

# Mechanical and Aerospace Engineering - Undergraduate Programs

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## Overview

The Department of Mechanical and Aerospace Engineering (MAE) offers three programs of study leading to the bachelor's degree. They are the Bachelor of Science in Aerospace Engineering, the Bachelor of Science in Mechanical Engineering, and a double degree of Bachelor of Science in Aerospace Engineering and Bachelor of Science in Mechanical Engineering. Both Aerospace Engineering and Mechanical Engineering degree programs offer a Fast Track option which enables outstanding undergraduate students to receive dual undergraduate/ graduate course credit for up to nine hours of coursework. Minor degrees are also offered in Aerospace Engineering and Mechanical Engineering. The Mechanical Engineering (B.S.) program is accredited by the Engineering Accreditation Commission (EAC) of ABET (<https://www.abet.org>), under the General Criteria and the Program Criteria for Mechanical Engineering and Similarly Named Engineering programs. The Aerospace Engineering (B.S.) program is accredited by the Engineering Accreditation Commission of ABET (<https://www.abet.org>), under the General Criteria and the Program Criteria for Aerospace Engineering and Similarly Named Engineering programs. The mechanical and aerospace engineering programs have been accredited since 1967 and 1968, respectively.

This section contains Department policies governing admission and academic progress which are common to both aerospace and mechanical degree programs.

## Admission

For admission to the aerospace engineering and mechanical engineering programs, students must meet the requirements for admission to the College of Engineering. For unconditional transfer into the department, a student must have a minimum grade point average of 2.50 in all science, mathematics and engineering courses, a minimum 3-GPA calculation of 2.50 in UTA coursework, and a total of no more than four unsuccessful attempts in engineering courses.

## Advising

The advising process is designed to assist students as they make important decisions related to their academic progress at UT Arlington and career goals in general.

Specifically, the purpose of advising is:

- To empower students to clarify and achieve their educational goals by providing timely and accurate information about degree requirements, as well as College and University policies and procedures.
- To provide every student with the opportunity to develop a relationship with a knowledgeable advisor in order to obtain sound academic advising with a degree of continuity.
- To provide students with information about additional services, programs, and support systems available within the College and University as appropriate.

Ultimately, the student is responsible for seeking academic advice, making decisions regarding goals, meeting degree requirements, and enrolling in appropriate courses. The academic advisor is to provide assistance in these decisions. Each student is responsible for understanding and complying with University and College policies and procedures.

During each long semester, the Mechanical and Aerospace Engineering Department conducts pre-enrollment advising weeks. Returning students (i.e., students who are or have previously been students at The University of Texas at Arlington) shall meet with their assigned advisors during advising weeks and complete the pre-enrollment advising process. Returning students who are unable to be present for advising during advising weeks should contact their advisor at the earliest opportunity. New students may receive pre-enrollment advising following advising weeks during normal advising hours.

## Goal of the Undergraduate Program

The overall goal of the undergraduate program is to provide the graduate an educational background for lifelong learning and the ability to assume a leadership role in the mechanical or aerospace engineering professions. The programs are broad-based and designed to provide a strong foundation in science, mathematics, and engineering science; technical competence in multiple areas of mechanical or aerospace engineering practice; and an understanding of the importance of ethics, safety, professionalism, and socioeconomic concerns in resolving technical problems.

## Program Educational Objectives and Student Outcomes

### Program Educational Objectives

A primary goal of the mechanical engineering and aerospace engineering degree programs is to provide an educational experience and training that will prepare graduates to excel within the broad scope of the mechanical and aerospace engineering professions. Our Program Educational Objectives are to enable our graduates to attain the following professional and career accomplishments during the first few years following graduation:

- Be employed in a professional mechanical, aerospace or related engineering organization, or be admitted to graduate programs in engineering or other professional areas,
- Become an active participant in professional society activities,
- Demonstrate the initiative, motivation and ability to grow professionally in their chosen endeavor.

### Student Outcomes

Mechanical engineering and aerospace engineering student outcomes established to accomplish the educational objectives are as follows.

- an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
- 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
- an ability to communicate effectively with a range of audiences
- 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
- 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
- an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
- an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

The mechanical engineering and aerospace engineering programs offer broad technical backgrounds for students who may choose other engineering fields for advanced study.

## Academic Regulations

### Academic Honesty

The College of Engineering takes academic honesty and ethical behavior very seriously. Engineers are entrusted with the safety, health, and well being of the public. Students found guilty of academic dishonesty will be punished to the full extent permitted by the rules and regulations of UT Arlington. In particular, a student found guilty of a second offense by the Office of Student Judicial Affairs will be subject to dismissal from the College of Engineering

### Academic Standing

To be in good academic standing within the MAE department, each mechanical engineering and aerospace engineering student in the pre-professional program must maintain a minimum 3-GPA calculation of 2.50 and have a total of no more than four unsuccessful attempts in engineering courses. Further, in the professional program, each student must maintain a minimum UTA cumulative GPA of 2.0 and a minimum major GPA of 2.0.

### Advancement into Mechanical and Aerospace Engineering Professional Programs

Requirements for advancement into the Professional Programs in Mechanical Engineering and Aerospace Engineering are in accordance with those in the College of Engineering with the added stipulation that:

- Each student must have a total of no more than four unsuccessful attempts in engineering courses and complete all pre-professional courses stipulated under "Requirements for a Bachelor of Science Degree in Aerospace Engineering" or "Requirements for a Bachelor of Science Degree in Mechanical Engineering" with a minimum grade of C in each course and a minimum GPA of 2.50 on a 4.0 scale in each of three categories:
  - a. overall,
  - b. required math, science, and engineering courses, and
  - c. required MAE courses.
- Application to the Professional Program is to be made to the Undergraduate Advisor during the semester following completion of the last pre-professional course.
- No professional Mechanical and Aerospace Engineering course may be taken unless the student is admitted into the professional program or obtains the consent of the Undergraduate Advisor. Professional courses may be taken to fill out a schedule in the semester that the last pre-professional course is taken.

- Some professional Mechanical and Aerospace Engineering courses are offered only once a year. Students are urged to plan their course sequence schedules carefully to avoid delaying their graduation.

## Additional Requirements

Requirements for the bachelor of science in mechanical engineering and bachelor of science in aerospace engineering are in accordance with those of the University and the College of Engineering with the added stipulation that:

- Each student must complete all professional courses stipulated under "Requirements for a Bachelor of Science Degree in Aerospace Engineering" or "Requirements for a Bachelor of Science Degree in Mechanical Engineering" with a minimum grade of C in each course.
- Each student must have a minimum UTA cumulative GPA of 2.0, and a minimum major GPA of 2.0. The major GPA includes all MAE courses in the degree plan.
- The College of Engineering requires that students who do not have two units of high school foreign language take six hours, in the same language, of modern or classical language courses in addition to the previously listed requirements.
- Mechanical Engineering and Aerospace Engineering students will satisfy the university core curriculum requirement by completing all General Education courses specified under "Requirements for a Bachelor of Science Degree in Aerospace Engineering" or "Requirements for a Bachelor of Science Degree in Mechanical Engineering" along with Engl 1301, Math 1426, Math 2425, Math 2326, Phys 1443 and Phys 1444, which are also required in the Pre-Professional program.
- After a student has begun the Mechanical Engineering or Aerospace Engineering professional program at UT Arlington, it is required that further professional courses be completed at UT Arlington.

## Oral Communication and Computer Use Competency Requirements

Mechanical Engineering and Aerospace Engineering students will satisfy the Oral Communication Competency requirement by completing COMS 2302 PROFESSIONAL AND TECHNICAL COMMUNICATION FOR SCIENCE AND ENGINEERING, and the Computer Use Competency requirement by completing MAE 2360 NUMERICAL ANALYSIS & PROGRAMMING.

## Other Provisions

Refer to the College of Engineering section of this catalog for information concerning the following topics: (<http://catalog.uta.edu/engineering/>)

- Preparation in High School for Admission to the College of Engineering
- Admission to the College of Engineering
- Advising in the College of Engineering
- Admission into the Professional Program
- College of Engineering Academic Regulations
- Course Transfer Policies
- College of Engineering Probation
- Repeating Course Policy
- Modern and Classical Languages Requirement

## Bachelor of Science in Aerospace Engineering (BSAE)

Academic requirements governing the Bachelor of Science in aerospace engineering. (p. 1)

Rapid advances in aerospace systems require the successful aerospace engineer to develop new concepts and bring them into reality as reliable, competitive, and environmentally acceptable products. Successful completion of a balanced study of basic science and engineering topics, further complemented by humanities, will ensure that graduates are well prepared to tackle tomorrow's challenges. The curriculum covers the broad areas of aerodynamics and fluid mechanics, propulsion and combustion, flight mechanics and controls, structural mechanics and material behavior, structural dynamics, and system design and optimization supplemented by appropriate laboratory experiences. The culmination of the curriculum is a vehicle design project. Students may broaden their education by choosing elective courses in a secondary field of interest or by taking a second bachelor's degree in mechanical engineering.

