Mechanical Engineering

MECHANICAL ENGINEERING 407
Modern Materials and Advanced Manufacturing Technologies.
This course focuses on the study of modern industrial materials and the process of developing creative solutions through conceptual analysis and synthesis on different advanced and automated manufacturing processes. The course will help students to learn the emerging topics in the material and manufacturing industries. The topics cover the study on today's popular industrial materials, material selections and industrial applications, and their related manufacturing techniques in US industry. Topics also include the introduction of quality control (QC) process that is important to the production with the high quality. The course has two class projects which will guide and help students to learn the ways of preparing for professional research and keep track of the latest technologies in modern materials, advanced and automated manufacturing processes. Pre-requisites: Engineering 111, Mechanical Engineering 223.
3 lecture hours; 3 semester hours

MECHANICAL ENGINEERING 410
Advanced Fluid Dynamics.
Advanced topics in applied fluid mechanics. Review of continuity, momentum, and energy equations for viscous, incompressible fluid; voracity and circulation concepts and theorems. Selected topics from the following areas: Complex potential, conformal mapping and applications. Airfoil and wing theory. Boundary layer theory; similarity solutions for laminar flows, integral techniques for turbulent flows. Compression and expansion waves in compressible flows; oblique shock waves, Prandtl-Meyer flow. Propagating waves and applications; shock tube, transients in duct systems. Pre-requisite: Undergraduate Fluid Mechanics, Mechanical Engineering 309.
3 lecture hours; 3 semester hours

MECHANICAL ENGINEERING 421
Computer Aided Engineering Design.
This course applies 3-D CAD system e.g., Pro E to industrial product and system design. These CAD systems are very practical and powerful 3-D CAD tools and they have been widely used in the industry. The first half of the class focuses on learning fundamentals of the 3-D system, its popular applications and its related techniques. The special topics of design concept are also included. The second half covers several practical projects. Students will combine the design techniques with the real project and use 3-D tools to design the product or part of industrial system. All projects will be presented by students in class. Pre-requisites: Engineering 111, Physics 111.
3 lecture hours; 3 semester hours

MECHANICAL ENGINEERING 422
Advanced Computer Aided Project Design.
This advanced course focuses on some hot and very practical topics in today's industrial design applications. Also, some useful knowledge, such as PLC (Program Logic Control), calculation and selection of industrial motors, fundamentals of automation, sensor technology, and selection of material on different industrial applications are included. Several more complicated projects in this class will help students learn how to manage the different engineering projects and understand all related design issues which will improve the future production and manufacturing process. Pro-E will be used as a 3-D CAD tool to design these advanced engineering projects. All projects should be presented by students in the class. Pre-requisites: Mechanical Engineering 421.
3 lecture hours; 3 semester hours

MECHANICAL ENGINEERING 423
Computer Aided Manufacturing (CAM) and NC Machining.
This course applies manufacturing and various numerical controlled software for designing computer-aided manufacturing and NC machining systems, processes and algorithms. This course is heavy in implementation of various manufacturing technologies and programming of NC machines. Pre-requisites: Engineering 111, Physics 111, Mechanical Engineering 421.
3 lecture hours; 3 semester hours

MECHANICAL ENGINEERING 424
Advanced CAM & Automation.
This course teaches students to simulate advanced manufacturing processes by learning high level functions in Pro-Engineer/Pro-Manufacturing software package. This course will cover the topics of some advanced and special manufacturing technologies, including laser cutting & welding, water jet cutting & cleaning, and plasma cutting & welding. Automation related topics will also be introduced, including the analysis and application of PLC control systems in manufacturing facilities and modern production systems. Several advanced and real projects will help students to be proficient in using this CAD/CAM package and learn more of US industrial & engineering knowledge through the instructor's lectures & guidance and also the students' self-motivated work.
3 lecture hours; 3 semester hours

MECHANICAL ENGINEERING 430
Design & Innovation.
The objective of this course is to convey a sense of Design and Innovation in the development of products. To accomplish this the class shall review a number of case studies and participate in the design of a project. In addition to the semester project we shall discuss a number of topics of concern to Design and Engineering through illustrated talks (slides/tapes) and when available with guest designers and engineers. Pre-requisites: Engineering 111, Engineering 300.
3 lecture hours; 3 semester hours

