

# MASTER OF INDUSTRIAL TECHNOLOGY AND OPERATIONS

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[www.intm.iit.edu](http://www.intm.iit.edu)

## INDUSTRIAL TECHNOLOGY AND MANAGEMENT (INTM)

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Industrial Technology and Management (INTM) programs provide students with a broad knowledge of industrial technologies and operational activities, and the managerial and communication skills required to effectively manage operations, personnel and resources in a competitive, performance-oriented industrial environment. Emphasis is on the range of competencies required for an individual to successfully function in a managerial, supervisory, or staff position in industry, and their ability to provide practical solutions to complex situations. INTM courses are taught by industry professionals who bring direct experience in their respective field of expertise into the classroom.

The Master of Industrial Technology and Operations (MITO) is a 10-course STEM (Science, Technology, Engineering and Math) degree which allows students to pursue a program of study suited to their professional interests and career objectives.

The MITO blends practical application of current technologies with the managerial skills needed to oversee a wide range of industrial operations. INTM courses focus on functional activities, utilization of current and emerging technologies, and the development of critical thinking and innovative problem-solving abilities. In-depth study of industry-specific topics is achieved through the completion of an industrial specialization, options for which include: Construction Technology (CT), Facilities Management (FM), Industrial Sustainability (ST), Manufacturing Technology (MT), and Supply Chain Management (SCM).

Prospective students who have previously obtained a MS or a PhD in highly technical subjects may be well served to pursue the MITO degree. These individuals are often technical experts who, once employed in industry, have found that they need to improve their managerial skills and expand their understanding of industrial operations and applied technologies. Considered a hybrid program covering technology and management, the MITO curriculum enables such specialists to move into operations or management. The MITO is not an M.B.A. or an engineering degree, therefore it is not recommended for those planning to pursue careers in academia or research.

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## Administration, Faculty and Staff

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### Program Manager

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### Industry Professors

Gopal, Gurram, Industry Professor, Academic Advisor. B.Tech., Indian Institute of Technology (India); M.S., Ph.D., Northwestern University. Chemical engineering, industrial engineering, operations research, global sourcing, CRM, economics, finance.

### Outreach Coordinator

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Safar, Mazin, Industry Professor, Program Director. B.S., Al-Hikma University (Iraq); M.S., Illinois Institute of Technology; M.B.A., University of Chicago. Operations management, supply chain, inventory control, economics

### Adjunct Faculty

Arditi, David, Professor of Civil and Architectural Engineering, B.S., M.S., Middle East Technical University (Turkey); Ph.D., Loughborough University (United Kingdom). Construction engineering and management.

Batka, Shawn, Adjunct Professor. B.S., Southern Illinois University, Industrial Technology; M.B.A, Finance, DePaul University. Manufacturing and logistics information systems.

Ayman, Roya, Professor of Psychology, Director of Industrial/Organizational Training. B.A., M.A., Ph.D., University of Utah. Leadership, diversity, organizational climate, work-family interface.

Calhoun, Mark, Adjunct Professor. B.S., Environmental Science & Natural Resources, Purdue University; M.B.A. (M.I.S.), Indiana State University. Supply chain management, procurement, energy management.

**Adjunct Faculty** *(continued)*

Cesarone, John, Senior Lecturer of Mechanical Engineering, B.S., M.S., University of Illinois; Ph.D., Northwestern University. Robotics, reliability engineering, manufacturing processes.

Coates, James, Adjunct Professor. B.S., National Louis University; M.S., Adult Education, DePaul University. Facilities maintenance, HVAC, stationary engineering, electrical systems.

Davis, Blake, Adjunct Professor. B.S., National Louis University. City and regional planning, sustainability, environmental issues.

Dunn, Robert, Adjunct Professor. B.S., Pennsylvania State; M.S., Virginia Institute of Technology. Operations, supply chain, procurement, inventory, sourcing.

Hamill-Governale, Nancy, Adjunct Professor. B.A., Geography, Environmental Planning, Southern Illinois University; Master of Architecture, Illinois Institute of Technology. Facilities management, sustainability.

Hoffman, Robert, Adjunct Professor. Oxford and London School of Economics. Transportation, logistics, economics.

Goldman, Elliot, Adjunct Professor. B.S., Electrical Engineering; MBA, Marketing and Management.

Gates, Chuck, Adjunct Professor. B.S., University of Illinois-Springfield; M.S., Purdue University. Manufacturing, factory operations, production processes, quality assurance.

