October 31, 2023

FACULTY OF ENGINEERING
MECHANICAL, AUTOMOTIVE & MATERIALS ENGINEERING

NOTICE RE GRADUATE ASSISTANT (GA) POSITIONS AVAILABLE FOR WINTER 2024

In accordance with Article 12:01 of the CUPE 4580 Collective Agreement, the Department of Mechanical, Automotive & Materials Engineering invites applications for GA positions for the Winter 2024 term. The total number of Graduate Assistantships allocated to MAME for 2023-2024 (S23, F23, W24) is 240. It is anticipated that 80 GA positions for 140 hours each will be required for Winter 2024, subject to final budgetary approval and sufficient enrolment.

List of courses that may utilize Graduate Assistants for Winter 2024 which will run from January 3, 2024 – April 30, 2024:

Students CANNOT serve as the GA for a course they are also registered in.

Expected GA duties

Assistants cannot commence their GA/TA duties until email confirmation of the approval of their contract is received from Human Resources (email titled "Authorization to Commence GA/TA Duties").

GA employees are expected to make themselves available to report for all assigned duties, **both in-person/on-campus and remote/online duties**. Most classes across the University are held face-to-face on campus or have a face-to-face component. Refer to the University's current health and safety regulations.

Course # and Name	Course Description	R=Required / P=Preferred Skills	Projected # of Gas
GENG-1102-01/ Engineering Graphics	Visualization techniques, graphical communication using sketching, descriptive geometry, and computer-aided design (CAD) for orthographic projection, pictorial drawings, dimensioning, section views, and auxiliary views. Reading engineering drawings. Engineering graphics e-portfolio and CAD project to develop visualization skills and task completion skills.	R - Must have Knowledge of DRAFTING: Sketching, orthographic views, auxiliary views, section views, familiar with mechanical drafting conventions/standard, Knowledge of AutoCAD software, only 2D - Drafting and Annotation Workspace and fluent in English. P - Previously taken/GA'd the course	2
GENG-1201-01/ cornerstone Design	The engineering design process: problem formulation, functional requirements and constraints, competitive evaluation and areas of improvement, conceptual design through ideation sketches, selection of design, communication of the design solution, prototype construction, testing, iteration, reporting. Includes group work to develop personal, teamwork, leadership, and task completion skills as part of the design process.	R – GA's must have experience with Arduino (programming, writing instructions and reports, and making presentations, in English). GA's must be proficient in comprehending and composing written English as well as communicating orally in English. Must be available during class labs/tutorials, to help with the hands-on activity and assessment of projects scheduled on Mon&Wed 8:30am-9:50am and/or Mon&Wed 10:00am-11:20am	6
GENG-2180-01/ Mechanics of Deformable Bodies	Introduction to stress, strain, stress-strain relations, and mechanical. A study of simple structures subjected to either axial load, flexure, and torsion, including flexure of beams, eccentric loads, shear and bending moment diagrams, shearing streses in beams. Additional topics may include statically indeterminate problems.	R - Strong knowledge of solid mechanics required; P - previously taken or GA'd this course having experience with testing equipment in CEI 1131 (Def bodies lab) preferred.	5
GENG-2190-01/ Engineering Materials Fundamentals	This course explains how the properties of solid materials are derived and are related to their basic crystallographic and electronic structures: Metals, ceramics, polymers, and electronic materials are covered.	R - Sound understanding of microstructures and properties of materials and the ability to communicate effectively with large number of students is required. P - Previously taken or GA'd this course and Materials Engineering background preferred.	5.5
GENG-2200-01/ Numerical analysis for Engineering	Application of numerical methods to real-world engineering problems. Development of mathematical background for numerical techniques. Root finding; numerical linear algebra; curve fitting; numerical quadrature; numerical solution to ordinary differential equations.	R - Familiar with MATLAB essential P - Previously taken or GA'd the course	7

