WILLIAM B. BURNSED, JR. MECHANICAL, AEROSPACE, AND BIOMEDICAL ENGINEERING

Department Information

(251) 460-6168

Department of Mechanical, Aerospace and Biomedical Engineering website
https://www.southalabama.edu/colleges/engineering/me/index.html (https://www.southalabama.edu/colleges/engineering/me/)

Title	Name
Chair	Haris Doumanidis
Professors	Doumanidis, Hsiao, Nelson, Phan
Associate Professors	Cauley, Kar, Montalvo, Tambe
Assistant Professors	Richardson, Dizbay-Onat
Professors Emeritus	Donovan, Engin
Part-Time Instructors	Boyd, Simmons, Thigpen, Webb

Mechanical Engineering is one of the broadest engineering disciplines. Mechanical engineers invent, analyze and design systems that produce power or convert energy. This encompasses such diverse applications as designing next-generation aircraft and automobiles, inventing novel methods of generating energy from renewable sources, and developing sophisticated new medical devices and systems. Mechanical engineers are in the forefront of exciting new technological fields, including nano-engineering, biomedical engineering, and energy research.

The basic fields of study for mechanical engineers include:

- Materials science, the study of the relationship between structure, properties, and processing of materials.
- Thermodynamics and heat transfer dealing with basic concepts and applications of work, energy, and power. Applications include power generation from fossil fuels, from renewable sources (solar, wind energy) and fuel cells.
- Engineering mechanics, the study of static and dynamic effects of forces applied to rigid and flexible solid bodies.
- Fluid mechanics, the study of the forces and motions of liquids and gases. Included in this area of study are hydraulics, gas dynamics, aerodynamics, and design and application of pumps, compressors, and turbines.
- Control systems including studies of transient and steady-state response of systems to external inputs.
- Design synthesis which integrates all fields of engineering in the production of safe, practical, efficient, and economically feasible solutions to real problems.

The curriculum leading to the degree of Bachelor of Science in Mechanical Engineering (BSME) is designed so that graduates can work in any Mechanical Engineering field, or continue their education at the graduate level.

All BSME students complete a senior-year “capstone” design project, in which a team of students defines and solves a unique, real-world engineering problem.

Aerospace Engineering Track

Students who plan to enter careers or graduate studies in aerospace, aeronautics, astronautics, or a related field may pursue the specialized track in Aerospace Engineering within the BSME program. Students in this track must complete AE 361 Introduction to Aerodynamics, in addition to two other approved aerospace engineering electives.

Students interested in the Aerospace Engineering track within the BSME program should consult their academic advisor.

Biomedical Engineering Track

Students who plan to enter careers or graduate studies in biomedical engineering may pursue the specialized track in Biomedical Engineering within the BSME program. This track may also be appropriate for students planning to pursue a career in the health sciences (medical school, dental school, or other health profession programs).

Students in the Biomedical Engineering track must complete General Biology I & II with labs (BLY 121, BLY 121L, BLY 122, BLY 122L), General Chemistry II with lab (CH 132, CH 132L) and Introduction to Biomedical Engineering BME 467.

Students interested in the Biomedical Engineering track within the BSME program should consult their academic advisor.

Students planning to apply for admission to a health profession program should also consult a Pre-Health Profession Advisor to identify any additional courses that may be required.

BSME Program Educational Objectives

Alumni of the Bachelor of Science in Mechanical Engineering (BSME) program should demonstrate the following traits and accomplishments within five years following graduation:

1. Graduates will achieve professional advancements or promotions with progressively higher levels of responsibility, competency, professional and ethical judgment and analysis. They will apply creative and innovative techniques to solve significant problems. They will apply team assimilation skills to successfully manage cross-disciplinary, collaborative projects that require global and multicultural perspectives.
2. Graduates will demonstrate effective written and oral communication skills in presenting, documenting and conveying their work via traditional and new media formats. They will use these skills in creating and supporting new or improved designs, inventions, and intellectual property, thereby contributing to the social, economic, and environmental well-being of local and global communities.
3. Graduates will demonstrate commitment to lifelong learning and continuous professional development through activities such as mentoring, participating in professional societies, completing advanced degrees and achieving professional registration or other certifications.

Mechanical Engineering graduates will accomplish these objectives in the course of professional employment, entrepreneurship, military or public service and postgraduate education.

