Subject	Catalog	Long Title (100 char)	Weight	Descr
MME-Engineering	9511	BIOMECHANICS OF THE MUSCULOSKELETAL SYSTEM	0.50	The objective of this course is to apply some fundamental principles of engineering to the analysis of the human musculoskeletal system. Specifically, the field of biomechanics will be covered, with special interest in the study of the human limb and joint. This will include the study of load carried in bone, the soft tissue around joints (i.e. ligaments), and through the joint articulation. In addition, the replacement of joints with implants will be covered, with special interest in design of these systems. Computer-assisted surgery will also be covered. Joints studied will include the shoulder, elbow, hip and knee.
MME-Engineering	9514	CORROSION AND WEAR	0.50	This course aims at developing students¿ knowledge and understanding of corrosion principles, types of corrosion, corrosion protection, friction, lubrication and wear. Materials selection for corrosion and tribological applications.
MME-Engineering	9515	FLUID MACHINERY	0.50	This course will introduce various types of turbomachines. Student will develop the ability of using basic conservation laws to predict the performance of turbomachines and understand various factors influencing the design and performance of turbomachines.
MME-Engineering	9516	HVAC I	0.50	Climate control and comfort in modern buildings is a major design issue. Heating, ventilation and air conditioning (HVAC) systems help to control the climate, and keep occupants comfortable by regulating the temperature and air flow. This course aims to developing students¿ knowledge and understanding of the psychrometry of air conditioning processes, comfort and inside design conditions, climate and outside design conditions, heat gains from solar and other sources, and cooling and heating load calculations.
MME-Engineering	9517	HVAC II	0.50	This course is continuation of HVAC I, and it aims to developing students¿ knowledge and understanding of the design of air distribution components and systems, fan/pump sizing and selection; air quality and ventilation; hot water heating systems; steam heating systems; cooling equipment; heat generation and transfer equipment; building automation controls; and operation and maintenance.
MME-Engineering	9521	SYSTEMS AND CONTROL	0.50	The subject is intended to expose you to a number of types of control systems and to develop your ability to analyze and design them. Emphasis will be placed on application to mechanical systems and on the classical feedback control techniques which are still widely used in the industry. This will be followed by concepts in modern control theory. Finally, the design of feedback control systems in the z-domain will be treated so that implementation of controllers via digital computers may be understood.
MME-Engineering	9526	ADVANCED COMPUTER AIDED ENGINEERING: MANUFACTURING TECHNOLOGIES	0.50	This course is an introduction to modern computer aided manufacturing technologies. Topics include subtractive technologies, such as computer-numerically controlled (CNC) machining, as well as additive technologies used for rapid prototyping purposes.
MME-Engineering	9527	ADVANCED COMPUTER AIDED EENGINEERING: REVERSE ENGINEERING	0.50	This course is an introduction to the use of modern computer-aided design (CAD) techniques in generation of 3D digital models from physical objects. Topics include contact and non-contact data acquisition techniques, data type and exchange formats, and advanced visualization and surfacing techniques.
MME-Engineering	9550	SELECTED TOPICS IN MECHANICAL AND MATERIALS ENGINEERING	0.50	This course covers specialized content not represented in the regular curriculum. This course is mainly for MEng students.
MME-Engineering	9601	DESIGN AND MANUFACTURING	0.50	This course will focus on fundamental and advanced concepts, methods and practices of design and manufacturing of mechanical products. The course is delivered in three modules: 1) Product design and development, 2) Design and manufacture of machine elements, and 3) Manufacturing systems
MME-Engineering	9602	ENGINEERING MATERIALS	0.50	This course will focus on presenting fundamental and advanced concepts governing the microstructure of engineering materials and to relate these concepts to the resulting physical properties of engineering materials. The course is delivered in three modules: 1) Metals, 2) Ceramics and glasses, and 3) Polymers and composites. Each module begins with a review of concepts describing the atomic bonding and microstructure and relates the microstructure and the physical properties of the particular class of material. The students will then learn about manufacturing techniques affecting material properties, including material forming, post-processing heat treatments, and surface treatments. Each module culminates with selected case studies and/or analyses of detailed materials-related problems.
