Department of Mechanical Engineering

Purpose and Goals

The Mechanical Engineering Department is one of five departments in the Roy G. Perry College of Engineering. As one of the broadest engineering branches, mechanical engineering includes:

- Aerodynamics and fluid mechanics
- Combustion and energy systems
- Design and manufacturing
- Dynamics systems and controls
- Robotics
- Materials and nanomaterial structures
- Vibrations, acoustics, and fluid interactions
- Biomechanics

Because of the global consequences of many engineering endeavors, and because of the continually changing technological climate, the Department emphasizes an integrated curriculum that overlaps other engineering branches and the physical sciences. Graduates of the mechanical engineering curriculum will be prepared to be technical leaders in tomorrow's society.

Admission Requirements

Table 1. First-time Freshmen Requirements for Direct Admission to the Mechanical Engineering Program

Academic Major	Meet PVAMU Admission Standards	High School GPA	SAT/ACT	High School Rank	THEA Passed
Mechanical Engineering	Yes	3.00	New SAT: 950/18		

Table 2. Transfer Students Requirements for Direct Admission to the Mechanical Engineering Program

Academic Major	Meet PVAMU Admission Standards	Transfer Grades	Transfer GPA (Math; Science and Engineering)
Mechanical Engineering	Yes	"C" or Greater	2.50

Accreditation Status

The Mechanical Engineering program is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org.

Requirements for Mechanical Engineering as a Minor

Students must complete the following 18 SCH of courses to satisfy the Minor requirements.

MCEG 3302	Thermodynamics II	3
MCEG 3303	Manufacturing Processes	3
MCEG 3304	Machine Design I	3
MCEG 3306	Fluid Mechanics	3
Two Approved 3000 or 4000 Level MCEG Courses		6
Total Hours		**18**

Professional and Honor Societies

American Society of Mechanical Engineers (ASME). The Department sponsors the student chapter of American Society of Mechanical Engineers, the national professional society for mechanical engineering that seeks to develop professional integrity, ethics, and organization skills among the mechanical engineering students on the campus.

Pi Tau Sigma National Honor Society . The Mechanical Engineering Department has a chapter of Pi Tau Sigma, the National Mechanical Engineering Honor Society to recognize and honor outstanding mechanical engineering students on the campus.

Courses

MCEG 1101 Intro Engr Cs Tech: 1 semester hour.
Introduction to basic engineering, computer science and technology concepts. Students will become aware of the various disciplines of engineering, computer science and technology, ethical responsibilities in these fields, creativity and design.
Co-requisite: MCEG 1102.

MCEG 1102 Introduction to Mechanical Engineering Drawing and Design Lab I: 1 semester hour.
Introduction to 3D modeling, technical sketching, multi-views and visualization, geometric dimensioning and tolerancing, and working drawings and assembly.

MCEG 2301 Thermodynamics I: 3 semester hours.
First Law, transformation of energy, theoretical limitations, Second Law, absolute temperature, entropy, and available energy, properties of gases, liquids, and vapors, and irreversibility.
Prerequisites: (MATH 2414 or MATH 2024) and (PHYS 2325 or PHYS 2513).

MCEG 2302 Engineering Mechanics II: 3 semester hours.
Kinematics and kinetics of particles and of rigid bodies as applied to engineering problems; Newton's laws of motion; work and energy; impulse and momentum; translations; rotation; plane motion; motion about a point; general motions; and periodic motions.
Prerequisites: CVEG 2301 or CVEG 2043.

MCEG 2303 Materials Science and Engineering: 3 semester hours.
Science concepts of crystal structures, atomic scale defects, bonding, phase diagrams and solidification. Relationship between microstructure and thermal, mechanical, optical, electrical and magnetic properties of materials.
Prerequisites: (CHEM 1303 or CHEM 1033) or (CHEM 1403 or CHEM 1034) or (CHEM 1304 or CHEM 1043).

