



### ***Twin Cities Campus***

## **Medical Device Innovation M.S.**

*Technological Leadership Institute*

### **College of Science and Engineering**

Link to a [list of faculty](#) for this program.

#### **Contact Information:**

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Website: <http://www.tli.umn.edu/>

- Program Type: Master's
- Requirements for this program are current for Fall 2018
- Length of program in credits: 34
- This program requires summer semesters for timely completion.
- Degree: Master of Science

Along with the program-specific requirements listed below, please read the [General Information](#) section of the catalog website for requirements that apply to all major fields.

The master of science in medical device innovation (MDI) program is an interdisciplinary program administered by the College of Science and Engineering's Technological Leadership Institute (TLI). The program is comprised of courses in the core areas of technology innovation management and medical industry dynamics. Students' experiences are enhanced through therapeutic area-based group activities and hands-on experiences in innovative biodesign through practicums at the Medical Devices Center. Students have the opportunity to specialize in an area of interest by taking 9 credits of electives in medical, technical, or business courses. The 14-month program draws upon the fields of technology innovation, product development, project and business management, intellectual property, regulatory affairs, clinical needs, entrepreneurship, emerging trends, globalization, reimbursement, and public policy. This program provides students with a full understanding of medical device innovation from start to finish. In doing so, it goes well beyond the traditional technology focus of most master's programs.

## **Program Delivery**

This program is available:

- via classroom (the majority of instruction is face-to-face)

## **Prerequisites for Admission**

The preferred undergraduate GPA for admittance to the program is 3.00.

A bachelor's degree in a related field, such as biological or physical sciences, engineering, computer science, mathematics, or statistics.

Other requirements to be completed before admission:

Strong background in science, engineering, and math, with at least two to five years of work experience.

#### **Special Application Requirements:**

Applications are accepted on a rolling basis for the program's start in the summer of each year. The deadline for international students is March 15. Additional information is available at <http://tli.umn.edu/graduate/mdi>.

International applicants must submit score(s) from one of the following tests:

- TOEFL
  - Internet Based - Total Score: 79
  - Internet Based - Writing Score: 21
  - Internet Based - Reading Score: 19
  - Paper Based - Total Score: 550
- IELTS
  - Total Score: 6.5
- MELAB
  - Final score: 80



The preferred English language test is Test of English as Foreign Language

Key to [test abbreviations](#) (TOEFL, IELTS, MELAB).

For an online application or for more information about graduate education admissions, see the [General Information](#) section of the catalog website.

## Program Requirements

**Plan B:** Plan B requires 28 major credits and 6 credits outside the major. The final exam is written and oral. A capstone project is required.

**Capstone Project:** The capstone project is independent, original, and applied research on a relevant subject, problem, or issue in areas of medical device technologies, policy, business, or innovation. The capstone project is rooted in real-world topics in the industry, and is usually framed in cooperation with the students organization or employer. The capstone is the students opportunity to demonstrate mastery of the concepts and methods (quantitative as well as qualitative) that have been learned in the MDI program, and to apply them to an industry-based medical device technology, venture, process, or organizational challenge. A written capstone report and formal presentation to the capstone committee is required.

This program may be completed with a minor.

Use of 4xxx courses towards program requirements is not permitted.

A minimum GPA of 3.25 is required for students to remain in good standing.

### Core Courses

- MDI 5001 - Technical Writing (1.0 cr)
- MDI 5002 - Technology Foresight and Forecasting (3.0 cr)
- [MDI 5004](#) - Clinical Foundations of Medical Device Innovation (3.0 cr)
- MDI 5006 - Finance, Valuation, and Entrepreneurship (3.0 cr)
- [MDI 5008](#) - Quality, Regulatory and Operations Management (3.0 cr)
- [MDI 5010](#) - Product Innovation & Development Management (2.0 cr)
- [MDI 5012](#) - Medical Industry Strategic Analysis (3.0 cr)
- [MDI 5013](#) - Biodesign Practicum I (2.0 cr)
- [MDI 5014](#) - Biodesign Practicum II (2.0 cr)
- [MDI 5015](#) - Biodesign Practicum III (2.0 cr)
- [MDI 5050](#) - Interpersonal & Team Effectiveness (1.0 cr)
- [MDI 5051](#) - Leading Innovation & Change (1.0 cr)

### Capstone Project

- [MDI 5020](#) - Medical Device Innovation Capstone (1.0 - 2.0 cr)

### Electives

Other courses may be selected in consultation with the director of graduate studies.

