

# Department of Industrial Engineering

## Master of Engineering Program in Industrial Engineering (International Program)

### M.Eng. (Industrial Engineering)

#### Plan A Option 2:

Total credits required: minimum 39 credits

(1) Major courses: minimum 27 credits

- Seminar: 2 credits

01206597 Seminar 1,1

- Major requirements: 1 credits

01206591 Research Methods in Industrial Engineering 1(1-0-2)

- Major electives: minimum 24 credits

Choose graduate electives at least 18 credits from the list below.

01206511 Industrial Engineering I 3(3-0-6)

01206512 Industrial Engineering II 3(3-0-6)

01206513 Applied Quantitative Sciences in Industrial Engineering 3(3-0-6)

01206521 Linear Optimization 3(3-0-6)

01206522 Non- Linear Optimization 3(3-0-6)

01206523 Dynamic Optimization 3(3-0-6)

01206524 Network Flows Optimization 3(3-0-6)

01206525 Integer and Combinatorial Optimization 3(3-0-6)

01206526 Multiple Criteria Optimization 3(3-0-6)

01206527 Fuzzy Decision Analysis and Optimization 3(3-0-6)

01206529 Applications of Soft-computing Techniques for Industrial Engineering 3(3-0-6)

01206531 Stochastic Modeling and Analysis 3(3-0-6)

01206532 Queuing Theory 3(3-0-6)

01206533 Reliability Theory 3(3-0-6)

01206534 Simulation Modeling and Analysis 3(3-0-6)

01206536 Game and Decision Theory 3(3-0-6)

01206541 Engineering Experimental Designs 3(3-0-6)

01206542 Applied Data and Regression Analysis 3(3-0-6)

01206543 Applied Statistics in Quality Control 3(3-0-6)

01206544 Technological Forecasting 3(3-0-6)

01206551 Design of Facility Layout and Locations 3(3-0-6)

01206552 Sequencing and Layout 3(3-0-6)

01206553 Inventory Theory 3(3-0-6)

01206554 Modern Production and Industrial Systems 3(3-0-6)

01206555 Engineering Project Management 3(3-0-6)

01206556 Advanced Quality Management 3(3-0-6)

01206557 Productivity Management 3(3-0-6)

01206558 Advanced Engineering Economics 3(3-0-6)

01206559 Logistics Engineering 3(3-0-6)

01206562 Production Planning and Inventory Control 3(3-0-6)

01206563 System Engineering and Life Cycle Management 3(3-0-6)

01206564 Integrated Manufacturing Systems 3(3-0-6)

01206565	Productivity Management	3(3-0-6)
01206567	Operational Flow Analysis and Control	3(3-0-6)
01206571	Geometric Modeling	3(3-0-6)
01206572	Computer Numerical Control of Manufacturing Processes	3(3-0-6)
01206596	Selected Topics in Industrial Engineering	1-3
01206598	Special Problems	1-3

In addition, student may choose graduate level course from other related field.

**2) Thesis: minimum 12 credits**

01206599	Thesis	1-12
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**Plan B:**

**Total credits required: minimum 39 credits**

**(1) Major courses: minimum 33 credits**

**- Seminar: 2 credits**

01206597	Seminar	1,1
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**- Major requirements: 1 credits**

01206591	Research Methods in Industrial Engineering	1(1-0-2)
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**- Major electives: minimum 30 credits**

Choose graduate electives at least 24 credits from the list below.

01206511	Industrial Engineering I	3(3-0-6)
01206512	Industrial Engineering II	3(3-0-6)
01206513	Applied Quantitative Sciences in Industrial Engineering	3(3-0-6)
01206521	Linear Optimization	3(3-0-6)
01206522	Non- Linear Optimization	3(3-0-6)
01206523	Dynamic Optimization	3(3-0-6)
01206524	Network Flows Optimization	3(3-0-6)
01206525	Integer and Combinatorial Optimization	3(3-0-6)
01206526	Multiple Criteria Optimization	3(3-0-6)
01206527	Fuzzy Decision Analysis and Optimization	3(3-0-6)
01206529	Applications of Soft-computing Techniques for Industrial Engineering	3(3-0-6)
01206531	Stochastic Modeling and Analysis	3(3-0-6)
01206532	Queuing Theory	3(3-0-6)
01206533	Reliability Theory	3(3-0-6)
01206534	Simulation Modeling and Analysis	3(3-0-6)
01206536	Game and Decision Theory	3(3-0-6)
01206541	Engineering Experimental Designs	3(3-0-6)
01206542	Applied Data and Regression Analysis	3(3-0-6)
01206543	Applied Statistics in Quality Control	3(3-0-6)
01206544	Technological Forecasting	3(3-0-6)
01206551	Design of Facility Layout and Locations	3(3-0-6)
01206552	Sequencing and Layout	3(3-0-6)
01206553	Inventory Theory	3(3-0-6)
01206554	Modern Production and Industrial Systems	3(3-0-6)
01206555	Engineering Project Management	3(3-0-6)
01206556	Advanced Quality Management	3(3-0-6)
01206557	Productivity Management	3(3-0-6)
01206558	Advanced Engineering Economics	3(3-0-6)

