Technology Management

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Master of Science Degree

The Master of Science Degree in Technology Management at Farmingdale State College (FSC) is intended to graduate qualified professionals capable of taking leadership roles in designing, developing, improving, and transforming the industrial systems that are the basis for much of the industry in the region. This program will provide an exceptional and affordable opportunity for advanced study in the critical field of technology management to qualified graduates of baccalaureate programs in technology, engineering technology and related fields.

The program consists of a twelve-credit core in technology management, nine credits of coursework in one of two tracks, three to nine credits of elective courses, and an elective three-credit capstone master’s project or an elective six-credit master’s thesis. The multi-disciplinary program builds on the strengths of the faculty, laboratories, and equipment of three undergraduate departments in the School of Engineering Technology: Mechanical Engineering Technology, Electrical/Computer Engineering Technology, and Architecture and Construction Management. Drawing on these strengths and addressing the industrial needs in the region, the program has two tracks:

• Track I: Electrical and Mechanical
• Track II: Construction Management

Technology Management (MS) Program Outcomes:

• Graduates will have knowledge and competency in the field of technology management with an emphasis on engineering technologies.
• Graduates will have the knowledge and skills necessary to be imaginative, critical thinkers who are able to discover problems and questions, develop logical answers, and apply effective solutions in the practice of technology management.
• Graduates will have knowledge of ethical behavior in professional positions in all aspects of technology management.
• Graduates will have competency in the management and leadership of technology in global industry.
• Graduates will have an awareness of diversity in the various fields of technology.
• Graduates will have skill to evaluate technical management issues in the context of ethical, technological, structural, cultural, human and environmental factors.
• Graduates will have skill to develop and foster critical thinking, analysis, planning, and communication.
• Graduates will have knowledge and skills in the improvement of productivity, quality control, and competitiveness in all aspects of technology management through collaborative relationships with regional industries.

Fall 2018- Subject to Revision

Core Courses (12 credits)
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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tr>
<td>ETM 501</td>
<td>Engineering Quality Management and Reliability</td>
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<td>BUS 502</td>
<td>Project Management</td>
<td>3</td>
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<tr>
<td>ETM 503</td>
<td>Research Methods</td>
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<tr>
<td>BUS 504</td>
<td>Technology Management Ethics and Policies</td>
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<tr>
<td><strong>Track I: Electrical and Mechanical (EM)</strong></td>
<td>Major Required Courses</td>
<td>(9 credits)</td>
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<tr>
<td>ETM 510</td>
<td>Energy and Power Management Analysis</td>
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<td>ETM 511</td>
<td>Nanotechnology Principles and Applications</td>
<td>3</td>
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<td>ETM 520</td>
<td>Control Systems Management</td>
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<td><strong>Track II: Construction Management (CM)</strong></td>
<td>Major Required Courses</td>
<td>(9 credits)</td>
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<td>ETM 530</td>
<td>Residential Development Management</td>
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<td>ETM 531</td>
<td>Construction Cost Analysis and Advanced Estimating</td>
<td>3</td>
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<td>BUS 532</td>
<td>Legal Aspects of Construction Management</td>
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<tr>
<td><strong>Technical Elective Courses</strong></td>
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<td>(3-9 credits)</td>
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<td>ETM 512</td>
<td>Applied Thermal Energy Systems</td>
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<td>ETM 513</td>
<td>Computer Applications in Engineering Technology</td>
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<td>ETM 514</td>
<td>Engineering Analysis</td>
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<td>ETM 521</td>
<td>Semiconductor Devices and Integrated Circuits</td>
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<td>ETM 533</td>
<td>Heavy Construction Operation and Equipment</td>
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<td>ETM 611</td>
<td>Modern Energy Conversion Technologies</td>
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<td>ETM 612</td>
<td>Robotics, Automation and Control Systems</td>
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<td>ETM 613</td>
<td>Emerging Clean Energy Technologies</td>
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<td>ETM 623</td>
<td>Optical Communications</td>
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<td>ETM 624</td>
<td>Fundamentals of Photovoltaics, Photonics</td>
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<td>BUS 630</td>
<td>Decision Making and Risk Management</td>
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<td>ETM 631</td>
<td>Construction Contracts</td>
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<td>ETM/BUS 680</td>
<td>Special Topics</td>
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<tr>
<td><strong>Elective Capstone Courses</strong></td>
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<td>(3-6 credits)</td>
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ETM/BUS 670 Master's Project 3
OR
ETM/BUS 671 Master's Thesis 6
Total Credits: 30

