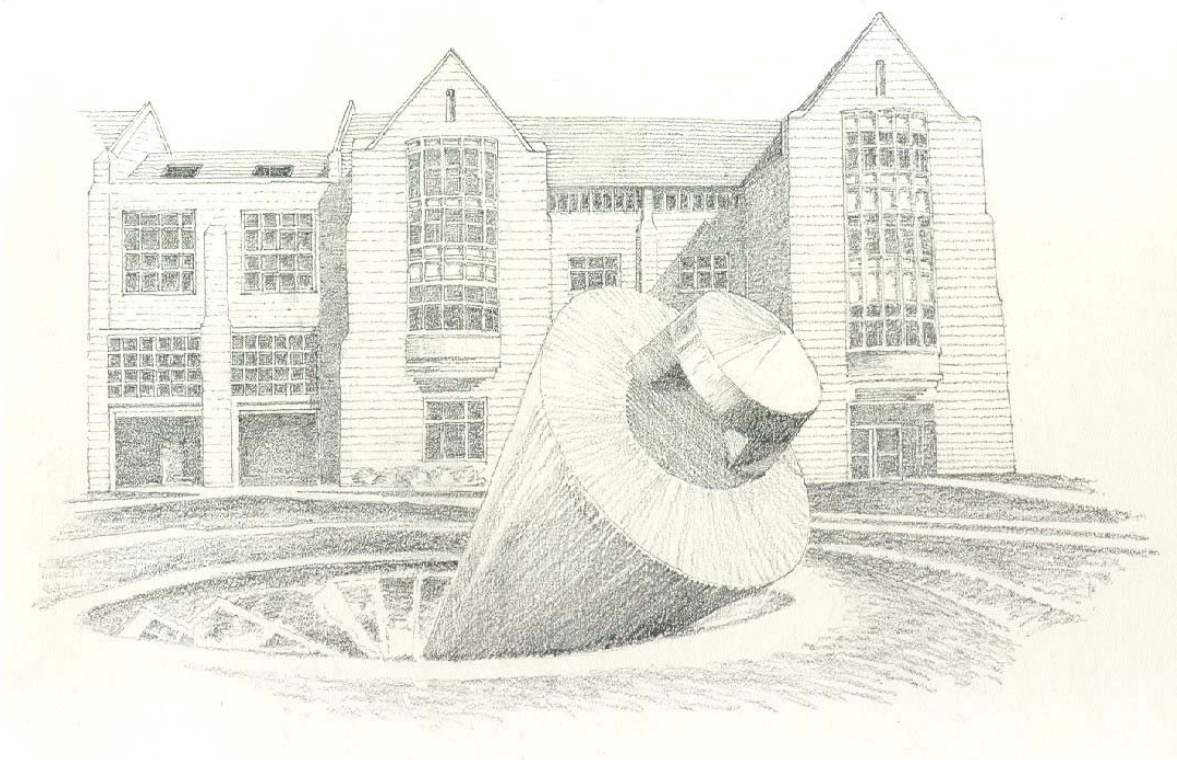


School of Engineering

Graduate Course Descriptions and Degree Plans for 2005-2006



UNIVERSITY
of ST. THOMAS
MINNESOTA

ETLS 501

Manufacturing Systems

A comprehensive review of modern production methods and systems for production and service industries. Topics include location and facility layout, job design and measurement, group technology, push/pull systems, process planning, forecasting, production and capacity planning, scheduling and manufacturing systems. The course also provides a brief review of FMC, FMS, CNC, DNC, and computer-integrated manufacturing.

ETLS 502

Manufacturing Processes

An overview of manufacturing processes with the objective of establishing the processes most appropriate to the characteristics and production requirements of the product. Metallurgy is briefly reviewed as a basis for material processing. Many conventional methods of fabrication are covered. Design for manufacturing and assembly techniques will be studied along with assembly methods and flow. Clean rooms and electronic assembly is also covered. Students unfamiliar with manufacturing processes will need to do independent study to determine all of the processes available.

ETLS 504

Excellence in Operations

An advanced course in concepts essential to achieving excellence in operations. The course covers the development and implementation of a coherent manufacturing strategy consistent with business and corporate strategies; importance of global competitiveness; and structuring of the production process based on the manufacturing mission. The human interaction involved in Current Quality Issues, Just-In-Time (JIT), Total Productive Maintenance (TPM), Set-up Time Reduction, Simultaneous Engineering, lean manufacturing and contemporary logistics systems, employee involvement and teamwork are key concepts of this course.

ETLS 505

Managerial Accounting and Performance Management

This course integrates the concepts of financial accounting, cost accounting and performance measurement as they are applied in the enterprise. The course emphasizes the concepts, terms, and techniques for using accounting and measurement information in planning, decision-making, and performance evaluation. Topics include analysis of financial statements, manufacturing and operations costs, fixed and variable costs, capital investment analysis, pricing, job and process cost systems, budgeting, responsibility accounting, cost allocation, and activity-based costing. Also covered are operational measures emphasizing physical units, process analysis, productivity measurement, and other non-accounting operational key indicator measurements. Consideration is also given to the influence of such concepts as Total Quality Management (TQM), Just-In-Time (JIT), Benchmarking, the Balanced Scorecard, Reengineering, Six Sigma, and Baldrige Awards as they relate to accounting and performance measurements.