BSME Student Outcomes

By the time of graduation from the BSME program, a student will have demonstrated attainment of the following outcomes:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, and environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

The Bachelor of Science degree program in Mechanical Engineering at the University of South Alabama is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org, under the General Criteria and the Program Criteria for Mechanical and similarly named Engineering programs.

Mechanical Engineering Accelerated Bachelor's to Master's Program

The USA Accelerated Bachelor's to Master's (ABM) in Mechanical Engineering provides exceptional undergraduate students the opportunity to earn a bachelor's and a master's degree at an accelerated pace. ABM students may count up to 12 credit hours of graduate coursework towards either the undergraduate or graduate degrees in Mechanical Engineering. ABM students typically complete the master's degree within one academic year after completing the undergraduate degree. See a departmental advisor for specific details.

Exam-Compliant Calculator Policy

Every Mechanical Engineering (ME) student must have an exam-compliant calculator. Only those calculators which are acceptable for use in the Fundamentals of Engineering (FE) exam are considered to be exam-compliant and may be used in Mechanical Engineering classes which allow calculator usage. Use of a calculator which is **not** exam-compliant in an ME test, quiz, or exam will be considered academic misconduct. For a list of exam-compliant calculator models, see https://ncees.org/exams/calculator/.

Degrees, Programs, or Concentrations

- Mechanical Engineering (BS) (http://bulletin.southalabama.edu/programs-az/engineering/mechanical-aerospace-biomedical-engineering/mechanical-engineering-bs/)
- Mechanical Engineering (BS) - Aerospace Track (http://bulletin.southalabama.edu/programs-az/engineering/mechanical-aerospace-biomedical-engineering/mechanical-engineering-bs-aerospace-track/)
- Mechanical Engineering (BS) - Biomedical Engineering Track (http://bulletin.southalabama.edu/programs-az/engineering/mechanical-aerospace-biomedical-engineering/mechanical-engineering-bs-biomedical-track/)
- Mechanical Engineering (MS) (http://bulletin.southalabama.edu/programs-az/engineering/mechanical-aerospace-biomedical-engineering/mechanical-engineering-ms/)
- Mechanical Engineering - Accelerated Bachelor's to Master's Program (http://bulletin.southalabama.edu/programs-az/engineering/mechanical-aerospace-biomedical-engineering/mechanical-engineering-accelerated-bachelors-masters-program/)

Courses

Aerospace Engineering (AE)

AE 361 Fundamentals of Aerodynamics 3 cr
Conservation laws, potential flow, airfoil and wing analysis. Boundary layer theory and pressure gradients on plates and airfoils. Introduction to turbulent and vortex-dominated flows.
Prerequisite: (EG 360 Minimum Grade of C and MA 227 Minimum Grade of C and PH 202 Minimum Grade of C)

AE 464 Principles of Spacecraft Desgn 3 cr
Introduction to space launch vehicle and spacecraft design, including an understanding of the various subsystems and how the overall vehicle's optimization leads to good conceptual designs. Introduction to parameters in aerospace analysis and how they effect the design.
Prerequisite: (ME 328 Minimum Grade of C and EG 360 Minimum Grade of C)

AE 468 Principles of Aircraft Design 3 cr
Introduction to aircraft design, including an understanding of the various components leading to a good conceptual design. Introduction to parameters in aerospace analysis and how they may impact a design. Application of design concepts to an RFP (request for proposal) for design competition.
Prerequisite: (ME 328 (may be taken concurrently) Minimum Grade of C and EG 360 Minimum Grade of C)
Cross-Listed: ME 468

AE 470 Aircraft Structural Analysis 3 cr
Introduction to elasticity. Torsion, bending and shearing of thin-walled skin-stringer structures. Failure mechanisms. Buckling of beams and plates. Introduction to finite element analysis and composite structural analysis.
Prerequisite: EG 284 Minimum Grade of C and EG 315 Minimum Grade of C and ME 328 (may be taken concurrently) Minimum Grade of C
Cross-Listed: ME 470

Biomedical Engineering (BME)

BME 467 Intro to Biomedical Eng 3 cr
Survey of topics and current issues in the field of biomedical engineering. Topics include biomechanics, biomedical instrumentation, biomaterials engineering, biomedical imaging, cellular mechanics, tissue engineering, biomedical design and ethics. A portion of the course is devoted to basic biology concepts and principles. Students will review literature and discuss technical and technological developments relevant to biomedical engineering.
Prerequisite: ME 328 (may be taken concurrently) Minimum Grade of C
Cross-Listed: ME 467

