions and equilibrium with an emphasis on combustion reactions; statistical thermodynamics including the effect of molecular and atomic structure, statistical concepts and distributions, calculation of thermodynamic properties of gas-phase atoms and molecules, kinetic theory of gases, and vibrations in crystals and the electron gas in metals; selected applications. 4 undergraduate hours. 4 graduate hours. Credit is not given for both ME 404 and any of PHYS 427, CHEM 442, or CHEM 444. Prerequisite: ME 200.

ME 410 Intermediate Gas Dynamics credit: 3 or 4 Hours. (https://courses.illinois.edu/schedule/terms/ME/410)
Solution of internal compressible-flow problems by one-dimensional techniques, both steady and unsteady; flows with smooth and abrupt area change, with friction, with heat addition, and with mass addition; flows with weak and strong waves, multiple confined streams, and shock waves. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: ME 200; ME 310, TAM 335 or AE 311.

ME 411 Viscous Flow & Heat Transfer credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ME/411)
Same as AE 412. See AE 412.

ME 412 Numerical Thermo-Fluid Mechs credit: 2 to 4 Hours. (https://courses.illinois.edu/schedule/terms/ME/412)
Numerical techniques for solving the equations governing conduction and convective heat transfer in steady and unsteady fluid flows: finite-difference and finite-volume techniques, basic algorithms, and applications to real-world fluid-flow and heat-transfer problems. Same as CSE 412. 2 or 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: ME 310 OR TAM 335; ME 320.

ME 420 Intermediate Heat Transfer credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ME/420)
Conduction heat transfer, radiation heat transfer, mass transfer, phase change, heat exchangers; numerical methods. 4 undergraduate hours. 4 graduate hours. Prerequisite: ME 310 OR TAM 335; ME 320.

ME 430 Failure of Engrg Materials credit: 3 or 4 Hours. (https://courses.illinois.edu/schedule/terms/ME/430)
Material anisotropy and elasto-plastic properties at the crystal level; microstructural basis for fatigue, fracture, and creep in metals, polymers, and ceramics; failure mechanisms and toughening in composites; structure and behavior of metal-matrix composites, ceramic-matrix composites, and polymer composites. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: ME 330 OR TAM 324.

ME 431 Mechanical Component Failure credit: 3 or 4 Hours. (https://courses.illinois.edu/schedule/terms/ME/431)
Relationship of materials and mechanics concepts to the design of structures and components: elasticity, plasticity, thermal loading, creep, fatigue, fracture, and residual-life assessments as they relate to materials selection and design. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: ME 330 and ME 371; Recommended: ME 430.

ME 432 Fundamentals of Photovoltaics credit: 3 or 4 Hours. (https://courses.illinois.edu/schedule/terms/ME/432)
In this course, we will develop a fundamental understanding of how solar cells convert light to electricity, how solar cells are made, how solar cell performance is evaluated, and the photovoltaic technologies that are currently on the market and/or under development. Using thermodynamics, materials physics, and engineering analysis we will assess and critique the potential and drawbacks of modern photovoltaic technologies, including single- and multi-crystalline silicon, tandem cells, CdTe, CIGS, PVT, bulk heterojunctions (organic), Graetzel cells, nanostructure-based, and third generation PV. 3 undergraduate hours. 4 graduate hours. Approved for Letter and S/U grading. Prerequisite: PHYS 212 and ME 330 or equivalent.

ME 440 Kinem & Dynamics of Mech Syst credit: 3 or 4 Hours. (https://courses.illinois.edu/schedule/terms/ME/440)
Kinematics and dynamics of constrained rigid-body mechanical systems; use of modern computer-based analysis software packages. 3 undergraduate hours. 4 graduate hours. Prerequisite: ME 370.
ME 445  Introduction to Robotics  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ME/445)
Same as AE 482 and ECE 470. See ECE 470.

ME 446  Robot Dynamics and Control  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ME/446)
Same as ECE 489 and SE 422. See SE 422.

ME 450  Modeling Materials Processing  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ME/450)
Manufacturing processes for metals and polymers; creation of process models based on momentum, heat, and mass transfer; model simplification by estimation and scaling; applications to casting, microstructure evolution, polymer molding and extrusion, and welding. 3 undergraduate hours. 3 graduate hours. Prerequisite: ME 320 and ME 330.

