

# Mechanical and Aerospace Engineering (MAAE)

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## Mechanical and Aerospace Engineering (MAAE) Courses

### MAAE 2001 [0.5 credit]

#### Engineering Graphical Design

Engineering drawing techniques; fits and tolerances; working drawings; fasteners. Elementary descriptive geometry; true length, true view, and intersection of geometric entities; developments. Assignments will make extensive use of Computer-Aided Design (CAD) and will include the production of detail and assembly drawings from actual physical models.

Includes: Experiential Learning Activity

Also listed as AERO 2001.

Prerequisite(s): Second-year status in Engineering.

Lectures and tutorials two hours a week, laboratory four hours a week.

### MAAE 2101 [0.5 credit]

#### Engineering Dynamics

Review of kinematics and kinetics of particles: rectilinear and curvilinear motions; Newton's second law; energy and momentum methods. Kinematics and kinetics of rigid bodies: plane motion of rigid bodies; forces and accelerations; energy and momentum methods.

Includes: Experiential Learning Activity

Precludes additional credit for CIVE 2101.

Prerequisite(s): Second-year status in Engineering.

Lectures three hours a week, problem analysis three hours a week.

### MAAE 2202 [0.5 credit]

#### Mechanics of Solids I

Review of Principles of Statics; friction problems; Concepts of stress and strain at a point; statically determinate and indeterminate stress systems; torsion of circular sections; bending moment and shear force diagrams; stresses and deflections in bending; buckling instability.

Includes: Experiential Learning Activity

Precludes additional credit for CIVE 2200.

Prerequisite(s): Second-year status in Engineering.

Lectures three hours a week, problem analysis and laboratory three hours a week.

### MAAE 2203 [0.5 credit]

#### Mechanics of Solids

Covers the essentials of solids for machine design, failure theories and stress concentrations.

Includes: Experiential Learning Activity

Prerequisite(s): second-year status in Engineering.

Lectures three hours a week, laboratory three hours alternate weeks.

### MAAE 2300 [0.5 credit]

#### Fluid Mechanics I

Fluid properties. Units. Kinematics, dynamics of fluid motion: concepts of streamline, control volume, steady and one-dimensional flows; continuity, Euler, Bernoulli, steady flow energy, momentum, moment of momentum equations; applications. Fluid statics; pressure distribution in fluid at rest; hydrostatic forces on plane and curved surfaces; buoyancy.

Includes: Experiential Learning Activity

Prerequisite(s): Second-year status in Engineering.

Lectures three hours a week, laboratory and problem analysis three hours a week.

### MAAE 2400 [0.5 credit]

#### Thermodynamics and Heat Transfer

Basic concepts of thermodynamics: temperature, work, heat, internal energy and enthalpy. First law for closed and steady-flow open systems. Thermodynamic properties of pure substances; changes of phase; equation of state. Second law: entropy. Simple power and refrigeration cycles. Introduction to heat transfer: conduction, convection, radiation.

Includes: Experiential Learning Activity

Prerequisite(s): Second-year status in Engineering.

Lectures three hours a week, laboratory and problem analysis three hours a week.

### MAAE 2401 [0.5 credit]

#### Mechatronics Thermodynamics and Heat Transfer

Basic concepts of thermodynamics: temperature, work, heat, internal energy and enthalpy. First law for closed and steady-flow open systems. Properties of pure substances. Second law: entropy. Simple power and refrigeration cycles. Introduction to heat transfer: conduction, convection, radiation. Heat exchangers and heat sinks.

Includes: Experiential Learning Activity

Prerequisite(s): Second-year status in Engineering.

Lectures three hours a week, laboratory and problem analysis three hours a week.

**MAAE 2700 [0.5 credit]****Engineering Materials**

Materials (metals, alloys, polymers) in engineering service; relationship of interatomic bonding, crystal structure and defect structure (vacancies, dislocations) to material properties; polymers, phase diagrams and alloys; microstructure control (heat treatment) and mechanical properties; material failure; corrosion.

Includes: Experiential Learning Activity

Precludes additional credit for CIVE 2700.

Prerequisite(s): Second-year status in Engineering.

Lectures three hours a week, problem analysis and laboratory three hours a week.

**MAAE 3004 [0.5 credit]****Dynamics of Machinery**

Kinematic and dynamic analysis of mechanisms and machines. Mechanism force analysis. Static and dynamic balancing. Kinematic and dynamic analysis of cams. Free and forced vibration of single-degree-of-freedom systems. Introduction to multibody dynamics.

Includes: Experiential Learning Activity

Prerequisite(s): MAAE 2101 and MATH 1005.

Lectures three hours a week, problem analysis and laboratories two hours a week.

**MAAE 3202 [0.5 credit]****Mechanics of Solids II**

Stress and strain transformations: torsion of non-circular sections; unsymmetric bending and shear centre; energy methods; complex stresses and criteria of yielding; elementary theory of elasticity; axisymmetric deformations.

Includes: Experiential Learning Activity

Precludes additional credit for CIVE 3202.

Prerequisite(s): MAAE 2202 and MATH 1005 (co-req).