MCEG 3101 Measurement and Instrumentation Laboratory: 1 semester hour.
The scope of this course includes fundamentals in measurement theory, statistical analysis of experimental data, uncertainty, accuracy assessments, and calibration techniques. The course includes the use and applications of instruments for measuring area, pressure, time, speed, temperature, strain, hardness, and deflection.
Prerequisites: (PHYS 2325 or PHYS 2513) and (PHYS 2125 or PHYS 2511) and (PHYS 2126 or PHYS 2521).

MCEG 3102 Thermal Science Laboratory: 1 semester hour.
This course includes experimental investigation of the performance of various thermal systems, such as engines, combustion unit, heat exchangers, nozzles, boilers and turbo machinery.
Prerequisites: (MCEG 3101 or MCEG 3011) and (MCEG 3301 (may be taken concurrently) or MCEG 3013 (may be taken concurrently)) and (ELEG 1304 (may be taken concurrently) or ELEG 1043 (may be taken concurrently)).

MCEG 3103 Manufacturing Processes Laboratory: 1 semester hour.
This lab includes experiments for metal identification, machinability of materials, effects of factors on surface roughness measurement, material removal rates, and cutting tool force analysis. It also includes illustrations of casting, forging, rolling, and powder metallurgy. Student will be required to design a structure part and perform manufacturing operations.
Co-requisite: MCEG 3303.

MCEG 3301 Heat Transfer: 3 semester hours.
Study of the fundamental modes of heat transfer, conduction, convection, and thermal radiation, separately and in combination. Theoretical, numerical, and design methods of analysis of steady, transient, single, and multidimensional problems will be emphasized.
Prerequisites: (MATH 2320 or MATH 2043) and (MCEG 3306 or MCEG 3063).

MCEG 3302 Thermodynamics II: 3 semester hours.
Continuation of Thermodynamics I, including various power cycles, refrigeration cycles, fluid flow, combustion process, and advanced concepts of gas dynamic, such as shock waves.
Prerequisites: (MCEG 2301 or MCEG 2013) and (MATH 2414 or MATH 2024).

MCEG 3303 Manufacturing Processes: 3 semester hours.
This course provides the concepts for the conversion of materials into products. It includes measurement and quality assurance, and processes of casting, forming, material removal, and joining. In addition, it involves the study of computer numerical control machines, manufacturing systems, and automation.
Prerequisites: MCEG 2303 or MCEG 2023.

MCEG 3304 Machine Design I: 3 semester hours.
Fundamentals of mechanical design methodology, design of machine elements for static and fatigue failure, individual projects and classroom discussions of various design solutions.
Prerequisites: (CVEG 2332 or CVEG 2063) and (MCEG 1102 or MCEG 1021).

MCEG 3305 Kinematic Design and Analysis: 3 semester hours.
This course includes the theory and application for the kinematic design of mechanisms. The students will be required to use computers to model, analyze, and synthesize mechanical systems.
Prerequisites: (MCEG 1102 or MCEG 1021) and (MCEG 2302 or MCEG 2053).

MCEG 3306 Fluid Mechanics: 3 semester hours.
The fundamental conservation laws in fluid statics and dynamics are derived and solved analytically and numerically. Other topics include: analysis of viscous and inviscid flow; laminar and turbulent flows in pipes and on external surfaces; open channel flow; hydraulic machinery; and introduction to compressible flow. Direct applications to problems encountered in practice and in engineering design will be covered. Problem solving and design application will be emphasized.
Prerequisites: (MCEG 2301 or MCEG 2013) and (MATH 2320 (may be taken concurrently) or MATH 2043 (may be taken concurrently)) and (MCEG 2302 (may be taken concurrently) or MCEG 2053 (may be taken concurrently)).

MCEG 3307 Automatic Controls: 3 semester hours.
Analysis and synthesis of continuous time control systems, transfer function, block diagrams, stability, root locus, state space representation, and design considerations for feedback control system.
Prerequisites: MATH 4317 (may be taken concurrently) or MATH 4173 (may be taken concurrently).