MME-Engineering	9603	SOLID MECHANICS	0.50	This course will focus on both basic fundamental aspects and advanced concepts of mechanics of materials. The course consists of four (4) units: (1) Stress/strain of mechanical structures in bending and torsion, and failure theories, plasticity; (2) Stresses in non-circular cross-sections, asymmetric bending, curved beams, and buckling; (3) Energy methods to analyze indeterminate structures, thin- and thick-walled pressure vessels; (4) Stress analysis in composite structures
MME-Engineering	9604	FLUID MECHANICS	0.50	The course is focused on basic fundamental aspects and advanced concepts in fluid mechanics. The course objective is to provide review of some fundamental topics from undergraduate curriculum that include conservation laws, dynamic similarity and introduction to boundary layer flows. The course then focuses on advanced topics that include detailed boundary layer analysis, jets, turbulence, aerodynamics, airfoils and compressible flows.
MME-Engineering	9605	PRODUCTION MANAGEMENT FOR ENGINEERS	0.50	This course examines traditional and modern (lean) production principles and practices adopted by world-class manufacturers as well as tools that are used to support and optimize manufacturing processes now and in the foreseeable future.
MME-Engineering	9606	ROBOTICS & MANUFACTURING AUTOMATION	0.50	An advanced course on modern robotics and manufacturing automation technologies and principles. Topics include automated production and assembly, data acquisition, actuators and drives, industrial robotics, machine vision, digital twinning, health monitoring, and machine learning for manufacturing optimization. Emphasis will be on the planning, design and implementation of automation systems and their advanced optimization. PLCs, robotic arms, analog/digital systems, machine vision, smart sensors, advanced digital twinning, and optimization algorithms will be used in the lab sessions.
MME-Engineering	9611	CONTINUUM MECHANICS	0.50	The objective of the course is to familiarize the student with the basic concepts of continuum mechanics, which are essential to engineering research and advanced specialized graduate courses in engineering.
MME-Engineering	9612	FINITE ELEMENT METHODS	0.50	This course has been developed for graduate students who come with goals, such as to gain knowledge to carry out research or upgrade skills to have better opportunities in the job marketplace. The variation al principles and detailed finite element methods for the stress analysis of structures and machine components are introduced. Students develop in-depth knowledge and understanding of the fundamental principles, computer implementation of the subject matter, applications of the knowledge attained to research as well as design environments. After the completion of this course, students shall be familiar with the fundamental theories of the FE Method and able to solve real life engineering problems using commercial software.
MME-Engineering	9613	ADVANCED FINITE ELEMENT MODELING	0.50	The emphasis of this Advanced Finite Element Modelling course is placed upon understanding the theories and advanced modelling techniques for developing high-quality, effective modelling analysis including structural analysis and/or advanced human body modelling. Hence, this course will delve into various theories of finite element analysis such as damping, hourglass, and eigen problem, as well as practicing hands-on exercises that can help to connect theories to real-world applications. In the end, the students will develop an understanding of the quality of modelling behind using the commonly used commercial/open-source software packages.
MME-Engineering	9614	APPLIED COMPUTATIONAL FLUID MECHANICS & HEAT TRANSFER	0.50	This course will introduce computational fluid dynamics (CFD) method and its applications. Students will develop the ability of using CFD method to predict fluid flow, heat transfer, and related processes.

MME-Engineering	9615	BIOMECHANICS OF HUMAN JOINT MOTION	0.50	Apply engineering concepts to human joint motion; especially the gait cycle. Examine various motion measurement methods, including practical applications and associated errors. Calculate external joint loads and understand inertial effects. Study the architecture and function of skeletal muscle; concepts of energy, work and power applied to joint motion.
MME-Engineering	9616	COMPOSITE MATERIALS	0.50	An introduction to microstructures and properties of composite materials.
MME-Engineering	9617	ENERGY CONVERSION	0.50	The basic technical and economic criteria for the design of efficient energy conversion systems are introduced. The principal traditional (steam, hydro and wind) as well as alternative (solar, Ballard) power systems are modeled. Strategies for increased energy efficient and environmentally friendly operation are developed. Design alternatives and selection criteria are studied based on long-term economic viability and overall energy management strategies.
MME-Engineering	9619	FUNDAMENTALS OF MICROELECTROMECHANICAL SYSTEMS AND NANOELECTROMECHANICAL SYSTEMS	0.50	This course will cover the fundamental basis of MEMS (Microelectromechanical Systems) and NEMS (Nanoelectromechanical Systems) including design, analysis, fabrication, testing, and applications.
MME-Engineering	9620	NANOMATERIALS AND NANOTECHNOLOGY	0.50	NanoMaterials are a key element of nanotechnology. The objective of this interdisciplinary course is to provide students with good understanding of the fundamentals and experimental approaches of the recent advancement in fabrication, properties and characterization of nanomaterials as well as their potential applications.