Jain, Jagit, Adjunct Professor. B. Tech in Mechanical Engineering; M.S., in Operations Research; M.B.A., Finance/Economics/Accounting. Supply chain, export/import, logistics.

Khalili, Nasrin, Associate Professor of Environmental Mgmt., Stuart School of Business. B.S., M.S.P.H., Tehran University; Ph.D., Illinois Inst. of Technology. Energy, environmental management and economics, energy systems, sustainability.

Kumiega, Andrew, Assistant Professor of Analytics, Stuart School of Business. B.S., M.S., Ph.D., Industrial Engineering and Operations Research, University of Illinois (Chicago); M.S., Finance, Illinois Institute of Technology. Industrial engineering, operations management, risk management, quality, finance.

Lemming, Raymond, Adjunct Professor. B.S. in Civil Engineering; B.S. in Psychology; M.B.A. in Organizations and Management; Juris Doctor. Facilities infrastructure, design, planning.

Lewis, Phillip, Adjunct Professor. B.A., Milwaukee School of Engineering. Industrial management, manufacturing processes, operations, marketing.

O'Kane, Brian, Adjunct Professor. BAC Industrial Technology and Management; MAS Industrial Technology and Operations, Illinois Institute of Technology. Stationary engineering, facilities maintenance, facilities management.

Olsen, Katherine, Adjunct Professor. B.S., Industrial Engineering, University of Illinois at Urbana-Champaign; M.S., Supply Chain Management, Elmhurst College. Supply chain design, sales & operations planning, warehouse management, six sigma, continuous improvement.

Rawson, Christopher, Adjunct Professor. B.A., Secondary Education-History, Western Michigan University; M.A., Education, St. Xavier University. Electrical construction, network communication systems, electrical regulations, compliance.

Rigopoulos, Theo, Adjunct Professor. B.A., Elmhurst College. Supply chain management, logistics, manufacturing.

Shankar, Rama, Adjunct Professor. B.S., Mechanical Engineering; M.S., Materials Management; M.S., Engineering Management. Quality control, industrial management and operations, quality, six sigma.

Shields, Herb, Adjunct Professor. B.S., Clarkson University. Electrical engineering, logistics, supply chain, purchasing.

Tijunelis, Donatas, PE, Adjunct Professor. B.S., M.S., Chemical Engineering; D.B.A. Operations management, strategic project management, energy and sustainability.

Tomal, Daniel, Adjunct Professor. B.S., M.S., Ph.D., Bowling Green State University. Electrical technology, industrial technology, administration and supervision.

Twombly, John R, Clinical Professor of Accounting and Finance and Director of Undergraduate Programs in Stuart School of Business. B.S., University of Chicago; Certified Public Accountant. Financial and managerial accounting.

Van Den Bussche, Pamela, Adjunct Professor. B.S., Northern Illinois University; MAS, Human Resource Management, Keller Graduate School; D.M., Organizational Leadership, University of Phoenix. Human Resource Management, Organizational Development, Industrial Training.

Waterloo, Daniel, Adjunct Professor. B.S.E.E., University of Illinois at Urbana-Champaign; M.P.M., M.B.A., Keller Graduate School of Management, DeVry University. Business development, sales, software, electronics technology

## Admission Requirements

Applicants must hold a four-year bachelor's degree from an accredited institution. Students with a GPA of 3.0/4.0 can be admitted unconditionally. Students with a GPA of 2.5/4.0 can be admitted contingent upon their achieving a 3.3 GPA or better in the first three courses taken at IIT. The GRE is not required for applicants who have completed a degree at a U.S. institution.

Applicants who have completed an undergraduate degree outside the U.S. must complete the GRE and submit scores with the admission application. Minimum required GRE scores are 2.5 for analytical writing and a combined score of 900 for the verbal and quantitative portions of the exam taken prior to August 2011, or 292 for exams taken August 2011 and after. Applicants from countries where English is not the primary language of instruction

also must complete the TOEFL with a minimum score of 70 on the Internet-based test with no individual section scored below 15. IELTS also accepted, with a minimum score of 5.5. Students with a TOEFL score between 70 and 89 or an IELTS score between 5.5 and 6.0 will be required to complete a remedial English course during their first term at IIT.

All applicants must submit a completed application form, the application fee, official transcripts (or certified copies) for all academic work at the college level, and a professional statement. International students must also submit financial support documentation verifying sufficient funds to cover degree studies and living expenses.

