For the courses listed below, the Department of Mechanical and Aerospace Engineering is seeking qualified contract instructors with excellent communication and presentation skills; strong teaching skills established through successful teaching of engineering courses in an accredited Canadian university engineering program; and a high level of up-to-date expertise in the subject of the course, established through industrial experience and/or research in academia or government labs. Candidates must have a degree in a relevant field of engineering. A P.Eng. license in Canada is required for the instruction of most undergraduate courses.

Applications will be accepted until July 1, 2018. Applications with a covering letter and curriculum vitae including educational background, employment history, and related work experience, should be sent via email to the hiring committee at Hiring.MAE@carleton.ca.

Carleton University is strongly committed to fostering diversity within its community as a source of excellence, cultural enrichment and social strength. We welcome those who would contribute to the further diversification of our University including but not limited to women, persons with disabilities, visible minorities, Aboriginal peoples, and persons of any sexual orientation or gender identity.

Fall 2018 (September – December)

AERO 3700 [0.5 credit]
Aerospace Materials
Properties, behaviour and manufacturing methods for metals, polymers and ceramics used in aerospace applications. Specialty alloys for gas turbines. Properties and manufacture of aerospace composites. Behaviour of materials in space.
Prerequisite(s): MAAE 2700.
Lectures three hours a week; problem analysis and laboratories one hour a week.

AERO 4003 [0.5 credit]
Aerospace Systems Design
Stress and deflection analysis; fatigue, safe life, damage tolerant design. Propulsion systems integration; landing gear; control and other subsystems. Mechanical component design. Airworthiness regulations and certification procedures. Weight and cost estimation and control. System reliability. Design studies of aircraft or spacecraft components.

Prerequisite(s): MAAE 2202 and AERO 3002.

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

AERO 4304 [0.5 credit]
Computational Fluid Dynamics
Differential equations of motion. Numerical integration of ordinary differential equations. Potential flows: panel methods; direct solution; vortex-lattice methods. Finite-difference formulations: explicit versus implicit methods; stability. Parabolized and full Navier-Stokes equations; conservation form. Transonic and supersonic flows: upwind differencing. Grid transformations. Computer-based assignments.

Prerequisite(s): MAAE 3300 or MECH 3310.
Lectures three hours a week.

AERO 4402 [0.5 credit]
Aerospace Propulsion
Propulsion requirements, effects of Mach Number, altitude, and application; basic propeller theory; propeller, turboshaft, turbojet, turbofan and rocket; cycle analysis and optimization for gas turbine power plant; inter-relations between thermodynamic, aerodynamic and mechanical designs; rocket propulsion; selection of aeroengines.

Precludes additional credit for MECH 4401.

Prerequisite(s): MAAE 2400 and MAAE 3300.

Lectures three hours a week.

AERO 4842 [0.5 credit]
Spacecraft Design II
System view of spacecraft. Requirements definition. Spacecraft payloads (remote sensing, imaging systems, astronomy instrumentation etc.). Exploration missions. Implications for systems and missions. Space system design case studies.
Precludes additional credit for AERO 4802 (no longer offered).

Prerequisite(s): AERO 3841.

Lectures three hours a week, tutorials or laboratories one hour per 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 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 4906 E [0.5 credit]
Introduction to Nuclear Engineering
This course provides an overview of nuclear engineering concepts and practices used to generate electricity and to make nuclear medicine possible. The course will include basic fundamentals, as well as lectures on specific topics such as nuclear medicine applications, xenon oscillations, radiation protection and hormesis.

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.

MECH 4407 [0.5 credit]
Heating and Air Conditioning
Environmental demands for residential, commercial and industrial systems. Methods of altering and controlling environment. Air distribution. Refrigeration methods, equipment and controls. Integrated year-round air-conditioning and heating systems; heat pumps. Cooling load and air-conditioning calculations. Thermal radiation control. Component matching. System analysis and design.

Prerequisite(s): MAAE 2400 and third- or fourth- year status in Engineering.

Lectures three hours a week.