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GENG-2220-01/ Treatment of Experimental Data	Treatment of engineering data using the concepts of frequency distribution; measures of central tendency and dispersion. Probability; random variables; discrete and continuous distributions. Tests of hypotheses; estimation; goodness-of-fit test; linear regression and correlation. Applications using computers in engineering design problems, quality control, and manufacturing processes.	R - Experience with Intermediate Statistics, Microsoft Excel required. P - Previously taken/GA'd the course preferred.	12
GENG-3400-60/ Mechatronics System Design	This course will introduce concepts to integrate mechatronic components such as mechanical, electronic, optical and computer programming. Basic concepts and fundamental principles in mechatronic system-based design for automation, packaging and other applications will be reviewed. Students will develop the knowledge and skills necessary to adopt an interdisciplinary approach to mechatronic system design. The hands-on laboratory activities will assist in developing the skills in designing and troubleshooting integrated mechatronic systems. Students will be organized into teams of three or four students, and each team will be proposing, conceptualizing, designing, building and demonstrating a significant hands-on mechatronic project. Through this course and team project the students will be prepared for the final Capstone Mechatronics.	P - Previously taken/GA'd the course	0.5
GENG-4210-01/ Engineering & Society	The technology-society relationship in a historical context; the nature of technological change and its consequences; the engineer's role in the control of technology and sustainable development; the responsibility of engineers for health and safety in the workplace, including OHSA, WHMIS. The development of the engineering profession; professional registration and the code of ethics; the duties and responsibilities of engineers; the engineer and the law.	R - Familiarity with Canadian law and Ontario as well Professional Engineer licensing requirements. P - Previously taken or GA'd the course	0.5
GENG-4300-60/ Intelligent and Digital Manufacturing	Manufacturing methods are shifting towards smart tools that are adaptive and self-aware. This course will introduce concepts and components for intelligent machining tools and interfacing them with digital manufacturing that will create the knowledge of Industry 4.0. Integration of smart sensors and controls, data processing, interconnected machines, digital link between design and production, analysis of manufacturing processes and supply chains will be discussed.	P - Previously taken or GA'd the course	0.5
GENG-4500-60/ Artificial Intelligence and Machine Learning	This course is an introduction to the area of Artificial Intelligence and designing intelligent machines. Artificial intelligence aims to understand thinking and intelligence in ways that enable the construction of computer systems that are able to reason in uncertain environments. Work in AI has supported the development of driverless cars and house-cleaning robots as well as systems that have defeated world chess champions and planned space explorations. The course has three core sections: search, representation, and uncertainty. Each section will provide a thorough understanding of major approaches, representational techniques and core algorithms. Students completing this course will have an in-depth understanding of three core areas of AI and the connections among them, and with such other key AI areas as machine learning, robotics, natural language processing and multi-agent systems.	P - Previously taken or GA'd the course	0.5

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GENG-8040-40/ MEM - Engineering Management Capstone	This is a jointly instructed and administered course between the Faculty of Engineering and the Odette School of Business. The course is the last course students take in the Masters of Engineering Management program and has mandatory prerequisites. The goal is to allow students to practice all business and management theory they learned in previous courses by completing one of: 1) an engineering management report 2) an engineering feasibility study, or 3) a new venture business plan. This course is entirely project-based.	P - Previously GA'd the course is preferred	0.5
INDE-3020-01/ Health, Safety and HF	Fundamentals of manufacturing safety and health are studied to provide manufacturing engineers with the knowledge to effectively incorporate design solutions for health and safety considerations in the workplace. Human capabilities and limitations in the industrial workplace are also assessed and taken into account when implementing design solutions. Topics will include: machine guards, confined space protocol, accident losses, prevention, liabilities and the Workplace Safety and Insurance Board by-laws, the Ontario Occupational Safety and Health Act, and related standards and codes. Also addressed are ergonomic issues such as the design of the workplace and environment, design of display and control systems and human factors in expanding technology.	P - Previously taken and passed Health, Safety and Human Factors (0691-302) course or equivelent	1
INDE-3110-01/ CAD/CAM	This courses focuses on CAD/CAM from theory to practice. Basic and generic design principles and tools are introduced and the course material is complemented with significant hands on practice and engineering applications. Students will learn modelling strategies, and advanced computer aided engineering design, analysis, manufacturing and measurement tools. Topics include: Solid modelling, GD & T, tolerance stack ups, assembly modelling and mechanism analysis, process planning, CNC code generation, tool path optimization and principles of measurement.	P - Previously taken or GA'd the course.	0.5
INDE-3270-01/ Product Quality and Reliability	Impact of quality on manufacturing processes and product design. Methods and theories of statistical process control. Control charts for attributes and for variables. Process capability analysis and six-sigma method. Acceptance sampling and sampling standards. Reliability engineering and various failure models. Failure modes and effects analysis (FMEA). Taguchi method. Product design and quality function deployment (QFD). ISO 9000/ QS 9000 standards. Total Quality Management (TQM) method.	R - knowledge of statistics and preferred experience with Quality issues required	0.5
INDE-3910-01/ Supply Chain Eng	This course explores the basic concepts of managing the flow of materials in a typical enterprise supply chain. This includes the design and operation of manufacturing and warehousing facilities. Students will examine a complete overview of material and information flow, from internal and external suppliers, to and from the enterprise. Topics covered include: basic elements of the supply chain; planning and managing inventories in supply chains; just-in-time; enterprise resource planning; demand and aggregate planning; the analysis of logistics capabilities and transportation issues; and interrelationships among customer service. The impact of e-commerce on supply chain management is also included. The students have the opportunity to explore and use SAP and other software packages.	R - Knowledge of Operational Research and supply chain mangement required.	0.5