## Requirements for a Bachelor of Science Degree in Aerospace Engineering

For a suggested course sequence, see the department web site: [www.uta.edu/mae](http://www.uta.edu/mae)

### Pre-Professional Courses

One of the following: <sup>1</sup>

UNIV 1131	STUDENT SUCCESS	1
ENGR 1101	ENTRANCE TO ENGINEERING FOR TRANSFER STUDENTS	
MATH 1426	CALCULUS I	4
MAE 1140	PROBLEMS IN MECHANICAL AND AEROSPACE ENGINEERING (This course is new for fall 2021)	1

MATH 2425	CALCULUS II	4
MATH 2326	CALCULUS III	3
MATH 3330	INTRODUCTION TO LINEAR ALGEBRA AND VECTOR SPACES	3
CHEM 1465	CHEMISTRY FOR ENGINEERS	4
PHYS 1443	GENERAL TECHNICAL PHYSICS I	4
PHYS 1444	GENERAL TECHNICAL PHYSICS II	4
ENGL 1301	RHETORIC AND COMPOSITION I	3
EE 2320	CIRCUIT ANALYSIS	3
MAE 1106	INTRODUCTION TO AEROSPACE ENGINEERING	1
MAE 1312	ENGINEERING STATICS	3
MAE 1351	INTRODUCTION TO ENGINEERING DESIGN	3
MAE 2312	SOLID MECHANICS	3
MAE 2315	FLUID DYNAMICS	3
MAE 2323	DYNAMICS	3
MAE 2360	NUMERICAL ANALYSIS & PROGRAMMING	3
MAE 2381	EXPERIMENTAL METHODS AND MEASUREMENTS	3
MAE 3309	THERMAL ENGINEERING	3
MAE 3360	ENGINEERING ANALYSIS	3
<b>Professional Courses <sup>2</sup></b>		
MAE 3181	MATERIALS AND STRUCTURES LAB	1
MAE 3182	AERODYNAMICS AND FLUIDS LAB	1
MAE 3185	INTRODUCTION TO MECHATRONICS (This course is new for fall 2021)	1
MAE 3302	INCOMPRESSIBLE AERODYNAMICS	3
MAE 3303	COMPRESSIBLE FLOW	3
MAE 3304	ASTRONAUTICS I	3
MAE 3405	FLIGHT DYNAMICS	4
MAE 3306	FLIGHT PERFORMANCE, STABILITY & CONTROL	3
MAE 3315	AEROSPACE STRUCTURAL STATICS	3
MAE 3324	STRUCTURE & MECHANICAL BEHAVIOR OF MATERIALS	3
MAE 4310	INTRODUCTION TO AUTOMATIC CONTROL	3
MAE 4314	MECHANICAL VIBRATIONS	3
MAE 4321	AEROSPACE PROPULSION	3
MAE 4350	AEROSPACE VEHICLE DESIGN I	3
MAE 4151	AEROSPACE VEHICLE DESIGN II	1
Technical Electives: Approved engineering, science, or mathematics (3000 level or higher) <sup>3</sup>		6
<b>General Education Courses: Additional courses required for the aerospace engineering degree</b>		
U. S. History electives: any courses which satisfy the University Core Curriculum requirements for U. S. History are accepted.		6
POLS 2311	GOVERNMENT OF THE UNITED STATES	3
POLS 2312	STATE AND LOCAL GOVERNMENT	3
Language, Philosophy and Culture elective: any course which satisfies the University Core Curriculum requirements for Language, Philosophy and Culture is accepted.		3
Communication: COMS 2302		3
Creative arts elective: any course which satisfies the University Core Curriculum requirements for Creative Arts is accepted.		3
Social/behavioral elective: ECON 2305 or IE 2308		3
<b>Total Hours</b>		<b>130</b>

Total hours completed will depend upon prior preparation and academic qualifications.

<sup>1</sup> UNIV 1131 is required for students admitted as Freshman. ENGR 1101 is required for students admitted as Transfer.

<sup>2</sup> All pre-professional courses must be completed before enrolling in professional courses.

<sup>3</sup> Technical electives must be approved in advance by the student's academic advisor. Normally, they are selected from the senior elective 4000 level courses in Mechanical and Aerospace Engineering.

## Recommended Core Curriculum

Aerospace Engineering students will satisfy the university core curriculum requirement by completing all General Education courses specified under "Requirements for a Bachelor of Science Degree in Aerospace Engineering" along with ENGL 1301, MATH 1426, MATH 2425, MATH 2326, PHYS 1443 and PHYS 1444, which are within the Pre-Professional Program. The university core curriculum allows each degree plan to designate a component area to satisfy three hours of the core requirement. For the aerospace engineering degree plan, the designated component area is Math and MATH 2326 is selected to satisfy the requirement. For more information, see [University Core Curriculum](http://catalog.uta.edu/academicregulations/degreerequirements/generalcorerequirements/). (<http://catalog.uta.edu/academicregulations/degreerequirements/generalcorerequirements/>)

## Bachelor of Science in Mechanical Engineering (BSME)

[Academic requirements governing the bachelor of science in mechanical engineering](#). (p. 1)

The mechanical engineer needs to be extremely versatile and can be found in a large variety of private and public sector organizations. He or she may be involved in product design and development, manufacturing, project management, power generation or other operations. Therefore, the mechanical engineering curriculum is broad-based and emphasizes fundamental engineering sciences and applications. Approximately equal emphasis is given to machine design, structural analysis, thermodynamics and energy, systems and control, and materials science. Classroom lectures are supplemented by laboratories. The student completes a capstone design project as the culmination of the undergraduate program.

## Requirements for a Bachelor of Science Degree in Mechanical Engineering

For a suggested course sequence, see the department web site: [www.uta.edu/mae](http://www.uta.edu/mae)

### Pre-Professional Courses

One of the following: <sup>1</sup>		1
UNIV 1131	STUDENT SUCCESS	
ENGR 1101	ENTRANCE TO ENGINEERING FOR TRANSFER STUDENTS	
MATH 1426	CALCULUS I	4
MAE 1140	PROBLEMS IN MECHANICAL AND AEROSPACE ENGINEERING (This course is new for fall 2021)	1
MATH 2425	CALCULUS II	4
MATH 2326	CALCULUS III	3
MATH 3330	INTRODUCTION TO LINEAR ALGEBRA AND VECTOR SPACES	3
CHEM 1465	CHEMISTRY FOR ENGINEERS	4
PHYS 1443	GENERAL TECHNICAL PHYSICS I	4
PHYS 1444	GENERAL TECHNICAL PHYSICS II	4
ENGL 1301	RHETORIC AND COMPOSITION I	3
EE 2320	CIRCUIT ANALYSIS	3
MAE 1107	INTRODUCTION TO MECHANICAL ENGINEERING	1
MAE 1312	ENGINEERING STATICS	3
MAE 1351	INTRODUCTION TO ENGINEERING DESIGN	3
MAE 2312	SOLID MECHANICS	3
MAE 2323	DYNAMICS	3
MAE 2360	NUMERICAL ANALYSIS & PROGRAMMING	3
MAE 2381	EXPERIMENTAL METHODS AND MEASUREMENTS	3
MAE 3310	THERMODYNAMICS I	3
MAE 3324	STRUCTURE & MECHANICAL BEHAVIOR OF MATERIALS	3
MAE 3360	ENGINEERING ANALYSIS	3

### Professional Courses <sup>2</sup>

MAE 3181	MATERIALS AND STRUCTURES LAB	1
MAE 3183	MEASUREMENTS LABORATORY II	1
MAE 3185	INTRODUCTION TO MECHATRONICS (This course is new for fall 2021)	1
MAE 3242	MECHANICAL DESIGN I	2
MAE 3311	THERMODYNAMICS II	3
MAE 3313	FLUID MECHANICS	3
MAE 3314	HEAT TRANSFER	3
MAE 3318	KINEMATICS AND DYNAMICS OF MACHINES	3
MAE 3319	DYNAMIC SYSTEMS MODELING AND SIMULATION	3
MAE 3344	INTRODUCTION TO MANUFACTURING ENGINEERING	3

MAE 4188	DESIGN PROJECT LABORATORY II	1
MAE 4287	DESIGN PROJECT I	2
MAE 4310	INTRODUCTION TO AUTOMATIC CONTROL	3
MAE 4342	MECHANICAL DESIGN II	3
MAE 4344	COMPUTER-AIDED ENGINEERING	3
Technical Electives: Approved engineering, science, or mathematics (3000 level or higher) <sup>3</sup>		9
<b>General Education Courses: Additional courses required for the mechanical engineering degree</b>		
U. S. History electives: any courses which satisfy the University Core Curriculum requirements for U. S. History are accepted.		6
POLS 2311	GOVERNMENT OF THE UNITED STATES	3
POLS 2312	STATE AND LOCAL GOVERNMENT	3
Language, Philosophy and Culture elective: any course which satisfies the University Core Curriculum requirements for Language, Philosophy and Culture is accepted.		3
Communication: COMS 2302		3
Creative arts elective: any course which satisfies the University Core Curriculum requirements for Creative Arts is accepted.		3
Social/behavioral elective: ECON 2305 or IE 2308		3
<b>Total Hours</b>		<b>130</b>

Total hours completed will depend upon prior preparation and academic qualifications.

<sup>1</sup> UNIV 1131 is required for students admitted as Freshman. ENGR 1101 is required for students admitted as Transfer.

<sup>2</sup> All pre-professional courses must be completed before enrolling in professional courses.

<sup>3</sup> Technical electives must be approved in advance by the student's academic advisor. Normally, they are selected from the senior elective 4000 level courses in Mechanical and Aerospace Engineering.

## Recommended Core Curriculum

Mechanical Engineering students will satisfy the university core curriculum requirement by completing all General Education courses specified under "Requirements for a Bachelor of Science Degree in Mechanical Engineering" along with ENGL 1301, MATH 1426, MATH 2425, MATH 2326, PHYS 1443 and PHYS 1444, which are within the Pre-Professional Program. The university core curriculum allows each degree plan to designate a component area to satisfy three hours of the core requirement. For the mechanical engineering degree plan, the designated component area is Math and MATH 2326 is selected to satisfy the requirement. For more information, see [University Core Curriculum](http://catalog.uta.edu/academicregulations/degree requirements/generalcorerequirements/). (<http://catalog.uta.edu/academicregulations/degree requirements/generalcorerequirements/>)

## Mechanical and Aerospace Engineering Double Major

A student wishing to obtain a double major in mechanical engineering and aerospace engineering under a single degree, simultaneously prior to graduation, can integrate the courses for the double major requirement throughout his/her undergraduate career at UT Arlington. When applying for graduation, a student should note on the application that he/she will be completing an additional major. One diploma is issued and both majors are recorded on a student's transcript and diploma. The student is encouraged to consult with the Undergraduate Advisor on the appropriate course of study.