## Master of Industrial Technology and Operations

30 credit hours

### Required Credit Hours

Elective courses: 18-30 hours

Special project: 0-6 hours

Optional specialization courses: 12 hours

Each student's program of study is customized to best serve individual career objectives. Of the 30 credit hours required for the MITO degree, the student must complete at least 18 credit hours of INTM graduate courses. Up to 12 credit hours of senior (400-level) courses can be taken as part of the MITO degree. A maximum of six credit hours may be applied from special project courses (INTM 597) or an Interprofessional Project (IPRO 497). Up to 12 credit hours may be completed within another IIT department, but the student must be suitably qualified and obtain permission to register from their advisor and the associated course instructor(s). A total of 9 credit hours taken at a different university (passed with the grade of "B" or better) may be transferred to Illinois Tech and applied towards the MITO degree if those credits have not been applied toward any earned degree (subject to administrative approval). No thesis or comprehensive examination is required as part of this degree.

The flexibility of course options within the MITO program allows students to pursue an industrial specialization, or simply take the ten courses of greatest interest. A specialization requires completion of 12 credit hours (four courses) in any one of five concentrations within the INTM curriculum. Alternatively, students may complete up to four (4) courses in another IIT department with appropriate qualifications and approvals. For example, MITO students have taken courses from Stuart School of Business, Armour College of Engineering, and Food Science and Nutrition.

INTM courses are presented live IIT Mies (Main) Campus in Chicago. Also, the MITO program can be completed over the Internet. Using a delayed Internet format (lecture videos are posted within 24 hours after the live session), students can log on and view class lectures at the time and location of their choice.

General management courses offered by INTM within the MITO program include:

INTM 404 Marketing, Sales and Product Introduction  
 INTM 410 Operations Management  
 INTM 425 Human Resource Management  
 INTM 477 Entrepreneurship in Industry  
 INTM 502 Industrial Engineering Concepts and Applications  
 INTM 508 Cost Management  
 INTM 511 Industrial Leadership  
 INTM 514 Topics in Industry  
 INTM 518 Industrial Risk Management  
 INTM 520 Applied Strategies for the Competitive Enterprise  
 INTM 522 Modeling for Decision-Making  
 INTM 540 Supply Chain Management  
 INTM 545 Strategic International Business  
 INTM 551 Data Analytics for Industry

## MITO Industrial Specializations

INTM's industrial specializations require completion of four (4) courses within one identified area:

### Construction Technology (CT)

INTM 413 Contract Administration for Construction Projects  
 INTM 417 Construction Estimating  
 INTM 507 Construction Technology  
 INTM 515 Advanced Project Management

### Facilities Management (FM)

INTM 411 Functional Facilities Management  
 INTM 413 Contract Administration for Construction Projects  
 INTM 515 Advanced Project Management  
 INTM 516 Integrated Facilities Management  
 INTM 523 Sustainable Facilities Operations

### Industrial Sustainability (ST)

INTM 523 Sustainable Facilities Operations  
 INTM 559 Issues in Industrial Sustainability  
 INTM 560 Sustainability of Critical Materials  
 INTM 561 Energy Options in Industry  
 INTM 562 Special Topics in Sustainability

### Manufacturing Technology (MT)

INTM 406 Quality Control  
 INTM 436 Lean Manufacturing  
 INTM 533 Chemical Manufacturing Processes in Industry  
 INTM 534 Manufacturing 4.0  
 INTM 535 Performance Management in Food Operations  
 INTM 537 Smart Factory Automation  
 INTM 546 Manufacturing and Logistics Information Systems

### Supply Chain Management (SCM)

INTM 427 E-Commerce in Marketing & Supply Chain Networks  
 INTM 432 Sales and Operations Planning  
 INTM 509 Inventory Control  
 INTM 530 Transportation  
 INTM 542 Warehousing and Distribution  
 INTM 543 Purchasing  
 INTM 544 Export/Import  
 INTM 546 Manufacturing and Logistics Information Systems  
 INTM 547 Supply Chain Strategies

## Course Descriptions

All courses earn three credits.

### **INTM 404 Marketing, Sales and Product Introduction**

This course examines marketing and sales, and the differences and details of these activities as applied within industry. The range of marketing types is covered, to include business-to-business, industrial, commercial, retail, internet, social media, and entrepreneurial/ professional. Sales fundamentals include understanding the customer and the competition, sales strategy, sales management, product positioning, product life cycle, sales structures, margins, and prospecting for new customers. Product development is addressed throughout the course, inclusive of market feedback, product evaluation, opportunity assessment, prototyping, field trials and marketing testing, and product launch.

