Mechanical Engineering (MECH) Courses

**MECH 3002 [0.5 credit] Machine Design and Practice**
The design of mechanical machine elements is studied from theoretical and practical points of view. Topics covered include: design factors, fatigue, and discrete machine elements. Problem analysis emphasizes the application to practical mechanical engineering problems. Prerequisite(s): MAAE 2001 and MAAE 3202. Lectures three hours a week, 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.

**MECH 3700 [0.5 credit] Principles of Manufacturing**

**MECH 3710 [0.5 credit] Biomaterials**
Materials used in biomedical applications: metals, polymers, ceramics and composites. Material response and degradation. Properties of biologic materials; bone, cartilage, soft tissue. Materials selection for biocompatibility. Prerequisite(s): MAAE 2700. Lectures three hours per week, laboratories and problem analysis three hours per week.

**MECH 4003 [0.5 credit] Mechanical Systems Design**
Design of mechanical systems: establishing design criteria, conceptual design, design economics, value analysis, synthesis and optimization. Mechanical elements/systems: gear and flexible drive systems, fluid power systems. These elements are utilized in group design projects. Prerequisite(s): MECH 3002. Lectures three hours a week, problem analysis three hours a week.

**MECH 4006 [0.5 credit] Vehicle Engineering I**
The course emphasizes the engineering and design principles of road transport vehicles. Topics to be covered include: performance characteristics, handling behaviour and ride quality of road vehicles. Prerequisite(s): MAAE 2101, MAAE 3004 (Dynamics of Machinery) and third- or fourth-year status in Engineering. Lectures three hours a week.

**MECH 4007 [0.5 credit] Vehicle Engineering II**
Engineering and design principles of off-road vehicles and air cushion technology. Topics include: mechanics of vehicle-terrain interaction - terramechanics, performance characteristics of off-road vehicles, steering of tracked vehicles, air cushion systems and their performance, applications of air cushion technology to transportation. Prerequisite(s): MAAE 2101, MAAE 3004 (Dynamics of Machinery) and third-or fourth-year status in Engineering. Lectures three hours a week.

**MECH 4013 [0.5 credit] Biomedical Device Design**
Medical Devices: the industry and its regulation. Design methodologies. Examination of specific medical devices: surgical equipment, orthopedic devices, rehabilitation engineering, life support, artificial organs. Case studies. Prerequisite(s): MECH 4210. Lectures three hours per week, laboratories or tutorial three hours per week.

**MECH 4101 [0.5 credit] Mechanics of Deformable Solids**
Course extends the student's ability in design and stress analysis. Topics include: introductory continuum mechanics, theory of elasticity, stress function approach, Lamé and Mitchell problems, stress concentrations, thermoelasticity and plasticity. Prerequisite(s): MAAE 3202. Lectures three hours a week.
MECH 4103 [0.5 credit]  
**Fatigue and Fracture Analysis**  
Elastic and elasto-plastic fracture mechanics. Fatigue design methods, fatigue crack initiation and growth Paris law and strain-life methods. Fatigue testing, scatter, mean stress effects and notches. Welded and built up structures, real load histories and corrosion fatigue. Damage tolerant design and fracture control plans.  
Prerequisite(s): MAAE 3202.  
Lectures three hours a week.

MECH 4104 [0.5 credit]  
**Vibration Analysis**  
Prerequisite(s): MAAE 3004.  
Lectures three hours per week.

MECH 4210 [0.5 credit]  
**Biomechanics**  
The biomechanics of biological systems; muscles and movement, nerves and motor control. Measurements of motion, strain and neural signals. The hand and manipulation; locomotion and the leg.  
Prerequisite(s): MAAE 3202 and MECH 3710. Additional recommended background: MECH 3310.  
Lectures three hours per week, laboratories or tutorials three hours per week.

MECH 4305 [0.5 credit]  
**Fluid Machinery**  
Prerequisite(s): MAAE 3300.  
Lectures three hours a week.

MECH 4401 [0.5 credit]  
**Power Plant Analysis**  
Criteria of merit; selection of power plant for transportation and power generation applications; interrelation among mechanical, thermodynamic and aerodynamic design processes; jet propulsion, turbojets and turbofans; alternative proposals for vehicular power plant; combined cycle applications.  
Precludes additional credit for Engineering AERO 4402.  
Prerequisite(s): MAAE 2400.  
Lectures three hours a week.