## Fast Track Program to *Master's Degree in Aerospace Engineering*

**Overview:** The Fast Track Program enables outstanding senior undergraduate Aerospace Engineering students to receive dual undergraduate/graduate course credit for six or nine hours of coursework. These designated graduate courses satisfy both bachelor's and master's degree requirements.

**Application:** Interested undergraduate students should apply to the appropriate program when they are within 30 hours of completing their bachelor's degrees. They must have completed at least 30 hours at UT Arlington, achieving a GPA of a least 3.0 in those courses, and have an overall GPA of 3.0 or better in all college courses. Additionally, they must have completed the Aerospace Engineering Foundation courses listed below with a minimum GPA of 3.3 in these courses, and a grade of B or better in each course.

Aerospace Engineering Foundation Courses Required for Admission into the Fast Track Program:

MAE 3302	INCOMPRESSIBLE AERODYNAMICS	3
MAE 3303	COMPRESSIBLE FLOW	3
MAE 3315	AEROSPACE STRUCTURAL STATICS	3
MAE 3405	FLIGHT DYNAMICS	4

MAE 3306	FLIGHT PERFORMANCE, STABILITY & CONTROL	3
<b>Total Hours</b>		<b>16</b>

**Requirements:** AE Fast Track students must meet the following requirements to complete the program.

1. **Course requirements:** Complete a minimum of 6 and maximum of 9 hours of graduate coursework from the list of core courses for AE Master's students. The graduate courses may be used in the undergraduate program only as follows. AE 5311 STRUCTURAL DYNAMICS may replace MAE 4314 MECHANICAL VIBRATIONS, and two AE Master's core courses, other than AE 5311, may replace technical electives. (See [Graduate catalog \(http://catalog.uta.edu/engineering/mechanical/graduate/#masterstext\)](http://catalog.uta.edu/engineering/mechanical/graduate/#masterstext) for the list of approved core courses.)

2. **Grade requirements:** Earn B or better in all graduate courses intended for both undergraduate and graduate credit.

3. **GPA:** Maintain UTA cumulative GPA of 3.0 or above.

**Requirements to Continue in the AE Fast Track Program.** If at any time an undergraduate Fast Track student falls below the 3.000 GPA requirements or earns a grade below B in a graduate course intended for both undergraduate and graduate credit, he or she will be obliged to leave the program immediately and will not be allowed to take additional graduate courses as an undergraduate. If a student does not complete at least two graduate courses with B or better, any graduate credits earned with a grade of C or better will be applied only to the undergraduate degree. Graduate courses used for credit in the undergraduate program cannot be applied towards a graduate degree.

**Benefits:** Students who successfully complete the Fast Track Program will be automatically admitted to Graduate School. They will not be required to take the Graduate Record Examination, complete an application for admission to the Graduate School or pay an application fee. For more details about the specifics of the Fast Track program contact the Undergraduate Advisor or Graduate Advisor in Aerospace Engineering or Mechanical Engineering.

**Course Enrollment Clearance:** Students must obtain clearance each semester from the Graduate Advisor and Undergraduate Advisor for all graduate courses that will be used to satisfy undergraduate degree requirements.

**Time Limit to Begin Graduate Studies:** A student may take off one long semester plus a summer after receiving the undergraduate degree before starting as a graduate student. An application for graduate admission must be completed and approved before post-baccalaureate studies can begin. Students returning after longer delays will have to apply as a regular student, completing a full application, paying all fees and meeting all admission requirements.

## Fast Track Program to *Master's Degree in Mechanical Engineering* for Mechanical Engineering Undergraduate Students

**Overview:** The Fast Track Program enables outstanding senior undergraduate Mechanical Engineering students to receive dual undergraduate / graduate course credit for up to nine hours of coursework. These designated graduate courses satisfy both ME bachelor's and ME master's degree requirements.

**Application:** Interested undergraduate students should apply to the program when they are within 30 hours of completing their bachelor's degrees. They must have completed at least 30 hours at UT Arlington, achieving a GPA of at least 3.0 in those courses, and have an overall GPA of 3.0 or better in all college courses. Additionally, they must have completed the Mechanical Engineering Foundation courses listed below with a minimum GPA of 3.3 in these courses, and a grade of B or better in each course.

Mechanical Engineering Foundation Courses Required for Admission into the Fast Track Program:

MAE 3242	MECHANICAL DESIGN I	2
MAE 3314	HEAT TRANSFER	3
MAE 3318	KINEMATICS AND DYNAMICS OF MACHINES	3
MAE 3319	DYNAMIC SYSTEMS MODELING AND SIMULATION	3
<b>Total Hours</b>		<b>11</b>

**Requirements:** ME Fast Track students must meet the following requirements to complete the program.

1. **Course requirements:** Complete a minimum of 6 and maximum of 9 hours of graduate coursework from the list of core courses for ME Master's students. The graduate courses may be used in the undergraduate program only as follows. ME 5303 CLASSICAL METHODS OF CONTROL SYSTEMS ANALYSIS AND SYNTHESIS may replace MAE 4310 INTRODUCTION TO AUTOMATIC CONTROL, and up to two ME Master's core courses, other than ME 5303, may replace technical electives. (See [Graduate catalog \(http://catalog.uta.edu/engineering/mechanical/graduate/#masterstext\)](http://catalog.uta.edu/engineering/mechanical/graduate/#masterstext) for the list of approved core courses.)

2. **Grade requirements:** Earn B or better in all graduate courses intended for both undergraduate and graduate credit.

3. **GPA:** Maintain UTA cumulative GPA of 3.0 or above.



**Requirements to Continue in the ME Fast Track Program.** If at any time an undergraduate Fast Track student falls below the 3.000 GPA requirements or earns a grade below B in a graduate course intended for both undergraduate and graduate credit, he or she will be obliged to leave the program immediately and will not be allowed to take additional graduate courses as an undergraduate. If a student does not complete at least two graduate courses with B or better, any graduate credits earned with a grade of C or better will be applied only to the undergraduate degree. Graduate courses used for credit in the undergraduate program cannot be applied towards a graduate degree.

**Benefits:** Students who successfully complete the Fast Track Program will be automatically admitted to Graduate School. They will not be required to take the Graduate Record Examination, complete an application for admission to the Graduate School or pay an application fee. For more details about the specifics of the Fast Track program contact the Undergraduate Advisor or Graduate Advisor in Aerospace Engineering or Mechanical Engineering.

**Course Enrollment Clearance:** Students must obtain clearance each semester from the Graduate Advisor and Undergraduate Advisor for all graduate courses that will be used to satisfy undergraduate degree requirements.

**Time Limit to Begin Graduate Studies:** A student may take off one long semester plus a summer after receiving the undergraduate degree before starting as a graduate student. An application for graduate admission must be completed and approved before post-baccalaureate studies can begin. Students returning after longer delays will have to apply as a regular student, completing a full application, paying all fees and meeting all admission requirements.

## Fast Track Program to *Master's Degree in Materials Science and Engineering* for Mechanical Engineering Undergraduate Students

The Fast Track Program enables outstanding senior undergraduate Mechanical Engineering students to receive dual ME undergraduate / MSE graduate course credit for up to nine hours of coursework. These designated graduate courses satisfy both bachelor's and master's degree requirements if they are completed within the last 15 hours of the undergraduate degree program. Students should refer to the Materials Science and Engineering section of the graduate catalog for detailed requirements of a master's degree in Materials Science and Engineering.

Interested undergraduate students should apply to the program when they are within 30 hours of completing their bachelor's degrees. They must have completed at least 30 hours at UT Arlington, achieving a GPA of a least 3.000 in those courses, and have an overall GPA of 3.000 or better in all college courses. Additionally, they must have completed the specific set of undergraduate foundation courses that are listed below with a minimum GPA of 3.250 in these courses, and a grade of B or better in each course.

Mechanical Engineering Foundation Courses Required for Admission into the Fast Track Program:

MAE 3314	HEAT TRANSFER	3
MAE 3324	STRUCTURE & MECHANICAL BEHAVIOR OF MATERIALS	3
MAE 3242	MECHANICAL DESIGN I	2
MAE 3344	INTRODUCTION TO MANUFACTURING ENGINEERING	3
<b>Total Hours</b>		<b>11</b>

Fast Track students may choose 3 graduate courses from the recommended course list to serve as technical electives in the undergraduate degree plan. Other appropriate materials oriented graduate courses may be used if approved by both the student's Undergraduate ME and Graduate MSE Advisors. MSE 5300 INTRODUCTION TO MATERIALS SCIENCE AND ENGINEERING and independent project courses (for example MSE 5391 ADVANCED STUDIES IN MATERIALS SCIENCE AND ENGINEERING) cannot be used toward the fast track degree.

