# MECHANICAL ENGINEERING, BS

## Program Description

Mechanical Engineering is an engineering discipline that requires an understanding of mechanics, kinematics, thermodynamics and energy, and involves the application of principles of physics and mathematics to develop mechanical systems. The American Society of Mechanical Engineers (ASME) defines mechanical engineering as the branch of engineering that serves society through the analysis, design, and manufacture of systems that convert a source of energy to useful work. The Bachelor of Science in Mechanical Engineering (BSME) program emphasizes service, systems-based knowledge, and sustainability with an eye toward the interface of traditional mechanical engineering with new and emerging fields, in particular unmanned aircraft systems, maritime sciences and marine biology that directly impact the Gulf Coast.

The program educational objectives of this program are:

1. Within two years of graduation from TAMU-CC, our graduates who have chosen to pursue a career in engineering or a related field will be working in industry, government, construction, or other professional service as mechanical engineers, or will be pursuing graduate degrees in mechanical engineering or post-baccalaureate degrees in other fields, such as law, business, or medicine.
2. Within five years of graduation from TAMU-CC our graduates who have chosen to pursue a career in engineering or a related field will have
    - advanced in their careers as indicated by obtaining promotions and positions of leadership, awards, recognitions as subject matter experts, and/or registration as professional engineers or in other professional disciplines; or by entrepreneurial activities, products or processes developed, patents, and/or publications;
    - demonstrated the ability to increase their knowledge and expertise through continuing education or advanced degrees; and
    - contributed to the improvement of the profession and of society through research, national and/or international collaboration, and/or professional and public service including mentoring.

## Student Learning Outcomes

Graduates will have:

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, 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.

## Admission from pre-engineering

For all students admitted into a pre-engineering program at TAMU-CC who wish to transfer into one of the TAMU-CC engineering programs (CEEN, EEEN, IEEN, MEEN), the cumulative GPA for all MATH, CHEM, PHYS, ENGR, COSC, CEEN, EEEN, IEEN, or MEEN courses that appear in the CEEN, EEEN, IEEN, or MEEN program curricula, plus any ENTC courses, taken at TAMU-CC, or their equivalents taken at other institutions, should be 2.5 or greater to be admitted into the CEEN, EEEN, IEEN, or MEEN programs at TAMU-CC. There should be a minimum of at least 12 hours of such courses taken at TAMU-CC or elsewhere before a transfer / admission to CEEN, EEEN, IEEN, or MEEN may be considered. All such students must also meet the requirements to take MATH 2413 Calculus I (4 sch) if they have not already done so.

## Master of Business Administration (MBA) Option

Mechanical Engineering students who have completed 96 credit hours toward the Mechanical Engineering B.S. degree and earned a cumulative GPA of 3.0 or higher may elect the MBA option in senior year. To satisfy the Technical Elective Block requirements, students who elect the MBA option are required to take

1. any upper division 3-credit hour math/physics/chemistry/biology course (MATH 3342 Applied Probability and Statistics (3 sch) preferred) and
2. three MBA foundation courses:

| Code | Title | Hours |
|---|---|---|
| ACCT 5312 | Foundations of Accounting | 3 |
| ECON 5311 | Foundations in Economics | 3 |
| FINA 5311 | Financial Management Concepts | 3 |

Students who plan to elect the MBA Option are encouraged to have summer internship experience before senior year, and will be able to complete an MBA degree study with 2 regular semesters and 1 summer session beyond a Mechanical Engineering B.S. degree study.

## General Requirements

The mechanical engineering curriculum consists of a minimum of 128 credit hours and can be divided into four main areas: University Core requirements, mathematics and science requirements, engineering requirements, technical electives, and capstone project.

Because courses in mechanical engineering tend to be sequential, it is very important that students have the proper prerequisites. When in doubt, students should check with their faculty mentor.

| Requirements | Credit Hours |
|---|---|
| Core Curriculum Program (http://catalog.tamucc.edu/undergraduate/university-college/programs/core-curriculum-program/) | 42 |

| | |
|---|---|
| First-Year Seminars (when applicable)[1] | 0-2 |
| Common Engineering and Math Courses | 45 |
| Required Mechanical Engineering Courses | 26 |
| Technical Elective Block | 12 |
| Capstone Project | 3 |
| **Total Credit Hours** | **128-130** |

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Full-time, first time in college students are required to take the first-year seminars.