Degree Type: MS
Total Required Credits: 30

Notes:

1. There are three options for degree completion:
   Option 1: Three technical elective courses
   Option 2: ETM 670 Master's Project Plus two technical electives
   Option 3: ETM 671 Master's Thesis plus one technical elective

2. Business courses cannot exceed 12 credits. 3. Students will file an Intent to Graduate form after completing 24 credits. Students may qualify for graduation after completing 30 credits. 4. The program courses are coded as follows: 50X: Core courses
   51X, 61X: Courses with emphasis on mechanical engineering technology
   52X, 62X: Courses with emphasis on electrical engineering technology
   53X, 63X: Courses with emphasis on construction management
   67X: Capstone courses
   68X: Special topics

Course Descriptions

**ETM 501 Engineering Quality Management and Reliability**
This course covers the normal or Gaussian distribution, standard deviation, and confidence intervals including six-sigma. Advanced statistical concepts and methods are covered with an emphasis on implementation and practical applications. Monitoring and controlling product quality using statistical methods and parametric control charts is an integral part of this course. The principles of reliability engineering and their practical applications, including basic probability models for engineering components and systems failure, are presented with emphasis on practice oriented problem-solving class projects. Prerequisite(s): Graduate Status in ETM and permission of the graduate coordinator. Credits: 3

**BUS 502 Project Management**
This course covers the core knowledge of the project management professions. It includes the creation of the project charter and scope statement, establishment of the Work Breakdown Structure (WBS), and communication of the overall plan including risk planning, resource planning, creation of the project schedule and budget, development of the project team, and measurement and control of project implementation. Course content is aligned with Project Management Professional Certification requirements, such that the course serves as a preparation for the PMP examination (PMP examination is not part of the course). Prerequisite(s): Graduate Status in ETM and permission of the graduate coordinator. Credits: 3

**ETM 503 Research Methods**
In this course the students will be introduced to current statistical analysis methods and modern data acquisition techniques by utilizing the most recent computer software applications. Introducing the students to advanced sensor technologies for measurements of pressure, temperature, humidity and flow rate through wireless data communication is an integral part of this course. Prerequisite(s): Graduate Status in ETM and permission of the graduate coordinator. Credits: 3

**BUS 504 Technology Management Ethics and Policies**
This course defines ethics in the context of engineering technology management and its application in the context of the profession and licensure. It also covers the role of ethics during the bidding stage. This course addresses ethics for union and management, the role of ethics in the event of a change order, and ethics in private versus public ventures. Other topics covered are ethics in domestic versus international markets, the application of ethics in a twenty-first century global market, individual responsibilities and values, cultural background and its effect on ethics, peer review and peer attitudes toward ethics, and leadership, power and the politics of ethics. This course uses real-life case studies as recorded by the National Society of Professional Engineers (NSPE). Prerequisite(s): Graduate Status in ETM and permission of the graduate coordinator. Credits: 3

**ETM 510 Energy and Power Management Analysis**
This course covers the identification and quantification of energy efficiency expressions for various energy sources. Greenhouse gas (GHG) emission and reduction methods and environmental management materials and techniques used in fossil fuel powered systems are discussed. Evaluation and comparison of the economic viability of both renewable and nonrenewable energy technologies, as well as monitoring, targeting, and forecasting (MT&F) their consumption, are integral elements of this course. Energy consumption management methods and techniques to help energy savings are also studied. Prerequisite(s): BUS 502 with a grade of C or better and Graduate Status in ETM and permission of the graduate coordinator. Credits: 3

**ETM 511 Nanotechnology Principles and Applications**
This course provides students with an overview of nanotechnology, covering the fundamental science and the numerous emerging applications of this interdisciplinary new technology. Starting with a discussion of the scientific principles governing nanotechnology, the course then explores novel approaches to making and characterizing nanomaterials and nanosystems. New optical, electrical, physical, and chemical properties of materials at nanoscale that may have a significant beneficial impact are examined. Emerging applications spanning the areas of bioscience, electronics, energy, the environment and others are explored. Prerequisite(s): Graduate Status in ETM and permission of the graduate coordinator. Credits: 3

