MECHANICAL ENGINEERING (MECH)

MECH 2112 Fundamentals of Mechanical and Computer Aided Design 5 cr
(Lab required) Provide instruction on the application of computer aided design software packages. The students will work in groups in the design and development of a product using CAD packages and digital fabrication technologies. May not be held for credit with CIVL 2830, the former ENG 2020, ENG 2022, MECH 2010, or MECH 2012.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: ENG 1430.
Mutually Exclusive: CIVL 2830, ENG 2020, ENG 2022, MECH 2010, MECH 2012

MECH 2150 Mechanical Engineering Modelling and Numerical Methods 4 cr
(Lab required) A case-study-based introduction to modelling and numerical methods with mechanical engineering applications. Selected problems, primarily from second and third year mechanical engineering course material, will be used to teach modelling. Derivation and application of appropriate numerical methods will be performed to solve the case study problems using a hands-on approach. A high level computer language and accompanying toolkit/built-in functions will be introduced for solution of the cases. May not be held with MATH 2120.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: COMP 1012 or COMP 1013. Pre- or corequisites: MATH 2132.
Mutually Exclusive: CIVL 3590, MATH 2120, MATH 2160, MATH 2161, MATH 2600, MATH 2601

MECH 2202 Thermodynamics 4 cr
(Lab required) Cycles, transient flow processes, entropy, gas mixtures, psychrometry combustion. May not be held for credit with MECH 2200.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: ENG 1460, (MATH 1500 or MATH 1510 and MATH 1700 or MATH 1710).
Equiv To: MECH 2200

MECH 2222 Mechanics of Materials 4 cr
(Lab required) Topics covered in this course include: axial and torsional loading, stress-strain and deformation in statically determinate/indeterminate systems, thermally induced stress, and stresses in beams (including reinforced beams) under pure bending and bending with shear. The mechanical properties of materials under various loading modes will be addressed.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: [PHYS 1050] and [ENG 1440 or ENG 1441 (ENG 1350)] and COMP 1012 and [MATH 1710 or MATH 1700].
Equiv To: MECH 2220, MECH 2270

MECH 2262 Fundamentals of Fluid Mechanics 4 cr
(Lab required) Fundamental concepts used in the analysis of fluid behaviour, pressure in stationary fluids, forces on submerged surfaces, buoyancy, integral methods, Bernoulli equation, pipeline analysis. May not be held for credit with the former MECH 2260.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: PHYS 1050 and ENG 1440 and ENG 1460 and MATH 2130 (or the former MATH 2110). Pre or Co requisite: MATH 2132 (or the former MATH 2100).
Mutually Exclusive: MECH 2260

MECH 2272 Engineering Materials 1 4 cr
(Lab required) Introduction to engineering materials; defects, strengthening mechanisms, and plasticity in engineering metals and alloys; fundamentals and application of heat treatment of metallic materials including topics such as diffusion, phase diagram, phase transformation, and thermal processing; mechanical properties of engineering metallic materials and their relationship to structure, defects, various strengthening mechanisms, and processing; structure of non-metallic polymers and ceramics. May not be held with MECH 2270, MECH 2290 or MECH 3540.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: [CHEM 2240 or [(CHEM 1110 or CHEM 1111) and CHEM 1126] or the former CHEM 1310 or the former CHEM 1311] and [MECH 2222 or the former MECH 2220].
Equiv To: MECH 2270, MECH 3540
Mutually Exclusive: MECH 2290

MECH 3170 Project Management 4 cr
(Lab required) Topics covered include project planning, scheduling, resource allocation, process analysis, layout and control. The course will make use of industrial projects for developing a strong design and analytical approach pertinent to project management. May not be held for credit with the former MECH 4170.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MECH 2112 (or the former MECH 2010 or the former MECH 2012) or CIVL 2830.
Mutually Exclusive: MECH 4170

MECH 3212 Electromechanical System Design 4 cr
(Lab required) Electromechanical system design with an emphasis on selecting and integrating sensors, actuators and controllers. Students will gain experience designing electromechanical systems. May not be held with the former ECE 3010.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: ENG 1450 and MECH 2112 (or the former MECH 2010 or the former MECH 2012).
Mutually Exclusive: ECE 3010, ECE 3680

MECH 3420 Vibrations and Acoustics 4 cr
(Lab required) Vibrations and computer simulations of single-degree-of-freedom systems, viscous and friction damping, MD of systems and modal analysis, measurement and sources of noise, noise control.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: MECH 3482 (formerly MECH 2120 and MECH 3480), and MATH 3132 (formerly MATH 3100).