- UNIV 1101 University Seminar I (1 sch)
- UNIV 1102 University Seminar II (1 sch)

Transfer students with 24 or more hours are exempt from First-Year Seminar.

# Program Requirements

The courses that are considered to be in the major field of study are all MATH, CHEM, PHYS, COSC, ENGR, MEEN, EEEN, and ENTC courses in the curriculum listed below (any EEEN or ENTC courses taken to fulfill MEEN degree requirements must be approved by the program coordinator and the department chair). Students who have been admitted as pre-mechanical engineering (PREM) majors must have a cumulative GPA of at least 2.5 in all MATH, CHEM, PHYS, COSC, and ENGR courses taken from the list below before they will be allowed to transfer into the Mechanical Engineering BS program and to take any upper-division (3000-level or above) ENGR, MEEN, or EEEN courses.

**Note:**

The specific requirements of the Bachelor of Science in Mechanical Engineering degree are indicated below. Students are encouraged to take the NCEES (National Council of Examiners for Engineering and Surveying) Fundamentals of Engineering (FE) exam during their senior year. The FE exam, http://ncees.org/exams/fe-exam/, is the first step in the process that leads to the P.E. license.

| Code | Title | Hours |
|---|---|---|
| **Full-time, First-year Students** | | |
| UNIV 1101 | University Seminar I | 1 |
| UNIV 1102 | University Seminar II | 1 |
| **Core Curriculum Program** | | |
| University Core Curriculum | | 42 |
| Mechanical Engineering students should take: [1] | | |
| MATH 2413 | Calculus I (3 hour lecture component) | |
| PHYS 2425 | University Physics I (3 hour lecture component) | |
| PHYS 2426 | University Physics II (3 hour lecture component) | |
| **Common Engineering, Math and Science Courses** | | |
| MATH 2413 | Calculus I (hours counting in core) | |
| PHYS 2425 | University Physics I (hours counting in core) | |
| PHYS 2426 | University Physics II (hours counting in core) | |
| MATH 2414 | Calculus II (3 hour lecture component counting in core, 1 hour laboratory component) | 1 |
| MATH 2415 | Calculus III | 4 |
| MATH 3315 | Differential Equations | 3 |
| ENGR 1201 | Introduction to Engineering | 2 |
| ENGR 1312 | Engineering Graphics I | 3 |
| COSC 1330 | Programming for Scientists, Engineers, and Mathematicians | 3 |
| CHEM 1411 | General Chemistry I | 4 |
| ENGR 3316 | Thermodynamics | 3 |
| ENGR 3322 | Materials Science | 3 |
| ENGR 2325 | Statics | 3 |
| ENGR 2326 | Dynamics | 3 |
| ENGR 2460 | Circuit Analysis | 4 |
| ENGR 3315 | Fluid Mechanics | 3 |
| ENGR 3320 | Strength of Materials | 3 |
| ENGR 3350 | Manufacturing Processes | 3 |
| **Required Mechanical Engineering Courses** | | |
| MEEN 3310 | Engineering Analysis for Mechanical Engineering | 3 |
| MEEN 3330 | Design of Machine Elements | 3 |
| MEEN 3230 | Solid Mechanics Laboratory | 2 |
| MEEN 3345 | Heat Transfer | 3 |
| ENGR 4240 | Project Management | 2 |
| MEEN 4351 | Dynamical Systems Analysis and Modeling | 3 |
| MEEN 4360 | Thermal Systems Design | 3 |
| MEEN 4365 | Mechanical Systems Design | 3 |
| ENGR 4420 | Engineering Lab Measurements | 4 |
| **Technical Electives Block** | | |
| Four courses or 12 hours. | | |
| *Statistics elective* | | |
| Select either MATH 3342 or MATH 3345 | | 3 |
| MATH 3342 | Applied Probability and Statistics | |
| MATH 3345 | Statistical Modeling and Data Analysis | |
| *Technical electives* [2] | | |
| Select 9 hours of elective courses. | | 9 |
| **Capstone Project** | | |
| ENGR 4370 | Capstone Projects | 3 |
| **Total Hours** | | **130** |