MECHANICAL ENGINEERING 440
Ergonomic Factors in Design.
This course introduces the student to the concepts of ergonomics. Ergonomics is the study of fitting the workplace and devises to the capabilities of the human worker. Students will have an understanding of the beginnings and evolution of the field of ergonomics. They will learn to recognize risk factors associated with repetitive stress disorders (e.g., carpal tunnel syndrome) and potential sprain/strain injuries as well as be familiar with the body areas affected. This

course covers principles of physiology and biomechanics and how they apply to workstation and tool design. Pre-requisites: Engineering 111.
3 lecture hours; 3 semester hours

MECHANICAL ENGINEERING 452
Advanced Vibrations.
Brief review of systems with one and two degrees of freedom. Rayleigh's method. Application of Lagrangian and matrix methods to discrete systems with many degrees of freedom; normal mode theory; vibrations of finite continua; solution methods and mathematical properties. Numerical and computer methods. Sensitivity analysis. Applications to machines and structures. Pre-requisites: Mechanical Engineering 315 or equivalent.
3 lecture hours; 3 semester hours

MECHANICAL ENGINEERING 453
Finite Element Methods in Mechanical Engineering.
Formulation of finite element characteristics using energy methods. Convergence criteria. Consistent load and mass matrices. In-plane and axisymmetric analysis using simple and higher-order triangular and quadrilateral elements. Finite element analysis of plate-bending problems. Isopara-metric concepts and formulation; applications to two-and three-dimensional stress analysis. Topics from the following areas will be chosen as time allows: buckling and vibration studies using discrete element techniques; finite element applications in fluid flow and heat transfer. Prerequisite: Mechanical Engineering 450 or permission of instructor. Pre-requisites: Basic Structural Mechanics, Math 214, Math 215, Engineering 111 or consent of instructor.
3 lecture hours; 3 semester hours

MECHANICAL ENGINEERING 454
Advanced Dynamics.
Orthogonal coordinate systems and their transformations. Particle kinematics in inertial and noninertial rotating coordinate systems. Dynamics of systems of particles and rigid bodies. Virtual work and generalized coordinates. Lagrange's equations and Hamilton's principle for holonomic and non-holonomic systems with applications. Lagrange multipliers. Prerequisites: Under-graduate Dynamics, Mathematics 301.
3 lecture hours; 3 semester hours

MECHANICAL ENGINEERING 456
Mechanics of Composite Materials.
Introduction to the mechanics of laminated filamentary composites. Prediction of stiffness and strength of laminated plates. Applications. Prerequisites: Undergraduate Strength of Materials, Mechanical Engineering 223.
3 lecture hours; 3 semester hours

MECHANICAL ENGINEERING 458
Fatigue and Fracture Mechanics.
Brittle fracture of structures, elastic stress analysis of cracked components, static and dynamic failures, plane stress and plane strain, elastic-plastic fracture mechanics, fatigue crack growth and life prediction under constant and variable amplitude loading, environmental effects. Term work is mainly design problems and is computer oriented. Pre-requisites: Undergraduate Strength of Materials, Mechanical Engineering 223.
3 lecture hours; 3 semester hours;
1 design semester hour

MECHANICAL ENGINEERING 463
Advanced Heat Transfer.
Topics in conduction, convection and radiation heat transfer. Numerical methods, phase change, boundary layer principles, gas and solar radiation, combined heat and mass transfer. Prerequisite: Mathematics 301, Physics 209, Mechanical Engineering 208.
3 lecture hours; 3 semester hours

MECHANICAL ENGINEERING 490
Intellectual Property and Technology.
This course is designed for graduate students who have an undergraduate degree in Engineering. Computer Science, Mathematics, Physics, Biology, Industrial Design, etc. Students need not have any familiarity with United States law but they must be prepared to read extensively under the instructor's guidance, statutes and cases decided by the Federal and State courts. Pre-requisites: Undergraduate degree in Engineering or Sciences.
3 lecture hours; 3 semester hours

MECHANICAL ENGINEERING 500
Graduate Co-op/Internship in Mechanical Engineering.
By arrangement.
1-3 semester hours