Recommended graduate courses include:

ME 6304 ADVANCED MECHANICS OF MATERIALS  
 ME 6314 FRACTURE MECHANICS  
 ME 5315 FUNDAMENTALS OF COMPOSITES  
 MSE 5312 MECHANICAL BEHAVIOR OF MATERIALS  
 MSE 5320 NANOSCALE MATERIALS  
 MSE 5321 PHASE TRANSFORMATIONS OF MATERIALS  
 MSE 5330 CORROSION SCIENCE AND ENGINEERING  
 MSE 5339 FAILURE ANALYSIS AND RELIABILITY ENGINEERING  
 MSE 5347 POLYMER MATERIALS SCIENCE  
 MSE 5353 FUNDAMENTALS OF SUSTAINABLE ENERGY  
 MSE 5355 MATERIALS FOR ENERGY  
 MSE 5343 NANOBIO TECHNOLOGY  
 MSE 5351 CURRENT TOPICS IN NANOTECHNOLOGY  
 MSE 5352 SOLAR ENERGY MATERIALS AND DEVICES  
 MSE 5355 MATERIALS FOR ENERGY



**Good Standing:** Students must maintain an overall GPA of at least 3.000 and must earn grades of B or better in all Fast Track-approved courses that will be used to satisfy undergraduate and graduate degree requirements. Students must enroll in at least 2 graduate courses and earn a B or better in all graduate courses taken prior to receiving their bachelor's degree.

If a student does not complete the two required graduate courses or fails to make adequate grades, he or she will be obliged to leave the program and apply as a regular graduate student after receiving the bachelor's degree. Any graduate credits earned will be applied only to the undergraduate degree. Graduate courses used for credit in the undergraduate program cannot be applied towards a graduate degree.

**Course Enrollment Clearance:** Students must obtain clearance each semester from the Graduate Advisor to take graduate courses that will be used to satisfy degree requirements. The advisor will monitor student progress carefully and advise accordingly.

**Time Limit to Begin Graduate Studies:** A student may take off one long semester plus a summer after receiving the undergraduate degree before starting as a graduate student. An application for graduate admission must be completed and approved before post-baccalaureate studies can begin. Students returning after longer delays will have to apply as a regular student, completing a full application, paying all fees and meeting all admission requirements.

## MINOR IN AEROSPACE ENGINEERING

To receive a minor in Aerospace Engineering (AE), a student must:

1. complete 18 hours of course work as listed below,
2. complete all prerequisites for courses used to satisfy the AE Minor,
3. complete all courses used to satisfy AE Minor requirements with a grade of C or better, and
4. complete at least 9 hours of the AE Minor course requirements in residence at UTA with approval in advance by the MAE Undergraduate Advisor.

**Additional requirements.** To pursue an AE Minor, a student must be in compliance with the AE 3-GPA calculation requirements for all completed courses that are part of the BSAE program and be in compliance with the COE 3-attempt rule, including prerequisite courses.

9 hours required:

MAE 2312	SOLID MECHANICS	9
MAE 2323	DYNAMICS	
MAE 2315	FLUID DYNAMICS	
or MAE 3313	FLUID MECHANICS	
Take one course from each of the following three core areas:		
Fluid Mechanics, Aerodynamics and Propulsion		3
MAE 3302	INCOMPRESSIBLE AERODYNAMICS	
MAE 3303	COMPRESSIBLE FLOW	
MAE 4321	AEROSPACE PROPULSION	
Solid Mechanics and Structures		3
MAE 3315	AEROSPACE STRUCTURAL STATICS	
MAE 4314	MECHANICAL VIBRATIONS	
or MAE 3316	AEROSPACE STRUCTURAL DYNAMICS	
Flight Mechanics and Controls		3 or 4
MAE 3304	ASTRONAUTICS I	
MAE 3405	FLIGHT DYNAMICS	
MAE 3306	FLIGHT PERFORMANCE, STABILITY & CONTROL	

**Total Hours**

**18-19**

## MINOR IN MECHANICAL ENGINEERING

To receive a minor in Mechanical Engineering (ME), a student must:

1. complete 18 hours of course work as listed below,
2. complete all prerequisites for courses used to satisfy the ME Minor,
3. complete all courses used to satisfy ME Minor with a grade of C or better,
4. complete at least 9 hours of the ME Minor course requirements in residence at UTA with approval in advance by the MAE Undergraduate Advisor.

**Additional requirements.** To pursue an ME Minor, a student must be in compliance with the ME 3-GPA calculation requirements for all completed courses that are part of the BSME program and be in compliance with the COE 3-attempt rule, including prerequisite courses.

9 hours required:

9

MAE 2312	SOLID MECHANICS
MAE 2323	DYNAMICS
MAE 3310	THERMODYNAMICS I

9 hours of coursework selected from the following:

9

MAE 3242	MECHANICAL DESIGN I
MAE 3311	THERMODYNAMICS II
MAE 3313	FLUID MECHANICS
MAE 3314	HEAT TRANSFER
MAE 3318	KINEMATICS AND DYNAMICS OF MACHINES
MAE 3319	DYNAMIC SYSTEMS MODELING AND SIMULATION
MAE 3324	STRUCTURE & MECHANICAL BEHAVIOR OF MATERIALS
MAE 3344	INTRODUCTION TO MANUFACTURING ENGINEERING
MAE 4310	INTRODUCTION TO AUTOMATIC CONTROL (BSAE majors only)
MAE 4342	MECHANICAL DESIGN II
MAE 4344	COMPUTER-AIDED ENGINEERING (BSAE majors only)

**Total Hours**

18

## Certificate in Automotive Engineering

### Program Objective and Requirements

The University of Texas at Arlington is pleased to offer a Certificate in Automotive Engineering through the Arnold E. Petsche Center for Automotive Engineering. This certificate confirms the student's commitment to automotive engineering and the learning experience gained from being a contributing member of a student design competition team. The Certificate in Automotive Engineering will be awarded concurrently with an undergraduate degree. The completed certificate program of study will be forwarded to the Office of Admissions, Records and Registration for verification and notation on the student's transcript. A formal certificate will be prepared for the student by the university.

The Certificate in Automotive Engineering is offered through the Mechanical and Aerospace Engineering Department.

### Admission Requirement

The certificate is open to all degree-seeking students.

### Academic Requirements

The Certificate in Automotive Engineering requires 15 credit hours of appropriate coursework as well as one semester of practical training experience that is documented by enrollment in either MAE 2010 or MAE 4010, the Automotive Engineering Practicum courses. The certificate requires that the student be a member of an automotive design competition team, such as Formula SAE, as determined by the director of the Arnold. E. Petsche Center for Automotive Engineering. All courses must be passed with a grade of C or better to apply to the Certificate in Automotive Engineering.

6 hours from the following list of courses.

6

EE 2341	DIGITAL CIRCUITS AND SYSTEMS
EE 3346	CIRCUIT ANALYSIS II (This course is new for fall 2021)
MAE 3315	AEROSPACE STRUCTURAL STATICS
MAE 3319	DYNAMIC SYSTEMS MODELING AND SIMULATION
MAE 4314	MECHANICAL VIBRATIONS
MAE 4342	MECHANICAL DESIGN II

9 hours from the following list of courses:

9

MAE 4357	AUTOMOTIVE ENGINEERING
MAE 4358	RACECAR ENGINEERING
MAE 4307	FINITE ELEMENT METHODS
MAE 4312	CONTROL SYSTEMS COMPONENTS
MAE 4315	INTRODUCTION TO COMPOSITES
MAE 4329	ADDITIVE MANUFACTURING
MAE 4331	DESIGN FOR MANUFACTURING

MAE 4378	INTRODUCTION TO UNMANNED VEHICLE SYSTEMS
One course from the following list of courses: <sup>1</sup>	
MAE 2010	AUTOMOTIVE ENGINEERING PRACTICUM I
MAE 4010	AUTOMOTIVE ENGINEERING PRACTICUM II
<b>Total Hours</b>	<b>15</b>

<sup>1</sup> MAE 2010 and 4010 are Automotive Engineering Practicum courses that have no academic credit and do not require a tuition fee. Students must gain approval to enroll in these courses from the faculty of the Arnold E. Petsche Center for Automotive Engineering.

## Certificate in Unmanned Vehicle Systems

### Program Objective

The Certificate in UVS (Unmanned Vehicle Systems) is offered through the Mechanical and Aerospace Engineering Department and will educate undergraduate students in the knowledge and skills required for design, development and operation of UVS including UAS (Unmanned Aircraft Systems), UGS (Unmanned Ground Systems) and UMS (Unmanned Maritime Systems). The certificate program will emphasize the common aspects of UVS such as sensors, actuators, communications, and more importantly, decision-making capabilities (autonomy), while also covering development of domain-specific mobile platforms such as airplane, rotorcraft, Ackerman steering car and boat. This program aims at the dual goal of providing the UVS industry with a knowledgeable, locally available workforce and developing career opportunities for its participants. To this end, the Certificate in UVS will be awarded concurrently with an undergraduate degree.

### Admission Requirements

The certificate is open to all degree-seeking students. Students should see the certificate advisor for admission to the program.

### Academic Requirements

Students must complete 15 hours of coursework as outlined below. All courses used to satisfy the certificate requirements must be passed with a grade of B or better.