1

Mechanical engineering students must take two courses in physics even if the natural science portion of the core curriculum is satisfied by other means. Students transferring to A&M-Corpus Christi from other institutions may have various means for fulfilling the core curriculum. Please refer to the “General Education Requirement” in the catalog section entitled “Undergraduate Programs (http://catalog.tamucc.edu/undergraduate/undergraduate-programs/).”
Three hours of the Component Area Option of the University Core Curriculum are satisfied by the fourth (lab) hour of each of MATH 2413 Calculus I (4 sch), PHYS 2425 University Physics I (4 sch), and PHYS 2426 University Physics II (4 sch) (the first three lecture hours of each are used to satisfy the mathematics and natural science components of the Core, as described above). The other three hours of the Component Area Option of the Core are satisfied by the three lecture hours of MATH 2414 Calculus II (4 sch).

2

Students must complete 9 hours of elective courses. These may include upper-division Engineering (CEEN, EEEN, IEEN, MEEN) and 4000-level Engineering Technology (ENTC) courses outside of the required courses in their degree plans, any 4000-level MATH, COSC, BIOL, CHEM, or PHYS courses, the specified courses in the 5-year BS/MBA program, and other courses approved by the Department of Engineering.

### Capstone Project

All mechanical engineering students must complete a senior-level capstone project in ENGR 4370 Capstone Projects (3 sch). Students will work with practicing engineers and mechanical engineering faculty. The capstone project will give engineering students practical, professional experience to prepare them for careers in mechanical engineering.

## Course Sequencing

| | | |
|---|---|---|
| **First Year** | | |
| **Fall** | | **Hours** |
| UNIV 1101 | University Seminar I | 1 |
| ENGL 1301 | Writing and Rhetoric I | 3 |
| ENGR 1201 | Introduction to Engineering | 2 |
| CHEM 1411 | General Chemistry I | 4 |
| MATH 2413 | Calculus I | 4 |
| HIST 1301 | U.S. History to 1865 | 3 |
| | **Hours** | **17** |
| **Spring** | | |
| UNIV 1102 | University Seminar II | 1 |
| ENGL 1302 or COMM 1311 | Writing and Rhetoric II or Foundation of Communication | 3 |
| ENGR 1312 | Engineering Graphics I | 3 |
| MATH 2414 | Calculus II | 4 |
| PHYS 2425 | University Physics I | 4 |
| HIST 1302 | U.S. History Since 1865 | 3 |
| | **Hours** | **18** |
| **Second Year** | | |
| **Fall** | | |
| COSC 1330 | Programming for Scientists, Engineers, and Mathematicians | 3 |
| PHYS 2426 | University Physics II | 4 |
| ENGR 2325 | Statics | 3 |
| MATH 2415 | Calculus III | 4 |
| Creative Arts Core Requirement | | 3 |
| | **Hours** | **17** |
| **Spring** | | |
| POLS 2305 | U.S. Government and Politics | 3 |
| ENGR 2326 | Dynamics | 3 |
| ENGR 3316 | Thermodynamics | 3 |
| ENGR 3322 | Materials Science | 3 |
| MATH 3315 | Differential Equations | 3 |
| | **Hours** | **15** |
| **Third Year** | | |
| **Fall** | | |
| POLS 2306 | State and Local Government | 3 |
| ENGR 2460 | Circuit Analysis | 4 |
| ENGR 3315 | Fluid Mechanics | 3 |
| ENGR 3320 | Strength of Materials | 3 |
| Statistics Elective (MATH 3342 or MATH 3345) | | 3 |
| | **Hours** | **16** |
| **Spring** | | |
| ENGR 3350 | Manufacturing Processes | 3 |
| MEEN 3330 | Design of Machine Elements | 3 |
| MEEN 3230 | Solid Mechanics Laboratory | 2 |
| MEEN 3345 | Heat Transfer | 3 |
| MEEN 3310 | Engineering Analysis for Mechanical Engineering | 3 |
| Language, Philosophy & Culture Core Requirement | | 3 |
| | **Hours** | **17** |
| **Fourth Year** | | |
| **Fall** | | |
| ENGR 4420 | Engineering Lab Measurements | 4 |
| ENGR 4240 | Project Management | 2 |
| MEEN 4360 | Thermal Systems Design | 3 |
| MEEN 4365 | Mechanical Systems Design | 3 |
| MEEN Technical Elective | | 3 |
| | **Hours** | **15** |
| **Spring** | | |
| ENGR 4370 | Capstone Projects | 3 |
| MEEN 4351 | Dynamical Systems Analysis and Modeling | 3 |
| MEEN Technical Elective | | 3 |
| MEEN Technical Elective | | 3 |
| Social and Behavioral Sciences Core Requirement | | 3 |
| | **Hours** | **15** |
| | **Total Hours** | **130** |