ME 451  Computer-Aided Mfg Systems  credit: 3 or 4 Hours. (https://courses.illinois.edu/schedule/terms/ME/451)
The application of computer technology and operations research to manufacturing systems. Use of microprocessors for direct numeric control of machine tools, adaptive control and optimization, and integrated manufacturing systems. Applications of industrial robots. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: ME 270.

ME 452  Num Control of Mfg Processes  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ME/452)
Numerical control systems, manufacturing processes, principles and practices basic to numerical control, and programming methodology for numerical control. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: CS 101 and ME 270.

ME 455  Micromanufacturing Process & Automation  credit: 3 or 4 Hours. (https://courses.illinois.edu/schedule/terms/ME/455)
Scaling laws in miniaturization, Micro-machine tools design and characterization, Micromanufacturing process modeling, simulation and automation, Micro-metrology and Micro-assembly systems. 3 undergraduate hours. 4 graduate hours. Prerequisite: ME 270 or equivalent or consent of instructor.

ME 460  Industrial Control Systems  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ME/460)
Industrial control techniques; case studies of industrial systems; design, selection, and maintenance of industrial control systems, including electromechanical, pneumatic, thermal, and hydraulic systems. 4 undergraduate hours. 4 graduate hours. Credit is not given for both ME 460 and ECE 486. Prerequisite: ME 340 and ME 360.

ME 461  Computer Cntrl of Mech Systems  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ME/461)
Microcomputer control of thermal and mechanical systems; sensors and transducers, signal transmission and conversion, and regulator actuation. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: ME 360 or ABE 425.

ME 470  Senior Design Project  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ME/470)
Solution of a real-world design problem: development, evaluation, and recommendation of alternative solutions subject to realistic constraints that include most of the following considerations: economics, environment, sustainability, manufacturability, ethics, health and safety, society, and politics. 3 undergraduate hours. No graduate credit. Departmental approval required. Prerequisite: Concurrent enrollment in no more than two required ME courses; completion of all required courses. This course satisfies the General Education Criteria for: Advanced Composition

ME 471  Finite Element Analysis  credit: 3 or 4 Hours. (https://courses.illinois.edu/schedule/terms/ME/471)
The finite element method and its application to engineering problems: truss and frame structures, heat conduction, and linear elasticity; use of application software; overview of advanced topics such as structural dynamics, fluid flow, and nonlinear structural analysis. Same as AE 420 and CEE 451. 3 or 4 undergraduate hours. 3 or 4 graduate hours. Credit is not given for both ME 471 and CEE 470. Prerequisite: CS 101 and ME 371 or TAM 470. Alternatively, AE 370 for AE students.

ME 472  Introduction to Tribology  credit: 3 or 4 Hours. (https://courses.illinois.edu/schedule/terms/ME/472)
Friction, wear, and lubrication; engineering surfaces; surface properties and surface topography; Hertzian contacts and contact of rough surfaces; friction of surfaces in contact; wear and surface failures; boundary lubrication; fluid properties; hydrodynamic lubrication; elastohydrodynamic lubrication; bearing selection; introductory micro- and nanotribology. 3 undergraduate hours. 3 or 4 graduate hours.

ME 481  Whole-Body Musculoskel Biomech  credit: 3 or 4 Hours. (https://courses.illinois.edu/schedule/terms/ME/481)
Exploration of the human musculoskeletal system with an emphasis on the whole-body or organism level; modeling and analysis techniques for examining human movement, such as rigid-body modeling techniques, forward and inverse dynamics, and Lagrangian mechanics; examination of current topics, such as orthopedic biomechanics, prosthetics and orthotics, postural control, and locomotion; use of computerized motion-capture equipment and software to examine, simulate, and analyze human movement. Same as BOE 481. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: TAM 212 and TAM 251.

ME 482  Musculoskel Tissue Mechanics  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ME/482)
Composition-structure-function relationships for musculoskeletal tissues, including bone, tendon, ligament, cartilage, and muscle; hierarchical structure of tissues from the macro- to nano-scales; relation of composition to mechanical properties of health and diseased tissue; experimental methods used to obtain mechanical properties. Same as BOE 482. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: TAM 251.