Take 6 or more credit(s) from the following:

- [BMEN 5001](#) - Advanced Biomaterials (3.0 cr)
- [BMEN 5101](#) - Advanced Bioelectricity and Instrumentation (3.0 cr)
- [BMEN 5151](#) - Introduction to BioMEMS and Medical Microdevices (2.0 cr)
- [BMEN 5201](#) - Advanced Biomechanics (3.0 cr)
- [BMEN 5311](#) - Advanced Biomedical Transport Processes (3.0 cr)
- [BMEN 5321](#) - Microfluidics in Biology and Medicine (3.0 cr)
- [BMEN 5351](#) - Cell Engineering (3.0 cr)
- [BMEN 5401](#) - Advanced Biomedical Imaging (3.0 cr)
- [BMEN 5411](#) - Neural Engineering (3.0 cr)
- [BMEN 5412](#) - Neuromodulation (3.0 cr)
- [BMEN 5413](#) - Neural Decoding and Interfacing (3.0 cr)
- [BMEN 5421](#) - Introduction to Biomedical Optics (3.0 cr)
- [BMEN 5501](#) - Biology for Biomedical Engineers (3.0 cr)
- [BMEN 5701](#) - Cancer Bioengineering (3.0 cr)
- [BMEN 8101](#) - Biomedical Digital Signal Processing (3.0 cr)
- [BTHX 5100](#) - Introduction to Clinical Ethics (3.0 cr)
- [BTHX 5210](#) - Ethics of Human Subjects Research (3.0 cr)
- [BTHX 5300](#) - Foundations of Bioethics (3.0 cr)
- [BTHX 5325](#) - Biomedical Ethics (3.0 cr)
- [BTHX 5400](#) - Intro Ethics in Hlth Policy (3.0 cr)



- BTHX 5411 - Health Law and Policy (3.0 cr)
- BTHX 5453 - Law, Biomedicine, and Bioethics (3.0 cr)
- BTHX 5610 - Research & Publication Seminar (1.0 cr)
- BTHX 5620 - Social Context of Health and Illness (3.0 cr)
- BTHX 8114 - Ethical and legal Issues in Genetic Counseling (2.0 cr)
- BTHX 8510 - Gender and the Politics of Health (3.0 cr)
- BTHX 8610 - Medical Consumerism (3.0 cr)
- CSCI 5103 - Operating Systems (3.0 cr)
- CSCI 5105 - Introduction to Distributed Systems (3.0 cr)
- CSCI 5115 - User Interface Design, Implementation and Evaluation (3.0 cr)
- CSCI 5143 - Real-Time and Embedded Systems (3.0 cr)
- CSCI 5204 - Advanced Computer Architecture (3.0 cr)
- CSCI 5211 - Data Communications and Computer Networks (3.0 cr)
- CSCI 5221 - Foundations of Advanced Networking (3.0 cr)
- CSCI 5231 *(Inactive)*(3.0 cr)
- CSCI 5451 - Introduction to Parallel Computing: Architectures, Algorithms, and Programming (3.0 cr)
- CSCI 5461 - Functional Genomics, Systems Biology, and Bioinformatics (3.0 cr)
- CSCI 5481 - Computational Techniques for Genomics (3.0 cr)
- CSCI 5523 - Introduction to Data Mining (3.0 cr)
- CSCI 5551 - Introduction to Intelligent Robotic Systems (3.0 cr)
- CSCI 5552 - Sensing and Estimation in Robotics (3.0 cr)
- CSCI 5609 - Visualization (3.0 cr)
- CSCI 5707 - Principles of Database Systems (3.0 cr)
- CSCI 5708 - Architecture and Implementation of Database Management Systems (3.0 cr)
- CSCI 5801 - Software Engineering I (3.0 cr)
- CSCI 5802 - Software Engineering II (3.0 cr)
- CSCI 8725 - Databases for Bioinformatics (3.0 cr)
- EE 5121 - Transistor Device Modeling for Circuit Simulation (3.0 cr)
- EE 5141 - Introduction to Microsystem Technology (4.0 cr)
- EE 5163 - Semiconductor Properties and Devices I (3.0 cr)
- EE 5164 - Semiconductor Properties and Devices II (3.0 cr)
- EE 5171 - Microelectronic Fabrication (3.0 cr)
- EE 5181 - Micro and Nanotechnology by Self Assembly (3.0 cr)
- EE 5364 - Advanced Computer Architecture (3.0 cr)
- EE 5371 - Computer Systems Performance Measurement and Evaluation (3.0 cr)
- EE 5393 - Circuits, Computation, and Biology (3.0 cr)
- EE 5542 - Adaptive Digital Signal Processing (3.0 cr)
- EE 5545 - Digital Signal Processing Design (3.0 cr)
- EE 8551 - Multirate Signal Processing and Applications (3.0 cr)
- EE 5581 - Information Theory and Coding (3.0 cr)
- EE 5583 - Error Control Coding (3.0 cr)
- EE 5585 - Data Compression (3.0 cr)
- EE 8367 - Parallel Computer Organization (3.0 cr)
- ENTR 6025 - Introduction to Entrepreneurship (2.0 cr)
- HINF 5502 - Python Programming Essentials for the Health Sciences (1.0 cr)
- HINF 5510 - Applied Health Care Databases: Database Principles and Data Evaluation (3.0 cr)
- HINF 5520 - Informatics Methods for Health Care Quality, Outcomes, and Patient Safety (2.0 cr)
- HINF 5530 - Health Care Software Management (2.0 cr)
- HINF 5531 - Health Data Analytics and Data Science (3.0 cr)
- IE 5111 - Systems Engineering I (2.0 cr)
- IE 5112 *(Inactive)*(3.0 cr)
- IE 5113 - Systems Engineering II (4.0 cr)
- IE 5522 - Quality Engineering and Reliability (4.0 cr)
- IE 5541 - Project Management (4.0 cr)
- IE 5545 - Decision Analysis (4.0 cr)
- IE 5551 - Production and Inventory Systems (4.0 cr)
- IE 5553 - Simulation (4.0 cr)
- MBA 6111 - Organizational Behavior (2.0 cr)
- MBA 6301 - Strategic Management (3.0 cr)
- ME 5223 - Materials in Design (4.0 cr)
- ME 5341 - Case Studies in Thermal Engineering and Design (4.0 cr)
- ME 8262 - Topics in Modeling and Analysis of Manufacturing Processes (4.0 cr)
- ME 8381 - Bioheat and Mass Transfer (3.0 cr)
- ME 8775 - Technical Communication (1.0 cr)
- MGMT 6055 - Management of Innovation and Change (2.0 cr)
- MGMT 6100 - Topics in Management (2.0 cr)