## Courses

### Engineering Courses

**ENGR 1201 Introduction to Engineering**
**2 Semester Credit Hours (1 Lecture Hour, 2 Lab Hours)**
Introduction to the engineering profession, ethics, and disciplines; development of skills in teamwork, problem solving and design; other topics include computer applications and programming; Newton's laws, unit conversions, statistics. Offering: Fall and Spring.
**Prerequisite:** MATH 1314.

**ENGR 1312 Engineering Graphics I**
**3 Semester Credit Hours (2 Lecture Hours, 2 Lab Hours)**
Topics include, depending on the major: emphasis on computer applications and programming and solids modeling using CAD tools or other software; fundamentals of engineering science; advanced graphic skills. Pre-req: MATH 1314 - College Algebra or equivalent academic preparation. Offered Fall and Spring.
**Prerequisite:** MATH 1314.
**TCCNS:** ENGR 1304

**ENGR 2105 Electrical Circuits Laboratory**
**1 Semester Credit Hour (3 Lab Hours)**
Laboratory experiments supporting theoretical principles presented in ENGR 2305 involving DC and AC circuit theory, network theorems, time, and frequency domain circuit analysis. Introduction to principles and operation of basic laboratory equipment; laboratory report preparation.
**Prerequisite:** ENGR 2305*.
* May be taken concurrently.
**Co-requisite:** ENGR 2305, SMTE 0099.

**ENGR 2106 Digital Systems Laboratory**
**1 Semester Credit Hour (3 Lab Hours)**
Basic laboratory experiments supporting theoretical principles presented in ENGR 2306 involving design, construction, and analysis of combinational and sequential digital circuits and systems, including logic gates, adders, multiplexers, encoders, decoders, arithmetic logic units, latches, flip-flops, registers, and counters; preparation of laboratory reports.
**Co-requisite:** ENGR 2306, SMTE 0099.

**ENGR 2305 Electrical Circuits**
**3 Semester Credit Hours (3 Lecture Hours)**
Principles of electrical circuits and systems. Basic circuit elements (resistance, inductance, mutual inductance, capacitance, independent and dependent controlled voltage, and current sources). Topology of electrical networks; Kirchhoff 's laws; node and mesh analysis; DC circuit analysis; operational amplifiers; transient and sinusoidal steady-state analysis; AC circuit analysis; first- and second-order circuits; Bode plots; and use of computer simulation software to solve circuit problems.
**Prerequisite:** PHYS 2426 and MATH 2414.
**Co-requisite:** ENGR 2105.

**ENGR 2306 Digital Systems**
**3 Semester Credit Hours (3 Lecture Hours)**
Introduction to theory and design of digital logic, circuits, and systems. Number systems, operations and codes; logic gates; Boolean Algebra and logic simplification; Karnaugh maps; combinational logic; functions of combinational Logic; flip-flops and related devices; counters; shift registers; sequential logic; memory and storage.
**Prerequisite:** MATH 2305*.
* May be taken concurrently.
**Co-requisite:** ENGR 2106.