Required courses:		6
MAE 4378	INTRODUCTION TO UNMANNED VEHICLE SYSTEMS	
MAE 4379	UNMANNED VEHICLE SYSTEM DEVELOPMENT	
Nine credit hours from the following list:		9
MAE (Mechanical and Aerospace Engineering) Courses:		
MAE 2312	SOLID MECHANICS	
MAE 2315	FLUID DYNAMICS	
or MAE 3313	FLUID MECHANICS	
MAE 3309	THERMAL ENGINEERING	
or MAE 3310	THERMODYNAMICS I	
MAE 3315	AEROSPACE STRUCTURAL STATICS	
MAE 3318	KINEMATICS AND DYNAMICS OF MACHINES	
MAE 3405	FLIGHT DYNAMICS	
MAE 3306	FLIGHT PERFORMANCE, STABILITY & CONTROL	
MAE 4315	INTRODUCTION TO COMPOSITES	
MAE 3319	DYNAMIC SYSTEMS MODELING AND SIMULATION	
MAE 4301	SPECIAL TOPICS IN MECHANICAL AND AEROSPACE ENGINEERING <sup>2</sup>	
MAE 4310	INTRODUCTION TO AUTOMATIC CONTROL	
MAE 4314	MECHANICAL VIBRATIONS	
MAE 3242	MECHANICAL DESIGN I	
MAE 4350	AEROSPACE VEHICLE DESIGN I	
MAE 4307	FINITE ELEMENT METHODS	
MAE 4345	INTRODUCTION TO ROBOTICS	
EE (Electrical Engineering) Courses:		
EE 2341	DIGITAL CIRCUITS AND SYSTEMS	
EE 3318	ANALOG AND DIGITAL SIGNAL PROCESSING	
EE 3317	LINEAR SYSTEMS	
EE 4314	CONTROL SYSTEMS	

EE 4318	DIGITAL SIGNAL PROCESSING
EE 4315	INTRODUCTION TO ROBOTICS
EE 4330	FUNDAMENTALS OF TELECOMMUNICATIONS SYSTEMS
CSE (Computer Science and Engineering) Courses:	
CSE 3313	INTRODUCTION TO SIGNAL PROCESSING
CSE 3442	EMBEDDED SYSTEMS I
CSE 4342	EMBEDDED SYSTEMS II
CSE 4308	ARTIFICIAL INTELLIGENCE
CSE 4360	AUTONOMOUS ROBOT DESIGN AND PROGRAMMING
IE (Industrial Engineering) Courses:	
IE 2305	COMPUTER APPLICATIONS IN INDUSTRIAL ENGINEERING
IE 3314	ENGINEERING RESEARCH METHODS
IE 4325	AUTOMATION AND ROBOTICS I
IE 4339	MANUFACTURING PROCESS & SYSTEM ANALYSIS
ENGR (Engineering) Courses:	
ENGR 4302	ENGINEERING ENTREPRENEURSHIP
PHYS (Physics) Courses:	
PHYS 2321	COMPUTATIONAL PHYSICS
PHYS 3445	OPTICS
PHYS 3455	ELECTRONICS
PHYS 4315	THERMODYNAMICS AND STATISTICAL MECHANICS
PHYS 4319	ADVANCED MECHANICS

**Total Hours****15**

<sup>2</sup> Special topics courses must be approved by the certificate advisor.

## COURSES

### **MAE 1104. INTRODUCTION TO ENGINEERING. 1 Hour.**

Introduction to basic engineering concepts. Students will become familiar with engineering and its many sub-fields, ethical responsibilities, creativity, and design.

### **MAE 1105. INTRODUCTION TO MECHANICAL AND AEROSPACE ENGINEERING. 1 Hour.**

Introduction to basic engineering concepts. Opportunities are provided to develop skills in oral and written communication and department specific material. Case studies are presented and analyzed. Prerequisite: C or better in ENGR 1250 (or concurrent enrollment), or C or better in ENGR 1300 or MAE 1104.

### **MAE 1106. INTRODUCTION TO AEROSPACE ENGINEERING. 1 Hour.**

An introduction to human flight and to the field of aerospace engineering through a combined theoretical and hands-on approach. Topics covered include history of flight and aerospace engineering and introductions to aerostatics and aerodynamics, aerospace structures, stability and control, and propulsion. Some College of Engineering requirements are satisfied by the content of this course. Prerequisite: C or better in MATH 1426 (or concurrent enrollment) or MATH 1426 qualifying score in Math Placement Test; or student group.

### **MAE 1107. INTRODUCTION TO MECHANICAL ENGINEERING. 1 Hour.**

Introduction to basic engineering concepts. Opportunities are provided to develop skills in oral and written communication, in engineering design teamwork, as well as in department-specific material. Some College of Engineering requirements are satisfied by the content of this course. Prerequisite: C or better in MATH 1426 (or concurrent enrollment) or MATH 1426 qualifying score in Math Placement Test; or student group.

### **MAE 1140. PROBLEMS IN MECHANICAL AND AEROSPACE ENGINEERING. 1 Hour.**

This course introduces students to units, 2D and 3D coordinate geometry, vector algebra and scientific problem solving, in preparation for higher level courses. Prerequisite: C or better in MATH 1426 (or concurrent enrollment); or student group.

### **MAE 1312. ENGINEERING STATICS. 3 Hours. (TCCN = ENGR 2301)**

A study of forces and force systems, resultants and components of force systems, forces due to friction, conditions of equilibrium, forces acting on members of trusses and frame structures, centroids and moments of inertia. Vector and index notation introduced. Prerequisite: C or better in each of the following, MAE 1140 (or ENGR 1250 or REE 1301), MATH 1426 (or HONR-SC 1426), and PHYS 1443; or student group.

### **MAE 1351. INTRODUCTION TO ENGINEERING DESIGN. 3 Hours.**

Foundational course in product design and manufacturing using computer-based methodologies. 3D parametric solid modeling of parts and assemblies. Technical sketching, and ASME Y14 engineering drawing standards. Industrial practices for product design and fabrication. Introduction to 3D product analysis tools. Prerequisite: C or better in MATH 1426 (or concurrent enrollment) or HONR-SC 1426 (or concurrent enrollment) or MATH 1426 qualifying score in Math Placement Test; or student group.

**MAE 2000. UNDERGRADUATE RESEARCH. 0 Hours.**

Sophomore level undergraduate research. Prerequisite: Departmental good standing and permission of instructor. May be taken a maximum of 3 times.

**MAE 2010. AUTOMOTIVE ENGINEERING PRACTICUM I. 0 Hours.**

Practical design experience as full team member of automotive design competition team. Prerequisite: Permission of Director of the Arnold E. Petsche Center for Automotive Engineering.

**MAE 2312. SOLID MECHANICS. 3 Hours.**

The relationship between stresses and strains in elastic bodies and the tension, compression, shear, bending, torsion, and combined loadings which produce them. Deflections and elastic curves, shear and bending moment diagrams for beams, and column theory. Prerequisite: C or better in each of the following, MAE 1140 (or ENGR 1250 or REE 1301) and MAE 1312; or student group.

**MAE 2315. FLUID DYNAMICS. 3 Hours.**

Introduction to Fluid Dynamics and low speed aerodynamics; fluid properties; dimensional analysis; conservation equations in integral and differential form; potential flow theory and viscous flow. Prerequisites: C or better in each of the following, MAE 1106, MAE 2323 (or concurrent enrollment), MAE 3309 (or concurrent enrollment) or MAE 3310 (or concurrent enrollment), and MAE 3360 (or concurrent enrollment); or student group.

**MAE 2323. DYNAMICS. 3 Hours. (TCCN = ENGR 2302)**

The relation between forces acting on particles, systems of particles and rigid bodies, and the changes in motion produced. Review of kinematics and vector analysis, Newton's Laws, energy methods, methods of momentum, inertia tensor and Euler's equations of motion. Prerequisite: C or better in each of the following, MAE 1140 (or ENGR 1250 or REE 1301), MAE 1312 and MATH 2425 (or HONR-SC 2425); or student group.

**MAE 2360. NUMERICAL ANALYSIS & PROGRAMMING. 3 Hours.**

Utilization of digital computers in mechanical and aerospace engineering. Computational algorithms and their representation in FORTRAN, C, and Matlab. Introduction to linear algebra and numerical methods. Prerequisite: C or better in MATH 1426; or student group.

**MAE 2381. EXPERIMENTAL METHODS AND MEASUREMENTS. 3 Hours.**

Introduction to data analysis, incorporating statistics and probability, design and planning of engineering experiments for error prediction and control. Measurement and instrumentation, basic instruments, their calibration and use. Prerequisite: C or better in each of the following, MAE 1351 and MATH 2425 (or HONR-SC 2425) and PHYS 1443 (or HONR-SC 1443); or student group.

**MAE 2391. SPECIAL PROBLEMS IN MECHANICAL AND AEROSPACE ENGINEERING. 3 Hours.**

Special problems in mechanical and aerospace engineering for preprofessional students in mechanical or aerospace engineering. Prerequisite: Instructor permission.

**MAE 3000. UNDERGRADUATE RESEARCH. 0 Hours.**

Junior level undergraduate research. Prerequisite: Departmental good academic standing and permission of instructor. May be taken a maximum of 3 times.

**MAE 3181. MATERIALS AND STRUCTURES LAB. 1 Hour.**

Experiments to study materials behavior and deformation of structural elements. Prerequisite: Must be in the professional ME or AE program and C or better in MAE 2381 and C or better in MAE 3315 (or concurrent enrollment) or MAE 3242 (or concurrent enrollment); or student group.

**MAE 3182. AERODYNAMICS AND FLUIDS LAB. 1 Hour.**

Wind tunnel experiments to study flow phenomena of aerodynamics interest, including scale testing of airfoils, wings, and aircraft. Prerequisite: C or better in each of the following, MAE 2381, MAE 3302 (or concurrent enrollment), and MAE 3303 (or concurrent enrollment); or student group.

**MAE 3183. MEASUREMENTS LABORATORY II. 1 Hour.**

Fundamental measurement techniques and experimental data analysis in mechanical engineering in the fields of thermal, fluid, structures, design, and dynamic systems. Introduction to sensor calibration, digital data acquisition, uncertainty analysis, and report writing. Prerequisite: Must be in the professional ME program and C or better in each of the following, MAE 2381, MAE 3314, and MAE 3319; or student group.

**MAE 3185. INTRODUCTION TO MECHATRONICS. 1 Hour.**

Project based introduction to the application of software and hardware required to build functioning electromechanical systems. Integrates the theory of electrical circuits, electromechanics, electronics, mechanics, and mechanical devices, along with computer and microprocessor programming and the software-hardware interface, for practical applications. Prerequisite: Professional AE or ME program and C or better in each of MAE 2360, MAE 2381, MAE 3360 and EE 2320; or student group.