### **INTM 406 Quality Control**

This course focuses on how organizations manage quality in a competitive marketplace regardless of the nature of the industry. Topics include principles of quality, cost of quality, inspection and receiving, audits, corrective and preventive action systems, Supply Performance Management (SPM), FMEA and control plans, process capability studies and Statistical Process Control (SPC), measurement system analysis, Quality Management Systems (QMS), process improvement methodologies (Lean, Six Sigma and Kaizen), and creation of a performance dashboard.

### **INTM 410 Operations Management**

Focuses on core processes within an organization – the activities that add value. An operations strategy depends on the industrial sector as well as the organization. This course introduces a variety of qualitative and quantitative tools for such activities as project management, process analysis, job design, forecasting, resource planning, productivity, quality, inventory and scheduling. The objective of this course is to provide the framework for integrating approaches covered in other INTM courses.

### **INTM 411 Functional Facilities Management**

Covers key activities in facilities management, the role and responsibilities of the facilities manager, and the functional aspects of management and maintenance activities by building type (commercial, high rise, hotels, hospital, data center). Budgeting, strategic planning, and coordination of capital and operating projects; inspection, repair, and renovation of equipment and buildings in accordance with health and safety standards; managing internal staffing, external contractors, insurance and control activities (parking, waste disposal, building security, etc.). Information systems, real estate management, sustainability issues and emergency preparedness also covered.

### **INTM 413 Contract Administration for Construction Projects**

Covers fundamentals of project administration and characteristics of the construction industry. Pre-construction discussion includes technical and economic feasibility, project delivery systems, documents, bonding and bidding. Duties and liability of parties at pre-contract stage and during contract administration, to include scheduling and time extensions, payment, retainage, substantial and final completion, change orders, suspension of work, contract termination and dispute resolution. Labor law, labor relations, safety, and general management of a construction company.

**INTM 417 Construction Estimating**

General approaches for estimating construction costs are covered. Several commercially available software packages are introduced. Emphasis is on acquiring the knowledge required to develop cost estimates for construction, renovation and maintenance projects for buildings, facilities and equipment.

**INTM 425 Human Resource Management**

This course will introduce students to key aspects of HR management, including legal requirements for all normal HR activities as well as techniques for dealing with employees when hiring, evaluating, promoting and terminating.

**INTM 427 E-Commerce in Marketing & Supply Chain Networks**

This course covers electronic commerce and its applications in industrial organizations. Topics covered include the role of e-commerce in a firm's business operations and competitiveness, e-commerce infrastructure technologies, e-commerce applications in product development and marketing, and effective use of e-commerce in supply chain management and collaboration. Innovations in business models, marketing strategies and supply chain processes driven by web-enabled applications are included. Social and ethical challenges posed by the widespread adoption of e-commerce will also be studied.

**INTM 432 Sales and Operations Planning**

This course covers Sales and Operations Planning (S&OP) processes, objectives and procedures utilized by leading global supply chain companies. Key elements of the S&OP process are explained, including demand plans, forecasts and capacity plans. Students also learn how to develop, maintain and manage supplier relationships (SRM) and how companies use Customer Relationship Management (CRM) tools to enhance business relationships.

**INTM 436 Lean Manufacturing**

Lean principles are the primary continuous improvement tool utilized in the manufacturing industry. In this course, students learn how to evaluate process performance, starting with lean thinking to determine exactly what is needed to achieve the desired outcome of a process and the value it creates. With lean thinking comes the identification of waste, which can take many forms including organizational policies and practices which may not provide any value to the customer. The next step is to map the process as it is in its current state so that potential future state improvement are more easily identified and serve as a catalyst toward achieving process perfection. Diagnostic tools are introduced, both qualitative and quantitative in nature, to help reveal the potential of the process.

**INTM 477 Entrepreneurship in Industry**

Introduces various forms of entrepreneurship with emphasis towards industrial organizations. Provides helpful tools for developing and implementing significant "game-changing" actions to effect change within an existing organization or develop a new business venture. Students complete an Opportunity Assessment (OPASS) Project wherein they identify, evaluate and develop an approach for a "real-life" business and produce a formal report and presentation.