01206559	Logistics Engineering	3(3-0-6)
01206562	Production Planning and Inventory Control	3(3-0-6)
01206563	System Engineering and Life Cycle Management	3(3-0-6)
01206564	Integrated Manufacturing Systems	3(3-0-6)
01206565	Productivity Management	3(3-0-6)
01206567	Operational Flow Analysis and Control	3(3-0-6)
01206571	Geometric Modeling	3(3-0-6)
01206572	Computer Numerical Control of Manufacturing Processes	3(3-0-6)
01206596	Selected Topics in Industrial Engineering	1-3
01206598	Special Problems	1-3

In addition, student may choose graduate level course from other related field.

**(2) Independent Study: 6 credits**

01206595	Independent Study	3
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### Course Description

<b>01206511</b>	<b>Industrial Engineering I</b>	<b>3(3-0-6)</b>
	Material science and manufacturing processes, motion and time study, introduction To industrial management and organization.	
<b>01206512</b>	<b>Industrial Engineering II</b>	<b>3(3-0-6)</b>
	Industrial statistics and quality control, operations research techniques, engineering economics and production management.	
<b>01206513</b>	<b>Applied Quantitative Sciences in Industrial Engineering</b>	<b>3(3-0-6)</b>
	Mathematical models and methods for decision making in analysis, design and control of industrial production systems, mathematical programming models, probabilistic and stochastic models, basic industrial data analysis and forecasting using statistical methods and manufacturing simulation under uncertainty.	
<b>01206521</b>	<b>Linear Optimization</b>	<b>3(3-0-6)</b>
	Theory of the simplex method, duality, sensitivity analysis, degeneracy, the revised simplex method, bounded variables problems, generalized upperbounding, decomposition, parametric analysis, multiple objectives linear programming, linear complementary, case studies with computer solutions.	
<b>01206522</b>	<b>Non- Linear Optimization</b>	<b>3(3-0-6)</b>
	Analysis of convex programming including convergence, duality, optimality and concavity, general procedures for unconstrained and constrained problems, quadratic programming, geometric programming, separable programming, fractional programming, and on-convex programming.	
<b>01206523</b>	<b>Dynamic Optimization</b>	<b>3(3-0-6)</b>
	Bellman's principle of optimality, integer optimization, path problems, equipment replacement, knapsack, assignment, production scheduling and facility location problems, stochastic optimization, Markova decision processes, calculus of variation and optimal control with major emphasis on algorithmic development and curse of dimensionality.	
<b>01206524</b>	<b>Network Flows Optimization</b>	<b>3(3-0-6)</b>
	Conservations of flows, definition and linear network flows modeling, shortest path, maximal flows, minimum cut, graphs and tree diagram, out-of kilter algorithm, minimum cost network flows algorithms, basic concepts of non-linear and time varying network.	
<b>01206525</b>	<b>Integer and Combinatorial Optimization</b>	<b>3(3-0-6)</b>
	Examples of integer programming models, primal and dual plane method, all	

integer cutting planes, branch and bound algorithms, 0-1 programming, group theory, NP-completeness, cutting stock problems, traveling salesman problems, vehicle routing problems, quadratic assignment problems, solving non-linear integer programming using dynamic programming.

