

DEPARTMENT OF INDUSTRIAL ENGINEERING

The courses in industrial engineering are designed to produce engineers specializing in problem solving and decision making functions. To this end production, planning and control, work study, quality assurance and control, systems and procedures analysis of emphasized in general, practical applications of production oriented operations research techniques, data processing, and computer programming fundamentals are also stressed. As well as the aforementioned techniques, the department is also making an effort in developing studies on human aspects industry as exemplified by the topics of human relationship in industry, ergonomics (Small group activities) and industrial law.

The Department of Industrial Engineering provides the Bachelor of Engineering degree, the Master of Engineering degree, and the Doctor of Philosophy (Ph.D.).

HEAD :

Paveena Chaovalitwongse, Ph.D. (Florida)

PROFESSORS :

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ASSISTANT PROFESSORS :

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LECTURERS :

Arisara Jiamsanguanwong, D.Eng. (Tokyo Tech)
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Poom Luangjarmekorn, M.Eng. (Nagoya)
Worachok Chaiwong, M.Eng. (Chula)

INDUSTRIAL ENGINEERING UNDERGRAD PROGRAMS

The department provides two undergraduate programs of study: a general program and a co-operative education program. Similar to all other engineering curriculums, the general program requires 2 credits of engineering practice during the summer semester. The co-operative education program offers a whole semester longer time for students to practice their skills in real workplaces.

**INDUSTRIAL ENGINEERING CURRICULUM OF BACHELOR'S DEGREE
FIRST YEAR CURRICULUM
COMMON TO ALL ENGINEERING STUDENTS**

GENERAL STUDY PROGRAM

COURSE NO.	SUBJECT	CREDITS	COURSE NO.	SUBJECT	CREDITS
THIRD SEMESTER			SIXTH SEMESTER		
2103213	ENGINEERING MECHANICS I	3	2104352	FACILITY DESIGN	3
2104251	INTRODUCTION TO MANUFACTURING SYSTEMS	2	2104358	INTRODUCTION TO SAFETY ENGINEERING	3
2104253	ENGINEERING STATISTICS I	3	2104354	INDUSTRIAL COST ANALYSIS AND BUDGETING	3
2301312	DIFFERENTIAL EQUATIONS	3	2104359	SIMULATION PROGRAMMING	3
5500208	COMMUNICATION AND PRESENTATION SKILLS	3	2106362	INDUSTRIAL ENGINEERING LAB II	1
2104255	APPLICATION DEVELOPING FOR INDUSTRIAL ENGINEERING	3	5500308	TECHNICAL WRITING FOR ENGINEERING	3
xxxxxxx	FREE ELECTIVE	<u>3</u>	xxxxxxx	GENERAL EDUCATION	<u>3</u>
		20			19
FOURTH SEMESTER			SUMMER SEMESTER		
2103261	FUNDAMENTALS OF THERMO- FLUID ENGINEERING	3	2100301	ENGINEERING PRACTICE (S/U)	<u>2</u>
2103392	ME LAB FOR NON ME	1			2
2104252	OPERATIONS MANAGEMENT	2	SEVENTH SEMESTER		
2104254	ENGINEERING STATISTICS II	3	2104491	INDUSTRIAL ENGINEERING PRE-PROJECT	1
2104256	QUALITY MANAGEMENT	2	xxxxxxx	ELECTIVE	3
2104257	MANUFACTURING PROCESSES	3	xxxxxxx	GENERAL EDUCATION	3
2104258	MANUFACTURING PROCESSES LABORATORY	1	xxxxxxx	FREE ELECTIVE	<u>6</u>
2104259	OPERATIONS RESEARCH	<u>3</u>			16
		18			
FIFTH SEMESTER			EIGHTH SEMESTER		
2102391	ELECTRICAL ENGINEERING I	3	2104409	INDUSTRIAL BUSINESS MANAGEMENT	3
2102392	ELECTRICAL ENGINEERING LABORATORY I	1	2104425	MAINTENANCE ENGINEERING	3
2104351	WORK DESIGN	3	2104499	INDUSTRIAL ENGINEERING PROJECT	
2104353	ENGINEERING ECONOMY	3	<u>OR</u>		
2104355	COMPUTER AND INFORMATION TECHNOLOGY FOR IE	2	2100499	SENIOR PROJECT	3
2104356	QUALITY CONTROL	2	xxxxxxx	ELECTIVE	3
2104357	ENGINEERING EXPERIMENTAL DESIGN	3	xxxxxxx	GENERAL EDUCATION	<u>3</u>
2104361	INDUSTRIAL ENGINEERING LAB	<u>1</u>			15
		17			

