

Department of Mechanical Engineering

ADMINISTRATIVE OFFICER

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FACULTY

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PURPOSE AND GOALS

As one of the broadest engineering branches, mechanical engineering includes design, analysis, and manufacturing associated with: (1) energy; and (2) structures and motion in mechanical systems. Mechanical engineers design machines, processes, and systems utilizing mechanical and thermal power. The work of mechanical engineers includes, but is not limited to, the following areas: machinery design and construction, design and analysis of thermal systems, manufacturing, instrumentation and controls, fluid and solid mechanics, plant engineering, materials specification and evaluation, research and development, and technical sales. Many mechanical engineers are promoted to management and administrative positions.

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.

The goal of the Mechanical Engineering Program is to produce industrial, scientific, and technological leaders capable of systematically identifying, addressing, and solving technical problems whose solutions will benefit society. Specific educational objectives of the Mechanical Engineering Program are to produce graduates who will:

1. Have successful careers in engineering and related fields, thereby, fulfilling the special purpose mission of the university in serving a diverse ethnic and socioeconomic population;
2. Be capable of advancing their careers by moving into other lucrative professions and leadership positions;
3. Successfully obtain admissions to pursue graduate degrees; and
4. Understand and maintain professional ethics and the need to safeguard the public, the environment, and the natural resources.

ELIGIBILITY TO TAKE UPPER DIVISION COLLEGE COURSES

The College of Engineering requires an eligibility standard for the students to take upper division college courses. Students in the Mechanical Engineering Program must complete a prescribed list of courses in the following with a minimum Grade Point Average (GPA) of 2.5 to be eligible to enroll in upper division (3000 or 4000 level) courses in the College. Students transferring to the College of Engineering with 60 or more semester hours from another institution will be allowed a period of one semester to comply.

CHEM 1034	Chemistry for Engineers
CHEM 1021	Inorganic Chemistry Laboratory II
ENGL 1143	Technical Writing
PHYS 2513	University Physics I
PHYS 2511	General Physics Lab I
MATH 1124	Calculus with Analytic Geometry I
GNEG 1121	Engineering Applications Lab II for Mathematics
MATH 2024	Calculus with Analytic Geometry II
GNEG 2021	Engineering Applications Lab III for Mathematics
MCEG 1011	Introduction to Engineering, Computer Science, and Technology
MCEG 1021	Introduction to Mechanical Engineering Drawing and Design Lab I
ELEG 1043	Computer Applications in Engineering

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	930/19	Top 25%	Yes (all subjects)

Table 2. First-time Freshmen Requirements for Conditional 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	2.50	820/17	Top 50%	No

Table 3. 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	Yes	“C” or greater	2.50

Engineering			
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These tables represent a summary of admission requirements. For more detailed requirements see the section in the catalog pertaining to the College of Engineering Admission.

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.

ACCREDITATION STATUS

The Mechanical Engineering program is accredited by the Engineering Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202 – telephone: 410-347-7700.

BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING DEGREE PROGRAM REQUIREMENTS

Core Curriculum **42 SCH**
All Mechanical Engineering Core Curriculum requirements are shown in the suggested degree program.

College and Support Area Requirements..... **46 SCH**
MATH 1124, 2024, 3685 13 SCH
GNEG 1121, 20212 SCH
CHEM 1034, 1021 5 SCH
PHYS 2511, 2521 2 SCH
CHEG 2003 3 SCH
CVEG 2043, 2053 6 SCH
ELEG 2053..... 3 SCH
MCEG 1011, 1021, 2013..... 5 SCH
MCEG, CHEG, CVEG, or ELEG 3051 1 SCH
MCEG, CHEG, CVEG, or ELEG 4473, 4483 6 SCH

Major Requirements **36 SCH**
MCEG 2023, 3011, 3013, 3021, 3023, 3031, 3033, 3043, 3053, 3063, 4043, 4063, 4093; CVEG 2063

Technical Electives **6 SCH**

Total Degree Requirements **130 SCH**

Mechanical Engineering Suggested Technical Electives

Technical electives must be 3000 level or above. At least one technical elective must be taken in the department. Internship and co-op courses are not suitable for technical electives.

MCEG 3073	Automatic Controls
MCEG 3193	Introduction to Robotics
MCEG 4123	Energy System Design
MCEG 4163	Special Topics

MCEG 4183	Gas Dynamics
CHEG 4133	Process Modeling and Simulation
CHEG 4153	Bioengineering
CHEG 4163	Engineering Optimization
CVEG 3073	Structural Analysis
CVEG 3043	Environmental Engineering
CVEG 4063	Water Resources Engineering
CVEG 4093	Systems Engineering
ELEG 3033	Physical Electronics
ELEG 3063	Logic Circuits
MATH 3073	Linear Algebra
MATH 4063	Numerical Analysis

Requirements For Mechanical Engineering as a Minor Field

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

MCEG 3023 Thermodynamics II
MCEG 3033 Manufacturing Processes
MCEG 3043 Machine Design I
MCEG 3063 Fluid Mechanics
and 6 semester hours of approved 3000 or 4000 level MCEG courses.

