

INDUSTRIAL ENGINEERING DEPARTMENT

POSTGRADUATE PROGRAM

The I.E. department offers the degree of master of science in Industrial Engineering

1. Area of Graduate Study

The I.E. department offers graduate courses and research opportunities in the following areas:

Industrial Engineering

Systems Engineering

Manufacturing Engineering

2. Program of Study

The program of study for each student is determined with the students advisor consultation and shall be approved according to the regulations regarding this matter. The program should include a minimum of 24 semester hours of graduate course work distributed as follows:

Minimum of 15 hours in the area of specialization.

Minimum 3 hours of the courses listed under " General Courses " in addition to EL 501- Advanced English Language which is mandatory but not counted for the degree.

The remaining courses that can be selected from the area of specialization or any other related areas depending upon students interest and need .

In addition to the graduate course work the program should include a thesis in the student's area of specialization . The thesis can be prepared as a theoretical or experimental research . The courses : ES 501 (Advanced Mathematics) and EL 501 (Advanced English Language) have to be taken before or along with the first graduate courses while considering also prerequisite requirements.

3. Course Structure

3.1 General Courses

Code	Course Name	Credit Hours	Prerequisite (s)
EL 501	Advanced English Language	3	
ES 501	Advanced Mathematics	3	
IM 501	Design and Analysis for Engineers	3	IE 310 or IM 504
IM 502	Numerical Analysis for Engineers Course Equivalent to ES 502	3	
IM 503	Selected Topics in Advanced Mathematics	3	
IM 504	Probability and Statistics for Engineers	3	
IM 505	Advanced Automatic Control	3	ME 406

3.2 Industrial Engineering

Code	Course Name	Credit Hours	Prerequisite (s)
IM 510	Plant Layout & Material Handling	3	IE306 ES 261
MI 511	Advanced Ergonomics	3	IE407
IM 512	Production Scheduling	3	IE 409, IE 405
IM 513	Reliability Engg . Maintenance Mgt.	3	IE 310
IM 514	Advanced Engineering Economy	3	IE 307
IM 515	Inventory System Design	3	IE 409
IM 516	Advanced Quality Control	3	IE 302
IM 517	Selected Topics in Industrial Eng .	3	Graduate standing in IE
IM 518	Maintenance Systems and Engineering	3	Graduate standing in IE
IM 519	Modeling and Analysis of Manufacturing Systems	3	IE404, IE405,IE 409

3.3 Manufacturing Engineering

Code	Course Name	Credit Hours	Prerequisite (s)
IM 520	Casting & Welding	3	ME 204, IE 208
IM 521	Deformation Processing	3	ME 222, ES 501 ,IE308
IM 522	Theory of Metal Cutting	3	IE 307,IE 308
IM 523	Metrology	3	IE 207
IM 524	Control of Machine Tools	3	ES 261 IE 308
IM 525	Advanced Tool Engineering	3	ME 222, IE 307,IE 308
IM 526	Advanced Machine Tool Design	3	ME 301 ,IE 308,1M
IM 527	Selected Topics in Manufacturing Engineering	3	graduate standing in Manufacturing Eng .
IM 528	Advanced Material Science	3	ME 204

3.4 Systems Engineering

Code	Course Name	Credit Hours	Prerequisite (s)
IM540	Queuing Theory	3	IE 405
IM541	Project Analysis and Control	3	IE405
IM 542	Nonlinear Programming	3	IE404
IM 543	Dynamic Programming	3	IE405
IM544	Production Systems Simulation	3	IE403
IM547	Selected Topics in Systems Engineering	3	Graduate standing in Systems Engineering

3.5 For All Specialization's

IM599 Thesis

Course Description

IM501 DESIGN AND ANALYSIS OF EXPERIMENTS

3 Credit hrs ; 3 Lecture hrs / week

Prerequisite(s) : IE 310 or IM 504 (or Equivalent)

Basic principle of experimental design, analysis of variance concept and development of single-factor experiments factorial designs development of fractional replications and nested arrangements.

IM 504 PROBABILITY AND STATISTICS FOR ENGINEERING

3 Credit hrs ; 3 Lecture hrs / week

Prerequisite(s):graduate standing in IM program . not open for students of B.Sc.

Axioms of probability , discrete and continuous distributions transformation of variables, theory of estimation and hypothesis testing, confidence intervals, simple and multiple linear regression, non linear regression, non parametric statistics. Application to problem in engineering design and analysis .