MECH 3430 Measurements and Control 4 cr
(Lab required) Mathematical modelling of mechanical systems. Feedback systems and stability. Digital control; analog to digital and digital to analog control systems.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: MATH 3132 (or MATH 3100) and ENG 1450 (or 130.118).

MECH 3460 Heat Transfer 4 cr
(Lab required) This is the first course in heat transfer. Topics covered include fundamental concepts relevant to heat transfer analysis, steady-state and transient conduction, forced and free convection, external and internal flows, heat exchangers and fundamentals of radiation. May not be held for credit with the former MECH 3470.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: MECH 2150, MATH 3132 (or the former MATH 3100) and ENG 1460. Pre- or corequisite: MECH 3492 (or the former MECH 3490).
Mutually Exclusive: MECH 3470

MECH 3482 Kinematics and Dynamics 4 cr
(Lab required) Fundamentals of 2D and 3D rigid body motions (kinematics) and the forces/moments (kinetics) needed to produce such motions. Applications will emphasize elements of machine design. May not be held for credit with MECH 2120 or MECH 3480.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: PHYS 1050 and [ENG 1440 or ENG 1441] and COMP 1012 and [MATH 1710 or MATH 1700].
Equiv To: MECH 2120
Mutually Exclusive: MECH 3480

MECH 3492 Fluid Mechanics and Applications 4 cr
(Lab required) The angular momentum principle, introduction to differential analysis of fluid motion, internal and external incompressible viscous flow, fluid machinery and multiple-path systems, fluid coupling and torque couplings and torque converters. May not be held with the former MECH 3490.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: MECH 2112 and MECH 2262 (or the former MECH 2260). Pre- or corequisite: MECH 2150 or CIVL 3590 or MATH 2120.
Mutually Exclusive: MECH 3490

MECH 3502 Stress Analysis and Design 4 cr
(Lab required) Strength and stability of columns, torsion of thin-walled members, unsymmetric loading and shear centres, beam deflflection and energy methods. May not be held with MECH 2220 or MECH 3500.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: MECH 2222 (the former MECH 2220), MATH 2130 (the former MATH 2110) and MECH 2112.
Mutually Exclusive: MECH 3500

MECH 3520 Aerodynamics 4 cr
(Lab required) Aeronautical definitions, compressible flow, plane normal shock waves, Mach. no. and shock waves in two-dimensional flow, potential flow theory in two-dimensional and axisymmetric flows. Two-dimensional wing theory, finite wing theory panel methods, elements of boundary layer theory. Compressibility and wings, wing design, flow control.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: MECH 2150 and MECH 3492 (or the former MECH 3490).

MECH 3542 Engineering Materials 2 4 cr
(Lab required) Mechanical properties of engineering non-metallic materials such as polymers, ceramics and composites, and their relationship to structure and processing; introduction to various shaping and joining processes used in manufacturing, their advantages and limitations; selection and application of engineering materials. May not be held for credit with MECH 2270, MECH 2290 or MECH 3540.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: MECH 2272 (formerly MECH 2270).
Equiv To: MECH 2270, MECH 3540
Mutually Exclusive: MECH 2290

MECH 3550 Robotics and Computer Numerical Control 4 cr
(Lab required) This course builds up a foundation in the area of Computer Aided Manufacturing (CAM) such as computer numerically controlled machine tools and robotics. Intense hands on experience is provided in the laboratory sessions on part programming using Computer Aided Design (CAD) packages and robots to demonstrate application in the area of CAM. Several case studies and manufacturing applications will be discussed.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MECH 2112 (or the former MECH 2010 or the former MECH 2012) or CIVL 2830.

MECH 3562 Introduction to Optimization 4 cr
(Lab required) The objective of this course is to develop the ability to formulate and analyze problems that will be encountered in a manufacturing system. The skills acquired will allow the students to approach problems from an optimization perspective. The students will be provided experience in related software packages. May not be held for credit with the former MECH 3560.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: (MECH 2112 or the former MECH 2010 or the former MECH 2012 or CIVL 2830) and [STAT 2220 preferred or (STAT 1000 and STAT 2000)].
Mutually Exclusive: MECH 3560

MECH 3570 Manufacturing Automation 4 cr
(Lab required) This course builds upon the foundation developed in a previous course: namely Robotics and Computer Numerical Control. The course covers a wide variety of topics in the area of computer controlled automation. The students are provided with hands on experience in design for automation. It will synthesize several aspects associated with integrated operation of computer controlled automated devices.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MECH 3550.