**MAE 3242. MECHANICAL DESIGN I. 2 Hours.**

The overall nature of design as a process is presented along with various models, methods, techniques, and tools for the various phases of the process provide the student with an excellent understanding of how to design. Students learn to design mechanical components based on stress/deflection and the associated failure theories. Prerequisite: Must be in the professional ME or AE program and C or better in each of the following, MAE 2312, MAE 2323, and MAE 3324; or student group.

**MAE 3302. INCOMPRESSIBLE AERODYNAMICS. 3 Hours.**

Introduction to and application of the methods used to determine the low speed aerodynamic forces on aerodynamic components such as wings and airfoils. Topics include potential flow theory for lifting flows; airfoil and finite wing theory; panel and vortex-lattice methods. Prerequisite: Must be in the professional ME or AE program and C or better in each of the following, MAE 2315, MAE 2323, MAE 3309 (or MAE 3310), and MAE 3360; or student group.

**MAE 3303. COMPRESSIBLE FLOW. 3 Hours.**

Fundamental thermodynamic concepts of compressible flow, isentropic flow, normal and oblique shock waves; expansion waves; quasi-one dimensional flows within nozzles and diffusers, linearized compressible flow theory, the method of characteristics and supersonic nozzle design. Prerequisite: Must be in the professional ME or AE program and C or better in each of the following MAE 2315, MAE 2323, MAE 3309 (or MAE 3310), and MAE 3360; or student group.

**MAE 3304. ASTRONAUTICS I. 3 Hours.**

Introduction to astronautics, the solar system, and the two-body problem. Orbit shaping and orbit transfers. Patched conic approximations for interplanetary transfers. Introduction to the three-body problem and relative motion. Rigid spacecraft equation of motion. Active and passive attitude stabilization techniques for spacecraft. Prerequisite: Must be in the professional ME or AE program and C or better in each of the following: MAE 2323, MAE 2360, and MAE 3360; or student group.

**MAE 3306. FLIGHT PERFORMANCE, STABILITY & CONTROL. 3 Hours.**

Review of aerodynamics. Introduction to aircraft performance and the assessment of aircraft static stability and control characteristics. Performance topics covered include cruise, climb, gliding flight, turns, range and endurance. Static stability and control topics covered include longitudinal, lateral and directional stability and control power calculations. Prerequisite: Must be in the professional ME or AE program and C or better in each of the following: MAE 3302 and MAE 3303.

**MAE 3309. THERMAL ENGINEERING. 3 Hours.**

Basic concepts and definitions, properties of pure substances, work and heat, first law of thermodynamics, second law of thermodynamics, entropy, and introduction to conductive, convective, and radiative transfer. Prerequisite: Must be in an EE or MAE department degree program and C or better in each of the following, CHEM 1465 or both CHEM 1441 and CHEM 1442; MATH 2425 (or HONR-SC 2425) and PHYS 1444; or student group.

**MAE 3310. THERMODYNAMICS I. 3 Hours.**

Basic concepts and definitions, properties of pure substances, work and heat, first law of thermodynamics, second law of thermodynamics, entropy, thermodynamics of gases, vapors, and liquids in various nonflow and flow processes, and irreversibility and availability. Prerequisite: Must be in an MAE department degree plan and C or better in each of the following, CHEM 1465 or both CHEM 1441 and CHEM 1442; MATH 2425 (or HONR-SC 2425), and PHYS 1444; or student group.

**MAE 3311. THERMODYNAMICS II. 3 Hours.**

Availability, power, refrigeration and heat pump cycles (both gas and vapor), property relations and equations of state, ideal gas mixtures, mixtures of gases and vapors, psychrometrics, adiabatic flame temperature, thermochemical equilibrium, and compressible flow. Emphasis is on applying these topics to thermal systems design. Prerequisite: Must be in the professional ME or AE program and C or better in each of the following, MAE 3313 (or concurrent enrollment) and MAE 3310; or student group.

**MAE 3313. FLUID MECHANICS. 3 Hours.**

Fundamental concepts of fluid mechanics leading to the development of both the integral and differential forms of the basic conservation equations. Application of the integral conservation equations to engineering problems in fluid dynamics including buoyancy and other hydrostatics problems. Dimensional analysis and similitude are also discussed. Prerequisite: Must be in the professional ME program and C or better in each of the following, MAE 2323, MAE 2360, MAE 3360, and MAE 3310 (or concurrent enrollment); or student group.

**MAE 3314. HEAT TRANSFER. 3 Hours.**

Topics cover the fundamental laws of heat and mass transfer, including steady and unsteady conduction, forced and free convection, and radiation as well as heat transfer in phase change. Applications of heat transfer to thermal systems design are included. Prerequisite: Must be in the professional ME or AE program and C or better in MAE 3313 or C or better in MAE 3302.

**MAE 3315. AEROSPACE STRUCTURAL STATICS. 3 Hours.**

Overview of aircraft basic structural elements and materials; introduction to elasticity; equations of equilibrium; constitutive equations of isotropic solids; bending and torsion analysis of thin-walled beams; flexure shear of thin-walled beams with stringer reinforcement; introduction to fatigue and fracture analysis; failure criteria; energy method to find strain energy release rate; elastic column buckling. Prerequisite: Must be in the professional ME or AE program and C or better in MAE 2312; or student group.

**MAE 3316. AEROSPACE STRUCTURAL DYNAMICS. 3 Hours.**

Harmonic and periodic motion including both damped and undamped free and forced vibration. Single- and multi-degree-of-freedom discrete systems. Vibration of continuous systems. Introduction of finite element method for structural dynamics. Prerequisite: Must be in the professional ME or AE program and C or better in each of the following, MAE 2312, MAE 2323, MAE 3360, and MATH 3330; or student group.

**MAE 3318. KINEMATICS AND DYNAMICS OF MACHINES. 3 Hours.**

The motion and interaction of linkage and mechanisms. Fundamental concepts of kinematics and dynamics applied to the determination of degree of freedom mechanisms and forces acting on joints of mechanisms. Specific mechanisms and applications such as multi-body mechanisms, linkage synthesis, cam design, and balancing. Prerequisite: Must be in the professional ME or AE program and C or better in MAE 2323, or student group.

**MAE 3319. DYNAMIC SYSTEMS MODELING AND SIMULATION. 3 Hours.**

Introduction to modeling and prediction of behavior of engineering systems. Analytic and numerical simulation, state-space differential equations, and Laplace transform methods. Effects of physical characteristics of system elements on system design and dynamic performance. Prerequisite: Must be in the professional ME or AE program and C or better in each of the following, MAE 3314 (or concurrent enrollment), EE 2320, and MATH 3330; or student group.



**MAE 3324. STRUCTURE & MECHANICAL BEHAVIOR OF MATERIALS. 3 Hours.**

Crystal structure and defects in materials. Diffusion, phase diagrams and phase transformations in metallic systems. The inter relationships between processing, structure, and properties of engineering materials with emphasis on the mechanical behavior of metals, polymers, and composite materials. Prerequisites: Must be in an MAE department degree program and C or better in each of the following, CHEM 1465 (or CHEM 1441 and CHEM 1442), MAE 2312 (or concurrent enrollment), and PHYS 1444; or student group.

**MAE 3344. INTRODUCTION TO MANUFACTURING ENGINEERING. 3 Hours.**

Introduction to casting, forming, machining, and joining processes for metals and nonmetals. Prerequisite: Must be in the professional ME program and C or better in each of the following, MAE 2312 and MAE 3324; or student group.

**MAE 3360. ENGINEERING ANALYSIS. 3 Hours.**

Mathematical analysis with emphasis on solution techniques and engineering applications. Topics include: ordinary differential equations (ODE), Laplace Transform, numerical solutions of ODE, boundary value problems, Fourier series, Sturm-Liouville problem and vector calculus. Prerequisite: Must be in an MAE department degree program and C or better in each of the following, MATH 2326 and MAE 2360 (or concurrent enrollment); or student group.

**MAE 3405. FLIGHT DYNAMICS. 4 Hours.**

Derivation of equation of motion (EOM) of a flight vehicle. Trimmed flight condition analysis based on the nonlinear EOM. Linearization of EOM for a given trimmed flight condition. State-space and transfer-function representations of the linear EOM. Aircraft stability and dynamic performance analysis based on the linear EOM. Prerequisite: Must be in the professional ME or AE program and C or better in each of the following, MAE 3306 and MATH 3330; or student group.

**MAE 4000. UNDERGRADUATE RESEARCH. 0 Hours.**

Senior level undergraduate research. Prerequisite: Departmental good academic standing and permission of instructor. May be taken a maximum of 3 times.

**MAE 4010. AUTOMOTIVE ENGINEERING PRACTICUM II. 0 Hours.**

Practical design experience as full team member of automotive design competition team. Prerequisite: Permission of Director of the Arnold E. Petsche Center for Automotive Engineering.

**MAE 4151. AEROSPACE VEHICLE DESIGN II. 1 Hour.**

Analysis and design of an aerospace system such as a complete flight vehicle, a propulsion system, a structural system, or a control system; market analysis, operating studies, mission specification, civil and military certification requirements; design process, methods and tools; configuration concept selection, harmonization of individual design disciplines (aerodynamics, performance, flight mechanics, structures, cost, systems, etc.). Prerequisite: Must be in the professional ME or AE program and C or better in MAE 4350.

**MAE 4188. DESIGN PROJECT LABORATORY II. 1 Hour.**

The design project from MAE 4287 continued. The design is finalized, a physical model (prototype) is manufactured and tested. Redesign and retest is accomplished as desired. The final design is documented by written report and oral presentation. Exit survey forms and exit essays must be submitted to complete the requirements of this course. Prerequisite: Must be in the professional ME program and C or better in MAE 4287.