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INDE-4000-01/ IE senior capstone design	Student teams, supervised by faculty, undertake a significant design project, which integrates mathematics, basic sciences, engineering sciences and complementary studies in making informed, thoughtful and creative decisions in devising a product, system, component, or process to meet specified needs. It is a creative open-ended and generative activity often iterative and multidisciplinary, subject to constraints which may be governed by corporate standards or applicable legislation to varying degrees depending upon the project. These constraints may relate to economic, health, safety, environmental, social or other pertinent factors. Course requirements include seminars, group meetings, oral presentations, and written reports. Faculty advisors and industrial preceptors will advise project groups and evaluate the progress and results of the design projects.	R - graduated from a Canadian Engineering program	1
INDE-4120-01/ Operations Research II	Probabilistic O.R. models. Markov chains and their properties; continuous-time Markov chains. Queuing theory; the role of Exponential and Poisson distributions. Applications of queuing theory in production systems. Markovian decision processes. Reliability. Renewal Theory. Use of computer software programs to solve optimization problems in queues and Markov Processes.	R - Must have knowledge in probabilistic operations research (Markov chains and Queuing theory) and should be comfortable with the software LINGO and Excel solver. P - Previously taken or GA'd the course.	0.5
INDE-4130-01/ Production Analysis	Analysis and control of production systems. Demand forecasting. Deterministic and stochastic inventory systems. Aggregate planning and master scheduling. Material requirement planning. Operations sequencing and balancing. Job shop scheduling and control systems. Introduction to group technology and flexible manufacturing systems.	R - Knowledge of Operation research, Excel solver, and operation analysis required. P - Previously taken or GA'd this the course is preferred	0.5
INDE-4350-01/ DOE Techniques for Manufacturing	Use of designed experiments (DOE) in engineering product and process design processes. Experiments involving one factor; ANOVA; fixed, random, and mixed models; randomized blocks, Latin squares, and incomplete block designs. Factorial designs. Fractional designs. The Taguchi method and robust product/process design. Emphasis is put on industrial applications of various designs.	P - Strong mathematical background and prior experience in Design of Experiments and MiniTab software preferred.	0.5
INDE-8210-01/ Industrial Exp. & appl Stats	Distributions of functions of variables, estimations and tests of hypotheses, power of tests, non-parametric tests, sampling techniques, analysis of variance, randomized blocks. Latin squares and factorial experiments.	R - knowledge of statistics and preferred experience with Quality issues required	0.5
INDE-8360-01/MECH-8290-09 Computer-Aided Design (CAD)	This course in CAD/CAM/CAE is directed towards students preparing to work as technical professionals and mechanical designers in industry. This course is based on from theory to practice and discusses important integration issues and approaches. The lectures present basic and generic principles and tools; this is supplemented with significant hands-on practice and engineering applications. Much of the learning will result from "hands-on" experience operating CAD software and learning the machining tools and a bit of programming (CAM) as well.	R - Good knowledge of CATIA is required or have taken MECH-4259.	0.5
INDE-8420-01/ Supply Chain Management and Logistics	This course covers the major issues associated with the management of Supply Chain and Logistics, covering both technical and managerial issues with emphasis on the analytical decision support methods and tools. Topics include supply chain network design, inventory models and theories, transportation and logistics planning, outsourcing and pricing, and case study.	R - Knowledge of Operational Research and supply chain mangement required.	1

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INDE-8900-01/MECH-8290-01 Robotics Fundamentals and Programming	The purpose of this course is to introduce you to basics of modeling, design, planning, and control of robot systems. Topics include coordinate frames and transformations, forward and inverse kinematic solutions to open and closed chain manipulators, the Jacobian, dynamics and control, sensors and actuators. In addition, Global Robotic specifications (GRS) will be introduced at high level 1): Communication control signals device-net safety/tooling, 2): Robot rules of process processes and limits, rough cycle time rules. 3): Robot integration and Programming, interference zones. 4): Payload data analysis, Robot duty cycle (joint's servomotor life), in addition students will learn to develop multi robots work-cell construction as a introduction to DM using the State of art of true DM work-cell design, Tecnomatix (PS, V17.1a; SIEMENS SW) is used.	R - Robotics and industrial automation experiences required. Must be able to attend the Lab solving problems and PS Virtual P - Previously taken or GA'd the course.	1
INDE-8900-34/ Lean Manufacturing and Process Improvement	This course teaches students the core concepts of Lean Manufacturing, Toyota Production System, World Class Manufacturing, and Six Sigma. Students will learn how to use these tools to improve processes and meet customer requirements. They will gain an understanding of lean manufacturing principles, identify waste, and learn methods to eliminate it for increased efficiency. By the end of the course, students will be able to apply these concepts to their business activities, improving performance in areas such as throughput, quality, FTC, and on-time delivery.	R - The candidate has taken lean course from U of W. Good understanding of process improvement basics, Lean and Six Sigma as well as Microsoft office/google suit is required. P - Previously has GA'd this course including working knowledge of Brightspace Management system is preferred.	1.5
INDE-8900-80/ Statistical Quality Control	Quality has become one of the most important consumer decision factors in the selection among competing products and services. Understanding and improving quality are key factors leading to business success, growth, and enhanced competitiveness. This course provides comprehensive coverage of the use of modern statistical techniques for quality control and improvement. Statistical techniques are emphasized throughout the course with a strong engineering and management orientation. This course will give special focus on the design of statistical process control systems, acceptance sampling, and process improvement.	R - Proficient in MiniTab and excel with Sound & working knowledge of basic statistics required. P - Previously taken the course preferred	1
INDE-8900-85/ Human Factors & Ergo Res Mthods	This course will allow students to gain familiarity with state-of-the-art research methods in human factors engineering and ergonomics, including study design, research hypotheses generation, literature search and management in human factors/ergonomics, experimental design and human behavior data analysis in human factors/ergonomics. Students will be able to formulate research hypotheses and to understand the relationship between research hypotheses and appropriate methods for testing the hypotheses. Students will read journal papers demonstrating a variety of research methods, as well as learn how to prepare a research journal proposal, conference and journal papers in human factors/ergonomics.	P - Previously taken the course is preferred	0.5
MATL-8811-01/ Casting: Modeling and Simulation	Review of casting fundamentals. Techniques for mathematical model formulation. Development of general numerical method based on control volume finite difference scheme to predict mold filling, heat transfer, and solidification phenomena. Treatment of gates, runners, risers, and overflow. Mesh generation for full casting. Applications using commerical casting-simulation software. Students will apply their knowledge of engineering mathematics and transport phenomena to the processes of manufacturing light weight automotive components.	P - Previously taken or GA'd the course.	0.5