MECH 3582 Manufacturing Planning and Quality Control 4 cr
(Lab required) The course covers topics such as: group technology, just-in-time, computer aided process planning, statistical process control and manufacturing planning and control. Issues related to the integration of several areas that fall within CIM are emphasized. Systems approach is introduced. May not be held with the former MECH 3580.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MECH 2112 (or the former MECH 2010 or the former MECH 2012) or CIVL 2830.
Mutually Exclusive: MECH 3580

MECH 3592 Simulation Modeling and Facility Planning 4 cr
(Lab required) The objective of this course is to introduce simulation for manufacturing operations and the concepts of facilities location and layout. The students will learn how to program WITNESS, a simulation language, and through simulation, explore the effects of facility planning; resource availability e.g. machines and quality related problems on manufacturing productivity and timing. May not be held with MECH 3590.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MECH 2112 (or the former MECH 2010 or the former MECH 2012) or CIVL 2830.
Mutually Exclusive: MECH 3590

MECH 3602 Manufacturing Process Fundamentals 4 cr
(Lab required) This course will give students hands on experience with numerous manufacturing processes, machines and systems. Using CNC mills, lathes, conventional machine shop equipment and hand tools, the students will manufacture mechanical components, assemble them and troubleshoot any problems. The object is to provide students with hands-on exposure to the application of basic manufacturing process tools. May not be held for credit with MECH 3600.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MECH 2112 (or the former MECH 2012 or the former MECH 2010) or CIVL 2830.
Mutually Exclusive: MECH 3600

MECH 3652 Machine Design 4 cr
(Lab required) Stress and failure analysis and the design of machine elements; shafts and couplings, threaded fasteners and power screws, clutches and power transmission components; spur, bevel, worm and helical gears; lubrication, journal and roller bearings. May not be held for credit with MECH 4650.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: (MECH 3482 or the former MECH 2120) and (MECH 3502 or the former MECH 3500).
Equiv To: MECH 4650

MECH 3982 Mechanical Laboratories in Solid Mechanics 2 cr
(Lab required) Laboratory course on topics that compliment and reinforce concepts developed in second and third year mechanical engineering courses in mechanics of solids and structures, and vibrations. May not be held for credit with the former MECH 3980, MECH 4980, or MECH 4990.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: (ENG 2030 or ENG 2040 or the former ENG 2010) and (MECH 2222 or the former MECH 2220). Pre- or corequisites: MECH 3420 and (MECH 3502 or the former MECH 3500).
Mutually Exclusive: MECH 3980, MECH 4980, MECH 4990

MECH 3992 Mechanical Laboratories in Thermofluids 2 cr
(Lab required) Laboratory course on topics that compliment and reinforce concepts developed in second and third year mechanical engineering courses in thermofluids. May not be held for credit with the former MECH 3980, MECH 4980, or MECH 4990.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: (ENG 2030 or ENG 2040 or the former ENG 2010), (MECH 2202 or the former MECH 2200), and (MECH 2262 or the former MECH 2260). Pre- or corequisites: MECH 3460 or the former MECH 3470.
Mutually Exclusive: MECH 3980, MECH 4980, MECH 4990

MECH 4162 Thesis 6 cr
This course will give students the opportunity to gain research or design experience in their area of interest. Thesis topics must be approved by the head of the department or designate. Restriction: Only students with a year class distinction of 4 or higher in Mechanical Engineering may register for this course and eligible to graduate. May not be held for credit with MECH 4160.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: ENG 2030 or ENG 2040 (or the former ENG 2010).
Mutually Exclusive: MECH 4160

MECH 4182 Aerospace Structures: Analysis and Design 4 cr
(Lab required) Methodology and techniques for design of aerospace structures and components to preclude failure with minimum weight, cost and resource consumption. Analysis of structural, air, gust and manoeuvre loads. May not be held for credit with MECH 4180.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: MECH 3502 (or MECH 3500).
Mutually Exclusive: MECH 4180