ETLS 506

Statistical Methods for Manufacturing Quality

An introduction to the basic philosophy of the statistical tools used to assure manufacturing quality. Tools to include hypothesis testing, regression analysis, analysis of variance, process capability, control charts (SPC), and six sigma. Students will conduct and report an industrial based statistical application project.

ETLS 520

Design and Manufacturing in the Medical Device Industry

This course is designed to provide an introductory overview of the medical device industry, and its unique design and manufacturing challenges. The course first examines the industry itself, reviewing basic industry statistics, current trends, and the many types of products that make up the medical device industry. It then helps students understand the fundamental systems that are used in the design, development and manufacture of medical devices and how these relate to regulations governing the development and manufacturing processes. Finally, the course explores in detail some of the unique aspects of manufacturing a medical product such as special material and process selection considerations, clean rooms, sterile packaging, sterilization processes, clinical testing, lot traceability and manufacturing control

ETLS 550, 650, 850

Leveraging Leadership for a Lifetime I, II, III

This series of three one-credit courses is a requirement for a graduate student in the Master of Science in Technology Management program. The series, which wraps the entire program, aims to provide the student with an ongoing close look at oneself as a learner, a leader and the person in charge of his/her life-long plan. The series intends to answer the question, "How do I get the *best possible* results for my life goals in this graduate program?" It includes self-assessment in a number of differing arenas (see list below), providing a roadmap for learning actions throughout the graduate program. Key outcomes include: a more comprehensive self-understanding and awareness of values, learning and leading styles, personality characteristics and social/ethic responsibilities; a defined learning contract for the 3-5 year graduate program that will help shape a life-long learning plan; a defined leadership agenda that maximizes application of all graduate learning in the workplace and in life; and a portfolio demonstrating learning accomplishments throughout the program.

This series of courses are intentionally staged throughout the graduate process: I at the onset of the program, II at mid-point, and III at the finish. These provides a wrapping for a more intentional and deliberate focus on the learning process itself, stimulating innovation, courage and passion. In turn, this develops critical self-awareness and responsibility for learning while defining key leadership actions and applications. Throughout the series, methods to accomplish the objectives include written papers, group presentations, and feedback from others in the students' personal/professional settings, assessment tools and experiential learning methods.

SPECIFIC ASSESSMENT TOOLS (to be used across the series of courses):

- Myers Briggs Type Indicator (MBTI) preference and its use in learning/leading
- Campbell Leadership Index (measures personal characteristics that are directly related to the nature and demands of leadership)
- Life Review Questionnaire (self assessment of ten learning/life dimensions)
- Emotional Intelligence (measures the style of learning, interacting with others as well as actual capacity)
- Self Rating of MSTM Learning Objectives and Competency Levels

ETLS 550

Leveraging Leadership for a Lifetime I (Offered as the initial course within the MSTM graduate program)

This course provides a comprehensive orientation to the newly accepted student in the MSTM program as well as launching the learning process for the upcoming three to five years. The student will build a base-line assessment of his/her competencies, values, learning style, leadership aptitude and personal/professional talents; build understanding of the graduate program's mission, vision and values and its "fit" with participant's values; identify key communication competencies that need strengthening; shape a learning plan that will serve as her/his contract for the next 3-5 years of professional life (graduate program, work, community, etc.); develop learning action steps that involve key stakeholders in their communities and be assigned to a peer group that will serve as a support vehicle for applications of the learning process. Expectations for the learning process will be identified; tools for student evaluation of program outcomes selected; portfolio design/development will be outlined; and critical communications tools/methods will be examined.

ETLS 551

Strategic Quality Management

Strategic quality management is presented as a Driver → System → Results model.

The DSR model provides a framework for better understanding your business and when and where to take action to improve results. The model is a tool that links company mission, strategic plans, competitive positioning, and customer focus as the **Driver**. People and processes form the **System** that actually designs, produces, and delivers products and services. **Results** include Financial, Customer, Employee and Process. This course also connects the DSR model with the Malcolm Baldrige Criteria for Performance Excellence, Six Sigma and lean improvement tools, ISO9000, and Quality Management Systems and tools such as Statistical Process Control (detailed training in tools such as SPC is not part of the class). In addition to developing an understanding of how to guide and manage quality strategically, the course also helps to identify and prioritize the "right questions to ask" to guide and manage tactically. Applying the course to real world situations should lead to improved results – Financial, Customer, Employee and Process.

ETLS 552

Supply Chain Synchronization

This applications-oriented course will review key topics in supply chain management and integrate these topics with current management thinking in lean manufacturing and six sigma. A systems thinking approach that maps logistics, forecasting, warehousing, transportation, and information

systems will be combined with discussions of vendor and customer relationships, motivations, and ethics to work toward a smoothly functioning supply system. Students will use proven industrial engineering and management principles, techniques and tools to design a supply chain for their industry, efficiently and effectively plan and lay out manufacturing operations, and improve processes to eliminate waste.

ETLS 570

Purchasing, Logistics and Distribution

An introduction to the operations aspects of logistics combined with an overview of Supply Chain Management. Topics will include purchasing, vendor relations, inventory strategies and control, warehousing, material handling, packaging, and transportation, combined under supply chain management philosophy. The course will be taught through lectures, problem sets, case studies, guest speakers, and a tour of a high volume order fulfillment facility.

Prerequisite: ETLS 505 Managerial Accounting and Performance Management is recommended but not required.