BME 567 Principles of Biomedical Eng 3 cr
Survey of topics and current issues in the field of biomedical engineering. Topics may include biomechanics, biomedical instrumentation, biomaterials engineering, biomedical imaging, cellular mechanics, tissue engineering, biomedical design and ethics. A portion of the course is devoted to basic biology concepts and principles. Students will review literature and discuss technical and technological developments relevant to biomedical engineering.
Prerequisite: MA 507 (may be taken concurrently) Minimum Grade of C
Cross-Listed: ME 567

Mechanical Engineering (ME)

ME 135 Engr Graphics and Comm 3 cr
Graphical representation of objects, orthographic, oblique, and isometric views. Freehand lettering and sketching, computer aided graphics, presentation of graphics based on numerical data using spreadsheet, word processor and presentation software.
Prerequisite: MA 125 (may be taken concurrently) Minimum Grade of C

ME 228 Computational Engineering 3 cr
Introduction to programming concepts in mechanical engineering including topics in linear algebra, loop structures for summations used in applications, and regression analyses.
Prerequisite: (MA 237 Minimum Grade of C)

ME 312 Mech Engr Thermodynamics 3 cr
Thermodynamics power and refrigeration cycles, gas mixtures, psychometrics, and combustion. One-half hour of design.
Prerequisite: EG 270 Minimum Grade of C

ME 314 Machine Component Design 3 cr
Analysis and design of machine elements to accomplish given tasks within limits of stress and size. One hour of design.
Prerequisite: EG 284 Minimum Grade of C and EG 315 Minimum Grade of C

ME 316 Instrumentatn & Exp Method 3 cr
Measuring system analysis and design, signal conditioning, analysis of data, statistical error analysis, communication of results.
Prerequisite: (EG 220 Minimum Grade of C and MA 238 Minimum Grade of C and PH 202 Minimum Grade of C) and (ME 228 Minimum Grade of C or ME 328 Minimum Grade of C)

ME 317 Heat Transfer 3 cr
Steady and transient, multi-dimensional conduction, forced and natural convection, radiation, and heat exchangers. One-half hour of design.
Prerequisite: (EG 360 Minimum Grade of C or ME 360 Minimum Grade of C) and (ME 228 Minimum Grade of C or ME 328 Minimum Grade of C) and EG 270 Minimum Grade of C

ME 319 Instrumentatn & Exp Method Lab 1 cr
Laboratory component of ME 316 Instrumentation. The same grade will be given in both courses.
Prerequisite: EG 220 Minimum Grade of D and (MA 238 Minimum Grade of D or MA 338 Minimum Grade of D) and (PH 202 Minimum Grade of D or PH 217 Minimum Grade of D)
Corequisite: ME 316

ME 326 Materials Science 3 cr
Mechanical, chemical, and physical properties of materials. Relationship between structure, processing, and properties engineering materials. One-half hour of design.
Prerequisite: (PH 202 Minimum Grade of C or PH 217 Minimum Grade of C) and (CH 115 Minimum Grade of C or CH 131 Minimum Grade of C) and EG 315 Minimum Grade of C

ME 328 Numerical Methods 3-4 cr
Numerical solutions of differential equations with applications to ME simulation and design. Introduction to Finite Element Analysis. One-half hour of design.
Prerequisite: (ME 228 Minimum Grade of C and MA 238 Minimum Grade of C)

ME 336 Material Science Lab-W 1 cr
Experimental study on the effect of thermal and mechanical processing on properties.
Prerequisite: ME 326 Minimum Grade of D and PH 202 Minimum Grade of C and CH 131 Minimum Grade of C and EG 315 Minimum Grade of C

ME 360 Mechanics of Fluids 3 cr
This course is a study of the properties of fluids including fluid statics and dynamics with applications to Mechanical Engineering and Aerospace Engineering. Topics include application of conservation of mass, momentum and energy; dimensional analysis; flow in pipes and duct; boundary layer flows; and compressible flow. Experiments are used to illustrate some principles.
Prerequisite: (EG 284 Minimum Grade of C and EG 270 Minimum Grade of C)
Cross-Listed: EG 360