MECH 4192 Aerospace Materials and Manufacturing Processes 4 cr
(Lab required) Properties of aerospace structural materials including glass and graphite fibre composites, light metal alloys and high strength steels. Properties of high temperature materials; superalloys ceramics, intermetallic compounds, metal matrix composites. Specialized methods for manufacture of these materials. May not be held for credit with MECH 4190.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: MECH 3542 (formerly MECH 3540).
Mutually Exclusive: MECH 4190

MECH 4200 Gas Turbine Propulsion Systems 4 cr
(Lab required) Gas turbine systems, shaft power cycles, gas turbine propulsion cycles, centrifugal compressors, axial flow compressors, combustion systems, design performance predictions, off-design operations and transient behaviour of gas turbines. Design performance predictions.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: MECH 2202 (or MECH 2200) and MECH 3520.

MECH 4292 IC Engines 4 cr
(Lab required) Thermodynamics of internal combustion engines and engine cycles; fuels and fuel systems; combustion; emission control systems; electronic engine controls and strategies; intake and exhaust systems; camshafts and valvetrain dynamics; balancing; performance and testing. May not be held for credit with MECH 4290.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MECH 2202 (or the former MECH 2200).
Mutually Exclusive: MECH 4290

MECH 4310 Contemporary Topics in Mechanical Engineering 1 4 cr
(Lab required) This course will cover contemporary topics in Mechanical Engineering. The specific topics and a detailed outline will be available at the time of registration prior to the start of the registration prior to the start of the registration period for the session in which the course will be offered.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: Permission of the department.
Mutually Exclusive: MECH 4542

MECH 4322 Contemporary Topics in Mechanical Engineering II 4 cr
(Lab required) This course will cover contemporary topics in Mechanical Engineering. The specific topics and a detailed outline will be available at the time of registration prior to the start of the registration period for the session in which the course will be offered. May not be held for credit with MECH 4320.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: Departmental Permission.
Mutually Exclusive: MECH 4320, MECH 4482, MECH 4582

MECH 4330 Contemporary Topics in Manufacturing Engineering 1 4 cr
(Lab required) This course will cover contemporary topics in Manufacturing Engineering. The specific topics and a detailed outline will be available at the time of registration prior to the start of the registration period for the session in which the course will be offered.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: Permission of the department.

MECH 4342 Contemporary Topics in Manufacturing Engineering II 4 cr
(Lab required) This course will cover contemporary topics in Manufacturing Engineering. The specific topics and a detailed outline will be available at the time of registration prior to the start of the registration period for the session in which the course will be offered. May not be held for credit with MECH 4340.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: Departmental Permission.
Mutually Exclusive: ENG 7510, MECH 4340, MECH 4432

MECH 4350 Topics in Engineering Material 1 4 cr
(Lab required) This course will cover contemporary topics in engineering materials. The specific topics and a detailed outline will be available prior to the start of registration period for the session in which the course will be offered.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: Departmental Permission.

MECH 4360 Topics in Engineering Materials 2 4 cr
(Lab required) This course will cover contemporary topics in engineering materials. The specific topics and a detailed outline will be available prior to the start of registration period for the session in which the course will be offered.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: Departmental Permission.

MECH 4412 Heating, Ventilation and Air Conditioning 4 cr
(Lab required) Psychometric processes, equipment selection, and the design of heating and cooling systems for typical buildings. May not be held for credit with MECH 4410.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MECH 2202 (formerly MECH 2200).
Mutually Exclusive: MECH 4410

MECH 4432 Systems Engineering 4 cr
(Lab required) The engineering support process as applied to the entire product life cycle from requirements definition to disposal. Focus on the system as a whole; from the outside, its interaction with its environment and other systems; and from the inside, its design requirements and implementation. May not be held with MECH 4342 when titled "Systems Engineering." Restricted to students in third year or above.
Mutually Exclusive: MECH 4342

MECH 4452 Aircraft Performance, Dynamics and Design 4 cr
(Lab required) A study of the morphology of aerospace vehicles; basic components and their functions, Aircraft performance; drag, thrust, lift, basics of orbital mechanics. May not be held for credit with MECH 4450.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: MECH 3520.
Mutually Exclusive: MECH 4450

MECH 4472 Mechanical Vibration 4 cr
(Lab required) Nonlinear Vibrations: mathematical theory for lumped vibratory systems; response of systems to nonharmonic excitation; solutions by Laplace transforms and Fourier analysis; introduction to the matrix formulation of vibration problems and vibration of distributed systems.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MECH 3420.