MECHANICAL ENGINEERING SUGGESTED DEGREE PROGRAM SEQUENCE

FRESHMAN YEAR

<i>First Semester</i>		<i>Hours</i>	<i>Second Semester</i>		<i>Hours</i>
MATH 1124	Calculus I	4	MATH 2024	Calculus II	4
GNEG 1121	Eng. Appl. Lab II for Mathematics	1	GNEG 2021	Eng. Appl. Lab III for Mathematics	1
MCEG 1011	Intro Eng CS Tech	1	PHYS 2513	University Physics I	3
MCEG 1021	Mechanical Drawing	1	PHYS 2511	General Physics Lab I	1
SPCH 1003	Fund. of Speech Communication	3	ENGL 1143	Technical Writing	3
ENGL 1123	Freshman Composition I	3	CHEM 1034	Chemistry for Engineers	4
ELEG 1043	Computer Appl. In Engineering	3	CHEM 1021	Inorganic Chemistry Lab II	1
Total		16	Total		17

SOPHOMORE YEAR

<i>First Semester</i>		<i>Hours</i>	<i>Second Semester</i>		<i>Hours</i>
HIST 1313	U.S. to 1876	3	MATH 2043	Differential Equations	3
CVEG 2043	Engineering Mechanics I	3	CVEG 2053	Engineering Mechanics II	3
POSC 1113	American Government I	3	CVEG 2063	Mechanics of Materials	3
MCEG 2023	Materials Science and Engineering	3	MCEG 2013	Thermodynamics I	3
PHYS 2523	University Physics II	3	HIST 1323	The U.S.-1876 to Present	3
PHYS 2521	General Physics Lab II	1	CHEG 2003	Economic Analysis and Technical Applications	3
Total		16	Total		18

SUMMER SESSIONS

<i>First Semester</i>		<i>Hours</i>
*MCEG 3156	Mechanical Engineering Internship I	6
Total		6

JUNIOR YEAR

<i>First Semester</i>		<i>Hours</i>	<i>Second Semester</i>		<i>Hours</i>
MCEG 3043	Machine Design I	3	MCEG 3013	Heat Transfer	3

MCEG 3023	Thermodynamics II	3	POSC 1123	American Government II	3
ELEG 2053	Introduction to Electrical Engin.	3	MCEG 3033	Manufacturing Processes	3
MCEG 3053	Kinematic Design and Analysis	3	MCEG 3031	Manufacturing Processes Lab	1
MCEG 3063	Fluid Mechanics	3	MCEG 3021	Thermal Science Lab	1
MCEG 3011	Measurement/Instrumentation Lab	1	MATH 3685	Mathematics for Engineers	5
Total		16	Total		16

SUMMER SESSIONS

First Semester	Hours
*MCEG 4156 Mechanical Engineering Internship II	6
Total	6

SENIOR YEAR

First Semester	Hours	Second Semester	Hours
MCEG 4473 Senior Design and Professionalism I	3	MCEG 4483 Senior Design and Professionalism II	3
MCEG 3051 Professional Engineering	1	MCEG 4063 Dynamic Systems and Controls	3
MCEG 4043 Machine Design II	3	Social and Behavioral Sciences Elective	3
Visual and Performing Arts Elective	3	Technical Elective	3
MCEG 4093 Finite Element Analysis and Design	3	Humanities Elective or Visual and Performing Arts Elective	3
Technical Elective	3		
Total	16	Total	15

* Course may be taken for credit during a summer internship, but is not required in degree plan.

Most courses in the College of Engineering will be offered only once a year. Courses listed in the **First Semester** in the **SUGGESTED DEGREE PROGRAM SEQUENCE** will be offered in the fall semester and may not be available in the spring or summer semesters. Courses listed in the **Second Semester** in the **SUGGESTED DEGREE PROGRAM SEQUENCE** will be offered in the spring semester and may not be available in the fall or summer semester.

MCEG 1011. Introduction to Engineering, Computer Science and Technology. (1-0) Credit 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 1021 or equivalent course determined by department.

MCEG 1021. Introduction to Mechanical Engineering Drawing and Design Lab I. (0-3) Credit 1 semester hour. Introduction to 3D modeling, technical sketching, multiviews and visualization, geometric dimensioning and tolerancing, and working drawings and assembly.