IM 505 ADVANCED AUTOMATIC CONTROL

3 Credit hrs ; 3 Lecture hrs / week

Prerequisite(s) : ME 406 (or equivalent)

Review of linear control systems-transient response analysis frequency response methods, the root - locus method , Roth's and Nyquist stability criteria. Compensation techniques - lead compensation, lag compensation, lag-lead compensation. Nonlinear systems - describing functions and describing - function analysis. Phase-plane anal and nonlinear control systems. Discrete time system - the Z-transformation and the inverse Z-transformation, pulse transfer functions, stability analysis in the Z-plane, state-space representation of control systems state-space analysis of time-invariant systems, linear time - varying systems, and discrete-time systems. Stability analysis of nonlinear systems. Optimal and adaptive control systems - controllability and observability of control systems, time-optimal control systems, adaptive control systems.

IM 510 PLANT LAYOUT AND MATERIALS HANDLING

3 Credits hrs. ; 3 lecture hrs/week

Prerequisite; IE306, ES261 (or equivalent)

Analysis and design of plant layout. Analytical models for evaluating plant layouts including computer models. Analysis of operation of material handling systems including analytical and computer models.

IM 511 ADVANCED ERGONOMICS

3 Credit hrs. ; 3 lecture hrs/week

Prerequisite : IE407 (or equivalent)

Advanced study of system and work center design considering human abilities and limitations. Measurement of environmental parameters and their consideration in the design of work environment. Information and control models.

IM 512 PRODUCTION SCHEDULING

3 Credit hrs. ; 3 lecture hrs/week

Prerequisites : IE409, IE405 (or equivalent)

Introduction to problems of sequencing and scheduling for single, multiple and parallel processor systems, discrete programming and heuristic procedures for flow-shop and job-shop models.

IM 513 RELIABILITY ENGINEERING & MAINTENANCE MANAGEMENT

3 Credit hrs. ; 3 lecture hrs/week

Prerequisite : IE310 (or equivalent),(This is not open for students who took IE406)

A study of methods on systems design and evaluation to assure reliability of performance. reliability of components and systems. Principles of maintainability and availability. Maintenance system design. Planning and control of maintenance function.

IM 514 ADVANCED ENGINEERING ECONOMY

3 Credit hrs. ; 3 lecture hrs/week

Prerequisite : IE307 (or equivalent)

Advanced analytical models and techniques of problems of equipment selection, replacement, and resource allocation. Consideration of elements of risk and uncertainty. Public sector projects.

IM 515 INVENTORY SYSTEMS DESIGN

3 Credit hrs. ; 3 lecture hrs/week.

Prerequisite IE409 (or equivalent)

Forecasting techniques, analysis of deterministic and probabilistic models , material requirement planning. Inventory control systems. Computer applications.

IM 516 ADVANCED QUALITY CONTROL

3 Credit hrs. ; 3 lecture hrs/week.

Prerequisite : IE302 (or equivalent)

Some economic aspects of quality decisions, some special types of acceptance sampling plans, applications of modern statistical theory.

IM 518 MAINTENANCE SYSTEMS AND ENGINEERING

3 Credit hrs. ; 3 lecture hrs/week.

Prerequisite : graduate standing in IE

Applying systems engineering and systems theory approaches to maintenance programs in industrial organizations. Establishing systematic framework for maintenance management. Reviewing quantitative techniques used for maintenance planning and control. Designing MIS for maintenance programs.

IM 519 MODELING AND ANALYSIS OF MANUFACTURING SYSTEMS

3 Credit hrs. ; 3 lecture hrs/week.

Prerequisite : IE 404, IE 405, IE 409

- Types of manufacturing systems, principles of manufacturing systems, and types and uses of manufacturing models.
- Material flow systems, assembly lines: reliable serial systems, problem formulation, approaches to line balancing, optimal solutions, sequencing mixed models, and unpaced lines.
- Shop scheduling with many products, bottleneck scheduling, flow shop scheduling, job shop scheduling, stochastic scheduling (static and dynamic analysis), and vehicle scheduling.
- Flexible manufacturing systems, system components, planning and control hierarchy, system design, part selection problem, loading problem, scheduling and control, and flexible assembly systems.
- General manufacturing systems: analytical queuing models, a single workstation, open network, closed network, a hybrid system.
- Grouping technology, design and planning issues in cellular manufacturing systems, project on machine grouping and layout, and optimal approach to solving CMS design problem.
- Computer applications.