MECH 4403 [0.5 credit]  
**Power Generation Systems**  
Precludes additional credit for SREE 4001.  
Prerequisite(s): MAAE 2300, MAAE 2400 and fourth year status in Mechanical, Aerospace, or Biomedical and Mechanical Engineering.  
Lectures three hours a week. Problem analysis three hours per week.

MECH 4406 [0.5 credit]  
**Heat Transfer**  
Precludes additional credit for AERO 4446.  
Prerequisite(s): MAAE 2400, MAAE 3300 or MECH 3310, or ENVE 3001 and permission of the Department of Mechanical and Aerospace Engineering.  
Lectures three hours a week.

MECH 4407 [0.5 credit]  
**Heating and Air Conditioning**  
Prerequisite(s): MAAE 2400 and third-year status in Engineering.  
Lectures three hours a week.

MECH 4408 [0.5 credit]  
**Thermofluids and Energy Systems Design**  
Integration of fluid mechanics, thermodynamics, and heat transfer for design of energy conversion systems. Chemical kinetics and mass transfer. Efficient combustion, fuel cells and batteries. Efficient operation and design of engines, power generators, boilers, furnaces, incinerators, and co-generation systems. Emerging energy systems.  
Prerequisite(s): MAAE 3400 and MECH 4406.  
Lectures three hours per week.
MECH 4501 [0.5 credit]
State Space Modeling and Control

MECH 4503 [0.5 credit]
An Introduction to Robotics
History of robotics and typical applications. Robotic actuators and sensors. Kinematics of manipulators, inverse kinematics, differential relationships and the Jacobian. Manipulator dynamics. Trajectory generation and path planning. Robot control and performance evaluation. Force control and compliance. Applications in manufacturing and other industries. Prerequisite(s): MATH 3705 and SYSC 3600 or SYSC 3610. Lectures three hours a week.

MECH 4604 [0.5 credit]
Finite Element Methods
Finite element methodology with emphasis on applications to stress analysis, heat transfer and fluid flow using the simplest one- and two-dimensional elements. Direct equilibrium, variational and Galerkin formulations. Computer programs and practical applications. Higher order elements. Prerequisite(s): MAAE 3202 and (MAAE 3300 or MECH 3310). Lectures three hours a week.

MECH 4704 [0.5 credit]
Integrated Manufacturing - CIMS
Overview of the topics essential to CIMS including integration of design and assembly techniques, numerical analysis, statistical process control and related production technologies within the manufacturing enterprise. Prerequisite(s): AERO 3700 or MECH 3700. Also offered at the graduate level, with different requirements, as MECH 5704, for which additional credit is precluded. Lectures three hours a week.

MECH 4705 [0.5 credit]
CAD/CAM
Introduction to contemporary computer aided design and manufacturing (CAD/CAM) Topics covered include mathematical representation, solid modeling, drafting, mechanical assembly mechanism design, (CNC) machining. Current issues such as CAD data exchange standards, rapid prototyping, concurrent engineering, and design for X (DFX) are also discussed. Prerequisite(s): MAAE 2001 (Engineering Graphics and Design) and fourth-year status in Engineering. Lectures three hours a week.

MECH 4705 [0.5 credit]
An Introduction to Robotics
History of robotics and typical applications. Robotic actuators and sensors. Kinematics of manipulators, inverse kinematics, differential relationships and the Jacobian. Manipulator dynamics. Trajectory generation and path planning. Robot control and performance evaluation. Force control and compliance. Applications in manufacturing and other industries. Prerequisite(s): MATH 3705 and SYSC 3600 or SYSC 3610. Lectures three hours a week.

MECH 4805 [0.5 credit]

MECH 4806 [0.5 credit]
Mechatronics
Introduction to the integration of mechanical, electronic and software components to build mechatronic devices. Mechanical and electrical systems modeling, simulation and implementation. Basic automation and computer requirements. Design tools and examples of mechatronic applications. Prerequisite(s): MAAE 4500 or AERO 4540 or SYSC 4505. Lectures three hours per week.

Summer session: some of the courses listed in this Calendar are offered during the summer. Hours and scheduling for summer session courses will differ significantly from those reported in the fall/winter Calendar. To determine the scheduling and hours for summer session classes, consult the class schedule at central.carleton.ca
Not all courses listed are offered in a given year. For an up-to-date statement of course offerings for the current session and to determine the term of offering, consult the class schedule at central.carleton.ca