**INTM 502 Industrial Engineering Concepts and Applications**

Beginning with productivity and productivity improvement, students learn Industrial Engineering concepts and are trained to apply them to optimize engineering and operational tasks. Topics covered include time and motion studies, work measurement, ergonomics, value stream engineering, and value stream mapping. Data envelopment analysis and analytical hierarchy processes are implemented using Excel to optimize operations. Plant location and layout are covered. Students learn to optimize project selection using ROI and other metrics and execute projects using Microsoft Project. An open source ERP system is used to illustrate MRP and other planning functions. The application of statistical methods, including hypothesis testing to improve performance is also covered.

**INTM 507 Construction Technology**

Introduces the full range of technologies involved in construction of both new and modified facilities, including steel, concrete and timber construction as well as supporting specialties such as HVAC, electrical, plumbing, etc. The interactions between the various construction trades will be covered along with the role of the architects and engineers.

**INTM 508 Cost Management**

This course introduces accounting information used for decision-making within a business enterprise. Financial reporting, financial terminology, and the three major financial statements are reviewed. Product costing, short-term and long-term decision-making, budgeting, control of operations, and performance evaluations are covered, as are cost-volume-profit relationships, relevant costs, flexible budgets and standard costs.

**INTM 509 Inventory Control**

Fundamentals of inventory control including inventory classifications, i.e. raw materials, work-in-process (WIP) and finished goods. Topics include inventory record keeping, inventory turnover, the 80/20 (or ABC) approach, safety stock, forecasting, dependent and independent demand, lead times, excess/obsolete inventory, and inventory controls. Material Resource Planning (MRP) and Enterprise Resource Planning (ERP) are included.

**INTM 511 Industrial Leadership**

Supervision and management practices are key to all components and sectors of industry. People are the key resources and their effective use is critical to a successful operation. As companies move to become high performance organizations, traditional management tools and techniques have to be reviewed and reconsidered. Skills covered include motivation, developing consensus, conflict avoidance and negotiations. Group dynamics along with handling of individual workers.



**INTM 514 Topics in Industry**

Provides overview of multiple industrial sectors and the influences that are forcing change. All aspects of industry are considered: history of industry, inventory, supply chain, e-commerce, management, manufacturing, industrial facilities, resource management, electronics and chemical industries, alternate energies, marketing, entrepreneurship, computers as tools, and other specialty areas.

**INTM 515 Advanced Project Management**

Covers project management in the PMP framework and provides a structured approach to managing projects using Microsoft Project and Excel. Coverage includes creation of key project management charts (Gantt, Pert, CPM, timelines and resource utilization), basic statistics used in estimating task times, critical path generation in Excel and Project, project cost justification in Excel, SPC and acceptance sampling for machine acceptance, project analysis via simulation, and management of personnel, teams, subcontractors and vendors. Case studies utilized to demonstrate core concepts and dynamic scheduling.

**INTM 516 Integrated Facilities Management**

This course involves understanding processes and tools needed to successfully manage building systems, functions and personnel in any type of building, complex of buildings or physical environment. Course covers topics in facilities management ranging from routine maintenance to complex systems interactions and financial decisions. Students learn to assess issues of safety, human comfort, sustainable use of resources, building and infrastructure life cycles, and company objectives, and develop solutions based on studying real problems in facilities management organizations.

**INTM 518 Industrial Risk Management**

Each year industrial companies are affected by critical incidents which cause disruptions in operations and significant monetary losses due to repairs and/or lost revenue. A small fire, an extended electrical outage or an incident of a more serious magnitude affects all company stakeholders – from the board of directors to the employees to the customers. Understanding the complexities of industrial resiliency requires a focus on issues of preparedness: prevention, mitigation and control. This course is designed to prepare the student for managing a critical incident, including understanding risk and business impact, emergency preparedness, contingency planning and damage control.

**INTM 520 Applied Strategies for the Competitive Enterprise**

Course covers the application of proven management principles and operational practices. Learn how high performance companies create a competitive advantage despite economic challenges and a transitional customer base. Factors covered include strategy deployment, financial analysis, new product development, quality, customer service, and attaining market leadership. Case studies illustrate variable impacts on business situations.