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MATL-8813-01/MECH-8290-93 Tribology: Materials and Manufacturing Aspects	This course will prepare students to perform experimental and analytical work on the materials and manufacturing aspects of tribology. Fundamentals equations of wear, wear testing methods; micromechanisms of wear, modeling of surface contacts, frictional heating during sliding contact; tribology of internal combustion engines, friction and wear during machining operations; wear control via surface coatings, coatings for cutting tools.	P - Previously taken or GA'd the course.	0.5
MATL-8890-05/MECH-8290-35 Ceramic Materials		P - Previously taken or GA'd the course.	0.5
MATL-8890-09/MECH-4832 Modern Steel	Traditional and advanced high strength steels. Automotive sheet steels. Stainless and tool steels. Cast irons. Steel industry in Canada. Mechanical and microstructural characterization laboratories.	P - Previously taken or GA'd the course.	0.5
MECH-2230-01/ Advanced Engineering and Design	Computer aided design applications for engineering graphic communication. Solid modeling; orthographic projection and isometric drawing; sections and conventions; dimensioning and tolerancing. Design portfolio and project.	R - Fluent in English essential. Good knowledge of CATIA for specific workbenches: sketching, part design, assembly design, drafting workbench and knowledge of drafting techniques and mechanical drafting conventions required.	6.5
MECH-3221-60/ Control Theory I	Control system concepts, linear modelling and analysis of response and stability of physical systems, complex variables and Laplace transforms, frequency, and transient response analysis and performance specifications.	R - Familiarity with electrical, mechanical, fluid dynamics and kinematics modeling; Familiarity with control theory concepts (state-space systems, Laplace transform, bode plots, PID controllers, stability, accuracy, vibration), familiarity with MATLAB and SIMULIN required. P - Previously taken or GA's this course or similar course preferred	0.5
MECH-3224-01/ Engineering Measurements	Basic concepts and applications in engineering data acquisition (DAQ), error analysis, signal conditioning and measurement presentation. Microcomputer-based data acquisition and analysis involving DAQ hardware, including sensors, and software will occur.	R – Previous experience with DAQ hardware and software, preferrably NI LabVIEW and the NI CompactDAQ DAQ system. Previous experiencing using sensors, including but not limited to, load cells, displacement transducers, and accelerometers in mechanical engineering measurement. P – Previously taken/GA'd the course.	0.5
MECH-3224-60/ Engineering Measurements	Basic concepts in instrumentation; error analysis; instrumentation and measurement systems including sensors, transducer, signal conditioning and display; microcomputer-based data acquisition and analysis.	P - Previously taken or GA'd the course is preferred	0.5
MECH-3671-01/ Aerospace Materials and Manufacturing	Properties and selection of metals, ceramics, polymers, and composite materials for aerospace applications. Structural and gas-turbine alloys. Machining, casting, forming, heat treating, and joining processes for original manufacture and repair. Manufacture and application of composites. In-service materials degradation.	R - GA must attend lab/tutorials P - students with Materials Engineering background, or those who previously taken or GA'd the course are preferred.	1
MECH-4200-01/ Mechanical Capstone Design	Student design teams, operating within a "company" environment, utilize the broad range of their undergraduate experience in interdisciplinary projects selected to promote interaction between the mechanical, automotive, and materials programs. Design methodologies and team interaction simulate future professional practice. Project milestones include: a design proposal with cost analysis and scheduling, construction and commissioning of the designed appartus, and a final report and presentation having both global and detail completeness.	P - Previously taken or GA'd the course is preferred	3
MECH-4211-01/ Design for Failure Prevention	Philosophy of machine design. Design factor/reliability relationships. Contemporary fatigue analysis, including low- and high-cycle, triaxial state of non-reversed stress and fatigue damage, with applications of selected mechanical elements.	R - GA must attend lab/tutorials P - Previously taken or GA'd the course is preferred	5.5