ME 365 Design of Fluid Power Systems 3 cr
Fluid power components are studied in detail. Design of complete hydraulic systems is stressed. One hour of design.
Prerequisite: EG 284 Minimum Grade of D and EG 315 Minimum Grade of D and (EG 360 Minimum Grade of D or CE 365 Minimum Grade of D or ME 324 Minimum Grade of D) and ME 328 Minimum Grade of D

ME 410 Principles of Eng Design-W 3 cr
In this course, students learn to apply engineering theory and methods to the design process. Topics include problem definition, concept development and evaluation, project management, materials selection, risk analysis, quality improvement and ethics in design (0-3-0).
Prerequisite: ME 314 Minimum Grade of C and EG 231 Minimum Grade of C and ME 336 (may be taken concurrently) Minimum Grade of C and ME 317 (may be taken concurrently) Minimum Grade of C and ME 316 Minimum Grade of C

ME 411 Thermal System Design 3 cr
Thermal system design using principles of thermodynamics, fluid mechanics, heat transfer, and numerical simulation. Communication of results. Three hours of design.
Prerequisite: ME 312 Minimum Grade of D and ME 317 Minimum Grade of D and ME 328 Minimum Grade of D and (EG 360 Minimum Grade of D or CE 365 Minimum Grade of D or ME 324 Minimum Grade of D)

ME 412 Thermal Science Laboratory 1 cr
Experimental study of thermal science principles and systems. Communication of results.
Prerequisite: ME 312 Minimum Grade of D and ME 316 Minimum Grade of D and ME 317 Minimum Grade of D and (EG 360 Minimum Grade of D or CE 365 Minimum Grade of D or ME 324 Minimum Grade of D)

ME 414 Capstone Design 1 cr
This course is considered a "Senior Capstone Course.
Prerequisite: ME 410 Minimum Grade of D
Corequisite: ME 416

ME 416 Capstone Design Project 2 cr
This is a team-based capstone project course. Each team is assigned a unique design problem in mechanical engineering or a closely-related field. Students must be enrolled concurrently in ME 414 - Capstone Design.
Prerequisite: ME 410 Minimum Grade of D
Corequisite: ME 414

ME 417 Dynamics of Machines 3 cr
A study of the effects of external forces and moments on the motion of machines. Topics include the study of the position, velocity and acceleration of machine components during operation and the determination of forces on the connections and members. One hour of design.
Prerequisite: EG 284 Minimum Grade of D and EG 315 Minimum Grade of D and ME 328 Minimum Grade of D

ME 419 Computer Aided Design & Manu 3 cr
Introduction to computer aided design (CAD) and computer aided manufacturing (CAM) principles and their practical applications as fundamental elements of contemporary product design and manufacturing. This course is dual listed with an equivalent 500-level mechanical engineering course. One hour of design.
Prerequisite: ME 135 Minimum Grade of D and ME 314 Minimum Grade of D

ME 421 Mechanical System Design 3 cr
A study of design techniques as applied to mechanical components and systems. Computer simulation and numerical techniques. Communication of results. Three hours of design.
Prerequisite: ME 314 Minimum Grade of D and ME 328 Minimum Grade of D

ME 422 Gas Turbines 3 cr
Introduction to gas turbines covering thermodynamics, fluid mechanics, combustion, cycle analysis, compressors, turbines and component design. One hour of credit.
Prerequisite: (EG 360 Minimum Grade of D or CE 365 Minimum Grade of D or ME 324 Minimum Grade of D) and ME 312 Minimum Grade of D

ME 426 Dynamic Systems and Control 3 cr
Modeling dynamic systems. Introduction to the principles of feedback control systems. Analysis of linear systems.
Prerequisite: (MA 238 Minimum Grade of D or MA 338 Minimum Grade of D) and ME 316 Minimum Grade of D and ME 328 Minimum Grade of D

ME 429 Controls & Instr. Lab 1 cr
Design and implementation of analog and digital feedback control of systems. Design and implementation of measurement systems, including signal conditioning, analog-to-digital and digital-to-analog conversion, statistical estimation of error, data analysis. Communication of laboratory results is emphasized.
Prerequisite: ME 426 (may be taken concurrently) Minimum Grade of D

ME 430 Mechanism Synthesis 3 cr
Kinematic synthesis of planar linkages for function, path, and motion generation. Topics include: degrees of freedom; graphical, linear analytical, and nonlinear analytical methods; and curvature theory. This course is dual-listed with an equivalent 500-level mechanical engineering course. One hour of design.
Prerequisite: EG 284 Minimum Grade of D and ME 328 Minimum Grade of D