MCEG 3312 Renewable Energy and Energy Sustainability: 3 semester hours.
The topics of various types of renewable energies, energy conversion, utilization and storage technologies, such as wind, solar, biomass, fuel cells and hybrid systems. For each source, the physical and technological principles are explained and the economics, environmental impacts and future prospects are examined. The course explores the main factors likely to influence the long-term evolution of the world's energy systems and the technologies and policies that could be adopted to create more sustainable energy systems.
Prerequisites: CHEG 3311 or CHEG 3113.

MCEG 3319 Introduction to Robotics: 3 semester hours.
Fundamental topics in Robotics covering configuration (forward and reverse) kinematics, motion kinematics, force/torque relations and trajectory planning. Rudiments of dynamics and position control are also introduced.
Prerequisites: MATH 4317 (may be taken concurrently) or MATH 4173.

MCEG 3615 Mechanical Engineering Internship I: 6 semester hours.
An internship program of work experience with an approved engineering firm.

MCEG 4247 Senior Design and Professionalism-1: 2 semester hours.
This is the first course of a two-semester capstone experience (MCEG 4482 must immediately follow MCEG 4472 or sequence must restart with MCEG 4472) involving engineering design of an industrial or advanced team project. Elements of ethics and professionalism in engineering practice are integrated into the project experience. The project will include application of relevant engineering codes and standards, as well as realistic constraints. Design achievements are demonstrated with written reports, and oral presentation, and professional standards and ethics examinations.
Prerequisites: (MCEG 3304 or MCEG 3043) and (MCEG 3101 or MCEG 3011) and (MCEG 3302 or MCEG 3023) and (MCEG 3301 (may be taken concurrently) or MCEG 3013).

MCEG 4248 Senior Design and Professionalism II: 2 semester hours.
A continuation of MCEG 4472 with required design modifications of the team projects necessary to produce a working prototype of the designs initiated in Senior Design and Professionalism I. Design project deliverables include an oral presentation, a final written report and demonstration of prototype, or model of the design. Elements of professionalism reinforce the importance of professional engineering ethics, corporate culture, life-long learning, and globalization.
Prerequisites: MCEG 4247 or MCEG 4472.

MCEG 4304 Machine Design II: 3 semester hours.
This is a design course featuring a design project using strength of materials, kinematics of machines, machine element design (e.g. gears and shafts), and CAD.
Prerequisites: (MCEG 3304 or MCEG 3043) and (MCEG 3305 (may be taken concurrently) or MCEG 3053 (may be taken concurrently)).

MCEG 4306 Dynamic Systems and Controls: 3 semester hours.
The scope of this course includes mathematical modeling, analysis, and feedback control of dynamic systems. Topics include free and force vibrations of single and multiple degrees of freedom systems. Transient, steady-state, and stability of linear feedback control systems will be studied in the course.
Prerequisites: (MCEG 2302 or MCEG 2053) and (MATH 2043 or MATH 2320).

MCEG 4308 Design Thinking and Device Development: 3 semester hours.
This course, designed for non-business majors, teaches students to identify customer needs and manage critical resources while incorporating constraints governing how products must be designed, developed, approved, and brought to market. This course is intended to introduce students to some of the complexities of designing robust devices that meet customer needs and engineering requirements. Students will work in teams on projects that reinforce these concepts. Students will be equipped with the analytical skills necessary to understand linkages between research and development, product design, intellectual property protection, and entrepreneurship.

MCEG 4309 Finite Element Analysis and Design: 3 semester hours.
An introduction to finite element analysis as a modern computational tool to solve boundary value problems. Applications will be in structural mechanics, fluid flow, and heat transfer. Design and computer projects included.
Prerequisites: (CVEG 2332 or CVEG 2063) and (MCEG 3301 (may be taken concurrently) or MCEG 3013 (may be taken concurrently)).

MCEG 4316 Special Topics: 3 semester hours.
Selected current and emerging topics in mechanical engineering depending on need determined by the department.