**ETM 520 Control Systems Management**
This course covers the principles and applications of time invariant linear control systems. Examples are drawn from electromechanical systems, sensors and actuators, electronic systems, active filters, robotics and programmable logic control systems (PLC). Topics covered include: Laplace transform, transfer function, time and frequency domain representations; block diagrams and signal flow graphs; state space representations; analysis and design of feedback control systems. Industry accepted software application such as MATLAB is extensively used throughout the course for projects and assignments. Prerequisite(s): Graduate Status in ETM and permission of the graduate coordinator. Credits: 3

**ETM 530 Residential Development Management**
This course covers current homebuilding systems in the United States from design to construction. It includes an overview of the homebuilding industry, housing demand, management of the homebuilding process, the regulatory environment, housing design guidelines, development of contract documents, and the residential construction process. It also covers structural, mechanical, electrical, and plumbing systems. Prerequisite(s): BUS 502 with a grade of C or better and Graduate Status in ETM and permission of the graduate coordinator. Credits: 3

**ETM 531 Construction Cost Analysis and Advanced Estimating**
This course covers the emerging techniques of construction cost analysis and advanced estimating. It includes estimating cycles, data collection and data sources for estimating, cost index, cost capacity factors, parameter cost, trade-off analysis, break-even analysis, depreciation, overhead, time value of money, rate-of-return analysis and forecasting. It also covers bid strategies, life cycle cost analysis, and cost-benefit ratio analysis. Prerequisite(s): BUS 502 with a grade of C or better and Graduate Status in ETM and permission of the graduate coordinator. Credits: 3

BUS 532 Legal Aspects of Construction Management
This course covers the complexity of legal environments in construction. It includes principles of contract, standard forms of contract, contractual relationships, bidding documents, dispute resolution, red-flag clauses, labor agreements, insurance and surety bonds, change order management, differing site conditions, delays, suspensions and terminations, liquidated damages, allocating responsibility for delays, constructive acceleration, and associated documentation. Prerequisite(s): BUS 504 with a grade of C or higher, and Graduate Status in ETM and permission of the graduate coordinator. Credits: 3

ETM 513 Computer Applications in Engineering Technology
This course is geared toward the conceptual design, manufacturing and maintenance of technological devices. Students are introduced to different aspects of computer aided design, including solid mechanics, computational fluid dynamics (CFD), motion analysis and heat transfer. Relevant laboratory activities are conducted to acquaint students with constraint-based reasoning and design optimization. Concepts of computational power, parallel computing and cloud computing will be discussed as well. Laboratory course work furthers the application of theoretical concepts. Prerequisite(s): Graduate Status in ETM and permission of the graduate coordinator. Corequisite: ETM 513L Credits: 3

ETM 514 Engineering Analysis
This course examines the concept of engineering analysis. The course focuses on problems drawn from various engineering fields, such as heat transfer, fluid flow, forced oscillations, electric circuits, electric potential, and wave propagation. Topics include matrix algebra, matrix manipulation, application to systems of ordinary differential equations, and vector calculus. Complex numbers and complex analytic methods, matrix algebra packages such as MathCAD, Mathematica, or MATLAB are used. Definitions and basic properties of Legendre, Bessel, and other special functions are covered. Common problems in partial differential equations and solution by separation of variables, Eigen function expansions, Fourier integral, Laplace transform, and Fourier transform also are discussed. Prerequisite(s): Graduate Status in ETM and permission of the graduate coordinator Credits: 3

ETM 521 Semiconductor Devices and Integrated Circuits
This course focuses on the fundamental concepts and practical perspectives of the semiconductor devices that comprise modern electronic circuits. It provides students with an in-depth understanding of device operating principles, circuit analysis and design methods, and an overview of processing technology. Topics covered include: semiconductor materials and devices; p-n junctions; bipolar junction transistors and field effect transistors; the MOS capacitor, MOSFET and CMOS; integrated circuits, amplifiers and frequency generators; digital integrated circuits; an overview of processing technology; novel nanoscale electronic and photonic devices. Prerequisite(s): Graduate Status in ETM and permission of the graduate coordinator. Credits: 3

