

# Mechanical and Aerospace Engineering (MAAE)

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**Department of Mechanical and Aerospace Engineering**

**Faculty of Engineering and Design**

## **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.

Prerequisite(s): ECOR 1010.

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.

Precludes additional credit for CIVE 2101.

Prerequisite(s): ECOR 1101 and MATH 1005 and MATH 1104.

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.

Precludes additional credit for CIVE 2200.

Prerequisite(s): ECOR 1101, MATH 1005 and MATH 1104.

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

## **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.

Prerequisite(s): MATH 1005, MATH 1104 and ECOR 1101.

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

Prerequisite(s): CHEM 1101 or CHEM 1001 and CHEM 1002, MATH 1005 and MATH 1104.

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.

Precludes additional credit for CIVE 2700.

Prerequisite(s): CHEM 1101 or CHEM 1001 and CHEM 1002 and ECOR 1101.

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.

Prerequisite(s): MAAE 2101.

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. Precludes additional credit for CIVE 3202.

Prerequisite(s): MAAE 2202.

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.

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: psychrometry and combustion. Principles of turbomachinery.

Prerequisite(s): MAAE 2400.

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

**MAAE 3901 [0.5 credit]****Mech and Aero Engineering Lab**

Students perform a series of laboratory exercises dealing with a wide range of mechanical engineering topics. Included in this course is a group design project. Students relate theory and practice and develop experience with modern engineering equipment, measurement techniques and design methodology. Good reporting practice is emphasized.

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

Lectures and tutorials one hour a week, laboratory five hours a week.

**MAAE 3999 [0.0 credit]****Co-operative Work Term****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 2700 and MAAE 3202.

Lectures three hours a week.

**MAAE 4500 [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.

Precludes additional credit for SYSC 4505.

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

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.

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

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

Student carries out a 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.

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