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MECH-4218-01/ Thermofluid Systems Design	Evaluation of major thermofluid systems: HVACandR, power generation. Factors affecting design and selection of thermofluid devices: boilers, pumps and compressors, valves, piping systems, heat exchangers, evaporators, and turbines. Effect of device characteristics on process efficiency. Application of optimization techniques to thermofluid systems. (Prerequisites: MECH-3212, MECH-3233, MECH-3228; and either MECH-3217 or MECH-3220.)	R - Basic knowledge on thermodynamics, heat transfer, fluid mechanics, design; familiar with software packages (Finite element analysis, computational fluid dynamics, MATLAB, etc). P - Previously taken or GA'd this course preferred	5.5
MECH-4250-01/ Gas Dynamics	Basic concepts and one-dimensional flow equations of gas dynamics. Emphasis on isentropic flows in variable area ducts as well as Fanno, Rayleigh and Isothermal flows in constant area ducts. Normal shock waves, their appearance in various flow types, their application in nozzles and diffusers. Oblique shock and Prandtl Meyer expansion waves. Considerations in compressible flow measurements.	R - Basic knowledge on thermodynamics, heat transfer, fluid mechanics. P - Previously taken or GA'd this course preferred.	0.5
MECH-4253-01/ Heating, Ventilation and Air Conditioning	Principles of environmental air quality and occupant comfort control. Psychrometric analysis of buildings as applied to common air distribution system designs. Current solar radiation estimation techniques and other energy transfer mechanisms; their application to cooling and heating load calculations. Analytical and numerical calculations. Computational tools.	R - Basic knowledge on thermodynamics, heat transfer, fluid mechanics. P - Previously taken or GA'd this course preferred.	2
MECH-4463-01/ Vehicle Dynamics	Classification and analysis of suspension types and geometry, powertrain layout, and ride quality. Tire modeling, stability, and numerical simulation of vehicle dynamics, including longitudinal and lateral vehicle response to driver inputs. Selected topics from industry experts.	P - Previously taken or GA'd this course preferred	2.5
MECH-4465-01/ Internal Combustion Engines	Mechanical design of vehicular internal combustion engines for different applications. Covers basic engine types and their operation from an energy conversion systems viewpoint, where the system needs to satisfy a number of requirements. These performance and operational requirements are derived from basic thermodynamics, operation of heat engine cycles, ignition and combustion processes, fuel system design, heat transfer, emissions formulation, available instrumentation and testing procedures. Environmental impact of vehicular designs on global pollution and government standards. Recent developments in energy-efficient and alternate fuel engines.	R - Must have experience with internal combustion engine operation, performance, and design. P - Prior successful completion of, or previously GA appointment for, MECH-4465 is significant asset	0.5
MECH-4471-01/ Automotive Materials and manufacturing methods	The objective of this course is to introduce both the metallic and non-metallic materials employed in automobiles. The metallic automotive materials are comprised of ferrous and nonferrous alloys. Although the traditional ferrous alloys – cast irons and steels are still present in automobiles, the advanced high strength ferrous alloys are emerging. The nonferrous alloys – aluminum and magnesium-based light alloys are increasingly used in the auto industry. Polymers as the non-metallic lightweight materials are widely employed in automobiles. The content to be covered ranges from the production of introduced automotive materials to their recent development. To understand the rationale for the usage of various automotive materials, the advantages of their manufacturability and properties are discussed. Various manufacturing processes corresponding to specific automotive materials are highlighted. The mechanical properties and microstructure of automotive materials are reviewed. The implementation of automotive materials in automobiles is presented. Upon the completion of this course, students are expected to understand basic principles of manufacturing, and advantages and	P - Previously taken or GA'd this course preferred	0.5