ME 431 Gas Dynamics 3 cr
Introduction to compressible fluid flow. Conservation laws, isentropic flow, adiabatic flow, flow with heat transfer, normal shock. One hour of design.
Prerequisite: (EG 360 Minimum Grade of D or CE 365 Minimum Grade of D or ME 324 Minimum Grade of D) and ME 312 Minimum Grade of D

ME 432 Advanced Thermodynamics 3 cr
Continuation of Mechanical Engineering Thermodynamics to develop a broader and deeper understanding of thermal energy transformations. One hour of design.
Prerequisite: ME 312 Minimum Grade of D

ME 438 Finite Element Analysis 3 cr
Introduction to the finite element method. Engineering application to stress-strain analysis is emphasized. Other field problems are also considered. This course is dual-listed with an equivalent 500-level mechanical engineering course.
Prerequisite: ME 328 Minimum Grade of D

ME 439 Boundary Elements I 3 cr
Fundamental concepts of the boundary element method of numerically solving partial differential equations. Application to potential flow problems in heat transfer. This course is dual listed with an equivalent 500-level mechanical engineering course.
Prerequisite: ME 328 Minimum Grade of D

ME 441 Microprocessors for Mech Engr 3 cr
Basic concepts of programming and applying microprocessors to the control of mechanical systems. Assembly language programming. Memory decoding and use. Input and output circuits. Interfacing with the PIA.
Prerequisite: EG 220 Minimum Grade of D and ME 316 Minimum Grade of D

ME 450 Heat Vent and Air Conditioning 3 cr
Addresses the heating and cooling of buildings. Covers related engineering sciences, cooling and heating loads, systems, and equipment. One hour of design.
Prerequisite: (EG 360 Minimum Grade of D or CE 365 Minimum Grade of D or ME 324 Minimum Grade of D) and ME 312 Minimum Grade of D and ME 317 Minimum Grade of D

ME 451 Refrigeration Systems 3 cr
Study of refrigeration systems including solutions of typical engineering design problems. Concepts from fluid mechanics, thermodynamics, and heat transfer are used. One hour of design.
Prerequisite: (EG 360 Minimum Grade of D or CE 365 Minimum Grade of D or ME 324 Minimum Grade of D) and ME 312 Minimum Grade of D and ME 317 Minimum Grade of D

ME 452 Combustion 3 cr
Introduction to the theory of combustion processes, chemical equilibrium, adiabatic flame temperatures, reaction kinetics. This course is dual listed with an equivalent 500-level mechanical engineering courses.
Prerequisite: ME 312 Minimum Grade of D

ME 453 IC Engines 3 cr
Principles for analysis and design of internal combustion (I.C.) engines. Topics: include fuel-air cycles, fuel, air and exhaust flows, heat and mass transfer, engine performance.
Prerequisite: (EG 360 Minimum Grade of D or CE 365 Minimum Grade of D or ME 324 Minimum Grade of D) and ME 312 Minimum Grade of D and ME 317 Minimum Grade of D

ME 460 Intro to Marine Engineering 3 cr
Categorization of Ships, Ship Geometry and Hydrostatics, Ship Stability, Ship Hazards, Resistance and Power, Propellers and Propulsion Systems, Ship Dynamics and Control.
Prerequisite: EG 360 Minimum Grade of D and EG 315 Minimum Grade of D

ME 461 Turbomachinery 3 cr
Energy transfer between fluid and rotor; fluid flow in turbomachines, centrifugal and axial flow pumps and compressors; radial and axial flow turbines. One hour of design.
Prerequisite: (EG 360 Minimum Grade of D or CE 365 Minimum Grade of D or ME 324 Minimum Grade of D) and ME 312 Minimum Grade of D

ME 463 Intro. Biomedical Engineering 3 cr
Survey of topics and current issues in the field of biomedical engineering. Topics include biomechanics, biomedical instrumentation, biomaterials engineering, biomedical imaging, cellular mechanics, tissue engineering, biomedical design and ethics. A portion of the course is devoted to basic biology concepts and principles. Students will review literature and discuss technical and technological developments relevant to biomedical engineering.