**ENGR 2325 Statics**
**3 Semester Credit Hours (3 Lecture Hours)**
Theory of engineering mechanics involving forces, moments, and couples on stationary structures; equilibrium in two and three dimensions; free body diagrams; truss analysis; friction; centroids; centers of gravity and moments of inertia.
**Prerequisite:** PHYS 2425 and MATH 2414*.
* May be taken concurrently.
**TCCNS:** ENGR 2301

**ENGR 2326 Dynamics**
**3 Semester Credit Hours (3 Lecture Hours)**
Theory of engineering mechanics involving the motion of particles, rigid bodies and systems of particles; Newton's Laws; work and energy relationships; principles of impulse and momentum; application of kinetics and kinematics to the solution of engineering problems.
**Prerequisite:** ENGR 2325.
**TCCNS:** ENGR 2302

**ENGR 2460 Circuit Analysis**
**4 Semester Credit Hours (3 Lecture Hours, 3 Lab Hours)**
This course covers principles of electronics: charge, voltage, resistance, current, and power; Ohm's Law; Kirchhoff's voltage and current laws; RC and LC circuits; periodic functions, average and RMS measurements; transformers, electrical measurement instruments. The laboratory provides hands-on experience with devices and circuits discussed in the classroom.
**Prerequisite:** (PHYS 2426, MATH 2414 and 3315*).
* May be taken concurrently.
**Co-requisite:** SMTE 0099.
**TCCNS:** ENGR 2305

**ENGR 3315 Fluid Mechanics**
**3 Semester Credit Hours (3 Lecture Hours)**
Fluid properties, fluid statics, dynamics, and kinematics, conservation of energy and momentum incompressible, laminar and turbulent flow. Similitude and dimensional analysis, and viscous flow. Offered: Fall Spring.
**Prerequisite:** MATH 3315*, ENGR 2326 and MATH 2415.
* May be taken concurrently.

**ENGR 3316 Thermodynamics**
**3 Semester Credit Hours (3 Lecture Hours)**
Theory and application of energy methods in engineering; conservation of mass and energy; energy transfer by heat, work and mass; thermodynamic properties; analysis of open and closed systems; the second law of thermodynamics and entropy; gas, vapor and refrigeration cycles.
**Prerequisite:** (PHYS 2425 and MATH 2414).

**ENGR 3320 Strength of Materials**
**3 Semester Credit Hours (3 Lecture Hours)**
Concepts in strength of materials, stress, strain; deformation under load, direct, shear, and combined stresses; stress concentrations, bending stresses and torsional shear stresses, deflection in beams and shafts; columns, and pressure vessels.
**Prerequisite:** ENGR 2325 and 3322 or ENGR 2322.

**ENGR 3322 Materials Science**
**3 Semester Credit Hours (3 Lecture Hours)**
Structure and properties of metallic and nonmetallic materials; microstructure, mechanical testing, phase diagrams, heat treatment, testing, ceramics, polymers, composites, construction materials, failure analysis, nondestructive evaluation, corrosion and thermal properties of materials.
**Prerequisite:** (CHEM 1411 and PHYS 2425).

**ENGR 3350 Manufacturing Processes**
**3 Semester Credit Hours (2 Lecture Hours, 3 Lab Hours)**
Introduction to metal and non-metallic manufacturing processes; casting, forging, rolling, extrusion, sheet metal forming, cutting tools turning and milling operations, abrasive machining, welding and joining, powder compaction, molding, forming of plastics, surface treatment, human factors and safety.
**Prerequisite:** ENGR 1312 and 3322.
**Co-requisite:** SMTE 0099.

**ENGR 4240 Project Management**
**2 Semester Credit Hours (2 Lecture Hours, 2 Lab Hours)**
Foundations of engineering economy, cash flow and equivalence, and project justification. Introduction to project management, planning, scheduling, and control, use of project management software, GANTT charts, PERT charts, and critical path. Students prepare proposals, including specifications, timelines, schedule, and budget, for projects to be implemented in ENGR 4370 - Capstone Projects. This course should be taken the semester preceding ENGR 4370 - Capstone Projects.
**Prerequisite:** (MEEN 3330 and 3345) or (EEEN 3330, 3310 and 3350) or (IEEN 3302 and 3320) or (CEEN 3320 and 4304).
**Co-requisite:** SMTE 0099.