IM 520 CASTING AND WELDING PROCESSES

3 Credit hrs. ; 3 lecture hrs/week.

Prerequisite : ME204,IE308 (or equivalent)

Corequisite : IM528

Melting furnaces, casting of shapes, solidification of castings and design of gating system. New casting processes, finishing of castings, design of castings, sand testing and control of mould characteristics casting. Welding metallurgy , distortion of welds, design of welds, testing of welded joints. Joining of difficult

to weld metals. Welding of plastics. welding defects, their causes and remedies. Testing and Inspection of casting and welds.

IM521 DEFORMATION PROCESSING

3 Credit hrs. ; 3 lecture hrs/week

Prerequisite(s) :ME222, IE308, ES501

Introduction to theories of elasticity and plasticity and their applications to the metal forming processes of wire and tube drawing, extrusion, forging and rolling including calculation of forces, power and maximum possible reduction.

IM522 THEORY OF METAL CUTTING

3 Credit hrs. ; 3 lecture hrs/week

Prerequisite : IE207, IE308 (or equivalent)

Theory of metal cutting, nomenclature of cutting tools economics of metal cutting operations. Design of single point cutting tools. Machine tool vibrations. Future trends in machining methods.

IM523 METROLOGY

3 Credit hrs. ; 3 lecture hrs/week

Prerequisite : IE207 (or equivalent)

Fundamentals of measurements, linear, radius and angular measurements, comparators, screw thread and gear measurements, systems of limits and fits. Design of limit gauges, acceptance tests for machine tools, surface finish measurement.

IM524 CONTROL OF MACHINE TOOLS

3 Credits hrs. ; 3 lecture hrs/week

Prerequisite(s) : ES261, IE308 (or equivalent)

Introduction to numerically controlled machine tools including principles of operation, programming system, computer assisted programming, performance characteristics and applications, machining center. Methods of increasing machine tool capacity, maintenance considerations.

IM525 ADVANCED TOOL ENGINEERING

3 Credit hrs. , 3 lecture hrs/week

Prerequisites : ME222, IE207, IE308.

Tool engineering, the design of tools, types of tools, Basic principles of Jigs and fixtures design such as form, locating and clamping devices and use of standardized parts. Materials for jigs and fixtures. Economics of using jigs fixtures.

IM526 ADVANCED MACHINE TOOL DESIGN

3 Credit hrs. ; 3 lecture hrs/week

Prerequisites : IM522, ME301, IE308 (or equivalent)

General introduction and classification of machine tools. Mechanical drive components in machine tools design. Electrical components in machine tool design. Pneumatics and hydraulics in machine tools design. Transmission of motion in machine tool design. Automatic and Numerical control in machine tool design.

IM528 ADVANCED MATERIAL SCIENCE

3 Credit hrs. ; 3 lecture hrs/week

Prerequisite : ME204 (or equivalent)

Quantitative metallography, Diffusion in Solids, strengthening in solids, phase transformation in solids and physical metallurgy of steels.

IM540 QUEUING THEORY

3 Credits hrs. ; 3 lecture hrs/week

Prerequisite :IE405 (or equivalent)

Review, Queuing theory and stochastic processes. Models with review; Queuing theory and stochastic processes. Models with general or service patterns. Advanced Markovian models and processes. Statistical inference in queuing. Design and Control of Queues.

IM541 PROJECT ANALYSIS AND CONTROL

3 Credits hrs ; 3 lecture hrs/week

Prerequisite : IE405 (or equivalent)

Mathematical formulation of network problems. Simulation of CPM networks. Multiprojects and sub projects. Cost control and analysis, scheduling resource-constraints projects. Comparison of heuristics. The role of management in implementation of projects. Application of CPM/PERT techniques.

IM542 NONLINEAR PROGRAMMING

3 Credits hrs ; 3 lecture hrs/week

Prerequisite : IE405 (or equivalent)

Theory and applications of unconstrained nonlinear programming methods with derivatives and without derivatives. Fundamental concepts and applications of constrained optimization procedures. Design and construction of test problems.

IM543 DYNAMIC PROGRAMMING

3 Credits hrs ; 3 lecture hrs/week

Prerequisite : IE405 (or equivalent)

Review, the principles of optimality and one-dimensional problem. Analytical solution of multidimensional and stochastic problems. Calculus of variation and the control theory. Reduction of state dimensionally and approximation. Advanced computational methods in dynamic programming.

IM544 PRODUCTION SYSTEM SIMULATION

3 Credits hrs ; 3 lecture hrs/week

Prerequisite : IE403 (or equivalent)

Review, simulation of queuing models. Verification and validation of simulation models. Output analysis comparison and evaluation and alternative system designs modeling using Q-GERT. Various discrete simulation languages with emphasis on GASP.