MECHANICAL ENGINEERING 503
Electronics Cooling.
This course is designed to help students understand the thermal challenges and demands of the electronics field. Fundamentals and physics of thermodynamics, heat transfer and fluid mechanics will be introduced and shown how to apply them to the design and testing of electronic hardware. The thermal characteristics and thermal failure modes of electronic components, and reliability prediction techniques will be reviewed. Numerical simulation and commercial CFD packages will be introduced for thermal analysis. Students will have a good understanding of the heat transfer and fluid mechanics principles affecting proper thermal management of electronic components and develop skills to identify potential thermal design problems and develop reliable, cost-effective solutions.
3 semester hours

MECHANICAL ENGINEERING 512
Computational Fluid Dynamics (CFD).
This course is intended as an introduction to the field of computational Fluid Dynamics. It will help students to develop practical skills in CFD and the use of commercial CFD packages, such as FLUENT. Students will apply these skills to relevant engineering applications and gain an appreciation of the limitations and advantages of CFD modeling.
3 semester hours

MECHANICAL ENGINEERING 570
Welding Engineering.
Welding is the most common method of joining materials and has been widely used in industries. This course is intended to provide knowledge of welding engineering and its application in developing and designing safe and durable welded structures.
3 semester hours

MECHANICAL ENGINEERING 571
Innovations and Product Development.
The goal of this course is to cover innovations and product development. Innovation is essential to gain competitive advantage with a wide range phenomenon relevant to all levels in different types of organizations. In introducing new products, a firm should focus mostly on the need to implement a Stage-Gate new product process. New product strategy, right resources and new product process should be in place. Pre-requisites: Engineering 111, Engineering 300.
3 semester hours

MECHANICAL ENGINEERING 572
Production Technology and Techniques.
This course is to introduce up-to-date technology, techniques and systems of the global manufacturing industry. American manufacturing situation would be analyzed and Japanese manufacturing success is also explored. Comprehensive ad readable description of manufacturing practice is researched. Pre-requisites: Engineering 111, Engineering 300.
3 semester hours

MECHANICAL ENGINEERING 573
Supply Chain Management.
The goal of this course is to cover not only high-level supply chain strategy and concepts, but also to give students a solid understanding of the analytical tools, to understand supply chain design, planning, and operation driven the performance of a firm. It also conveys how supply chain drivers used on a conceptual level during supply chain design and operation leading to performance improvement.
3 credits with 14 sessions

MECHANICAL ENGINEERING 574
Principles of Logistics.
This course presents materials management, logistics theory and concepts in today's manufacturing and commercial environments. It integrates all of the functional areas of the business as well as incorporating logistics into corporate operation. They are examined in light of how they interrelate with other functions for the firms. Pre-requisites: Engineering 111, Engineering 300.
3 semester hours

MECHANICAL ENGINEERING 575
Manufacturing Strategy.
This course provides the necessary strategic perspective for manufacturing managers' sights and sustaining manufacturing excellence in the competitive manufacturing environment. The strategic perspective of manufacturing forms that the approach places these issues within the rightful context. It emphasizes the essential requirement to link with other functions in order to determine the best strategies for the business as a whole.
3 lecture hours; 3 semester hours

MECHANICAL ENGINEERING 596
Master's Project.
1-3 semester hours

MECHANICAL ENGINEERING 597 A
Master's Project.
Lecture hours and topics to be arranged with Department Chair.
1 credit hour

MECHANICAL ENGINEERING 597 B
Master's Project.
Lecture hours and topics to be arranged with Department Chair.
2 credit hours

MECHANICAL ENGINEERING 597 C
Master's Project (completion).
Lecture hours and topics to be arranged with Department Chair.
1 credit hour

MECHANICAL ENGINEERING 598
Thesis in Mechanical Engineering.
Lecture hours, semester hours and topics to be arranged.
3-6 semester hours

MECHANICAL ENGINEERING 599
Independent Study in Mechanical Engineering.
Independent study of advanced topics in Mechanical Engineering and submission of project report as required. Problem assignment to be arranged with and approved by the Department Chair.
3 semester hours