ETLS 571

Automation Systems in the US and Overseas

This course provides an examination of automation and the processes and systems in which it works. The course focuses on electronic, electromechanical, and mechanical manufacturing and also touches on highly automated molding and its tooling. Topics include flexible and hard automation within a variety of systems environments. The course moves from automation basics to designing for automation followed by a hard look at the processes such as group technology, sensors, and systems that allow for and improve automation. The course consists of lectures, guest speakers, videos, and visits to factories and laboratories.

ETLS 600

Designing Corrective and Preventive Action Systems (CAPA)

Practical and statistical engineering methods to improve quality, reliability and design improvements in a manufacturing environment are reviewed. The closed loop systems dynamics framework is used for developing robust design of a preventive and corrective action system. Topics include: systems thinking, simultaneous design, enhanced product realization, quality philosophies and quality standards, product/process design, statistical process control, process variability, process reliability, process capability and acceptance sampling. Practical exposure includes work on industry problems and case studies from different types of manufacturing industries to reinforce the concepts/principles applied in developing robust quality control systems. Plant tour(s) will be planned. Leading experts in the field will be invited as guest speakers.

Prerequisite: ETLS 506 Statistical Methods for Manufacturing Quality

ETLS 601

Program/Project/Team Management

Focusing on the applications of project management, students gain insight and understanding of the day-to-day activities of project management (including cost analysis and scheduling techniques) and exposure to software options. A significant portion of the course focuses on conflict resolution, time management, leadership, and other personnel-related topics with the goal that engineers might effectively carry out the requirements of their companies without paying a penalty in lost good will or personnel.

ETLS 602

Management Science

On one-level management science is set of tools based on mathematical models of business actions such as allocating resources, planning production, scheduling work, and managing inventory. On another level it is computer software that implements these models and converts business data into useful solutions. At a higher level management science is a philosophy of observation and analysis of business systems with the goal of minimizing costs and maximizing resource utilization and profit. This course will look at all three levels with emphasis on generating computer solutions and interpreting and implementing results.

Prerequisites are: ETLS 504 Excellence in Operations (MMSE 510) and ETLS 506 Statistical Methods for Manufacturing Quality (MMSE 615).

ETLS 650

Leveraging Leadership for a Lifetime II

Offered at mid-point—after the student has completed 5-8 courses in the MSTM program)

This course, through a variety of methods, assesses progress with the learning process, re-evaluates growth in key leadership dimensions, and identifies critical success factors to date. As a result of the renewed assessment profile, the student will: modify learning action steps as needed; build broader and deeper understanding of team effectiveness, workplace applications of learning to date; and development of leadership competencies; share presentations and writings with peers, seeking feedback and demonstration of newly developed competencies; deepen his/her understanding of the impact of the global environment on technology strategy; and develop competencies with social and ethical responsibilities. Portfolio design and development will be evaluated; communications skills enhanced and a beginning leadership agenda will be shaped.

Prerequisite is: ETLS 550 Leveraging Leadership for a Lifetime I

ETLS 670

Masterful Leaders and Leadership

This course challenges the learner to make a fundamental decision to refocus their minds in a leadership way of thinking which is about personal maturity and its impact on the bottom line. The focus is on emotional intelligence, culture, and leadership greatness.

ETLS 671

Human Aspects of Technical Management

Managers use written, oral and non-verbal communication to accomplish many purposes. This course teaches the student techniques and practice skills for targeting your audience, coaching and supporting employees, interviewing, salesmanship, performance management, personnel selection and employee development, conflict management, running meetings, problem solving and decision making, teamwork, networking and customer and vendor relationships.

ETLS 672

Excellence in Product Design

This course focuses on the key elements which define “excellence in product design.” The underlying constituent criteria for design excellence are explored in depth. The role of the industrial designer will be explored. Examples of good and

bad design will be considered. Industry experts with experience in industrial design and product design will serve as guest lecturers in a format designed to stimulate a high level of interaction and discussion. Each student will, through class discussion, reading, tours, presentations, personal research and book reviews, approach what “design excellence” means for him/herself.

ETLS 673

Enhanced Product Realization

Quality and productivity are only the price of admission for competing in the new millennium. Success increasingly depends on how quickly a company can develop new products. In today’s marketplace, months of delay often translate into millions of dollars of lost profits and the pace will only increase. Various techniques have been used by leading companies to dramatically accelerate development projects. This course will provide tips and techniques in all areas from setting product strategy to team selection, from product architecture to progress reporting. Various techniques and approaches used for the development process from planning a product to shipping it will be reviewed including approaches which work and which don’t. A few of these techniques are: QFD, activity based management, virtual prototyping, concurrent engineering, and innovation. Systems thinking, supply chain management and internet based collaboration will provide the basic framework. Collaborative tools currently being pilot tested will also be reviewed. Leading experts in the field will be invited as guest speakers.

ETLS 674

Managing for Improved Profitability

This course covers both the strategic and tactical aspects of improved profitability by analyzing historical cases and real-world examples of both industrial success and failure. Successful and unsuccessful strategies and tactics are then contrasted to provide useful insights in strategic and tactical performance management. Measurements are examined to demonstrate how measures related to strategies and critical success factors can be used to improve performance. Techniques such as activity-based management, lean operations, re-engineering, function and process analysis, just-in-time, constraint theory, team management, six sigma TQM, flexible manufacturing and capacity planning are studied for applications to performance improvement and cost management situations. Subject or topic matter experts are used as guest-lecturers to point out lessons to be learned in the practical implementation of performance improvement initiatives. Class members are expected to prepare a methodology and plan of implementation for at least one performance improvement initiative.