**MAE 4191. SPECIAL PROBLEMS IN MECHANICAL AND AEROSPACE ENGINEERING. 1 Hour.**

Special problems in mechanical and aerospace engineering for students of professional program standing. Prerequisite: Must be in the professional ME or AE program.

**MAE 4287. DESIGN PROJECT I. 2 Hours.**

Team engineering approach to a design project that integrates engineering knowledge from several courses. Problem definition and creative synthesis of prospective design solutions. Engineering proposals, feasibility studies, trade-off studies, systems models and analysis, decision making, and engineering reports and presentations. Professionalism, ethics, and societal impact issues. Prerequisite: Must be in the professional ME program and C or better in MAE 4344 (or concurrent enrollment) and must be within two calendar semesters of graduation (possibly including an 11-week summer session). MAE 4287 and MAE 4188 must be taken in consecutive semesters.

**MAE 4291. SPECIAL PROBLEMS IN MECHANICAL AND AEROSPACE ENGINEERING. 2 Hours.**

Special problems in mechanical and aerospace engineering for students of professional program standing. Prerequisite: Must be in the professional ME or AE program.

**MAE 4301. SPECIAL TOPICS IN MECHANICAL AND AEROSPACE ENGINEERING. 3 Hours.**

Topics will vary from semester to semester depending on student interest and the availability of faculty. May be repeated, provided topics are different. Prior approval by the student's advisor required. Prerequisite: Must be in the professional ME or AE program and others that vary by topic.

**MAE 4302. INTRODUCTION TO BEARING DESIGN AND LUBRICATION. 3 Hours.**

The course introduces 1) selection principles and design guidelines for various rolling element bearings, 2) theory of liquid and gas lubrication, 3) various novel fluid film bearings used in modern high speed turbomachinery and energy systems, and 4) fundamental principles of rotordynamics. Prerequisite: Must be in the professional ME or AE program and C or better in MAE 3313.

**MAE 4304. ASTRONAUTICS II. 3 Hours.**

The restricted three-body problem, the n-body problem, and approximations. Interplanetary transfers. Design considerations for both manned and unmanned interplanetary vehicles. Prerequisite: Must be in the professional ME or AE program and C or better in MAE 3304.

**MAE 4305. FUNDAMENTALS OF ELECTRONIC PACKAGING. 3 Hours.**

An introductory treatment of electronic packaging, from single chip to multichip, including materials, electrical design, thermal design, mechanical design, package modeling and simulation, processing considerations, reliability, and testing. Prerequisite: Must be in the professional ME or AE program and C or better in MAE 3314 or MAE 3309; or student group.

**MAE 4306. COMPUTATIONAL TECHNIQUES FOR ELECTRONIC PACKAGING. 3 Hours.**

Characterization of the thermo/mechanical reliability of microelectronics devices using commercial computational heat transfer codes (Icepak, Flotherm, and ANSYS). Industry related problems ranging from first level packages through system level packages analyzed. Formulate and model contemporary problems using commercial CFD codes. Prerequisite: Must be in the professional ME or AE program and C or better in MAE 3314 or MAE 3309; or student group.

**MAE 4307. FINITE ELEMENT METHODS. 3 Hours.**

Static response of complex structures and continua; application to field problems; mesh generation; error estimation and adaptive refinement. Prerequisite: Must be in the professional ME or AE program and C or better in MAE 3242.

**MAE 4310. INTRODUCTION TO AUTOMATIC CONTROL. 3 Hours.**

Block diagram algebra, transfer functions, and stability criteria. The use of transient response, frequency response, and root locus techniques in the performance analysis, evaluation, and design of dynamic systems. Prerequisite: Must be in the professional ME or AE program and C or better in each of the following, (MAE 3314 and MAE 3319) or (MAE 3405 and EE 2320); or student group.

**MAE 4312. CONTROL SYSTEMS COMPONENTS. 3 Hours.**

The components used in mechanical, electronic, and fluid power control systems are studied. Modeling and performance analysis are used to help in the understanding of system behavior. Prerequisite: Must be in the professional ME or AE program and C or better in MAE 4310.

**MAE 4314. MECHANICAL VIBRATIONS. 3 Hours.**

Harmonic and periodic motion including both damped and undamped free and forced vibration. Single and multi-degree-of-freedom discrete systems. Vibration of continuous systems. Introduction of finite element method for structural dynamics. Prerequisite: Must be in the professional ME or AE program and C or better in each of the following, MAE 2312, MAE 2323, MAE 3360, and MATH 3330; or student group.

**MAE 4315. INTRODUCTION TO COMPOSITES. 3 Hours.**

Composite classification, laminate coding, fiber and weight fractions of composite lamina; lamina constitutive equations; structural characteristics of [A], [B], [D] matrices; lamination theory; thermal and moisture induced load and moment; lamina stress analysis and failure prediction; issues in composite structural design. Prerequisite: Must be in the professional ME or AE program and C or better in MAE 2312 (or CE 2313); or student group.

**MAE 4320. HYDRAULIC AND PNEUMATIC SYSTEMS. 3 Hours.**

The fundamentals of fluid mechanics as applied to hydraulic and pneumatic hardware. Mathematical models of pumps, motors, pistons, accumulators, valves, and transmission lines. Design and analysis procedures for implementing total fluid power systems with high operating efficiencies and adequate dynamic response characteristics. Theory is supported by laboratory demonstrations. Prerequisite: Must be in the professional ME or AE program and C or better in each of the following, MAE 3313, MAE 4310, and MAE 3310; or student group.

**MAE 4321. AEROSPACE PROPULSION. 3 Hours.**

Introduction to rocket and air-breathing propulsion systems. Development of thrust and efficiency relations, mission requirements, rocket and gas turbine engine cycle analysis, off-design performance, component design and performance analysis, advanced propulsion system concepts. Prerequisite: Must be in the professional ME or AE program and C or better in MAE 3303 or C or better in each of MAE 3313 and MAE 3311.

**MAE 4322. ROCKET PROPULSION. 3 Hours.**

Examines chemical, nuclear, and electrical propulsion concepts. Development of design and performance analysis methods. Flight performance of rocket powered vehicles. Prerequisite: Must be in the professional ME or AE program and C or better in MAE 3303 (or MAE 3311).

**MAE 4323. ENERGY CONVERSION. 3 Hours.**

Thermodynamics as applied to thermo-mechanical systems such as power cycles, engines, turbines, refrigeration, and air-conditioning systems. Prerequisite: Must be in the professional ME or AE program and C or better in each of the following, MAE 3311 and MAE 3314.

**MAE 4324. POWER PLANT ENGINEERING. 3 Hours.**

Fundamental thermodynamics and heat transfer principles behind design and optimization of power generation systems with significant emphasis on component and system design. This class will cover a number of power plant types, including coal/gas fired, hydroelectric, nuclear, and solar. Concepts learnt in this class prepare students for an engineering career in power plants, oil, gas and related industries. Prerequisite: Must be in the professional ME or AE program and C or better in MAE 3310 (or MAE 3309); or student group.

**MAE 4325. COMBUSTION. 3 Hours.**

Fundamental treatment of problems involving simultaneous occurrence of chemical reaction and transfer of heat, mass and momentum. Topics include kinetically controlled combustion phenomena; diffusion flames in liquid fuel combustion; combustion of solids; combustion of gaseous fuel jets; flames in premixed gasses. Prerequisite: Must be in the professional ME or AE program and C or better in MAE 3311 or MAE 3303.

**MAE 4326. COMPUTATIONAL AERODYNAMICS I. 3 Hours.**

Solution of engineering problems by finite-difference methods, emphasis on aerodynamic problems characterized by single linear and non-linear equations, introduction to and application of major algorithms used in solving aerodynamics problems by computational methods. Prerequisite: Must be in the professional ME or AE program and C or better in MAE 3314 or MAE 3303.

**MAE 4327. HEATING, VENTILATION, AND AIR CONDITIONING. 3 Hours.**

Application of engineering sciences to design of heating, venting, and air conditioning (HVAC) systems. Humidification and dehumidification, psychrometric charts, heat load, cooling load, degree-days, comfort zones, and air distribution systems. Prerequisite: Must be in the professional ME or AE program and C or better in each of the following, MAE 3311 and MAE 3314.

**MAE 4328. METAL ADDITIVE MANUFACTURING. 3 Hours.**

This course will provide students with essential knowledge and technical skills for metal additive manufacturing (AM), providing a solid foundation for a future career in the field. Primary areas of focus include: metal AM processes and their capabilities, process fundamentals, part design and analysis, build preparation and machine set-up, fabrication and post-processing, inspection and monitoring, microstructure analysis and mechanical testing, and process optimization. Prerequisite: Must be in the professional ME or AE program.

**MAE 4329. ADDITIVE MANUFACTURING. 3 Hours.**

The range of technologies and processes, both physical and digital, used to translate virtual solid model data into physical models using additive layering methods. Emphasis is given to application of these technologies to manufacture end use components and assemblies but rapid prototyping is also discussed. Metal, polymer, ceramic, and composite material applications of additive manufacturing (AM) are included. Discussion includes advantages and limitations of additive methods with respect to subtractive methods and to each other. Principles of design for AM are covered along with discussion of applications. Students complete a project to design and build an engineering component or assembly for additive manufacture. Prerequisite: Must be in the professional ME or AE program and C or better in each of the following, MAE 1351 and MAE 3324; or student group.

**MAE 4331. DESIGN FOR MANUFACTURING. 3 Hours.**

The interaction between design and manufacturing stressed in terms of the design process, customer-focused quality, design specifications versus process capability and tolerances, and redesign for producibility. Topics include material and manufacturing process selection, tolerancing, quality function deployment (QFD), design for assembly (DFA), quality control techniques, reliability, and robust design. Prerequisite: Must be in the professional ME or AE program and C or better in each of the following, MAE 3242 and MAE 3344.