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	disadvantages of introduced automotive materials over other materials in terms of performance and weight saving. The course also trains students in obtaining knowledge of advanced manufacturing processes, and structure characterization and property evaluation as well as component design of various automotive materials.		
MECH-4670-01/ Aerospace propulsion	Application of gas dynamics and thermodynamics to aerospace engines. Analysis of engine cycles. Theory and design of propellers; turboprop engine analysis, Internal combustion and gas turbine engines. Component design for compressors, combustors, afterburners, exhaust nozzles.	R - Experience with air-breathing and/or rocket propulsion modelling, analysis, and design. P - Previous experience GAing this course is an asset	0.5
MECH-4673-01/ Aerospace Structures	Parts of an airplane, their function and loads transfer between major structural elements; airframe loads; trusses in aerospace applications and stress analysis of truss structures; airframe as a thin-walled stiffened beam: bending of thin-walled beams, shear of thin-walled beams, torsion of thin-walled beams, structural idealization of airframe; stress analysis of wing spars and box beams; stress analysis of fuselages; stress analysis of wings.	R - strong knowledge of solid mechanics required; P - previously taken/GA'd this course preferred	0.5
MECH-8000-01/ Materials and Manufacturing Methods	MENG-AUTO - This course will present the Mechanisms associated with elastic, plastic, and creep behavior of materials and models for material deformation. Mechanical testing of materials to assess basic material properties will be presented. Materials selection for automotive applications will be thoroughly discussed focusing on (i) design analyses for material selection, (ii) mechanical properties of engineering materials (applicable to automotive applications, including metallic, polymeric and composite materials), (iii) processing methods of engineering materials and treatment of such materials. Analytical and numerical modeling of automotive materials during processing and in field conditions will also be extensively discussed in this course.	P - Previously taken or GA'd this course preferred	1.5
MECH-8000-03/ Hybrid Power Train	MENG-AUTO - Environmental concerns due to fossil fuel combustion and an alarming depletion of fossil fuel reserves are the two primary reasons that have encouraged the development of hybrid electric vehicles (HEVs). HEVs typically integrate an internal combustion engine with an electric motor and a power source to significantly reduce fuel consumption and harmful emissions, partly due to their regenerative capability which can provide a 20% improvement in fuel efficiency. The present commercial success of HEVs due to these advantages is a strong indicator that HEVs are here to stay. The high---voltage electrical system in HEVs plays an important role on the efficiency and performance of these vehicles. The hybrid vehicle electric power system consists of an electric motor, a power electronic converter driven by a control algorithm and a source of electrical energy.	P - Previously taken or GA'd this course preferred	0.5
MECH-8000-05/ Controls of Electric Vehicle	MENG-AUTO - This course covers the principals of Battery Management Systems (BMS) for monitoring, diagnosis, and control of batteries in Hybrid Electric Vehicles (HEVs) and Battery Electric Vehicles (BEVs). The course is targeted towards systems engineers, research scientists, and academics who want to gain a fundamental understanding of battery modeling, analysis, state of charge, and state of health estimation. Topics include introduction to battery systems, battery equivalent circuit-based modeling, battery electrochemical modeling, cell balancing, thermal management, state of charge, and state of health estimation. Concepts such as parameters estimation, system identification, optimization, filtering,	P - Previously taken or GA'd this course preferred	0.5

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	and control theory will be applied to battery systems. The techniques covered in this course are mostly related to Li-ion cells and packs as used in automotive applications. These can however also be applied to other battery chemistries		
MECH-8011-01/ Bluff Body Aerodynamics	MENG-AUTO - Atmospheric boundary layers. Flow around bluff bodies, separation and wakes. Lift and drag, pressure and force coefficients. Streamlined bodies, bluff bodies. Flow over flat plates and walls, rectangular prismatic shapes, circular cylinders. Fluctuating forces and pressures on bluff bodies. Wind tunnel testing, similarity requirements, wind tunnel techniques. Vehicle aerodynamics, drag and lift of passenger cars, cross wind stability, wind tunnel and road testing. Architectural aerodynamics, design wind speed, flow in and around building, wind-induced response of low-rise buildings, tall buildings, and large roof and sports stadium. Aerodynamics of Wind Turbines.	R - Knowledge in the STARCCM+ required. Background in fluid mechanics and CFD P - Previously taken or GA'd this course preferred	1
MECH-8025-01/ Automotive Application for Noise Vibration & Harness evaluation	MENG-AUTO - This course introduces the automotive applications and tools for the evaluation of noise, vibration and harshness. It includes reviews of measurement techniques presently used in the automotive industry to measure various aspects of noise, including the concept of sound quality, vibration and the quantification of the term harshness. The course consists of a review of papers which are to be presented to the class. Participants perform critical reviews on the presentations. Course evaluation is based on weekly reports, presentations of reviews of papers and critical reviews by participants	Previously taken an undergraduate noise course or equivalent graduate noise class preferred. Experience with sound acquisition equipment is essential. background in fluid mechanics and CFD	1.5
MECH-8030-01/ Fundamentals of Automotive Engineering	MENG-AUTO - Overview of primary automotive systems. Engine types and configurations, combustion, emission control, vehicle performance. Powertrain, suspension, frame and chassis. Materials and fabrication issues. Engine and vehicle dissection laboratory. Identification of industry issues and trends.	R - Must have hands on experience with internal combustion engines, including their disassembly. Basic understanding and knowledge of all major systems in automotive engineering, including ICEs, electric propulsion, manual/automatic transmissions, steering, suspension, brakes, body, and chassis. P - Previously taken MECH-8030 or MECH-3430, or GA'd either course in the past.	2
MECH-8067-01/ Vehicle Thermal Management	MENG-AUTO - A study of controlled passenger compartment environment, and automotive thermal management hardware: radiator, heater core, air-conditioning components. Topics include the thermal comfort model of occupants in a vehicle, determination of heating and cooling loads, the practical application of refrigeration in automotive air---conditioning followed by design of equipment and HVAC system, description and design of engine cooling system.	Previously taken MECH-4467 or GA'd Thermal Management course preferred and/or Thermal Fluid Major	1
MECH-8240-01/ Applied Finite Element Analysis	This course focuses on the modeling aspects of the finite element method using three well known commercial Finite Element Analysis (FEA) software packages known as DYNA, IDEAS and ANSYS. A variety of stress analysis problems in two and three dimensions are studied and the accuracy of the simulations are assessed through comparison with available theoretical and experimental results. Both static and dynamic situations are covered. The students are expected to prepare a final report summarizing their work and an oral presentation	P - Previously taken or GA'd the course	0.5