<b>01206526</b>	<b>Multiple Criteria Optimization</b> Multiple criteria examples, multi attribute decision analysis, linear multiple Objectives programming, objective rows parametric programming, goal and compromising programming, concepts of utility function, non-dominated solution, efficient points, optimal weighting and human judgment, non-linear and integer case studies.	<b>3(3-0-6)</b>
<b>01206527</b>	<b>Fuzzy Decision Analysis and Optimization</b> Fuzzy aspects of set theory, Set operations, Numbers and arithmetic, System and logic, Relations, Regression events, Decision analysis, Optimization and clustering. Case studies.	<b>3(3-0-6)</b>
<b>01206529</b>	<b>Applications of Soft-computing Techniques for Industrial Engineering</b> Soft – Computing techniques. Artificial Intelligence, evolutionary algorithms, and meta-heuristics for solving industrial engineering problems.	<b>3(3-0-6)</b>
<b>01206531</b>	<b>Stochastic Modeling and Analysis</b> Examples and modeling of basic stochastic processes including random walks, Poisson process, discrete and continuous Markova chains, birth-death process, renewal phenomena, semi-Markova process, regenerative, branching, Diffusion and stationary processes, Brownian motion and martingales.	<b>3(3-0-6)</b>
<b>01206532</b>	<b>Queuing Theory</b> Analysis of queue with static or dynamic arrival and service times; General distributions, single and multiple server, queueing network, queue discipline. Transient and steady state analysis with analytical and simulation solutions.	<b>3(3-0-6)</b>
<b>01206533</b>	<b>Reliability Theory</b> Deterministic and probabilistic reliability models and its applications. Reliability analysis with emphasis on modeling time to failures with exponential, Weibull, gamma, and normal distributions; Single and multiple elements; Redundancy; Reliability optimization.	<b>3(3-0-6)</b>
<b>01206534</b>	<b>Simulation Modeling and Analysis</b> Discrete event simulation. Development of computer simulation models. Model validation and verification. Random number generation. Input data analysis. Estimation theory and goodness of fit test.	<b>3(3-0-6)</b>
<b>01206536</b>	<b>Game and Decision Theory</b> Definition of matrix game and min-max theorem; Search of optimal policy for discrete and continuous games; Relationships between linear programming and game theory, Infinite game; Analysis and basic solution techniques using case studies and decision theory under uncertain information.	<b>3(3-0-6)</b>
<b>01206541</b>	<b>Engineering Experimental Designs</b> Analysis of variance, single factor experiment with block, completely randomized and Latin square design. Fixed and random effect. Factorial experiments, nested and split plot design, confounding and fractional replications. Concepts of expected mean square, mean and variance comparisons, and contrasts. Experimentations in regression analysis and response surface exploration.	<b>3(3-0-6)</b>
<b>01206542</b>	<b>Applied Data and Regression Analysis</b> Reviews of descriptive statistics. Simple linear least squares, multiple regression,	<b>3(3-0-6)</b>

	polynomial regression, stepwise regression, multi co linearity, correlation. Nonlinear, least squares and transformations. Techniques of application, with use of computer packages.	
01206543	<b>Applied Statistics in Quality Control</b> Sampling and life testing procedures in evaluating product quality with emphasis to optimal sample size, performance specifications, military standards and federal regulations. Review of recent research in applied probability and statistics in quality control. Applied optimization in quality assurance. Taguchi method.	3(3-0-6)
01206544	<b>Technological Forecasting</b> General methods for technological forecasting with major emphasis on predicting trend development of technology and academy, demand and supply of technology by using historical examples.	3(3-0-6)
01206551	<b>Design of Facility Layout and Locations</b> To develop an understanding of the principles of manufacturing, facility layout and location, material handling systems, warehouse and storage systems. The course emphasizes on modeling, design, analysis and problem solving techniques. A mini research experience will be provided.	3(3-0-6)
01206552	<b>Sequencing and Layout</b> Deterministic/probabilistic nature of sequencing and scheduling problems. Single and multiple machine scheduling. Modern industrial scheduling environments such as flexible shop system, computerized material handling systems, Measurement of solution technique effectiveness, Project scheduling with emphasis on time/cost tradeoff and resource leveling and constraints.	3(3-0-6)
01206553	<b>Inventory Theory</b> Analysis of inventory models with emphasis in cost analysis, demand forecasting, lead time, backordering, static and dynamic order quantity, stochastic demand, multi-level systems. Concepts of MRP and JIT inventory management with case studies.	3(3-0-6)
01206554	<b>Modern Production and Industrial Systems</b> Comprehensive knowledge of the functional activities that typically occur within manufacturing facilities; Information associated with these manufacturing activities; Modeling techniques and problem-solving methodologies for manufacturing systems.	3(3-0-6)
01206555	<b>Engineering Project Management</b> Organization structures of project management; Applying network analysis in planning and scheduling of each project activity with consideration of total time, cost, labor and other related resources; Data base systems for project administration; Capital budgeting; Control and operations techniques for meeting project due dates; Project management standard; Virtual project management and global project management.	3(3-0-6)
01206556	<b>Advanced Quality Management</b> Definition, philosophy and ideas in quality management; Statistical process control, Quality assurance system; Quality inspection; Modern quality management techniques in leading industry; Operations and administration of quality control circle and total quality control.	3(3-0-6)
01206557	<b>Productivity Management</b> Importance and definition of productivity, measurement and analysis of productivity, techniques and simulation models of productivity improvement, organization management and productivity administration, human resource development, total productivity management with case studies.	3(3-0-6)