**MAE 4335. ANALYTICAL & COMPUTATIONAL DYNAMICS. 3 Hours.**

The course focuses on developing the equations of motion for dynamic systems composed of multiple, connected and unconnected, rigid bodies using Kane's method and the Lagrangian approach. The resulting model is used to simulate and visualize the predicted motion. Topics include: kinematics, Euler parameters, kinematic constraints, virtual work, the calculus of variations, energy, momentum, contact, impact, and checking functions. Prerequisite: Must be in the professional ME or AE program and C or better in MAE 3318.

**MAE 4336. ADVANCED MECHANICAL BEHAVIOR OF MATERIALS. 3 Hours.**

Concept of stress and strain; elementary dislocation theory. Deformation of single crystals; strengthening mechanisms including solid solution strengthening, and precipitation hardening. Fracture mechanics; microscopic aspects of fracture, fatigue, and creep of materials; design and processing of materials for improved mechanical properties. Prerequisite: Must be in the professional ME or AE program and C or better in each of the following, MAE 2312 and MAE 3324; or student group.

**MAE 4338. FAILURE ANALYSIS. 3 Hours.**

Theory and practice of techniques for determining modes of failure and fracture of engineering materials. Prerequisite: Must be in the professional ME or AE program and C or better in each of the following, MAE 2312 and MAE 3324; or student group.

**MAE 4339. FRACTURE MECHANICS. 3 Hours.**

Theory and applications of fracture mechanics. Stress analysis of cracks, crack-tip plasticity, fatigue crack growth, and stress corrosion cracking. Applicability to materials selection, structural design, failure analysis, and structural reliability. Prerequisite: Must be in the professional ME or AE program and C or better in MAE 3242.

**MAE 4342. MECHANICAL DESIGN II. 3 Hours.**

Analysis for the design and manufacture of basic mechanical elements, and their role in the design of machines. A brief review of relevant topics including stress/deflection, failure theories, and contact stress is initially conducted. It is then extended to the design of fundamental mechanical components including shafts, gears, springs, bearings, fasteners, and clutches/brakes. Prerequisite: Must be in the professional ME or AE program and C or better in each of the following, MAE 3242 and MAE 3318 (or concurrent enrollment).

**MAE 4344. COMPUTER-AIDED ENGINEERING. 3 Hours.**

A study of the principles of computer-aided engineering in mechanical and aerospace engineering. Applications in mechanical, structural, and thermal systems. Prerequisite: Must be in the professional ME or AE program and C or better in each of the following, MAE 3242, MAE 3314 (or concurrent enrollment), and MAE 3318.

**MAE 4345. INTRODUCTION TO ROBOTICS. 3 Hours.**

Overview of industrial robots. Study of principles of kinematics, dynamics, and control as applied to industrial robotic systems; robotic sensors and actuators; path planning; guidelines to robot arm design and selection; introduction to mechatronics; laboratory exercise in designing, building, and controlling a 3D-printed robotic manipulator. Prerequisite: Must be in the professional ME or AE program.

**MAE 4347. HEAT EXCHANGER DESIGN. 3 Hours.**

Design procedure system evaluation; design parameters in heat exchangers. The course considers various heat exchanger configurations and includes student design projects. Prerequisite: Must be in the professional ME or AE program and C or better in MAE 3314.

**MAE 4348. COOLING OF ELECTRONIC PACKAGES. 3 Hours.**

The calculation of heat loads and temperature fields using different cooling techniques. Includes parameter evaluation and design studies. Prerequisite: Must be in the professional ME or AE program and C or better in, MAE 3314 (or MAE 3309); or student group.

**MAE 4350. AEROSPACE VEHICLE DESIGN I. 3 Hours.**

Analysis and design of an aerospace system such as a complete flight vehicle, a propulsion system, a structural system, or a control system; market analysis, operating studies, mission specification, civil and military certification requirements; design process, methods and tools; configuration concept selection, integration of design disciplines (aerodynamics, performance, flight mechanics, structures, cost, systems, etc.). Prerequisite: Must be in the professional ME or AE program and C or better in each of the following: MAE 3405 (or concurrent enrollment) and MAE 3306.

**MAE 4351. AEROSPACE VEHICLE DESIGN II. 3 Hours.**

Analysis, design, and synthesis of an aerospace system such as a complete flight vehicle, a propulsion system, a structural system, or a control system; market analysis, operating studies, mission specification, civil and military certification requirements; design process, methods and tools; configuration concept selection, integration of individual design disciplines (aerodynamics, performance, flight mechanics, structures, cost, systems, etc.). Also included will be economic, environmental, sustainability, manufacturability, safety, social and political considerations. Formal written and oral reports are required. Exit survey forms and exit essays must be submitted to complete the requirements of this course. Prerequisite: Must be in the professional AE program and C or better in MAE 4350.

**MAE 4352. SPACE VEHICLE AND MISSION DESIGN. 3 Hours.**

Space vehicle design; influence of space environment, astrodynamics, and atmospheric reentry. Space vehicle sub system design; propulsion, attitude determination and control, structural design, thermal control, power and telecommunications. Investigation into mission design concepts and considerations. Prerequisite: Must be in the professional ME or AE program and C or better in each of the following, MAE 2323 and MATH 2326; or student group.

**MAE 4357. AUTOMOTIVE ENGINEERING. 3 Hours.**

Introduction to automotive engine types and performance, drive train modeling and vehicle loading characteristics, fueling requirements, fuel injection systems, tire characteristics and modeling, suspension characteristics and handling, braking systems and requirements. Course taught through lecture, student presentations and student design projects. Prerequisite: Must be in the professional ME, AE or EE program and C or better in each of the following, MAE 3360 (or MATH 3319) and MAE 2312 (or EE 3346); or student group.

**MAE 4358. RACECAR ENGINEERING. 3 Hours.**

This course is intended for Formula SAE team members and other interested students to develop new systems or analyze concepts for the Formula SAE or Formula Electric racecar and related equipment. The students will form teams and perform research and development on projects related to automotive or racecar engineering. Prerequisites: Must be in the professional ME, AE or EE program and C or better in each of the following, MAE 3360 (or Math 3319) and MAE 2312 (or EE 3346); or student group.

**MAE 4362. INTRODUCTION TO MICRO AND NANOFUIDICS. 3 Hours.**

As going down to micro scales, the basic hypothesis in the macro scale fluid mechanics may not be applicable in such scales. The objectives of this course are: to identify dominant forces and their effects in micro scale fluid systems that are different from those in the macro scales; to understand the fundamentals of micro fluidic phenomena; to discuss various microfluidic applications in research and commercial levels; and to explore new possible microfluidic applications in the emerging fields. Topics include overview of microfluidics, scaling laws, violation limit of the Navier-Stokes equations, surface force, surface tension, electrowetting, electrokinetics, dielectrophoresis, and soft lithography. Prerequisite: Must be in the professional ME or AE program and C or better in MAE 3313 and MAE 3310; or student group.

**MAE 4363. INTRODUCTION TO ROTORCRAFT ANALYSIS. 3 Hours.**

History of rotorcraft. Behavior of the rotor blade in hover and forward flight. Rotor configurations, dynamic coupling with the fuselage, elastic and aeroelastic effects.

**MAE 4378. INTRODUCTION TO UNMANNED VEHICLE SYSTEMS. 3 Hours.**

Introduction to UVS (Unmanned Vehicle Systems) such as UAS (Unmanned Aircraft Systems), UGS (Unmanned Ground System) and UMS (Unmanned Maritime System), their history, missions, capabilities, types, configurations, subsystems, and the disciplines needed for UVS development and operation. UVS missions could include student competitions sponsored by various technical organizations. This course is team-taught by engineering faculty. Prerequisite: Admission to a professional engineering or science program.

**MAE 4379. UNMANNED VEHICLE SYSTEM DEVELOPMENT. 3 Hours.**

Introduction to the technologies needed to create an UVS (Unmanned Vehicle System). Integration of these technologies (embodied as a set of sensors, actuators, computing and mobility platform sub-systems) into a functioning UVS through team work. UVS could be designed to compete in a student competition sponsored by various technical organizations or to support a specific mission or function defined by the instructors. This course is team-taught by engineering faculty. Prerequisite: B or better in MAE 4378 and admission to the UVS certificate program.

**MAE 4382. RESEARCH TRENDS IN RENEWABLE ENERGY TECHNOLOGIES. 3 Hours.**

This course is offered to graduate and senior level undergraduate students with engineering and science background to introduce them to micro/nano research and development for energy conversion and storage. This course will include: Scaling laws, MEMS fabrication, Nanomaterial synthesis, Electrochemical energy storage/conversion (Batteries, Fuel Cells & Supercapacitors), Solar energy (photovoltaics and solar thermal energy), Energy harvesting and Solar water splitting and electrocatalysis. Prerequisite: Must be in the professional ME or AE program.

**MAE 4386. WIND & OCEAN CURRENT ENERGY HARVESTING FUNDAMENTALS. 3 Hours.**

A broad senior/graduate first course in wind/wave/ocean current energy harvesting systems, focused on fundamentals, and serving as the basis for subsequent MAE specialized follow-on graduate course offerings focused on structures (conventional and composite), aero/hydro-mechanical response and control, and tailoring and smart material actuation, respectively, as well as for non-MAE, specialized graduate courses. Prerequisite: Must be in the professional ME or AE program and C or better in EE 2320 and C or better in either MAE 3313 or MAE 2315, or student group.

**MAE 4391. SPECIAL PROBLEMS IN MECHANICAL AND AEROSPACE ENGINEERING. 3 Hours.**

Special problems in mechanical and aerospace engineering for students of professional program standing. Prerequisite: Must be in the professional ME or AE program.