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MECH-8290-02/ Advanced Energy Systems	This course focuses on current energy conversion technologies with focus on the tools used for design and evaluation of system performance. The approach used focuses on first and second laws of thermodynamics. Hence, students will learn to determine the availability and irreversibility through thermodynamic analysis. The essential idea is that all energy resources have the potential to do work by virtue of being out of equilibrium with the environment. Students will apply first law of thermodynamics to calculate the maximum possible work that can be extracted from a resource, and to identify the location in a complex energy system that work potential is destroyed by irreversibilities. COMSOL Multiphysics will be presented and used to simulate energy flows and identify irreversibilities.	P - Previously taken or GA'd the course	0.5
MECH-8290-04/ Air Conditioning	This course discusses the principles of environmental air quality and occupant comfort control, Psychrometric analysis of buildings as applied to common air distribution system designs, solar radiation estimation techniques and other energy transfer mechanisms, and their application to cooling and heating load calculations.	R - Must be familiar with "OpenStudio" software. P - Previously taken or GA'd the course	0.5
MECH-8290-17/ Additive Manufacturing	3D Printing, or additive manufacturing (AM), has captured the world's imagination. Complex component designs in the aerospace and medical industries, jewelry designs, fashion, archeological artifact reconstructions have all shown to be exciting growth areas for AM solutions. However, it is perceived that intricate designs can be 'done in one' using a one-button fabrication process, but the reality is not so optimistic. This course will introduce you to the AM process family, the workflow, materials, and system infrastructure requirements. Design for Additive Manufacturing and process planning elements will be covered. This course is designed to introduce several AM processes, providing a basic scientific understanding of the possibilities and limitations. Students will be exposed to several slicer software tools. Students should have CAD skills.	R - CAD skills, CURA / Slicr3r software skills, powder bed fusion & stereolithography experience, GD & T & some machining / manufacturing knowledge required. P - Knowledge of Insight / Prusa slicer software skills preferred. P - Previously taken or GA'd the course	0.5
MECH-8290-23/ Advanced Fluid Mechanics	This course provides a solid grounding in the principles of incompressible fluid mechanics for graduate students. The course covers advanced fluid mechanics topics and begins with review of the fundamental fluid mechanics conservation laws of mass, momentum (Navier-Stokes equations) and energy using tensorial (indicial) notations. The processes of how a fluid flow is modeled, the development of the basic equations of fluid mechanics, the simplification of these basic equations using appropriate assumptions, the establishment of proper boundary/initial conditions, and methods of reducing the resulting equations through judicious parameter scaling will be covered. The physical interpretation of the mathematical terms used in solutions to fluid mechanics problems applied to canonical flows, such as boundary layers, jets and wakes will be discussed. A brief introduction to turbulence, statistical representation of turbulence, turbulence spectra and Kolmogorov hypothesis are also planned. Various examples of analytical and numerical solutions to fluid problems will be analyzed as described in the current research literature. The course will provide an opportunity to review fluid mechanics fundamentals, to read research papers and build the necessary engineering intuition needed to practically employ effective numerical solution techniques	P - Previously taken or GA'd the course	0.5

Course # and Name	Course Description	R=Required / P=Preferred Skills	Projected # of GAs
MECH-8290-27/ Advanced Body Structure	MENG-AUTO - This course will focus on the fundamentals of automotive body structure design and analysis. Functional requirements for durability, NVH and crash safety will be translated to measurable structural design targets. Basic mechanics---based analysis procedures will be used to assess the body structure performance for global bending, torsion, modal frequency, and crashworthiness targets.	R - must have taken graduate course on finite element methods; familiar with HyperMesh and ABAQUS P - Previously taken or GA'd the course	1
MECH-8290-37/ Industrial Fluid Power	Fluid power encompasses most applications that use liquids or gases to transmit power in the form of mechanical work, pressure, and/or volume in a system. In this course, students will learn the benefits and limitations of fluid power, how to analyze fluid power components and circuits, and how to design and simulate fluid power circuits for applications.	P - Previously taken or GA'd the course	0.5
MECH-8290-38/ Optimization	Classical theory of optimization. Kuhn-Tucker conditions. Unconstrained optimization; gradient methods, conjugate gradient methods, variable metric methods, search techniques. Constrained optimization. Approximation methods, projection methods, reduced gradient methods; penalty function methods; computational algorithms. Recent advances in optimization. Use of computer software packages.	P - Previously taken or GA'd the course	0.5
MECH-8290-44/ Vehicle Dynamics	An introduction to the development of mathematical models of vehicle motion. Simple models that are suited for algebraic manipulation, allowing qualitative characterization of vehicle behaviors, and more complex models, intended for numerical simulation, for precise quantitative predictions will be covered using Altair MotionView® Software. The effects of linear vs nonlinear models will be discussed. The course begins with an introduction to tire modelling, and proceeds to cover longitudinal, lateral, and vertical dynamics. Vehicle accelerating performance, stability and ride quality will be discussed, along with vehicle response to driver and road inputs.	R - familiar with multibody dynamic concept P - Previously taken or GA'd the course, Mechanical Engineering background	0.5
MECH-8290-53/ Elements of Ocean & Subsea Engineering	Elements of Ocean and Subsea Engineering will examine the application of engineering principles to the ocean and subsea environments. An assortment of subsea devices and vehicles will be studied along with energy generating offshore structures and systems. While this course will concentrate on some technical design aspects and ocean engineering principles, the need for these devices, vehicles and systems for the exploration, exploitation, and security of a nation's oceanic resources and territory will also be emphasized, particularly with regard to the impact of rising sea levels, future global food security, and the shortcomings of subsea communication technologies. The engineering development of (a) national security systems, e.g., submarines, (b) underwater survey and measurement equipment, e.g., AUVs (autonomous underwater vehicles), (c) scientific and commercial submersibles, and (d) underwater and offshore energy enterprises, will be reviewed along with consideration of new systems such as gliders and drones.	R= Previously taken the course P - PhD student with previous experience as a Graduate Assistant is preferred.	1.5
MECH-8290-56/ Engineering Heritage: Industrial & Military	The central focus of this Special Topics/Directed Studies Course is the development of engineering heritage pathways, from ancient to modern technologies, together with the identification of the reasons - military, industrial, technical, mathematical, and societal - for such developments. The need to understand the heritage factors, so as to better cope with future engineering challenges, will be emphasized. In the first part of the course students will study particular technologies and, in	R= Previously taken the course P - PhD student with previous experience as a Graduate Assistant is preferred.	1.5