MECH 4482 Applied Aerospace Instrumentation 4 cr
(Lab required) Principles and practices of test and measurement system design and analysis for aerospace applications. Topics include transducers, signal conditioning, data acquisition and analysis, uncertainty analysis, calibration and correlation, system design and maintenance, and piping and instrumentation diagrams, and an introduction to LabVIEW software. This course may include a field trip component. May not be heldfor credit with MECH 4322 when titled "Applied Instrumentation".
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: MECH 3430 and [(MECH 3982 and MECH 3992) or the former MECH 3980 or (the former MECH 4980 and the former MECH 4990)].
Mutually Exclusive: MECH 4322

MECH 4510 Fundamentals of Finite Element Analysis 4 cr
(Lab required) Fundamentals of the Finite Element Method, basic components in a Finite Element procedure, application of FEM to solve engineering problems and use of commercial software.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: (MECH 2150 or MATH 2120) and (MATH 3132 or MATH 3100) and MECH 2222 (or the former MECH 2220).

MECH 4532 Advanced Strength of Materials 4 cr
(Lab required) Stress and strain in three dimensions; thick walled cylinders, beams of elastic foundations, unsymmetrical bending and sheet-stringer construction, curved beams. Additional topics such as the analysis of fibre-composite material, techniques in experimental stress analysis and studies in metallics fatigue may be presented. May not be held for credit with MECH 4530.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MECH 3502 (formerly MECH 3500).

MECH 4542 Principles of Turbomachinery 4 cr
(Lab required) Principles and design of turbomachinery, including fluid dynamics, thermodynamics and engineering applications. A variety of turbomachines are introduced, including hydraulic pumps and turbines, centrifugal compressors and fans, and axial flow compressors and fans. May not be held for credit with MECH 4310 when titled "Turbomachinery."
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: MECH 2202 (or the former MECH 2200) and MECH 3492 (or the former MECH 3490).
Mutually Exclusive: MECH 4310

MECH 4550 Noise Control 4 cr
(Lab required) An elective course open to all branches of Engineering; a recommended course for students taking Air Conditioning. Wave propagation, transducers and measurement techniques, psycho-acoustic criteria, legislation, techniques of noise and vibration control.

MECH 4560 Selected Topics in Fluid Mechanics 4M 4 cr
(Lab required) Topics may include: wind tunnel design; experimental techniques; some exact solutions of the conservation equations; fundamentals of turbulence; secondary flows; fluidization; elementary meteorology; fluidics; other topics of current interest.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: [MATH 3132 or the former MATH 3100] and [MECH 3492 or the former MECH 3490].

MECH 4582 Vehicle Testing, Condition Monitoring, and Fault Analysis 4 cr
(Lab required) General testing and fault diagnostic techniques for ground vehicles including common signal analysis techniques, vibration testing and fault analysis methods. Basic knowledge of vibration based condition monitoring including the basic theory and applications of engineering tools, damage analysis and detection, and modal analysis. May not be held for credit with MECH 4322 when titled "Ground Vehicle Testing Technology."
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MECH 3420.
Mutually Exclusive: MECH 4322

MECH 4620 Corrosion of Metals and Alloys 4 cr
(Lab required) Electrochemical basis of corrosion, corrosion prevention by cathodic protection, inhibitors, alloying and heat treatment, passivation, stress corrosion cracking, corrosion fatigue; ionic and electronic conduction; oxidation of metals and alloys.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MECH 3542 (or MECH 3540).

MECH 4672 Advanced Mechanism Design 4 cr
(Lab required) Graphical, analytical and computer techniques for the analysis and design of mechanisms to produce a desired set of motion characteristics; design of linkages, double lever, slider and dwell mechanism; cognate linkages. Kinetic synthesis tasks function generation, path generation and motion generation. May not be held for credit with MECH 4670.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MECH 3482 (formerly MECH 2120).
Mutually Exclusive: MECH 4670

MECH 4680 Energy Conservation and Utilization 4 cr
(Lab required) Energy supply and demand, advanced thermodynamic cycles, conventional energy sources, alternative energy, conservation of energy, environmental considerations.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MECH 2202 (formerly MECH 2200).