ME 483  Mechanobiology  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ME/483)
Integrative approach to mechanobiology; mechanics of cell adhesion; cytoskeletal structure and mechanics; mechanotransduction; mechanics of cell proliferation, apoptosis, cancer cells, and stem cells; aging; critical issues facing the mechanobiological sciences. 4 undergraduate hours. 4 graduate hours. Prerequisite: CHEM 103 and TAM 251.

ME 485  MEMS Devices & Systems  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ME/485)
Same as ECE 485. See ECE 485.
ME 487 MEMS-NEMS Theory & Fabrication  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ME/487)
Physical and chemical theory, design, and hands-on fabrication of micro- and nano-electromechanical systems (MEMS and NEMS); cleanroom fabrication theory, including general cleanroom safety, lithography, additive and subtractive processes, bulk and surface micromachining, deep reactive ion etching (DRIE), lithographic Galvanoformung Abformung (LIGA), packaging, scaling, actuators, and micro-nanofluids; fabrication of two take-home devices, such as piezoresistive sensors and microfluidic logic chips, that demonstrate advanced fabrication processing. 4 undergraduate hours. 4 graduate hours. Prerequisite: PHYS 212.

ME 496 Honors Project  credit: 1 to 4 Hours. (https://courses.illinois.edu/schedule/terms/ME/496)
Special project or reading course for James Scholars in engineering. 1 to 4 undergraduate hours. No graduate credit. May be repeated. Prerequisite: Consent of instructor.

ME 497 Independent Study  credit: 1 to 3 Hours. (https://courses.illinois.edu/schedule/terms/ME/497)
Independent study of advanced problems related to mechanical engineering. 1 to 3 undergraduate hours. No graduate credit. May be repeated in separate terms to a maximum of 6 hours, as topics vary. Prerequisite: Consent of Instructor. Students with Junior or Senior standing.

ME 498 Special Topics  credit: 0 to 4 Hours. (https://courses.illinois.edu/schedule/terms/ME/498)
Subject offerings of new and developing areas of knowledge in mechanical engineering intended to augment the existing curriculum. See Class Schedule or departmental course information for topics and prerequisites. 0 to 4 undergraduate hours. 0 to 4 graduate hours. May be repeated in the same or separate terms if topics vary to a maximum of 9 hours.

TAM Class Schedule (https://courses.illinois.edu/schedule/DEFAULT/DEFAULT/TAM)

Theoretical and Appl Mechanics Courses

TAM 195 Mechanics in the Modern World  credit: 1 Hour. (https://courses.illinois.edu/schedule/terms/TAM/195)
Freshman introduction to engineering mechanics and its role in modern engineering analysis and design. Project activity.

TAM 199 Undergraduate Open Seminar  credit: 1 to 5 Hours. (https://courses.illinois.edu/schedule/terms/TAM/199)
May be repeated.

TAM 201 Mechanics for Technol & Mgmt  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/TAM/201)
Engineering mechanics (statics, dynamics, solid mechanics, and fluid mechanics) and the role that mechanics plays in engineering analysis and design. For Technology and Management majors only.

TAM 210 Introduction to Statics  credit: 2 Hours. (https://courses.illinois.edu/schedule/terms/TAM/210)
Forces, moments, couples; resultants of force systems; equilibrium analysis and free-body diagrams; analysis of forces acting on members of trusses, frames, etc.; shear-force and bending-moment distributions; Coulomb friction; centroids and center of mass; applications of statics in design. Credit is not given for both TAM 210 and TAM 211. Prerequisite: PHYS 211; credit or concurrent registration in MATH 241.

TAM 211 Statics  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/TAM/211)
Forces, moments, and couples; resultants of force systems; equilibrium analysis and free-body diagrams; analysis of forces acting on members of trusses, frames, etc.; shear-force and bending-moment distributions; Coulomb friction; centroids, center of mass, moment of inertia, polar moment of inertia, and product of inertia; virtual work; hydrostatic pressure; applications of statics in design. Credit is not given for both TAM 211 and TAM 210. Prerequisite: PHYS 211; credit or concurrent registration in MATH 241.