ME 466 Aerospace Propulsion 3 cr
Airbreathing engines course. Apply fluids, thermodynamics, and heat transfer to analysis of air breathing engines. Topics to include: ideal cycle analysis, component performance, non-ideal cycle analysis, and blade aerodynamics.
Prerequisite: ME 312 Minimum Grade of D and ME 317 Minimum Grade of D and (EG 360 Minimum Grade of D or CE 365 Minimum Grade of D or ME 324 Minimum Grade of D)

ME 469 Aircraft Stability and Control 3 cr
Introduction to flight dynamics of aerospace vehicles. Basic overview of stability analysis and linear feedback control.
Prerequisite: ME 328 Minimum Grade of C and EG 360 Minimum Grade of C

ME 472 Vibration Analysis-Synthesis 3 cr
Steady-state and transient vibration analysis of discrete and continuous systems. Vibration problems as related to design are also included.
Prerequisite: EG 284 Minimum Grade of C and EG 315 Minimum Grade of C and ME 328 Minimum Grade of D

ME 474 Noise and Vibration Control 3 cr
Principles of acoustics; human response to noise; control of noise and vibration by means of vibration isolation, sound barriers, and absorption. One hour of design.
Prerequisite: ME 472 Minimum Grade of D

ME 490 Special Topics 1-3 cr
Topics of current mechanical engineering interest. Prerequisite: Consent of instructor

ME 494 Directed Studies 1-3 cr
Selected mechanical engineering topics of special or current interest not available to regularly scheduled courses. Prerequisite: Consent of instructor.

ME 499 Honors Senior Project - H 1-6 cr
Under the advice and guidance of a faculty mentor, honors students will identify and carry out a research project, relevant to the field of Mechanical Engineering study, that will lead to a formal presentation at the Annual Honors Student Colloquium. The senior project will be judged and graded by three faculty, chaired by the honors mentor. This course is required for Honors recognition. A minimum of 4 credit hours is required, but students may enroll for a maximum of 6 credit hours over two semesters. Prerequisites: Completion of an approved project prospectus.

ME 518 Adv Mechanical Engr Analysis 3 cr
Application of numerical methods including finite differences; finite element and boundary element techniques to the solution of problems in Mechanical Engineering. Prerequisite: Consent of instructor.

ME 519 Computer Aided Design/Manufac 3 cr
Introduction to computer aided design (CAD) and computer aided manufacturing (CAM) principles and their practical applications as fundamental elements of contemporary product design and manufacturing. This course is dual listed with an equivalent 400-level mechanical engineering course.

ME 520 Advanced Fluid Mechanics 3 cr
Analysis of steady and unsteady motion of a viscous fluid. Topics include: conservation equations, Newtonian fluids and the Navier-Stokes equations, vorticity, analytical solutions, boundary layers, instability of viscous flows. Prerequisite: Consent of instructor.

ME 522 Gas Turbines 3 cr
Introduction to gas turbines covering thermodynamics, fluid mechanics, combustion, cycle analysis, compressors, turbines, and component matching.
Prerequisite: ME 520 Minimum Grade of C

ME 525 Boundary Layer Theory 3 cr
Development of Navier-Stokes and boundary layer equations, perturbation theory application and boundary layer transition. Prerequisite: Consent of instructor.

ME 530 Mechanism Synthesis 3 cr
Kinematic synthesis of planar linkages for function, path, and motion generation. Topics include: degrees of freedom; graphical, linear analytical, and nonlinear analytical methods; and curvature theory. This course is dual-listed with an equivalent 400-level mechanical engineering course. Prerequisite: Consent of instructor.

ME 538 Finite Element Analysis 3 cr
Introduction to the finite element method. Engineering application to stress-strain analysis is emphasized. Other field problems are also considered. This course is dual- listed with an equivalent 400-level mechanical engineering course. Prerequisite: Consent of instructor.
Prerequisite: MA 507 (may be taken concurrently) Minimum Grade of C or MA 508 (may be taken concurrently) Minimum Grade of C

ME 539 Boundary Elements I 3 cr
Fundamental concepts of the boundary element method of numerically solving partial differential equations. Application to potential flow problems in heat transfer. This course is dual listed with an equivalent 400 level mechanical engineering course. Requires special permission of instructor.

ME 540 Advanced Heat Transfer 3 cr
Steady and transient conduction, external and internal forced convection, natural convection, radiation with participating media, boiling heat transfer, Stefan condition. Prerequisite: Consent of instructor.