MCEG 4318 Gas Dynamics: 3 semester hours.
Fundamentals in compressible fluid flow, one dimensional and two dimensional flows, subsonic and supersonic flow. Topics include isentropic flow, normal and oblique shock, Prandtl-Meyer Flow, flow with friction and heat transfer, and various engineering applications.
Prerequisites: MCEG 3302 (may be taken concurrently) or MCEG 3023 and (MCEG 3306 or MCEG 3063).

MCEG 4399 Independent Study: 3 semester hours.
Reading, research, and/or field work in selected topics.

MCEG 4615 Mechanical Engineering Internship II: 6 semester hours.
Continuation of MCEG 3156.

MCEG 5302 Advanced Thermodynamics: 3 semester hours.
Theories of thermodynamics and their application to the more involved problems in engineering practice or design. Topics include advanced power cycles, superconductivity, thermodynamic relations, chemical thermodynamics and phase equilibrium.

MCEG 5303 Advanced Machine Design: 3 semester hours.
A systematic approach to machine design is studied in detail. Topics include systematic steps for planning and design, methods for developing and evaluating solutions, conceptual design, embodiment design, and product life cycle.

MCEG 5312 Advanced Combustion Processes: 3 semester hours.
Advanced Combustion Processes will cover the advanced treatment of fundamental combustion and flame processes, conservation equations for reacting gas mixtures, reaction-kinetic processes that govern combustion rates, the structure of diffusion and premixed flames, and the dynamics of droplet evaporation and combustion. Topics covered include thermochemistry, heat and mass transfer, chemical kinetics, laminar premixed and diffusion flames, droplet burning. Optional topics may include turbulent flames, burning of solids, or complex combustion systems.

MCEG 5316 Advanced Engineering Fluid Dynamics: 3 semester hours.
A comprehensive study of fluid mechanics and dynamics is considered. This includes Potential flow, Stokes flow, Oseen flow, other inviscid flow, Echkman Row, and other viscous flows such as Boundary Layer Analysis. An introduction to perturbation to theory will also be given.

MCEG 5318 Computer Integrated Manufacturing: 3 semester hours.
A total integration of manufacturing, management, strategic planning, finance, and the effective use of computer technology in the control of the production process.

MCEG 5322 Advanced Heat Transfer: 3 semester hours.
An advanced study of heat and mass diffusion, convection, conjugate heat transfer, heat exchangers two-phase heat transfer, micro-scale heat and mass transfer, and thermal radiation. Lumped, integral, differential, and numerical analysis will be included and a term project will be required.

MCEG 5324 Dynamics of Engineerng Systems: 3 semester hours.
Modeling and manipulation of dynamic engineering systems, basic component models, system models, state-space equations, analysis of linear systems, and nonlinear simulation.

MCEG 5325 Advanced Engineering Materials: 3 semester hours.
Qualitative and quantitative relationships between microstructure and mechanical properties. Studies of dislocation theory, elasticity, plasticity, brittle and ductile fracture, fatigue and creep, design criteria and statistical aspects of failure.

MCEG 5326 Robotics: 3 semester hours.
Topics in Robotics covering configuration (forward and reverse) kinematics, Jacobians (velocities and static forces), force/torque relations, trajectory planning, dynamics and position control.

MCEG 5332 Multiphase Flow and Heat Transfer: 3 semester hours.
Multiphase Flow and Heat Transfer will cover the advanced treatment of fundamental aspects of heat, mass, and momentum transfer in multiphase flow systems. Topics include conservation laws, flows with particles, drops and bubbles, boiling, and condensation.

MCEG 5333 Computational Fluid Dynamics: 3 semester hours.
Potential flow theory. Application of numerical methods and the digital computer to inviscid flow analysis. Application of vortex lattice, panel element, and boundary element methods to incompressible and compressible three dimensional aerodynamic flow problems. Wings and Wing-body analysis and incorporation of boundary integration for complete modeling.