Prerequisite: ETLS 505 Managerial Accounting & Performance Management

ETLS 677

Sustainable Development Strategies

Students will demonstrate an understanding of the many environmental and social equity issues and solutions faced by business. They will be given the tools such as, life cycle management, eco-efficiency, and design for environment, etc., to propose solutions related to sustainable development for these issues. Students will learn about environmental controls, regulations, waste management issues, etc. and how they can be addressed. Through required outside reading, they will see both an industrial and environmental perspective of sustainable development. This course will contain technical information and calculations necessary for industry to evaluate energy

alternatives, product impacts, design alternatives, and environmental control options as well as financial impact.

ETLS 682

Safety, Health and Environmental Considerations in Manufacturing

This course focuses on some of the safety, health, and environment factors that influence manufacturing. Emphasis is placed on developing a practical working knowledge of these issues. Program development and management as well as the roles of regulatory agencies and the judicial system will be examined.

ETLS 699

Selected Topics

Manufacturing and leadership topics will be presented in a seminar format. (This course may be repeated for credit.)

ETLS 701

Design of Experiments

This course provides the student with a set of skills to improve products and processes already in manufacturing as well as to develop products and processes in the development stages. The definition of DOE promoted is “a tool to assist in the process of understanding a system.” There will be discussion of how DOE fits into the overall product lifecycle and where it applies in the area of testing. Tools covered include full and fractional factorials, central composite, Box-Behnken, Taguchi, Evolutionary Operation and the method of steepest ascent. Theoretical statistics understanding is assumed prior the course. A standard, simple process will be presented which allows for improved communication and user confidence in using the tool set. The primary objective is to assist the student with implementing the skills learned during the course. This is an application-orientated course that includes case studies, team projects, student presentations and reports, guest lecturers and use of computational software. A quick statistical overview will be provided in the class as a refresher, but is not intended to cover the subjects in depth to students new to the subject. It is recommended students review all of the topics prior to starting the class.

Prerequisite: ETLS 506 Statistical Methods for Manufacturing Quality

ETLS 720

Anatomy and Physiology for Medical Devices

This course teaches fundamentals of anatomy and physiology for nerves, muscle, heart, blood vessels, gastrointestinal system, urinary tract, liver and hormones. A broad range of disease states and medical devices are introduced to help students better relate to the anatomic and physiologic information presented. Class experience also includes guest speakers, one site visit at a local hospital and student presentations about devices and medical conditions.

NOTE: Credit will not be given for both ETLS 720 and ETLS 730 Cardiovascular Anatomy, Physiology and Medical Devices

ETLS 721

Medical Device Regulatory Submissions

This course teaches the student about submissions for regulatory approval of medical devices. Topics include: medical device law, custom and research devices, significant and non-significant risk devices, FDA investigational device exemption, 510(k) substantial equivalence determination, pre-market approval, PMA supplements, third party review, combination devices European economic area CE mark, international harmonization, MDR, device tracking, post market surveillance, annual post approval reporting.

Depending upon the degree of class interest medical device submissions in Canada, Australia, and Japan may be covered.

ETLS 722

Medical Device Quality Systems

This class will focus on the different quality system requirements, from a regulatory viewpoint, for medical device manufacturers. The majority for the class time will be spent reviewing the FDA Quality Requirements and the European ISO 9000 Series requirements. There will also be some discussion regarding submissions required for approval of new products, and changes to products and/or manufacturing processes, especially in the context of changes to the quality systems that have been implemented. There will also be several classes on how to handle FDA inspections, and the ramification of non-compliance's discovered during inspections. Classroom methodology will be lectures with substantial student interaction encouraged. Students will be encouraged to share their experiences from their own companies regarding the subjects being discussed. Some portions of several of the classes will be presented by selected students, sharing what they have learned from small group interaction during class time.

ETLS 723

Biomaterials in the Design of Medical Devices

This course will develop the necessary background to understand the selection process of a material as needed in the design and development of medical devices. The students' knowledge of biomaterials will be increased and an appreciation for the relationships between a material's structure, its properties, and the implementation of properties to achieve a desired functionality will be developed. The goal is to present a balanced view suitable for students who do not have an extensive background in organic chemistry, biochemistry or materials science. The first half of the semester will concentrate on the properties of several classes of materials including metals and alloys, polymers, ceramics, composites and biological materials. Topics such as mechanical testing and regulatory matters will be included in the second half. The course will be applications oriented, with particular emphasis on orthopaedic and cardiovascular applications. Other current topics to be covered include tissue engineering, drug delivery systems, and biological materials testing.

Prerequisite: ETLS 771 Materials Engineering

ETLS 724

Medical Device Clinic Studies

This course teaches clinical study design, research hypotheses, statistical considerations, clinical study planning and execution. Students are trained to apply this information to include clinical studies that encompass a wide variety of clinical objectives: prototype evaluation, pivotal studies, FDA approval requirements, marketing claims, customer acceptance, reimbursement, etc. Other topics include data form design, databases, applicable U.S. and International Regulations and selected topics of interest.