**INTM 522 Modeling for Decision-Making**

Management Information Systems (MIS) are utilized in all industrial sectors to manage, analyze and optimize operational processes. This course examines the integration of MIS for a range of operational activities, including production scheduling, inventory control, purchasing, shipping and invoicing. Students will be exposed to the theory of MIS by reviewing case studies and successful applications. Students learn how to build spreadsheet models for multiple business problems using linear programming (LP) and integer programming (IP), and perform regression analysis and basic time series forecasting. A variety of Microsoft Excel tools are introduced.

**INTM 523 Sustainable Facilities Operations**

Maintaining and managing buildings and facilities is a challenging, multifaceted occupation. Facilities are becoming smarter and greener as the goals of energy conservation and occupant comfort have shifted to include environmental responsibility. This course examines facility operations and management (O&M) related to sustainability and green technology, with an emphasis on the U.S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) requirements, rating system, and the process for properties to apply for certification as a resource-efficient operation.

**INTM 530 Transportation**

Course covers transportation practices and strategies for the 21st century. The role and importance of transportation in the economy and its relationship to the supply chain will be covered in detail. Transportation modes – truck, rail, air, and water – will be examined for both domestic and global transportation. Costing and pricing strategies and issues will be discussed, as well as security issues in domestic and international transportation.

**INTM 533 Chemical Manufacturing Processes in Industry**

This course provides an overview of current and emerging chemical processes employed in the energy, food, drug, and plastics sectors. Current and future impacts of various manufacturing processes on society, environment, and sustainability are covered as are issues related to OSHA, EPA, FDA, USDA, and other regulatory systems. The various implications of recovery and reuse are explored as well as new non-polluting, zero-emissions processes and technologies. Students will gain an appreciable understanding of "how it's made" and the range of chemical processes and related technical challenges involved in manufacturing. A background in chemistry is not required.

**INTM 534 Manufacturing 4.0**

This course focuses on the Fourth Industrial Revolution (Industry 4.0) and the major manufacturing technologies that must be integrated and implemented effectively in a timely manner in order to sustain a competitive advantage. Advances in product design, breakthrough achievements in materials used in products, and the reduced time to market require the use of advanced industrial processes to maximize customer service and company profitability. Topics include: shaping the fourth industrial revolution, manufacturing 4.0, manufacturing economics, manufacturing analytics, supply chain 4.0, quality 4.0, Industrial Internet of Things (IIoT), future of manufacturing skills, advanced manufacturing (digital, automated, additive), AI, augmented reality, modern manufacturing leadership, and change management.

**INTM 535 Performance Management In Food Operations**

Creating an organizational culture of quality and performance is critical to managing the unique demands of a food processing company. Students will learn how to develop, manage, and improve food production processes, implement lean principles to eliminate waste and improve yields, and measure operational performance. Coursework includes Total Quality Management (TQM), evaluation and management of supply chain activities, and strategic deployment techniques.

**INTM 537 Smart Factory Automation**

Technology changes how companies operate, impacting internal processes and how comprehensive manufacturing solutions are established to serve customer needs. The challenge lies in connecting independent processes into systems that are reliable, self-adjusting, and communicate in real time. Internal systems must successfully blend hardware, software, sensors and codes, and integrate new technologies to automate, assess and control manufacturing operations. The goal is to achieve a transparent system with faster processing times, fewer interruptions and a more continuous flow, resulting in competitive advantage throughout the entire value stream. This course covers interconnection, optimization and automation of processes to achieve competitive advantage in manufacturing operations.

**INTM 540 Supply Chain Management**

This course covers the full range of activities involved in the supply chain. This includes management tools for optimizing of supply chains, relationships with other parts of the organization, in-house versus third party approaches, and suitable performance measurements. Topics covered include: Warehouse Management Systems (WMS), Transportation Management Systems (TMS), Advanced Planning and Scheduling Systems (APS), as well as cost benefit analysis to determine the most appropriate approach.

**INTM 542 Warehousing and Distribution**

This course covers warehouse layout and usage based on product requirements such as refrigeration, hazardous material, staging area, and value added activities. Processes covered include receiving, put-away, replenishment, picking and packing. The requirement for multiple trailer/rail car loading and unloading is considered as well as equipment needed for loading, unloading, and storage. Computer systems for managing the operations are reviewed. Emphasis is on material handling from warehouse arrival through warehouse departure.

**INTM 543 Purchasing**

Purchasing responsibilities, processes, and procedures are included. Topics covered include: supplier selection and administration, qualification of new suppliers, preparing purchase orders, negotiating price and delivery, strategic customer/vendor relationships, and resolution of problems. All aspects of Supplier Relation Management (SRM) are covered.