MME-Engineering	9621	COMPUTATIONAL METHODS	0.50	The objective of this course is to present some of the important methods and techniques used in the numerical analysis of certain types of mechanical engineering problems.
MME-Engineering	9622	ADVANCED KINEMATICS AND DYNAMICS	0.50	This course will build on the basic understanding of topics learnt in the fundamental courses in kinematics and dynamics, and provide an in-depth understanding of selected advanced topics in the area of three dimensional kinematics, three dimensional dynamics as well as flexible body dynamics. This course is intended to provide knowledge in the advanced topics and aid students in their research as well as in the application of the methods to mechanical systems in practice.
MME-Engineering	9623	THEORY AND PRACTICE OF PLASTICITY	0.50	To present the theories and observed phenomena that describe the plastic deformation of engineering materials (particularly metals). Plastic deformation will be considered from two perspectives: 1) a mathematical description based upon continuum mechanics and 2) a physical description based upon the motion of defects through a crystalline material.
MME-Engineering	9624	ACTUATOR PRINCIPLES, INTEGRATION AND CONTROL	0.50	This course focuses on actuators commonly used in mechatronic systems for the purpose of motion control. Students will learn the operation and characteristics of commonly used actuators; derive models of actuators for use in control design; select an appropriate mechanical and electric connection to the mechatronic system; and design a controller for the mechatronic system in the analog and digital domains.
MME-Engineering	9639	VISCOUS FLOW AND BOUNDARY LAYER	0.50	The objective of the course is to familiarize students with the fundamental concepts of viscous and boundary layer flows. Laminar solutions to the full governing equations and the Prandtl Boundary Layer Equations are investigated. Stability theories and the transition to turbulence are considered. Finally, the universal law of the wall is derived to understand turbulent boundary layers, and methods of numerically simulating turbulence are discussed.
MME-Engineering	9640	MEDICAL DEVICE DESIGN	0.50	Introduction to the design, development and operation of medical and assistive devices that can improve the quality of human life. Topics include: principles of medical device design; industry standards and government regulations; human factors engineering; biocompatibility of materials; medical implants; biosensors; and integrated lab-on-a-chip systems.
MME-Engineering	9641	THERMAL SYSTEMS ENGINEERING	0.50	To introduce fundamental theory, basic design criterion and performance evaluation of different thermal engineering systems including heat exchangers, refrigeration systems, internal combustion engines and renewable energy systems
MME-Engineering	9643	COMPOSITE PROCESSING	0.50	Manufacture of composite materials involves different processes according to combination of fiber and resin, composite structure and mechanical and physical properties of polymers. In this course, students will learn composite processing technologies through understanding of chemistry, rheology, mechanics, selection criteria and material behaviors.
MME-Engineering	9648	EXPERIMENTATION AND DATA ANALYSIS	0.50	The course is design to enhance knowledge and skills in research experimentation. It is divided into three sections. Through the lectures and assignments, each student will develop the knowledge and skills that will then lead to experiential learning through a hands-on course project.
MME-Engineering	9650	SPECIAL TOPICS IN MME	0.50	This course covers specialized content not represented in the regular curriculum.
MME-Engineering	9651	ADDITIVE MANUFACTURING	0.50	Additive manufacturing offers a new paradigm for product design, manufacturing, metallurgy, and functionality. This course provides graduate students with an in-depth understanding of additive manufacturing processes and applications. The course covers the fundamental aspects and recent developments in additive manufacturing including design for additive manufacturing, design and metallurgical benefits of additive manufacturing, additive manufacturing processes for polymers and metals, quality aspects in additive manufacturing, and future trend of additive manufacturing in industry.
MME-Engineering	9654	MECHATRONIC SYSTEMS ENGINEERING	0.50	As microcontrollers, sensors, and other electronic devices have become more accessible, and wireless communication technologies have become ubiquitous, mechatronic systems continue to increase in capability and find new applications. This course aims to provide students with the background required to design and implement mechatronic solutions to engineering design problems for consumer and research applications. Emphasis will be placed on an understanding of the operation, integration, and programming of modern embedded microcontrollers. Students will develop the knowledge and skills necessary to adopt an interdisciplinary approach to mechatronic system design through lectures and hands-on activities including laboratory assignments and a term project.