Lectures three hours a week, problem analysis and laboratory three hours a week.

**MAAE 3300 [0.5 credit]****Fluid Mechanics II**

Review of control volume analysis. Dimensional analysis and similitude. Compressible flow: isentropic flow relations, flow in ducts and nozzles, effects of friction and heat transfer, normal and oblique shocks, two-dimensional isentropic expansion. Viscous flow theory: hydrodynamic lubrication and introduction to boundary layers.

Includes: Experiential Learning Activity

Prerequisite(s): MATH 2004 and MAAE 2300.

Lectures three hours a week, problem analysis and laboratory three hours a week.

**MAAE 3400 [0.5 credit]****Applied Thermodynamics**

Gas and vapour power cycles: reheat, regeneration, combined gas/vapour cycles, cogeneration. Heat pump and refrigeration cycles: vapour compression cycles, absorption refrigeration and gas refrigeration. Mixtures of perfect gases and vapours: psychometry and combustion. Principles of turbomachinery.

Includes: Experiential Learning Activity

Prerequisite(s): MATH 1005 and MAAE 2400.

Lectures three hours a week, problem analysis and laboratories three hours a week.

**MAAE 3500 [0.5 credit]****Feedback Control Systems**

Introduction to the linear feedback control. Analysis and design of classical control systems. Stability and the Routh-Hurwitz criteria. Time and frequency domain performance criteria, robustness and sensitivity. Root locus, Bode and Nyquist design techniques. Control system components and industrial process automation.

Includes: Experiential Learning Activity

Precludes additional credit for MAAE 4500 (no longer offered), SYSC 4505.

Prerequisite(s): MATH 3705 and (SYSC 3600 or SYSC 3610).

Lectures three hours a week, problem analysis and laboratories three hours a week.

**MAAE 3505 [0.5 credit]****Mechatronics I**

Introduction to mechatronics systems. Lectures, labs, assignments, and a semester-long project to develop a mechatronics system and program microcontrollers.

Includes: Experiential Learning Activity

Prerequisite(s): ELEC 3508, ELEC 4709, MAAE 3002.

Lectures three hours a week, laboratory three hours a week.

**MAAE 3999 [0.0 credit]****Co-operative Work Term**

Includes: Experiential Learning Activity

**MAAE 4102 [0.5 credit]****Materials: Strength and Fracture**

Analysis and prevention of failures in metals; plasticity analysis and plastic collapse; micro-mechanisms of fracture, conditions leading to crack growth and transition temperature effects, fracture mechanics, fatigue, environmentally assisted cracking, non-destructive evaluation and testing.

Prerequisite(s): MAAE 2202 and MAAE 2700 and fourth-year status in Engineering.

Lectures three hours a week.

**MAAE 4706 [0.5 credit]****Mechatronics II**

Advanced topics in mechatronics, including a semester-long project to develop a fully integrated mechatronic system.

Includes: Experiential Learning Activity

Prerequisite(s): MAAE 3505.

Lectures three hours a week, laboratory three hours a week.

**MAAE 4902 [0.5 credit]****Special Topics: Mechanical and Aerospace Engineering**

Selected advanced topics of interest to Aerospace and Mechanical Engineering students, subject to the discretion of the Faculty of Engineering and Design.

Prerequisite(s): permission of the Department.

Lecture three hours a week.

**MAAE 4903 [0.5 credit]****Special Topics: Mech & Aero Eng.**

At the discretion of the Faculty, a course may be offered that deals with selected advanced topics of interest to Aerospace and Mechanical Engineering students.

Prerequisite(s): permission of the Department.

Lecture three hours a week.

**MAAE 4904 [0.5 credit]****Special Topics: Mechanical and Aerospace Engineering**

Selected advanced topics of interest to Aerospace and Mechanical Engineering students, subject to the discretion of the Faculty of Engineering and Design.

Prerequisite(s): permission of department.

Lectures three hours a week.

**MAAE 4906 [0.5 credit]****Special Topics: Mech and Aero Eng.**

At the discretion of the Faculty, a course may be offered that deals with selected advanced topics of interest to Aerospace and Mechanical Engineering students.

Prerequisite(s): permission of the Department.

**MAAE 4907 [1.0 credit]****Engineering Design Project**

Team project in the design of an aerospace, biomedical, mechanical, or sustainable energy system. Opportunity to develop initiative, engineering judgement, self-reliance, and creativity in a team environment. Results submitted in a comprehensive report as well as through formal oral presentations.

Includes: Experiential Learning Activity

Prerequisite(s): Fourth-year status in engineering and (completion of or concurrent registration in AERO 4003, AERO 4842, MECH 4003, MECH 4013, or SREE 4001, or permission of Department). Certain projects may have additional prerequisites.

**MAAE 4917 [0.5 credit]****Undergraduate Directed Study**

Study, analysis, and solution of an engineering problem. Results presented in the form of a written report. Carried out under the close supervision of a faculty member.

Intended for students interested in pursuing graduate studies. Requires supervising faculty member and proposal from student.

Includes: Experiential Learning Activity

Prerequisite(s): permission of the Department and completion of, or concurrent registration in, MAAE 4907.