- MILI 6235 - Pharmaceutical Industry: Business and Policy (2.0 cr)
- MILI 6562 - Information Technology in Health Care (2.0 cr)
- MILI 6589 - Medical Technology Evaluation and Market Research (2.0 cr)
- MILI 6726 - Medical Device Industry: Business and Public Policy (2.0 cr)
- MILI 6985 - The Health Care Marketplace (2.0 cr)
- MILI 6991 - Anatomy and Physiology for Managers (2.0 cr)
- MILI 6992 - Healthcare Delivery Innovations:Optimizing Cost and Quality (2.0 cr)
- MILI 6995 - Medical Industry Valuation Laboratory (2.0 cr)
- MKTG 6088 - Strategic Marketing (3.0 cr)
- NEUR 5230 - Cerebrovascular Hemodynamics and Diseases I (4.0 cr)
- NEUR 5240 (*Inactive*)(4.0 cr)
- PDES 5701 - User-Centered Design Studio (4.0 cr)
- PDES 5702 - Visual Communication (3.0 cr)
- PDES 5704 - Computer-Aided Design Methods (3.0 cr)
- PHSL 5061 - Principles of Physiology for Biomedical Engineering (4.0 cr)
- PHSL 5510 - Advanced Cardiac Physiology and Anatomy (2.0 - 3.0 cr)
- PHSL 5525 - Anatomy and Physiology of the Pelvis and Urinary System (1.0 - 2.0 cr)
- PSY 5065 - Functional Imaging: Hands-on Training (3.0 cr)
- PUBH 6751 - Principles of Management in Health Services Organizations (2.0 cr)
- PUBH 6832 - Economics of the Health Care System (3.0 cr)
- PUBH 6862 - Cost-Effectiveness Analysis in Health Care (3.0 cr)
- RSC 5101 - Mathematical Tools for Research Applications in Health, Rehab, and Human Movement Sciences (1.0 cr)
- RSC 5106 - Introduction to Rehabilitation Science (1.0 cr)
- RSC 5135 - Advanced Biomechanics I: Kinematics (3.0 cr)
- RSC 5200 - Introduction to Neuromodulation (1.0 - 3.0 cr)
- RSC 5231 - Clinical Biomechanics (2.0 - 5.0 cr)
- RSC 5281 - Physiology for Physical Rehabilitation (2.0 - 4.0 cr)
- SCB 8181 - Stem Cell Biology (3.0 cr)
- ST 8109 - Cybersecurity Foundations - Technology, Risk & Communication (2.0 cr)
- ST 8110 - Security Science and Technology Foundations (3.0 cr)
- ST 8111 - Methods, Theory, and Applications (2.5 cr)
- ST 8113 - Information and Cyber Security (2.0 cr)
- ST 8220 - Vulnerability, Risk and Threat Assessment and Management (2.5 cr)
- ST 8330 - Critical Infrastructure Protection (2.5 cr)
- ST 8331 - Dynamic Systems Modeling and Simulation Tools (2.0 cr)
- ST 8513 - Cyber Threat Intelligence (2.0 cr)
- ST 8661 - Securing Cyberspace (Fundamentals) (3.0 cr)
- ST 8662 - Securing Cyberspace - Advanced (3.0 cr)
- Students may choose a minor in human factors and ergonomics, but must have courses pre-approved by the director of graduate studies.