Course # and Name	Course Description	R=Required / P=Preferred Skills	Projected # of GAs
	the second part, individually or in groups, be directed to further research some of these technologies. Semester instructional time for both lectures and independent research will be 3 hours per week as per the course schedule, with 6-7 directly taught modules and 4-5 directed reading modules. This course is available to all graduate students, especially MEng, but also MASc, and PhD in the MAME programs, as allowed by their Departmental graduate program regulations. Graduate students from other Engineering Departments may register for this course if space is available and their specific program regulations allow. All students are encouraged to have completed the engineering graduate course GENG 8000 (or its equivalent) prior to taking this course.		
MECH-8290-79/ Practical CFD and Turbulence Modeling	**CFD fundamentals, principles, modelling procedures, meshing considerations and requirements, grid sensitivity analysis, boundary condition types and the user input for each boundary type including multiphase flows. Setting up of the physical properties of fluid, turbulence modelling (RANS, DES & LES), solution control parameters and discretization schemes. Guidelines for verification and validation of CFS simulation. Open source CFD solver OpenFOAM will also be briefly reviewed.**	**R - Knowledge in the OpenFOAM required. Background in fluid mechanics and CFD** **P - Previously taken or GA'd the course**	**0.5**
MECH-8290-88/ Mechanism Design in Catia v5	**The focus of the course is to design mechanisms which are common in mechanical engineering applications. In addition to creating simple animation modes of such mechanisms, the kinematic laws are incorporated to accommodate their real-life behaviour. The CAD tool used for such purposes is the well known Catia v5 commercial code widely employed in the automotive and aerospace sectors.**	**R - Good knowledge of CATIA is required or have taken MECH-4259.**	**0.5**

Refer to the timetable (www.uwindsor.ca/registrar/timetable-information) for class and exam hours and location.

Eligibility requirements:
GA appointments shall be offered in accordance with the criteria specified in Article 12:03 of the Collective Agreement. Note that the number of G.A. positions for each course is determined by the enrolment in the course, instructor requests and laboratory requirements. In addition, previous experience of applicants in courses posted will be taken into consideration. Students must maintain fulltime registration throughout the term and must be in good standing in the degree program in order to hold a Graduate Assistantship. Students who meet the Phase I tuition refund deadline are therefore not eligible to hold a GA. A full graduate assistantship requires an average of 10 hours per week for a maximum of 140 hours per semester. Refer to Articles 12, 13, and 14 of the Collective Agreement for eligibility details.

All Graduate Assistants must meet the specific requirements related to the duties listed with the course(s) above.

"With respect to those students who have applied for and been accepted for Assistantships, the Assistant will not be paid for any shortfall of hours at the end of their respective program, provided the University has satisfied its obligation to post available positions each term in writing and on the AAU website and to offer the minimum terms of support in accordance with Article 13:01 (a) & (b) and provided that the Assistant has applied in writing or via e-mail by the application deadline for each term until they have received the minimum terms of support in accordance with Article 13:01 (a) & (b)."

In pursuit of the University of Windsor's Employment Equity Plan, members from the designated groups (Women, Aboriginal Peoples, Visible Minorities, Persons with Disabilities, and Members of Sexual Minorities) are encouraged to apply.

Online applications, submitted through Qualtrics link - https://uwindsor.ca1.qualtrics.com/jfe/form/SV_cG6sTO2WLYh62tE

Ms. A. Haskell,
MAME Department, Room 2166 CEI

Deadline for completing the online application – 8:30am – Monday, November 13, 2023

Dr. Minaker
Head