MECH 4805 [0.5 credit]
Measurement and Data Systems
Experimental data, accuracy and uncertainty analysis. Analog systems. Sensors. Signal conditioning. Op-Amps, instrumentation amplifiers, charge amplifiers, filters. Digital techniques. Encoders, A/D D/A converters. Data acquisition using microcomputers. Hardware and software considerations. Interfacing. Applications to measurement of motion, strain, force/torque, pressure, fluid flow, temperature.

Precludes additional credit for Engineering ELEC 4805.

Prerequisite(s): STAT 3502, SYSC 3600 or SYSC 3610, and ELEC 3605 or ELEC 2501 or SYSC 3203.

Lectures three hours a week.

MECH 5407 [0.5 credit] (MCG 5347)
Conductive and Radiative Heat Transfer
Analytical, numerical and analog solutions to steady-state and transient conduction heat transfer in multi-dimensional systems. Radiative heat exchange between black, grey, non-grey diffusive and specular surfaces, including effects of athermanous media.

MECH 5601 [0.5 credit] (MCG 5361)
Creative Problem Solving and Design
Problem-solving processes and how they can be applied in engineering design. Emphasis on learning methodologies rather than accumulating information. Techniques can be successfully applied in any engineering specialty.
Also listed as IDES 5301

MECH 5801 [0.5 credit] (MCG 5489)
3D Machine Vision: From Robots to the Space Station
This course provides an introductory overview to 3D imaging and scanning systems from basic opto-mechanical designs and tradeoffs through applications for robotics, automation, assembly, mapping and navigation. The course focuses on mechanical operations while touching on electronic and control issues, calibration and standards.

MECH 5802 Wind Engineering [0.5 credit]
This course is designed to cover all the theoretical and practical areas pertinent to the operation of wind turbines. After finishing the course, a student is expected to have gained the knowledge to (a) be considered as a wind engineer and (b) be prepared to work in any company engaged in designing, manufacturing or utilization of wind turbines and the associated components, or in utility companies

MECH 5804 [0.5 credit] (MCG 5384)
Economics of Engineering with Applications to Energy and Transportation
The purpose of the course is to acquaint students with the economic tools used in the choice and assessment of science and engineering projects and policies. Examples will be drawn from energy and transportation issues. Energy-economic modelling and the economics of climate change will also be discussed.

Winter 2019 (January – April)

AERO 4009 [0.5 credit]
Aviation Management and Certification
Product development, quality control. Strategic organizational analysis and design. Airworthiness, type certification and planning, delegation of authority, airplane flight manual. Aerospace system design and safety.

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

Lectures three hours per 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, Bernouilli, 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 4906 A [0.5 credit]
Nuclear Power Plant Design
The objective of the course is to describe the basic design and technology of nuclear reactors, The course will describe the major systems in a nuclear power plant as well as the important CANDU reactor safety principles and systems; describe the important systems and components of the Balance of Plant (BoP); describe how safety systems meet licensing requirements with particular reference to IAEA, CNSC and USNRC regulations on plant design and discuss some computer codes used in the safety assessments and design of nuclear power plants.

MAAE 4906 B [0.5 credit]
Reactor Thermal-Hydraulic Fundamentals
The objective of the course is to describe the basic concepts and engineering methods used in the formulation of the analyses of thermal processes taken place in a nuclear system during normal operation and under postulated accident conditions.

MAAE 4906 C [0.5 credit]
Corrosion and Corrosion Control
The purpose of this course is to introduce the underlying science of corrosion and the fundamentals of corrosion engineering. The deterioration of the metallic components of critical structures by corrosion is often life-limiting. This course will examine the general mechanisms of corrosion and relate these specific engineering issues and methods used to reduce the cost of corrosion.

MAAE 4906 G [0.5 credit]
Internal Combustion Engines
This course will introduce students to the fundamentals of internal combustion engines. Emphasis will be placed on performance, operation, mechanical design, engine manufacturing processes, and environmental impact. At the completion of the course, the students will have broad understanding of engine operation, design, manufacturing and the ability to analyse engine size, configuration, mapping and efficiency for specific applications.

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.