**ENGR 4350 Machine Vision and Image Processing Applications**
**3 Semester Credit Hours (3 Lecture Hours)**
Introduces students to automated vision systems and components, camera models, testing and measurement, and fundamentals of image processing. Topics include image analysis and processing in binary, gray scale and color images in spatial- and frequency-domain. Texture and shape analysis, hyperspectral imaging, other transforms, and filters are discussed and applied.
**Prerequisite:** (COSC 1330 or 1435) and ENGR 2460 and MATH 2414.

**ENGR 4370 Capstone Projects**
**3 Semester Credit Hours (1 Lecture Hour, 5 Lab Hours)**
This course allows students to employ the knowledge attained in other courses to implement (including building, testing, and documenting) an approved project, within budget and on schedule. Course requirements include a written report and oral presentations.
**Prerequisite:** ENGR 4240.
**Co-requisite:** SMTE 0099.

**ENGR 4390 Special Topics in Engineering**
**1-3 Semester Credit Hours (1 Lecture Hour)**
Subject material variable. May be repeated for credit when topics are different.

**ENGR 4420 Engineering Lab Measurements**
**4 Semester Credit Hours (2 Lecture Hours, 4 Lab Hours)**
Principles of physical measurements; standards, calibration, error estimation; static and dynamic performance of measuring systems; laboratory experience, experiment planning, report writing. The purpose of this course is for students to gain proficiency in designing, assembling, and operating an experiment; and analyzing and presenting experimental results. This encompasses skills such as an understanding control and data acquisition electronics, operation and limitation of modern sensors, calibration and error analysis, assessing applicability of theory and the impact of secondary experimental variables, and writing and presenting reports and analysis.
**Prerequisite:** PHYS 2426 and (MATH 3342 or 3345).
**Co-requisite:** SMTE 0099.

## Mechanical Engineering Courses

**MEEN 3230 Solid Mechanics Laboratory**
**2 Semester Credit Hours (4 Lab Hours)**
Experimental principles from Strength of Materials, and experiments and computer-based analysis of machine elements and structures for Strength of Material and Solid Mechanics.
**Prerequisite:** MEEN 3330 or 3330*.
* May be taken concurrently.
**Co-requisite:** SMTE 0099.

**MEEN 3310 Engineering Analysis for Mechanical Engineering**
**3 Semester Credit Hours (3 Lecture Hours)**
Applications of fundamentals of linear algebra, vector analysis, numerical methods, computer programming, and probability and statistics for mechanical engineering. (Cross-listed with MATH 3310 - Mathematical Analysis for Mechanical Engineering )
**Prerequisite:** MATH 3315.

**MEEN 3330 Design of Machine Elements**
**3 Semester Credit Hours (3 Lecture Hours)**
Stress analysis of deformable bodies and mechanical elements; stress transformation; combined loading; failure modes; material failure theories; fracture and fatigue; deflections and instabilities; thick cylinders; curved beams; design of structural/mechanical members; design processes for shafts, bearings, springs, fasteners, and mechanical joints.
**Prerequisite:** ENGR 3320.

**MEEN 3335 Introduction to Unmanned Aircraft Systems**
**3 Semester Credit Hours (3 Lecture Hours)**
Overview of unmanned aerial systems: history, platforms, operations, command and control, sensor systems, payloads, regulations, policy. Current developments in unmanned aerial systems.

**MEEN 3340 Solid Modeling and Finite Elements**
**3 Semester Credit Hours (2 Lecture Hours, 3 Lab Hours)**
Use of computer aided design and solid modeling tools in engineering design, and analysis, and manufacturing including: solid modeling, stress, flow, and heat transfer analysis using finite element methods.
**Prerequisite:** MEEN 3310 and ENGR 3320.