ETLS 730

Cardiovascular Anatomy, Physiology and Medical Devices

Lectures and instructional materials will emphasize the anatomy and physiology of the heart and blood vessels. Topics in general, nerve and muscle physiology will also be presented, since they are important in understanding how the heart and cardiovascular systems functions. Many cardiovascular diseases and contemporary cardiovascular devices will be

covered during lectures and in student presentations. Guest speakers and a trip to a local Cardiac Catheterization Laboratory will complement the instruction materials.
Note: Credit will not be given for both ETLS 720 Anatomy and Physiology for Medical Devices and ETLS 730.

ETLS 740 Thermodynamics

A study of thermal and mechanical energy and their applications to technology. First law of thermodynamics (energy conservation); second law of thermodynamics (restrictions on energy transformations). Thermophysical properties of substances. Power producing devices and heat pumping devices. Humidity, dew point and other characteristics of non-reacting mixtures.

Prerequisites: Physics II and calculus

ETLS 741 Heat Transfer and Fluid Flow

Modes of heat transfer: convection, conduction and radiation. Coupling of convective heat transfer with fluid flow. Fundamentals of fluid flow: statics, boundary layers, pipe flows, pressure drop, and friction factor. Convective heat transfer at external surfaces and internal surfaces. Conduction in solids of various shapes; use of heat-conducting fins to improve performance of heat exchangers. Radiation heat transfer between surfaces.

Prerequisite: ETLS 740 Thermodynamics

ETLS 752 Technology Forecasting and Strategic Prospective

This course assists the student in developing a framework for understanding the technological environment and the process of technological change and in developing technological and strategic foresight.

Topics will include:

- Techniques for describing, monitoring and understanding trends and forces in the technological environment;
- An overview of the history of technological change and analysis of the relationship between technological change and forces in the economic, social, political and natural environments;
- Application of these concepts in the development and use of models for anticipating and planning for future technological and strategic change.

ETLS 770 Automated Control of Manufacturing Processes

An introduction to the key elements of control systems employed in manufacturing with examples from both batch and continuous-process applications. First, the fundamental theory of operation for closed loop (binary and analog) control systems is developed. Students will explore using PLCs to implement modern systems and become familiar with a PLC programming language. Second, the theory of operation and performance limits of sensors and actuators used in the industrial environment is explored. Some sensors to be considered measure position, speed, temperature, flow rate, level, and force. Some actuators to be considered include pumps, hydraulic and pneumatic cylinders, heaters, valves, stepping motors, and AC and DC motors. Future trends in control systems targeted for the manufacturing plant will be presented. Students will demonstrate their ability to automate a manufacturing cell and quantify the cost impact of the project on the manufacturing example chosen in a term paper.

Prerequisite: Instructor's permission for MS, Certificate, and MBA

ETLS 771 Materials Engineering

This course introduces the student to theory and application of engineering materials. While particular emphasis is placed on traditional structural materials, emerging materials technology is also discussed. Topics explore the physical and mechanical properties of metals, polymers, ceramics, and composite materials. Useful applications and limitations of those materials are presented, and means of modifying their properties are discussed at length. Guest speakers and industrial tours supplement traditional learning by exposing the student to practical materials application, processing and evaluation.

ETLS 772 Injection Molding, Die Casting, and Related Net Shape Processes

This course covers the creation of tooling for thermoplastic injection molding, die casting, blow molding, and other related net shape processes. In-depth coverage is given to mold design and process parameters. Part design issues related to these processes are investigated including material selection, part geometry, and cost estimating. Computer tools applicable to net shape manufacturing are also discussed including CAD, flow analysis, rapid prototyping systems, and expert systems.
Prerequisite: ETLS 502 Manufacturing Processes

ETLS 773 Principles of MEMS Design and Development

The field of Micro-Electro-Mechanical Systems (MEMS) refers to the design and manufacture of micron-scale devices which can ultimately be used to create both sensors and actuators that promise to be very small, very lightweight, very inexpensive, and very precise. By leveraging the mature state of semiconductor fabrication techniques within the integrated circuit industry, MEMS devices are beginning to emerge in the automotive, medical, aerospace, telecommunication and biotechnology industries. This course will investigate the entire process of developing a micro-sensor idea into a product. Along the way, topics of discussion will include picking an appropriate application of the MEMS technology, designing a MEMS device, MEMS fabrication and packaging techniques, the challenging aspects of characterizing MEMS devices, and the unique physical environment that exists at the micron scale. Other discussions will address the existing MEMS market, the future of MEMS and the difficulties associated with establishing a successful MEMS business. The course will be taught through real world examples of existing MEMS implementations, drawing on both the successes and failures of past efforts to paint a realistic view of this exciting yet challenging new technology.

Prerequisite: ETLS 771 Materials Engineering

ETLS 775 Polymers in Design

This course focuses on describing: what polymers are; how they are manufactured; why they behave the way they do; and how they are fabricated into structural objects-parts, fibers, films; how they can be compounded into alloys, reinforced composite structures, flexibilized toughened structures; how they are increasingly being used in functionally active roles-photopolymers as imaging elements in the printing and electronics industries, polymer membranes in separation processes, polymer fiber optics, photonic elements and optical discs. The presentation method is highly descriptive with frequent reference to commercial examples and attempts to avoid, to the degree compatible with qualitative understanding,

detailed excursions into underlying chemistry and rigorous mathematical physics.