MECH 5009 [0.5 credit] (MCG 5309)
Environmental Fluid Mechanics Relating to Energy Utilization
Characteristics of energy sources and emissions into the environment. The atmosphere; stratification and stability, equations of motion, simple winds, mean flow, turbulence structure and dispersion near the ground. Flow and dispersion in groundwater, rivers, lakes and oceans. Physical and analytical modeling of environmental flows.

MECH 5105 [0.5 credit] (MCG 5315)
Orbital Mechanics and Space Control
Orbital dynamics and perturbations due to the Earth's figure, the sun, and the moon with emphasis on mission planning and analysis. Rigid body dynamics applied to transfer orbit and on-orbit momentum management and control of spacecraft. Effects of flexible structures on a spacecraft control system.

MECH 5304 [0.5 credit] (MCG 5334)
Computational Fluid Dynamics of Compressible Flows
Solution techniques for parabolic, elliptic and hyperbolic equations developed for problems of interest to fluid dynamics with appropriate stability considerations. A staged approach to solution of full Euler and Navier-Stokes equations is used. Grid generation techniques appropriate for compressible flows are introduced.

MECH 5401 [0.5 credit] (MCG 5341)
Turbomachinery
Types of machines. Similarity: performance parameters; characteristics; cavitation. Velocity triangles. Euler equation: impulse and reaction. Radial pumps and compressors: analysis, design and operation. Axial pumps and compressors: cascade and blade-element methods; staging; off-design performance; stall and surge. Axial turbines. Current design practice.

MECH 5500 [0.5 credit] (MCG 5350)
Advanced Vibration Analysis
General theory of continuous and discrete multi-degree-of-freedom vibrating systems. Emphasis on numerical techniques of solving complex vibrating systems, with selected applications from aerospace, civil, and mechanical engineering.

MECH 5602 [0.5 credit] (MCG 5362)
Failure Prevention (Fracture Mechanics and Fatigue)
Design of engineering structures to ensure against failure due to fatigue or brittle fracture. Nature of fatigue and brittle fracture; selection of suitable material, geometry, and inspection procedures for the load and environmental conditions.

MECH 58XX [0.5 credit] (MCG 5xxx)
Introduction to Smart Materials and Structures
The objective of this course is to give students an introduction to the fundamentals of smart materials and structures. It will cover (a) the definition and categories of the smart materials; (b) their fundamental characteristics, operating principals, physical properties; (c) Design of sensors and actuators from smart materials, their advantages and limitations; (d) the concept and design framework of smart structures; (e) signal processing, modeling and control experimentation of smart structures; (f) Application case studies.

The following courses have been assigned to graduate students, post-doctoral fellows, or visiting scholars. These courses are not open for applications but the department will contact the most senior incumbent to review their rights under Article 17.6 of the CUPE 4600-2 Collective Agreement.

Fall 2018 (September – December)

AERO 3700 [0.5 credit]
Aerospace Materials
Properties, behaviour and manufacturing methods for metals, polymers and ceramics used in aerospace applications. Specialty alloys for gas turbines. Properties and manufacture of aerospace composites. Behaviour of materials in space.
Prerequisite(s): MAAE 2700.
Lectures three hours a week; problem analysis and laboratories one hour 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, Bernouilli, 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.

MECH 3310 [0.5 credit]
Biofluid Mechanics
Applications of fundamental fluid mechanics to human circulatory and respiratory systems. Basic viscous flow theory including: blood flow in the heart and large arteries, air flow in extra-thoracic (nose-mouth throat) airways and lungs.

Prerequisite(s): MATH 2004 and MAAE 2300.
Lectures three hours per week, laboratories or tutorials three hours per 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.

Winter 2019 (January – April)

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.

* *A note to all applicants:* As per Articles 16.3 and 16.4 in the CUPE 4600-2 Collective Agreement, the posted vacancies listed above are first offered to applicants meeting the incumbency criterion. A link to the current CUPE 4600-2 Collective Agreement can be found at the Employment Agreements webpage on the Carleton University Human Resources website http://carleton.ca/hr/collective-agreements/ and the CUPE 4600-2 website http://4600.cupe.ca/.