ME 541 Conduction Heat Transfer 3 cr
Closed form analytical and approximate numerical solutions of one, two- and three-dimensional steady state and transient problems in conduction heat transfer. Prerequisite: Consent of instructor.
Prerequisite: MA 507 Minimum Grade of C

ME 542 Convection Heat Transfer 3 cr
Fundamental laws of motion and energy balance for a viscous fluid, classical solution of the Navier-Stokes and energy equations, laminar/ turbulent hydrodynamic and thermal boundary layers, convection heat transfer in laminar/ turbulent internal flows. Prerequisite: Consent of instructor.

ME 543 Radiation Heat Transfer 3 cr
Blackbody radiation, diffuse-gray surfaces, radiative exchange in a multi-surface enclosure, gas radiation in enclosures with participating media, introduction to available numerical methods. Prerequisite: Consent of instructor.

ME 544 Heat Trans - Change of Phase 3 cr
Boiling heat transfer and critical heat flux, condensation heat transfer, Stefan problem, freezing and melting, ablation, introduction to available numerical techniques. Prerequisite: Consent of instructor.
Prerequisite: ME 540 Minimum Grade of C or ME 542 Minimum Grade of C

ME 545 Exp Fluid Mech and Heat Trans 3 cr
Uncertainty analysis, system response, sampling theory and FFT, differential pressure measurement and multi-hole probes, thermo-couple and RTD, thermal anemometry, LDV and other non-intrusive optical methods, flow visualization. Prerequisites: Consent of instructor

ME 550 Combustion 3 cr
Introduction to the theory of combustion processes, chemical equilibrium, adiabatic flame temperature, reaction kinetics, flame structure. This course is dual-listed with an equivalent 400-level mechanical engineering course. Prerequisite: Consent of instructor.

ME 551 Classical Thermodynamics 3 cr
Postulational treatment of the physical laws of equilibrium, equations of state, processes, equilibrium, stability, reactive systems, phase transition. Prerequisite: Consent of instructor.

ME 552 Statistical Thermodynamics 3 cr
Principles of kinetic theory, quantum mechanics, and statistical mechanics with particular reference to thermodynamic systems. Conclusions of classical thermodynamics are established from the microscopic viewpoint. Prerequisite: Consent of instructor.

ME 553 IC Engines 3 cr
Principles for analysis and design of internal combustion (I.C.) engines. Topics include: fuel-air cycles, fuel, air and exhaust flows, heat and mass transfer, engine performance.

ME 560 Compressible Fluid Flow 3 cr
Foundations of fluid dynamics and thermodynamics of one dimensional flow and heat transfer, isentropic flow, shock waves and method of characteristics. Prerequisite: Consent of Instructor.

ME 561 Turbomachinery 3 cr
Energy transfer between fluid and rotor; fluid flow in turbomachines, centrifugal and axial-flow pumps and compressors; radial and axial flow turbines. Prerequisite: Consent of instructor.

ME 562 Comp Fluid Dyn - Heat Trans I 3 cr
Derivation of conservation equations, numerical solution of inviscid and viscous incompressible flow problems, emphasis on finite volume method, introduction to finite element and spectral method. Prerequisite: Consent of instructor.

ME 563 Comp Fluid Dyn - Heat Trans II 3 cr
Governing equations in general coordinates, differential geometry for curvilinear coordinates, grid generations, numerical uncertainties. Prerequisite: Consent of instructor.
Prerequisite: ME 562 Minimum Grade of C

ME 564 Turbulent Flow 3 cr
Reynolds equations, statistics of turbulence, analysis of free and wall turbulence, turbulence models. Prerequisite: Consent of instructor.
Prerequisite: ME 520 Minimum Grade of C

ME 565 Lubrication 3 cr
Friction of solids and fluids. Lubricants. Theory of sliding bearings. Multi-dimensional bearings with constant forces and velocities. Solid, hydrodynamic and gas lubrication. Design of bearings. Prerequisite: Consent of instructor.

ME 566 Aerospace Propulsion 3 cr
Airbreathing engines course. Apply fluids, thermodynamics, and heat transfer to analysis of air breathing engines. Topics to include: ideal cycle analysis, component performance, non-ideal cycle analysis, and blade aerodynamics.

ME 569 Aircraft Stability and Control 3 cr
Introduction to flight dynamics of aerospace vehicles. Basic overview of stability analysis and linear feedback control.
Corequisite: MA 507

ME 571 Advanced Engineering Dynamics 3 cr
Three-dimensional kinematics and kinetics of particles and rigid bodies, energy, momentum, and stability; application of Lagrange's equations to machinery and gyrodynamics. Prerequisite: Consent of instructor.