Prerequisite: ETLS 771 Materials Engineering

ETLS 776

Advanced Engineering Materials

Provides a comprehensive overview of ceramic materials and processing with special emphasis on newer so-called advanced ceramics. Examples include aerospace materials, bioceramics, engine components, optical fibers, multilayer electronic substrates, and oxide superconductors. The goal is to familiarize students with the broad array of ceramic materials, their uses, advantages, and disadvantages. Important design and manufacturing issues will be discussed. Specific topics will include glass processing and properties, ceramic powder processing, advanced processing, composites, mechanical properties, electrical ceramics, traditional and advanced applications, and related background materials such as crystal structures and phase diagrams.

Prerequisite: ETLS 771 Materials Engineering

ETLS 777

Finite Element Analysis

This course teaches techniques which are needed to apply the finite element method to a wide array of engineering problems. The course will utilize the ANSYS FEA software for addressing problems in structural and thermal mechanics. The sole course assignment will be a major design project which will be based on real-world engineering application. The outcome of the design project will be a report of publishable quality.

ETLS 778

Process Design and Improvement – Computer Based Tools

An introductory graduate course covering various computer based tools such as EXCEL, VISIO, VBA, and ARENA to understand and improve business operating systems: manufacturing, service or a combination. Major emphasis will be on using these tools to document and analyze process design and/or improvement problems from students' work environments.

Prerequisite: Basic Knowledge of Statistics & Excel

ETLS 783

Practical Study and Training in Manufacturing (1 credit course)

A work oriented/internship opportunity to experience U.S. manufacturing techniques in a real-world setting for students who seek on the job manufacturing experience. May be taken three times for credit.

ETLS 785

Simulation of Logistics and Industrial Systems

This course covers current software and methodologies used to model and simulate manufacturing processes, logistics and industrial systems. After studying a leading simulation tool in detail, a term project requires each student to evaluate and demonstrate the potential role of computer simulation in his/her work environment.

Prerequisite: ETLS 501 Manufacturing Systems and ETLS 778 Process Design & Improvement: Computer Based Tools

ETLS 799

Selected Topics

Manufacturing and leadership topics will be presented. (This course may be repeated for credit.)

ETLS 808

Capstone Course

The Capstone Course is designed to provide the graduating student with a long-term perspective on progressive trends in industry. The course provides an integrative approach to the formulation and implementation of strategy and policy based on examples of successful and unsuccessful strategies. This course integrates the knowledge that students have acquired in other courses to develop a perspective of global business. It emphasizes organizational policy, company objectives, alternative strategic decision making, international planning and control.

Prerequisite: Completion of 33+ credits

ETLS 815

Leadership and Technology

This course is designed to offer students a framework from which to approach the following observations:

Technology mediates human connections,

Any new technology inherently carries leadership challenges and change dynamics,

Understanding and using specific analytical frames will offer ways to make sense out of the often contradictory nature of techno-effects. The purpose of this course is to provide each student both a "hand-on" feel for the mediating effects of technology, and a clear set of analytical frames from which they can make sense of their own technological challenges, both personal and institutional.

ETLS 840

Technology Transfer/Contemporary Problems

The rewards of technology transfer can be great, yet few have a comprehensive understanding of the subject. This course provides a broad understanding of the process of technology transfer including strategic fit, identification and selection of technology, licensing, structuring the transfer, and practical problems of implementation. The course is conducted in a seminar format, with experienced technology transfer guest speakers and hands-on use of the Internet and other resources for locating technology sources. Students will survey their companies, write a proposal for technology transfer, and develop a personal technology transfer network.

ETLS 841

Lean Six Sigma

Lean Six Sigma is a seminar course designed for combining Six Sigma Quality and Lean speed. Guest speakers will be utilized to develop knowledge of the inter-relationship of these two concepts and how to develop plans for product and process improvements in development, production operations as well as in service activities. Each student will create specific plans for their organizations using these concepts.

Prerequisites: Either ETLS 504 Excellence in Operations or ETLS 551 Strategic Quality Management.

ETLS 850

Leveraging Leadership for a Lifetime III (Offered at the conclusion of the student's program—after 13-14 courses have been completed)

This course aims to provide a capstone for the graduate learning experience, identifying key learning outcomes, measuring growth in all self-assessment areas and designing the life-long leadership and learning plans. As a result of the assessment at the completion of the program, the student will:

identify leadership intentions for his/her future, based on broad understanding of leadership style, competencies and character; share his/her portfolio of learning with the class, demonstrating how this will be used in his/her workplace applications; give a final presentation on their learning process and how this will fuel their leadership/learning plans for a life-time; develop a vision for their leadership stance/influence in 5-10 years; and finalize the metrics for measuring the Program Objectives.

ETLS 851

Enterprise Information Systems

This course examines the requirements and needs of companies and other organizations for operating information and, in particular, the capabilities of automated systems to manage, analyze and deliver this information. A review will be made of information system vendors that provide an integrated approach to information management including software features and equipment requirements. Systems that provide these features are typically referred to as Enterprise Resource Planning (ERP) or Enterprise Resource Management (ERM) systems. The process and techniques of assessing, designing, evaluating, selecting and implementing enterprise information systems in order to develop and establish a repeatable organization methodology for this process is actively studied and applied. The importance of process flow documentation and change management are studied in relation to successful enterprise information system implementation. Preparing requests for vendor proposals and analyzing vendor responses to choose a supplier are also studied. Topics include sales quotation and order processing, purchasing, manufacturing resource planning, shop floor control, inventory control, capacity planning, job shop and repetitive manufacturing, quality control, master scheduling, financial accounting and cost control, human resource management, logistics, engineering operations and E-commerce as they relate to automated information systems.