<b>01206558</b>	<b>Advanced Engineering Economics</b> Accounting and engineering information systems, applied advanced mathematical methods for analyzing engineering economic models, applied quantitative procedures for decision making under certainty and uncertainty, multiple choices analysis with multi-objectives.	<b>3(3-0-6)</b>
<b>01206559</b>	<b>Logistics Engineering</b> Integration of logistic support and systems engineering processes. Design and use of the systems throughout their life cycles. Analysis of logistic problems in terms of reliability, maintainability, human factors and economic feasibility.	<b>3(3-0-6)</b>
<b>01206562</b>	<b>Production Planning and Inventory Control</b> Overview and importance of production planning and control. Modeling techniques. Problem-solving methodologies. Alternative production systems. Real-world manufacturing planning cases.	<b>3(3-0-6)</b>
<b>01206563</b>	<b>System Engineering and Life Cycle Management</b> Principles of system engineering, system life cycle, system design process, designs affecting operational feasibility, life cycle costing, designs for reliability, maintainability, human factors supportability and economic feasibility, application of quantitative methods for system engineering management.	<b>3(3-0-6)</b>
<b>01206564</b>	<b>Integrated Manufacturing Systems</b> Applications and benefits of concurrent engineering, computer integrated manufacturing concepts, computer-aided designs and manufacturing, computerized numerical control programming, flexible manufacturing systems, computer-process interfacing, condition monitoring of processes and tools, computer-aided quality control, assembly systems, assembly lines, assembly line balancing, design for manufacture, human interface in manufacturing systems.	<b>3(3-0-6)</b>
<b>01206565</b>	<b>Productivity Management</b> Principles and models of maintenance. Processes for analyzing requirements of business environments. Safety and quality standards. System analysis, Maintenance failure and condition monitoring, planning and control. Inventory selection and control. Human factors and organization. Information flows and computer control. Overall equipment effectiveness. Total productive maintenance. Information system for maintenance.	<b>3(3-0-6)</b>
<b>01206567</b>	<b>Operational Flow Analysis and Control</b> Operational flow on organizational performance, Operational flow design in different working conditions, Performance measurement of operational flow. Operational flow analysis. Operational flow simulation.	<b>3(3-0-6)</b>
<b>01206571</b>	<b>Geometric Modeling</b> Concepts and tools to design and implement three-dimensional geometric modeling systems for curves, surfaces and solids. Geometric and topological representation of three dimensional object. Curve and surface representation. Geometric algorithms and operations on curves, surfaces, and solids. Integration of geometric modeling and computer aided manufacturing.	<b>3(3-0-6)</b>
<b>01206572</b>	<b>Computer Numerical Control of Manufacturing Processes</b> Theory and application of computer numerical control for machine. Machine structural elements. Control systems and programming. Manual and computer part programming.	<b>3(3-0-6)</b>
<b>01206591</b>	<b>Research Methods in Industrial Engineering</b> Research principles and methods in industrial engineering, problem analysis for	<b>1(1-0-2)</b>

research topic identification, data collection for research planning, identification of samples and techniques, research analysis, result explanation and discussion, report writing, presentation and preparation for journal publication.

<b>01206595</b>	<b>Independent Study</b>	<b>3</b>
	Individual study on selected topics from industrial applicable problems (for non-thesis programs only)	
<b>01206596</b>	<b>Selected Topics in Industrial Engineering</b>	<b>1-3</b>
	Selected topics in Industrial Engineering at the master's degree level. Topics are subject to change each semester.	
<b>01206597</b>	<b>Seminar</b>	<b>1</b>
	Presentation and discussion on current interesting topics in industrial engineering at the master's degree level.	
<b>01206598</b>	<b>Special Problems</b>	<b>1-3</b>
	Study and research in industrial engineering at the master's degree level and compile into a written report.	
<b>01206599</b>	<b>Thesis</b>	<b>1-12</b>
	Research at the master's degree level and compile into a thesis.	