TAM 212 Introductory Dynamics  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/TAM/212)
Kinematics and dynamics of the three-dimensional motion of particles; kinematics and dynamics of the plane motion of rigid bodies; methods of work energy and impulse momentum; moving reference frames. Prerequisite: TAM 210 or TAM 211.

TAM 251 Introductory Solid Mechanics  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/TAM/251)
Relationship between internal stresses and deformations produced by external forces acting on deformable bodies, and design principles based on mechanics of solids: normal stresses, shear stresses, and deformations produced by tensile, compressive, torsional, and bending loading of members; beam deflections; elastic energy and impact; multi-dimensional stress states; buckling of columns. Prerequisite: TAM 210 or TAM 211.

TAM 252 Solid Mechanics Design  credit: 1 Hour. (https://courses.illinois.edu/schedule/terms/TAM/252)
Design problems and projects intended to accompany TAM 251. Prerequisite: Credit or concurrent registration in TAM 251.

TAM 270 Design for Manufacturability  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/TAM/270)
Same as ME 270. See ME 270.

TAM 297 Introductory Independent Study  credit: 1 to 3 Hours. (https://courses.illinois.edu/schedule/terms/TAM/297)
Independent study and/or individual projects related to engineering mechanics. Approved for Letter and S/U grading. May be repeated to a maximum of 6 credit hours for letter grade; no limit for S/U grade mode. Prerequisite: Consent of Instructor.

TAM 302 Engineering Design Principles  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/TAM/302)
Examples of mechanical design problems that occur in engineering practice and the procedures and issues involved in solving them; technical aspects and societal ramifications of the design process; intellectual property, ethics, and contemporary issues; probability and statistics; computational mechanics; case studies; student discussion of design-related issues at different levels; design project reports and presentations; student teams.

TAM 324 Behavior of Materials  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/TAM/324)
Same as CEE 300. See CEE 300.

TAM 335 Introductory Fluid Mechanics  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/TAM/335)
Fluid statics; continuity, momentum, and energy principles via control volumes; ideal and real fluid flow; introduction to the Navier-Stokes equation; similitude; laminar and turbulent boundary layers; closed-conduit flow, open-channel flow, and turbomachinery. Prerequisite: TAM 212.
TAM 412  Intermediate Dynamics  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/TAM/412)
Lagrangian mechanics of dynamical systems with an emphasis on vibrations; constraints and generalized coordinates; motion in accelerating frames; conservation laws and invariance of the Lagrangian; particle motion in one dimension, the two-body problem, and central-force motion; free and forced vibration of linearized single-degree-of-freedom and multi-degree-of-freedom discrete systems; weakly nonlinear vibrations; parametric resonance; introduction to Hamiltonian dynamics; rigid-body motions. 4 undergraduate hours. 4 graduate hours. Credit is not given for both TAM 412 and AE 352. Prerequisite: MATH 225 or MATH 415; MATH 285 or MATH 441; TAM 212.

TAM 413  Fund of Engr Acoustics  credit: 3 or 4 Hours. (https://courses.illinois.edu/schedule/terms/TAM/413)
Same as ECE 473. See ECE 473.

TAM 416  Intro to Nonlinear Dyn & Vib  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/TAM/416)
Single- and multi-degree-of-freedom oscillators; asymptotic methods; forced, internal and combination resonances; time-discrete dynamical systems (maps); complex dynamics; parametric vibrations and resonances; introduction to nonlinear localization and nonlinear targeted energy transfer; nonlinear vibrations of elastic continua; application in mechanics and engineering. 4 undergraduate hours. 4 graduate hours. Prerequisites: MATH 285 OR MATH 441; MATH 415; TAM 212.

TAM 424  Mechanics of Structural Metals  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/TAM/424)
Micromechanisms at the atomic, single-crystal, and polycrystal levels and their use in explaining the deformation and failure characteristics of metals; elastic deformation, dislocation mechanics, plastic deformation and strengthening mechanisms, fracture mechanics and fracture mechanisms, fatigue, and creep; design criteria; special topics. 3 undergraduate hours. 3 graduate hours. Prerequisite: CEE 300 or ME 330.