**INTM 544 Export/Import**

Internationalization of industry requires special expertise and knowledge; which must be taken into consideration throughout all interactions with overseas companies either as customers or suppliers. Topics covered include custom clearance, bonded shipping, international shipping options, import financing and letters of credit, customer regulations, insurance, import duties and trade restrictions, exchange rates, and dealing with different cultures.

**INTM 545 Strategic International Business**

Organizational involvement in international business activities – whether sourcing material and designs, expanding product sales and reach, or creating economies of scale and scope – requires an understanding of various factors in international finance, marketing and strategy. This course brings together these disciplines to explore financial factors that may add or transform risks, the necessary adjustments in the creation of a global marketing strategy, and the strategies for creating and preserving a competitive advantage in the international arena.

**INTM 546 Manufacturing and Logistics Information Systems**

Provides an overview of manufacturing, logistics and supply chain management (SCM) information systems and software packages, as well as practical tools and techniques for effective decision making. Emphasis on the importance of accurate and timely data, efficient business processes, and utilizing state-of-the-art information tools and technologies. Students gain hands-on experience using a modern ERP system to understand the features, functionality, and end-to-end dependencies of the core ERP modules used in an enterprise. Prerequisite: INTM 441 or INTM 540, or department permit.

**INTM 547 Supply Chain Strategies**

The range of supply chain strategies to be considered when assessing a firm's internal and external supply chain network. Strategies involved in the end-to-end supply chain, including product life cycle management (PLM), inventory optimization, network design optimization, management tools for optimizing supply chains, relationships with other parts of the organization, in-house versus third party approaches, and suitable performance measurements. Prerequisite: INTM 441 or INTM 540, or department permit.

**INTM 551 Data Analytics for Industry**

Organizations of all types employ rigorous analysis of vast amounts of internal and external data to improve the quality of decision making. This course prepares students to define and organize data, perform exploratory analysis, and select and implement analytical models, with a focus on applications in the areas of operations and marketing. Excel plugins, statistical packages (R, SAS or SPSS), and business intelligence products like Tableau will be used extensively for modeling. The course covers descriptive and inferential statistics, principles of design of experiments and analysis of variance (ANOVA), and supervised and unsupervised learning methods including regression, classification and clustering. Prior completion of a course in elementary probability and statistics highly recommended. Prerequisite: INTM 502 or INTM 522, or department permit.

**INTM 559 Issues in Industrial Sustainability**

This course examines the concept of sustainability and its application in the industrial environment. Underlying stresses on natural and human environments are identified as well as resultant problems for business and society, including legal, ethical and political issues related to sustainability. Global warming, peak oil, and commodity pricing are considered as indicators of the need for sustainability improvements. Industrial Ecology is discussed as well as strategies for developing sustainable practices in manufacturing, power generation, construction, architecture, logistics, and environmental quality. Case studies on businesses employing successful sustainability programs are reviewed.

**INTM 560 Sustainability of Critical Materials**

This course explores the limitations in supply and the need for sustainable use of carbon and non-carbon based materials such as oil, minerals, food, water and other natural resources used by industry. Limitations in the global availability of such resources pose challenges to industry which will require careful consideration and planning to ensure continued prosperity for current and future generations. Course will cover strategies and options to mitigate anticipated shortages and optimize the use of non-renewable natural resources, review of fuel and raw material pricing, and cost/benefit analysis of sustainable development proposals. Technical analyses will be presented during class discussions, but a technical background is not required.

**INTM 561 Energy Options for Industry**

Carbon-based fuels are a limited resource and within decades will be in very short supply. Associated energy costs will increase and industry will be required to incorporate alternate fuels and/or power sources, such as uranium (for nuclear power), hydroelectric, geothermal, wind, wave, solar, etc. This course presents such energy options and explores the anticipated impact on industry.

**INTM 562 Special Topics in Sustainability**

This course allows the student to research and report on an industrial sustainability issue of interest and relevance to their career objectives. Topics may touch on industrial ecology, ethics, regulations, environment, resource use, alternative manufacturing methods, facilities, logistics, etc. This is the fourth course in a specialization in Industrial Sustainability.

**INTM 597 Special Projects**

Independent study and project. Permission of instructor required. Variable credit.

***Please note:*** This information is compiled from IIT's current Graduate Programs Bulletin and includes recent department updates. The Graduate Programs Bulletin is the official university publication consulted when delineating or assessing degree requirements.