**MEEN 3345 Heat Transfer**
**3 Semester Credit Hours (3 Lecture Hours)**
Steady and unsteady conduction in one- and two-dimensions; forced convection, internal and external flows; heat exchangers; introduction to radiation; elements of thermal system design.
**Prerequisite:** (ENGR 3316 and 3315).

**MEEN 4325 Energy Conversion**
**3 Semester Credit Hours (3 Lecture Hours, 3 Lab Hours)**
Natural resources: fuels, solar, wind, geothermal, wave, and ocean thermal; thermodynamics of power cycles and processes: Rankine, Brayton, gas turbine, IC engines, fuel cell; nuclear power; direct energy conversion: photovoltaic, thermoelectric, thermionic, magnetohydrodynamics; non-reactive processes: wind, wave/tidal, ocean thermal energy, solar thermal; concept of life cycle assessments of carbon foot print. Student teamwork of a class term paper is expected.
**Prerequisite:** ENGR 3316.

**MEEN 4330 Introduction to Plasma Engineering and Applications**
**3 Semester Credit Hours (2 Lecture Hours, 2 Lab Hours)**
Physical, electrical, chemical properties of plasmas; differences in properties of thermal and non-thermal plasmas, direct and alternating current plasma sources, inductive and capacitive coupled plasma sources, diagnostics and applications of plasmas.
**Prerequisite:** ENGR 2322 and (ENGR 2460 or PHYS 2426).
**Co-requisite:** SMTE 0099.

**MEEN 4331 Compressible Flow and Introduction to Jet Propulsion**
**3 Semester Credit Hours (3 Lecture Hours)**
Introduction to compressible flows: isentropic flow, normal shocks, oblique shocks, expansion fans, internal flows. Flows with friction and heat addition. Introduction to gas turbine engine cycle and components. Derivation of thrust equation for turbojet engines.
**Prerequisite:** (ENGR 3315 or ENTC 3306) and (ENGR 3316 or ENTC 3320).

**MEEN 4335 Introduction to Aircraft Aerodynamics and Performance**
**3 Semester Credit Hours (3 Lecture Hours)**
Forces on aircraft; standard atmosphere; steady-state cruise, climb, and turn performance; performance optimization; introduction to aircraft longitudinal stability.
**Prerequisite:** ENGR 2326 and COSC 1330.

**MEEN 4336 Introduction to UAS for Agricultural Applications**
**3 Semester Credit Hours (3 Lecture Hours)**
Provides the foundations to acquire remote sensing data using Unmanned Aircraft Systems (UAS) and to interpret, process, and apply remotely sensed data for agricultural applications. Principles of remote sensing, digital image processing, and geospatial analysis will be covered. Emphasis will be on the use of UAS remote sensing technology for various disciplines in agricultural sciences including plant breeding, plant physiology, crop scouting, pest management and entomology. Offered Spring.
**Prerequisite:** MEEN 3335.

**MEEN 4345 Sensors and Systems**
**3 Semester Credit Hours (3 Lecture Hours)**
This course covers sensors and sensing systems where sensing modalities, analysis of sensed data, data transmission and reception are discussed. Filtering and estimation in sensing systems are considered. The course covers sensors at component level to develop subsystems and more complex sensing systems that monitor physical phenomena in laboratory or marine/terrestrial environments. Other topics include multidimensional signal and image processing, object tracking, multisensory data fusion, applications in environmental monitoring, remote sensing and surveillance.
**Prerequisite:** MATH 2414, PHYS 2426 and ENGR 2460.

**MEEN 4350 Controls, Automation and Robotics**
**3 Semester Credit Hours (2 Lecture Hours, 3 Lab Hours)**
Automation in a manufacturing and assembly setting for ocean and marine environments, material handling systems, remote guided vehicles, automated storage and retrieval systems, computer numerical machine tools, robotics.
**Prerequisite:** MATH 3315, ENGR 2326 and 2460.
**Co-requisite:** SMTE 0099.