TAM 427  Mechanics of Polymers  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/TAM/427)
Mechanical behavior of amorphous and semi-crystalline polymers; overview of polymer structure, properties, and processing; polymer linear viscoelasticity using Boltzmann superposition and mechanical models; measurement of viscoelastic properties; polymeric yield phenomena; fracture and craze formation; impact and fatigue. Same as AE 427 and MSE 454. 3 undergraduate hours. 3 graduate hours. Prerequisite: CEE 300 or ME 330.

TAM 428  Mechanics of Composites  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/TAM/428)
Same as AE 428 and MSE 456. See MSE 456.

TAM 435  Intermediate Fluid Mechanics  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/TAM/435)
Analytical solution methods for problems involving ideal and real fluids: potential flow theory, boundary-layer theory; surface waves, vortex dynamics, and compressible flows. 4 undergraduate hours. 4 graduate hours. Prerequisite: One of AE 312, ME 310, TAM 335.

TAM 445  Continuum Mechanics  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/TAM/445)
Tensor algebra and analysis; kinematics of continua; mass, force, stress, and the general balance laws of continuum mechanics; introduction to constitutive equations. 4 undergraduate hours. 4 graduate hours. Prerequisite: TAM 251.

TAM 451  Intermediate Solid Mechanics  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/TAM/451)
Analysis of stress and strain (definitions, transformation of axes, equilibrium equations, and symmetry of the stress tensor); linear materials, Hooke's law; strain energy, potential energy, energy principles and methods; two-dimensional problems in elasticity (torsion, axisymmetric problems); the finite-element method for two- and three-dimensional boundary-value problems in linear elasticity; plasticity (introduction, yield criteria, elastic-plastic behavior, and limit-load calculations); linear-elastic fracture mechanics (introduction, Griffith's approach, stress intensity factor, and energy release rate). 4 undergraduate hours. 4 graduate hours. Prerequisite: TAM 251.

TAM 456  Experimental Stress Analysis  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/TAM/456)
Basic theories for measuring stresses and deformations in load-carrying engineering components; use of optical, electrical, and mechanical instrumentation; laboratory sessions on brittle coatings, electrical resistance strain gages, photoelasticity, and moire interferometry. 3 undergraduate hours. 3 graduate hours. Prerequisite: TAM 251.

TAM 461  Cellular Biomechanics  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/TAM/461)
Mechanics of biological cells and tissues: cell structure; mechanics of biomembranes; the cytoskeleton and cortex; dynamic cell processes; cell motility and control of cell shape and proliferation; experimental approaches and theoretical models. Same as BIOE 461. 4 undergraduate hours. 4 graduate hours. Prerequisite: TAM 251.

TAM 470  Computational Mechanics  credit: 3 or 4 Hours. (https://courses.illinois.edu/schedule/terms/TAM/470)
Modercomputational mechanics: mappings and iterative methods; stability; convergence; consistency; numerical and symbolic solutions of ordinary and partial differential equations; finite-difference methods; the finite-element method; spectral methods. Applications to problems in solid mechanics, fluid mechanics, and dynamics. Same as CSE 450. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: CS 101; MATH 285 OR MATH 286 OR MATH 441.

TAM 497  Independent Study  credit: 1 to 3 Hours. (https://courses.illinois.edu/schedule/terms/TAM/497)
Individual studies in any area of theoretical and applied mechanics. 1 to 3 undergraduate hours. No graduate credit. May be repeated to a maximum of 6 hours in separate terms as topics vary. Prerequisite: Consent of Instructor. Students with Junior or Senior standing.

TAM 498  Special Topics  credit: 1 to 4 Hours. (https://courses.illinois.edu/schedule/terms/TAM/498)
Subject offerings of new and developing areas of knowledge in theoretical and applied mechanics intended to augment the existing curriculum. See Class Schedule or departmental course information for topics and prerequisites. 1 to 4 undergraduate hours. 1 to 4 graduate hours. May be repeated in the same or separate terms if topics vary to a maximum of 9 undergraduate hours or 12 graduate hours.

TAM 499  Senior Thesis  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/TAM/499)
The thesis investigation of special subjects in mechanics, including theoretical or experimental research. 3 undergraduate hours. No graduate credit. Prerequisite: Department and instructor approval required.