Prerequisite: ETLS 505 Managerial Accounting and Performance Management and ETLS 601 Program/Project/Team Management

ETLS 852

Technology Risk Management

The objective of this course is to help the student identify and understand elements of uncertainty in assessing business risks associated with technological and social change. The course focuses on examples from business ventures and from new products arising from changing market demands. Students will be required to prepare a risk assessment for an existing venture, new product or large engineering project and to describe ways risks can be managed to improve the chance of long term business success including a competitive return on invested capital.

ETLS 853

Introduction to Intellectual Property Law

An introduction to intellectual property concepts, focusing on patents, copyrights, trademarks, and trade secrets, and emphasizing their role in strategic planning.

ETLS 854

Management of Technology and Innovation

Introduction to the subject of organized technological innovation. A framework is presented which bridges the gap between engineering and management educational system and addresses the dynamics and structure of organizations concerned with technological innovation.

ETLS 855

Implementing Innovation

This course is designed as a seminar for students in the Engineering and Technology Management program. Its goals are to increase the students' ability to 1) think broadly like an executive, 2) build allies and supporters, 3) communicate with people from a broad range of backgrounds and 4) become a better communicator and advocate for getting acceptance of new technology in their company. The course focuses on learning that selling is a relationship-building process, and that we all sell - every day - if we are trying to change anything. Elements of the course include understanding buyer types and behavior, what motivates each, and how to work with each individually and in groups. The course employs a variety of methods including readings, workshop exercises, role-playing, presentations, individual practice and a company project.

Note: MMSE 840 Implementing Innovation is the new name of the MMSE 799 course, Technical Selling, taught Summer 2001 or Spring 2002. Credit will NOT be given twice

ETLS 858

Technology Capstone

The Capstone Course is designed to provide the graduating student with a long-term perspective on progressive trends in industry. The course provides an integrative approach to the formulation and implementation of strategy and policy based on examples of successful and unsuccessful strategies. This course integrates the knowledge that students have acquired in other courses to develop a perspective of global business. It emphasizes organizational policy, company objectives, alternative strategic decision making, international planning and control.

Prerequisite: Completion of 36+ credits

ETLS 880

Directed Studies

This course is a faculty-supervised project involving research into manufacturing methods, systems or procedures which relate to real-world manufacturing situations. A specific project and methodology, appropriate to the student's program of study, is chosen with the approval of a faculty member.

Prerequisite: Advisors consent

ETLS 881

Engineering Project Credits

Finalization of entire thesis/project and successful completion of the defense are required to attain these credits. Selection of a topic for the thesis/project is part of the Engineering Project/Thesis Seminar and is done in conjunction with your project/thesis advisor.

ENTR 703

New Venture Marketing

This course is designed to help students understand the requirements of a formal marketing plan, market potential, evaluation, niche identification and sequential distribution channels. The course focuses on the marketing knowledge necessary for new products and new ventures. Case analyses and visitors from industry add real-world experience. Students will be required to prepare a market entry strategy for their existing or potential new venture.

MGMT 706

GSB Great Books Seminar

The seminar is designed for those who are called upon to: create cohesion among dispersed business units; shape organizational culture and the decision-making process; conduct business in a global environment; encourage innovation, growth, and constant change; and manage

relationships with diverse audiences. The seminar addresses the higher-order aspects of leadership: beliefs, attitudes, values, and assumptions. By examining the philosophical and historical roots of core issues facing today's businesses and society, Seminar participants become better prepared to: listen and communicate; create strategic unity in decentralized organizations; understand the basic interests influencing diverse stakeholders; convey values; manage change and innovation; and act with integrity. The Socratic method is used whereby moderators encourage participants to share various interpretations of classic and contemporary readings from which a new collective understanding emerges that is much greater than what each individual would have derived from solitary reading.

Unique to the nation, this three-credit course uses selected writings of great classic and contemporary thinkers as the starting point for an intensive, focused discussion with peers. You'll discuss the enduring ideas and ideals of world civilization, the problems and opportunities of today and the issues to be faced in the years ahead. In a sense, the readings function as case studies in leadership and leadership values. Readings are arranged around such universal human concerns as justice, freedom, economic equity, community, leadership and democracy. Discussion and debate are spirited as students get to know one another in a retreat-like environment.

ADDITIONAL AREAS OF STUDY (Available through Independent Study)

Several courses have been dropped from active offering but can be studied individually through independent study. If you are interested in any of these courses, please contact Student Services.

- Manufacturing scheduling and industrial plant layout,
- Engineering economics
- Sustainable development for industry
- Ergonomics: physical and cognitive aspects
- Packaging engineering
- Responsible packaging
- Computer-aided design and computer-aided manufacturing
- Advanced sensors for manufacturing systems
- Assembly systems, design and evaluation.
- Introduction to Mechatronics
- Measurement for Quality

2005-2006 Degree Plans

M.M.S.E.

The Master of Manufacturing Systems Engineering degree requires 45 credits with an Engineering Project or requires 48 credits (all class work).

Required courses:

ETLS 501 Manufacturing Systems
 ETLS 504 Excellence in Operations
 ETLS 505 Managerial Acct. & Perf. Mgmt.
 ETLS 506 Stat. Methods for Manuf. Quality
 ETLS 601 Program/Project/Team Mgmt.
 ETLS 701 Design of Experiments
 ETLS 771 Materials Engineering
 ETLS 808 Capstone Course

Process, Assembly and Product Engr.