ME 572 Advanced Vibrations 3 cr
Free and forced vibrations of mechanical systems having lumped mass and elasticity; introduction to vibrations of continuous systems; engineering applications. Prerequisite: Consent of instructor.
Prerequisite: MA 507 (may be taken concurrently) Minimum Grade of C or MA 508 (may be taken concurrently) Minimum Grade of C

ME 573 Vibrations of Continuous Sys 3 cr
Equations of motion for strings, membranes, bars, and plates with various boundary conditions, steady state and transient solutions, exact and approximate methods; wave propagation in elastic media. Prerequisite: Consent of instructor.
Prerequisite: MA 507 Minimum Grade of C

ME 574 Nonlinear Vibrations 3 cr
Vibrations of damped and undamped systems with nonlinear restoring forces; free and forced oscillations in self- sustained systems; Hills equation and its application to the study of the stability of nonlinear oscillations. Prerequisites: Consent of instructor.
Prerequisite: ME 572 Minimum Grade of C and MA 508 Minimum Grade of C

ME 575 Continuum Mechanics 3 cr
Cartesian tensor analysis. Analysis of stress and strain, fundamental laws of continuum mechanics. Constitutive equations, application to solid and fluid mechanics. Prerequisite: Consent of instructor.

ME 582 Advanced Materials Science 3 cr
Classical and quantum mechanical model of atoms, bonding, magnetism, superconductivity, high strength low density materials, corrosion, biomedical materials. Prerequisite: Consent of the instructor.

ME 583 Applied Elasticity 3 cr
Classical problems in elasticity, torsion and bending theory, plane problems in rectangular and polar coordinates; axisymmetric problems, thermoelasticity. Prerequisite: Consent of instructor.
Prerequisite: MA 507 (may be taken concurrently) Minimum Grade of C or MA 508 (may be taken concurrently) Minimum Grade of C

ME 584 Introductory Metal Theory 3 cr
Theories of metal to explain electrical conductivity and scattering process, electronic and lattice heat capacity, magnetic behavior, cohesion and lattice constant. Prerequisite: Consent of instructor.
Prerequisite: MA 507 Minimum Grade of C

ME 585 Theory of Plates 3 cr
Basic equations of rectangular and circular plates with various boundary conditions; classical solutions and approximate methods in the theory of thin plates. Prerequisite: Consent of instructor.
Prerequisite: MA 507 Minimum Grade of C

ME 586 Theory of Shells 3 cr
Introduction to differential geometry; general equations for arbitrary shells; shallow shell theory with applications; solutions to membrane and bending theory for shells of revolution. Prerequisite: Consent of instructor.
Prerequisite: ME 585 Minimum Grade of C

ME 589 Biomechanics 3 cr
Discrete mass and continuum mechanics description of biological materials, biodynamics of limb and gross body motions, various models for injury to head, neck, torso, and extremities. Prerequisite: Consent of instructor.

ME 590 Sp Top - 1-3 cr
Topics of current mechanical engineering interest. Prerequisite: Consent of instructor.

ME 592 Directed Independent Study 1-3 cr
Directed study, under the guidance of a faculty advisor, of a topic from the field of Mechanical Engineering not offered in a regularly scheduled course. Requires permission of the instructor.

ME 594 Projects in Mechanical Engr 1-3 cr
May be repeated for credit. Prerequisite: Approved proposal and consent of director of engineering graduate studies.

ME 599 Thesis 1-6 cr
Thesis research may be taken more than once. Prerequisite: Approved prospectus.

Faculty

Faculty Name	Faculty Department	Faculty Position	Degrees Held
CAULEY, LANIER S. (lcauley@southalabama.edu)	Mechanical Engineering	Associate Professor	BS, Virginia Polytechnic Inst and MS, Virginia Polytechnic Inst and PHD, Clemson University
DIZBAY-ONAT, MELIKE (monat@southalabama.edu)	Mechanical Engineering	Assistant Professor	MS, Auburn University MSEE, Auburn University PHD, Univ of Alabama-Birmingham
DOUMANIDIS, CHARALABOS CONSTANTINOS (doumanidis@southalabama.edu)	Mechanical Engineering	Professor	MS, Northwestern University PHD, Massachusetts Inst of Tech
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