MME-Engineering	9655	IMPACT BIOMECHANICS	0.50	To develop a critical understanding of the fundamentals of impact biomechanics and acquire basic knowledge of how impact events are modeled through theoretical, physical, or mathematical models.Learn the mechanisms by which impact injuries (such as concussion) occur and learn the injury tolerance of body regions to impact loading. Become familiar with the theory behind methods and devices for prevention of impact-related injuries with particular focus on automotive accidents and sports-related injuries.
MME-Engineering	9656	DYNAMICAL SYSTEMS	0.50	This course examines the mathematical modelling and analysis of simple and complex systems that evolve over time. The fundamental principles of modelling dynamical systems (mechanical, electrical, fluidic, and biological) are reviewed and mathematical techniques for analyzing continuous and discrete time systems are introduced. Through the lectures, assignments, project and seminar, each student will develop the knowledge and skills necessary to apply systems engineering principles to a variety of applications
MME-Engineering	9657	ADVANCED KINEMATICS FOR BIOMECHANICS	0.50	Advanced kinematics applied to human motion. Euler and Cardan angles, helical axes and quaternions. Examination of applications and limitations.
MME-Engineering	9658	MICROMECHANICS OF PLASTICITY IN CRYSTALLINE SOLIDS	0.50	This course presents an analysis of plastic deformation in crystalline solids based upon consideration of the elastic strain around crystal defects.
MME-Engineering	9710	ADVANCED COMPUTATIONAL FLUID DYNAMICS	0.50	This course introduces students to the finite-volume method for solving the transport equations for energy and fluid motion. Students will develop a thorough working knowledge of this discretization technique through weekly lectures and by writing finite-volume computer codes to solve assigned problems.
MME-Engineering	9711	CONVECTION HEAT TRANSFER	0.50	This course is to provide the basis for the analysis and investigation of convection heat transfer. Emphasis is placed on understanding and applying fundamentals. Consideration is given to analytical and numerical models as well as experimental techniques as used in the research environment. Advanced topics will be covered to the level of technical publications. Knowledge of basic concepts in fluid mechanics and heat transfer is expected.

MME-Engineering	9713	HYDRODYNAMIC STABILITY	0.50	Fluid motions are difficult to predict as many forms of such motions are possible. Hydrodynamic stability permits to determine which forms are stable and to identify conditions when transitions between different forms occur. The course provides exposition to basic concepts of stability theory and illustrates these concepts using classical problems from fluid mechanics, e.g., laminar-turbulent transition, convective motions driven by heating, secondary motions induced by centrifugal affects, etc.
MME-Engineering	9715	MECHANISM AND THEORY OF TURBULENT FLOW	0.50	To provide an understanding of the underlying concepts concerning the nature of turbulence that are of relevance to engineering flow analysis.
MME-Engineering	9718	THEORY OF ELASTICITY	0.50	The mathematical theory of linear deformation of solids is considered.
MME-Engineering	9722	ENERGY MATERIALS AND SYSTEMS	0.50	Fuel cells are clean energy devices. This course aims at developing students' knowledge and understanding of various fuel cell systems. Strong emphasis will be put on fuel cell fundamentals including thermodynamics, electrode kinetics, transport issues, and fuel cell performance. These issues will be discussed in the context of operation of following systems Polymer Electrolyte Membrane (PEMFC), Direct Methanol (DMFC), Alkaline (AFC), Solid Oxide (SOFC), and Molten Carbonate (MCFC). Advanced Materials applications including nanomaterials in fuel cells will be discussed. Overview of the current fuel cell industry will be given. Also, we will add battery part for EVs
MME-Engineering	9726	ADVANCED NANOMATERIALS	0.50	Nanotechnology involves behavior and control of materials and processes at the Atomic and molecular levels. The understanding of structure and properties of nanomaterials is a key element for various applications of nanomaterials. The objective of this interdisciplinary course is to provide students with increased understanding of the advanced approaches of fabrication and characterization of nanomaterials as well as their novel and potential applications.
MME-Engineering	9729	OPTOMECHATRONIC SYSTEMS: TECHNIQUES AND APPLICATIONS	0.50	This course examines how optical, fiber optic and photonic technologies can be incorporated into a variety of products and processes to improve operational performance, enhance embedded control and enable innovative designs. Through the class lectures, laboratory assignments, seminar and term project, each student will develop the knowledge and skills necessary to adopt an interdisciplinary and integrated approach to product design.
MME-Engineering	9750	ADVANCED AND SPECIAL TOPICS IN MECHANICAL ENGINEERING	0.50	This course covers specialized content not represented in the regular curriculum. It will provide advanced knowledgebase on the specific research area.