MECH 4690 Topics in Heat Transfer and Energy 3 cr
(Lab required) Some combination of the following advanced topics: conduction heat transfer, radiation, heat-exchanger design, two-phase phenomena, fluidization, alternative energy, energy conservation. Other topics of current interest may also be included.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MECH 3460 (or MECH 3470).
Mutually Exclusive: MECH 4694

MECH 4692 Renewable Energy 4 cr
(Lab required) Introduction to renewable energy systems, current and future global energy issues and the need for renewable energy applications, and distributed renewable energy generation. Renewable energy systems that will be considered are; solar heat, solar PV, biomass heat and power, hydro power, and wind power. Students will develop simple numerical models of renewable energy systems.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: MECH 2202 (formerly MECH 2200) and MECH 2262 (formerly MECH 2260). Pre- or Co requisite; MECH 3460 (formerly MECH 3470).

MECH 4694 Advanced Topics in Heat Transfer 4 cr
(Lab required) Some combination of the following advanced topics; conduction heat transfer radiation, heat-exchanger design, two-phase phenomena, fluidization, alternative energy, energy conservation. Other topics of current interest may also be included. May not be held for credit with MECH 4690.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MECH 3460 (or MECH 3470).
Mutually Exclusive: MECH 4690

MECH 4702 Design of Thermal Systems 4 cr
(Lab required) Modeling of thermal systems; system simulation; design applications of optimization methods: Lagrange multipliers, search methods, and dynamic geometric and linear programming. May not be held for credit with MECH 4700.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MECH 2202 (or MECH 2200).
Mutually Exclusive: MECH 4700

MECH 4812 Automotive Engineering 4 cr
(Lab required) Introduction to vehicle dynamics; power trains; braking systems; road loads, aerodynamics and fuel efficiency; ride and suspension systems; steering systems; tire properties and dynamics; structural analysis and crash safety; performance vehicle design. May not be held for credit with MECH 4810.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MECH 3502 (or the former MECH 3500). Pre or Co-requisite: MECH 3420.
Mutually Exclusive: MECH 4810

MECH 4822 Numerical Heat Transfer in Fluid Flow 4 cr
(Lab required) General conservation equations; specific forms of the conservation equations and energy equations; finite difference methods: one dimensional steady problems, one dimensional unsteady problems, two dimensional steady problems; two dimensional unsteady problems; convection, solution for the flow fluid. May not be held for credit with the former MECH 4820.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: (MATH 3132 or the former MATH 3100), (MECH 2150 or MATH 2120), MECH 3460 (or the former MECH 3470) and MECH 3492 (or the former MECH 3490).
Mutually Exclusive: MECH 4820

MECH 4832 Biomaterials in Biomedical Engineering 4 cr
(Lab required) Biomechanics and design of hard biomaterials and soft biomaterials and their applications in orthopedics, cardiovascular and neural systems. Course includes fundamental biological concepts, materials science fundamentals and medical/clinical concerns.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: MECH 3542 (or the former MECH 3540) or (BIOE and BIOE 3590).

MECH 4860 Engineering Design 5 cr
(Lab required) Design projects; teams of students prepare written and oral design reports on solutions to specific problems from Manitoba industries; series of seminars by invited speakers.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: eligibility for graduation in the current academic year or registered in third year Industrial Cooperative Education Program. Prerequisites: (ENG 2030 or ENG 2040 or the former ENG 2010) and MECH 3170 and (MECH 3652 or the former MECH 4650).

MECH 4870 Fracture and Failure of Engineering Materials 4 cr
(Lab required) Criteria for crack initiation and propagation leading to structural failure. Fracture mechanics and fracture toughness phenomena. Effects of structure geometry, loading rate, environment, temperature, composition and microstructure on material integrity.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MECH 3542 (or MECH 3540).

MECH 4900 Mechatronics System Design 4 cr
(Lab required) The course covers topics in the analysis of control systems and components with the goal to provide students with tools and an understanding of issues related to integrating mechanical, electronic and software components towards building mechatronic devices. Hands-on-experience is provided in the laboratory sessions on simulation and actual computer control of various devices. Problems considered would include application to fluid power systems, systems integration and validation. The focus is placed on learning to work with real hardware.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MECH 3430.

MECH 4930 Mechanical Engineering Industry Internship (IIP) 0 cr
Supervised work experience normally of 12-16 months duration,
concluded by a work report. (Pass/Fail grade only.)