ETM 533 Heavy Construction Operation and Equipment
This course covers current heavy construction practice in the United States in terms of construction planning and optimum use of heavy equipment. It includes earthwork planning, equipment cost, geotechnical materials, machine specifications, trucks and hauling equipment management, aggregate production including concrete and asphalt, cranes, piles and pile driving equipment, and equipment for pumping water for job sites. The course includes ten laboratory experiments, two on planning earthwork, three on geotechnical materials, compaction, and stabilization, one on compressed air, two on aggregate production, and two on concrete production. Prerequisite(s): BUS 502 with a grade of C or better and Graduate Status in ETM and permission of the graduate coordinator. Corequisite(s): ETM 533L Credits: 3
ETM 611 Modern Energy Conversion Technologies
This course provides description and analysis of energy conversion technologies with an emphasis on alternative energy sources including solar, wind turbine, and biomass energy systems. Biomass gasification to produce synthesis gas is discussed. Hydrogen cleanup and separation techniques using water gas shift (WGS) and palladium membrane or electrochemical systems (hydrogen pump) are also discussed. Other energy conversion devices are investigated, including thermoelectric and light-emitting diodes, solid-state refrigerators and Peltier, and Seebeck effects. Prerequisite(s): Graduate status in ETM and permission of the graduate coordinator. Credits: 3

ETM 612 Robotics, Automation and Control Systems
This course covers different types of robots and their applications and control systems and provides 3D vector presentation for the kinematics and dynamics of robots. Feedback and fuzzy logic control systems are discussed. The use of robotics simulation software is integral throughout the course, which culminates in a project leading to the design and development of robotics integration systems with their peripherals. Prerequisite(s): ETM 520, Graduate Status in ETM and permission of the graduate coordinator. Credits: 3

ETM 623 Optical Communications
This course covers the principles of optical fiber communication systems and optical networks. Topics include optical fibers, propagation characteristics, attenuation and dispersion, optical sources such as light emitting diodes (LEDs) and lasers, passive components, optical receivers, PIN and avalanche photodiodes, optical amplifiers, and optical switches. Optical system design issues are discussed including power budget, bandwidth, Q-factor, and bit error ratio (BER). Wavelength division multiplexing (WDM) systems, nonlinear effects, and modulation techniques are also covered along with optical networks, topologies, and applications. Prerequisite(s): Graduate status in ETM and permission of the graduate coordinator. Credits: 3

ETM 624 Fundamentals of Photovoltaics, Photonics
This course focuses on the principles and applications of optical engineering systems as well as photonics and photovoltaics. Concepts in optical engineering and design of optical systems are covered. Topics include optoelectronic devices, photovoltaic solar cells and systems, photonic devices, and an introduction to LASERs. The operating principles of photovoltaic solar cells, including photon absorption, excitons, generation and recombination processes, carrier densities, and charge transport are covered. Emerging technologies involving nanostructures, quantum dots, and heterojunctions are also discussed. Opportunities and challenges facing the industry as devices are scaled at the nanometer range are explored. Examples of optical device design are drawn from areas of current interest such as photovoltaic solar cells, optical sensors, photonic crystals, and nano-photonics. Prerequisite(s): ETM 503 and ETM 520, graduate status in ETM and permission of the graduate coordinator. Credits: 3

BUS 630 Decision Making and Risk Management
This course covers concepts and methods for making complex decisions in Technology Management. Students will identify criteria and alternatives, set priorities, and engage in allocating resources, strategic planning, resolving conflict, and making decisions. Students will select the most effective decision making approaches to evaluate multiple alternatives in scenarios with conflicting objectives and different levels of uncertainty. Students will also learn how to generate risk management plans, appraise mitigating risk options and revise decision making failures Prerequisite(s): Graduate status in ETM and permission of the graduate coordinator. Credits: 3

ETM 631 Construction Contracts
This course covers details of construction contracts and related documents, which include contract documents, design phase documents, pre-bid documents, bid submission documents, forms of agreement, and documents supporting the agreement. This course also covers site condition clauses, red flag clauses, insurance contracts, and surety bonds, as well as documentation and record keeping requirements. In addition, labor agreements and joint venture agreements will be
discussed. Prerequisite(s): BUS 502 with a grade of C or higher, graduate status in ETM and permission of the graduate coordinator Credits: 3

Admission to Farmingdale State College - State University of New York is based on the qualifications of the applicant without regard to age, sex, marital or military status, race, color, creed, religion, national origin, disability or sexual orientation.