MCEG 2013. Thermodynamics I. (3-0) Credit 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 2024, PHYS 2513.

MCEG 2023 Materials Science and Engineering. (3-0) Credit 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. Prerequisite: CHEM1034, or CHEM 1033, or equivalent.

MCEG 3011. Measurement and Instrumentation Laboratory. (0-3) Credit 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 2513, PHYS 2511.

MCEG 3013. Heat Transfer. (3-0) Credit 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. Prerequisite: MATH 2043; Co-requisite or prerequisite: MCEG 3063.

MCEG 3021. Thermal Science Laboratory. (0-3) Credit 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 3011; Co-requisite or prerequisite: MCEG 3013.

MCEG 3023. Thermodynamics II. (3-0) Credit 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. Prerequisite: MCEG 2013 and MATH 2024.

MCEG 3031. Manufacturing Processes Laboratory. (0-3) Credit 1 semester credit 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 or prerequisite: MCEG 3033.

MCEG 3033. Manufacturing Processes. (3-0) Credit 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 2023.

MCEG 3043. Machine Design I. (2-2) Credit 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 2063 and MCEG 1021.

MCEG 3051. Professional Engineering I. (0-3) Credit 1 semester hour. Fundamentals of engineering and related science subjects including chemistry, computers, dynamics, electric circuits, engineering economics, ethics, fluid mechanics, materials science, mathematics, mechanics of materials, statistics, and thermodynamics. Passing a mock exam for “fundamentals of engineering” is a requirement of passing this course. Prerequisite: junior standing in engineering major. Course equivalence: CHEG 3051, CVEG 3051 or ELEG 3051.

MCEG 3053. Kinematic Design and Analysis. (2-2) Credit 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 1021 and CVEG 2053.

MCEG 3063. Fluid Mechanics. (3-0) Credit 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 2013; Co-requisite or prerequisite: MATH 2043.

MCEG 3073. Automatic Controls. (3-0) Credit 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 3685 and Junior standing.

MCEG 3156. Mechanical Engineering Internship I. (0-0) Credit 6 semester hours, An internship program of work experience with an approved engineering firm. Prerequisites: Junior standing.

MCEG 3193. Introduction to Robotics. (3-0) Credit 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 3685 and Junior standing.

MCEG 4043. Machine Design II. (2-2) Credit 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. Prerequisite: MCEG 3043; co requisite or prerequisite MCEG 3053.

MCEG 4063. Dynamic Systems and Controls. (3-0) Credit 3 semester hours. The scope of this course includes mathematical modeling, analysis, and feedback control of dynamic systems. Topics include free and forced 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: CVEG 2053 and MATH 2043.

MCEG 4093. Finite Element Analysis and Design. (3-0) Credit 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. Prerequisite: CVEG 2063; co-requisite or prerequisite: MCEG 3013.

MCEG 4123. Energy System Design. (3-0) Credit 3 semester hours. A design course emphasizing heat exchangers, heat pipes, heat reclamation devices, piping systems, and solar heating and cooling systems. Prerequisite: MCEG 3013 and MCEG 3023.

MCEG 4156. Mechanical Engineering Internship II. (0-0) Credit 6 semester hours. Continuation of MCEG 3156. Prerequisites: Senior standing.

MCEG 4163. Special Topics. (3-0) Credit 3 semester hours. Selected current and emerging topics in mechanical engineering depending on need determined by the department. Prerequisite: Consent of advisor.

MCEG 4183. Gas Dynamics. (3-0) Credit 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 3023, 3063.

MCEG 4473. Senior Design and Professionalism I. (1-4) Credit 3 semester hours. This is a capstone engineering design of an industrial or advanced team project. Elements of ethics and professionalism in engineering practice will be integrated into the project experience. The design achievement will be demonstrated by written report, oral presentation, and professional standards and ethics examinations. Prerequisites: MCEG 3043; co-requisite or prerequisite: MCEG 3013.

MCEG 4483. Senior Design and Professionalism II. (1-4) Credit 3 semester hours. A continuation of MCEG 4473 with required design modifications of the team projects necessary to produce a working prototype of the designs initiated in Senior Design and Professionalism I. Results of the design are presented in a formal, final oral presentation, as well a final report. Professionalism education will reinforce the importance of professional ethics, corporate culture, life-long learning, and globalization. Prerequisites: MCEG 4473.

MCEG 4991-4993. Independent Study. (1-0, 3-0) Credit 1 or 3 semester hours. Readings, research, and/or field work on selected topics. Prerequisite: Consent of advisor.