**MEEN 4351 Dynamical Systems Analysis and Modeling**
**3 Semester Credit Hours (3 Lecture Hours)**
Modeling and analysis of systems that have a time-based response. Transient as well as steady state solutions for SDOF and MDOF systems and computational solutions including time response, Bode plots, phase plots, and other plots relevant to the system. Linear and non-linear modeling of systems will be studied. Modeling of mechanical systems (vibrations), electrical circuits, and thermal/fluid systems will be covered.
**Prerequisite:** COSC 1330, ENGR 2460, 2326 and MEEN 3310.

**MEEN 4355 Marine Fabrication**
**3 Semester Credit Hours (2 Lecture Hours, 3 Lab Hours)**
Advanced topics in manufacturing and fabrication related to ships and offshore platforms and construction.
**Prerequisite:** ENGR 3350.
**Co-requisite:** SMTE 0099.

**MEEN 4356 Micro-Electronical & Mechanical Manufacturing**
**3 Semester Credit Hours (3 Lecture Hours)**
Basic principles and techniques in microelectronics manufacturing (semiconductor manufacturing and micro-electrical mechanical systems (MEMS). Emphasis will on process descriptions, terminology, equipment requirements, and process controls. Basic micro-fabrication including semiconductor and MEMS physics and process chemistry will be combined with control schemes to arrive at overall systems descriptions.

**MEEN 4360 Thermal Systems Design**
**3 Semester Credit Hours (3 Lecture Hours)**
Analysis, management and cost, optimal design, and computer simulation of thermal systems and components; Applications in fluid flow and heat transfer, pumps, turbines and heat exchangers. Selected course topics are assigned as projects.
**Prerequisite:** MEEN 3345.

**MEEN 4365 Mechanical Systems Design**
**3 Semester Credit Hours (3 Lecture Hours)**
Analysis, management and cost, optimal design, and computer simulation of mechanical systems and components; machine elements, and stress analysis. Selected course topics are assigned as projects.
**Prerequisite:** (MEEN 3330 and ENGR 3350).

**MEEN 4375 Fuel Cells**
**3 Semester Credit Hours (3 Lecture Hours)**
Students will acquire an understanding of thermodynamics, transport phenomena and reaction fundamentals that are required to understand the processes and phenomena that pose limits on fuel cell performance.
**Prerequisite:** ENGR 3316, MEEN 3345 and CHEM 1411.

**MEEN 4380 Renewable Energy**
**3 Semester Credit Hours (2 Lecture Hours, 2 Lab Hours)**
Renewable and alternative energy sources and fuels; modern energy conversion devices, such as offshore wind farms, marine current turbines, fuel cells, photovoltaic cells, and micro-power turbines. Cost and environmental analysis of renewable sources. Installation, design characteristics, operational performance, and maintenance of motors, turbines, pumps and compressors. Introduction to global energy concerns; fossil and nuclear fuels; energy consumption analysis; energy management and conservation techniques.
**Prerequisite:** ENGR 3316, 2460 and MEEN 4325.
**Co-requisite:** SMTE 0099.

**MEEN 4385 Offshore Energy Management**
**3 Semester Credit Hours (3 Lecture Hours)**
Topics related to the design and energy management of ships and offshore platforms will be covered. Such topics may include oil and gas exploration, wind and marine energy systems, and environmental protection.
**Prerequisite:** MEEN 3345.

**MEEN 4390 Introduction to Computational Fluid Dynamics**
**3 Semester Credit Hours (2 Lecture Hours, 3 Lab Hours)**
Introduction to numerical, computational, modeling and simulation of thermo-fluid systems. Applications related to ships and offshore platforms and structures will be presented.
**Prerequisite:** MEEN 3345.

**MEEN 4395 Offshore Water Exploration and Desalination Systems**
**3 Semester Credit Hours (2 Lecture Hours, 3 Lab Hours)**
Advanced and future applications of sea floor mapping, under-water acoustics and GIS for fresh water exploration and mining. Renewable energy driven coastal, near-shore, and offshore desalination systems.
**Prerequisite:** ENGR 3316.

**MEEN 4396 Directed Independent Study**
**3 Semester Credit Hours**
Requires a formal proposal of study to be completed in advance of registration, approval of supervising faculty and chairperson.