Select **ONE** of the following courses:

ETLS 672 Excellence in Product Design
 ETLS 770 Automated Control Mfg. Processes
 ETLS 777 Finite Element Analysis

Required (Choose one of the following options)

ETLS 881 Engineering Project Credits with completion of Engineering Project (45 credits)

OR

ETLS 777 Finite Element Analysis and One Additional Elective Course (48 credits)

Five Elective Courses*

M.S.M.S.

The Master of Science in Manufacturing Systems degree requires 42 credits or 14 three-credit courses. Seven core required courses; two track courses, and five electives

Required Courses:

ETLS 504 Excellence in Operations
 ETLS 505 Managerial Acct. & Perf. Mgmt.
 ETLS 506 Stat. Methods for Manuf. Quality
 ETLS 570 Purchasing, Logistics, & Dist.
 ETLS 671 Human Aspects of Tech. Mgmt.
 ETLS 808 Capstone Course

Take either course:

ETLS 701 Design of Experiments **OR**
 ETLS 841 Lean Six Sigma

Choose one of the following tracks:

Service Track

Work with your advisor to select two elective courses that closely relate to your industry

Manufacturing Track

ETLS 501 Manufacturing Systems
 ETLS 502 Manufacturing Processes

Five Elective Courses*

M.S.T.M.

The Master of Science in Technology Management degree requires 45 credits or 14 three-credit courses and three one-credit courses. There are 13 required courses and four electives.

Required Courses:

ETLS 505 Managerial Acct. & Perf. Mgmt.
 ETLS 551 Strategic Quality Management
 ETLS 552 Supply Chain Synchronization
 ETLS 601 Program/Project/Team Mgmt.
 ETLS 751 Technology Forecasting & Strategic Prospective
 ETLS 851 Enterprise Information Systems
 ETLS 852 Technology Risk Management
 ETLS 853 Intro. to Intellectual Property Law
 ETLS 858 Technology Management Capstone
 ENTR 703 New Venture Marketing

Leveraging Leadership for a Lifetime

(One credit course taken three times)

ETLS 550 LLL1 taken prior to or after first class
 ETLS 650 LLL2 taken after five to seven classes
 ETLS 850 LLL3 taken after twelve classes

Four Elective Courses*

* Elective courses may be from any graduate program (provided prerequisites are met), including: Engineering and Technology Management, College of Business, Graduate Programs in Software, and Graduate School of Education.

**Certificate Programs available through
The School of Engineering
2005-2006**



Certificate programs include: Medical Device, Quality, Product Development, Manufacturing Leadership and Manufacturing Systems. Each certificate is five courses and earns transcript credit and a certificate of completion. The courses can be used at a later time toward a master's degree. Certificate programs are for the degreed individual who wishes to obtain knowledge in an area but doesn't wish to pursue a degree at this time.

To apply: complete an application, send a one-time non-refundable \$30.00 application fee, enclose a resume outlining educational background, work experience and professional affiliations, a short statement of your goals for taking the program and a copy of your transcript showing degree. If you have any questions or would like an application and course schedule sent, please call 651-962-5756.

Students may select elective courses from any offered by any St. Thomas graduate program with approval of advisor.

Quality Certificate: (total of 5 courses required)

- Required: ETLS 506 Statistical methods for manufacturing quality
ETLS 551 Strategic quality management
ETLS 841 Lean Six Sigma
- Suggested Elective Courses
ETLS 504 Excellence in operations
ETLS 600 Designing corrective and preventive action (CAPA) systems
ETLS 672 Excellence in product design
ETLS 701 Design of experiments

Product Development Certificate: (total of five courses required)

- Required: ETLS 506 Statistical methods for manufacturing quality
ETLS 601 Program/project/team management
ETLS 701 Design of experiments
- Suggested Elective Courses
ETLS 672 Excellence in product design
ETLS 673 Enhanced product realization
ETLS 840 Technology transfer/contemporary problems

Manufacturing Systems Certificate: (total of five courses required)

- Required: ETLS 501 Manufacturing systems
ETLS 504 Excellence in operations
ETLS 505 Managerial accounting & performance management
- Suggested Elective Courses
ETLS 502 Manufacturing processes
ETLS 506 Statistical methods for manufacturing quality

Manufacturing Leadership Certificate: (total of five courses required)

- Required: ETLS 551 Strategic quality management
(ETLS 552 Supply chain synchronization OR ETL 570 Purchasing, logistics and distribution)
ETLS 671 Human aspects of technical management
- Suggested Elective Courses
ETLS 505 Managerial accounting & performance management
ETLS 552 or ETL 570 not taken as required
ETLS 601 Program/project/team management

Medical Device Certificate: (total of five courses required)

- Required: ETLS 520 Design and manufacturing in the medical device industry
ETLS 721 Medical device regulatory submissions
ETLS 722 Medical device quality systems
- Suggested Elective Courses
ETLS 571 Automation in the U.S. and overseas
ETLS 600 Designing corrective and preventative action (CAPA) systems (Prereq: ETL 506 or knowledge of statistics)
ETLS 720 Anatomy, physiology for medical devices
ETLS 723 Biomaterials in the design and reliability of medical devices
ETLS 724 Medical device clinical studies
ETLS 730 Cardiovascular anatomy, physiology and medical devices
ENTR 700 New venture strategies