TOTAL CREDITS FOR GRADUATION = 144

**INDUSTRIAL ENGINEERING CURRICULUM OF BACHELOR'S DEGREE
FIRST YEAR CURRICULUM
COMMON TO ALL ENGINEERING STUDENTS**

CO-OPERATIVE EDUCATION PROGRAM

COURSE NO.	SUBJECT	CREDITS	COURSE NO.	SUBJECT	CREDITS
THIRD SEMESTER			SIXTH SEMESTER		
2103213	ENGINEERING MECHANICS I	3	2104352	FACILITY DESIGN	3
2104251	INTRODUCTION TO MANUFACTURING SYSTEMS	2	2104358	INTRODUCTION TO SAFETY ENGINEERING	3
2104253	ENGINEERING STATISTICS I	3	2104354	INDUSTRIAL COST ANALYSIS AND BUDGETING	3
2301312	DIFFERENTIAL EQUATIONS	3	2104359	SIMULATION PROGRAMMING	3
5500208	COMMUNICATION AND PRESENTATION SKILLS	3	2106362	INDUSTRIAL ENGINEERING LAB II	1
2104255	APPLICATION DEVELOPING FOR INDUSTRIAL ENGINEERING	3	5500308	TECHNICAL WRITING FOR ENGINEERING	3
xxxxxxx	FREE ELECTIVE	<u>3</u>	xxxxxxx	GENERAL EDUCATION	<u>3</u>
		20			19
FOURTH SEMESTER			SUMMER SEMESTER		
2103261	FUNDAMENTALS OF THERMO- FLUID ENGINEERING	3	2100301	ENGINEERING PRACTICE	2 (S/U)
2103392	ME LAB FOR NON ME	1			2
2104252	OPERATIONS MANAGEMENT	2	SEVENTH SEMESTER		
2104254	ENGINEERING STATISTICS II	3	2104401	CO-OPERATIVE EDUCATION	6
2104256	QUALITY MANAGEMENT	2	2104491	INDUSTRIAL ENGINEERING PRE-PROJECT	1
2104257	MANUFACTURING PROCESSES	3	2104499	INDUSTRIAL ENGINEERING PROJECT	
2104258	MANUFACTURING PROCESSES LABORATORY	1	<u>OR</u>		
2104259	OPERATIONS RESEARCH	<u>3</u>	2100499	SENIOR PROJECT	<u>3</u>
		18			10
FIFTH SEMESTER			EIGHTH SEMESTER		
2102391	ELECTRICAL ENGINEERING I	3	2104409	INDUSTRIAL BUSINESS MANAGEMENT	3
2102392	ELECTRICAL ENGINEERING LABORATORY I	1	2104425	MAINTENANCE ENGINEERING	3
2104351	WORK DESIGN	3	xxxxxxx	ELECTIVE	3
2104353	ENGINEERING ECONOMY	3	xxxxxxx	GENERAL EDUCATION	9
2104355	COMPUTER AND INFORMATION TECHNOLOGY FOR IE	2	xxxxxxx	FREE ELECTIVE	3
2104356	QUALITY CONTROL	2			21
2104357	ENGINEERING EXPERIMENTAL DESIGN	3			
2104361	INDUSTRIAL ENGINEERING LAB	1			
		18			

TOTAL CREDITS FOR GRADUATION = 144

NAME OF THE DEGREE

: Master of Engineering
: M. Eng.

COURSE REQUIREMENTS

1) Required Courses 6 credits

2104688	Research Methodology in Industrial Engineering and Operations Management	3(3-0-9) (S/U)
2104690	Quantitative Data Analysis for Industrial Engineering	3(3-0-9)

2) Approved Elective 9 credits

The students must select 2 fields in the approved elective courses with a minimum of 2 subjects in each selected field..

- Operations Research
- Quality Management and Control
- Production Engineering
- Safety Engineering and Ergonomics
- Industrial Management

Remark: Approved electives and subjects to change, with approval from the committee of the program or Industrial Engineering Department.

- Operations Research

2104523	Introduction to Stochastic Models	3(3-0-9)
2104612	Computer Simulation Technique	3(3-0-9)
2104613	Principle of Optimization	3(3-0-9)

- Quality Management and Control

2104516	Quality Improvement	3(3-0-9)
2104604	Advanced Quality Management	3(3-0-9)
2104615	Engineering Experimental Design	3(3-0-9)

- Production Engineering

2104512	Production and Operations Management Information Systems	3(3-0-9)
2104626	Materials and Processing	3(3-0-9)
2104627	Product and Production Design	3(3-0-9)
2104711	Advanced Manufacturing Engineering	3(3-0-9)

- Safety Engineering and Ergonomics

2104645	Applied Biomechanics	3(2-3-7)
2104646	Work Physiology	3(2-3-7)
2104647	Hazardous Material and Fire Protection Engineering	3(3-0-9)

- Industrial Management

2104601	Engineering Economic Analysis	3(3-0-9)
2104606	Advanced Industrial Organization	

	and Management	3(3-0-9)
2104650	Project Management Concepts	3(3-0-9)

3) Free Elective 12 credits

2104505	Machinery and Instrument Appraisal	3(3-0-9)
2104506	Engineering Project Management	3(3-0-9)
2104507	Logistics and Supply Chain Management	3(3-0-9)
2104509	Warehouse and Warehousing Management	3(3-0-9)
2104511	Introduction to Virtual Environments	3(3-0-9)
2104512	Production And Operations Management Information Systems	3(3-0-9)
2104513	Industrial Engineering Integration	3(3-0-9)
2104515	Responsible Care	3(3-0-9)
2104516	Quality Improvement	3(3-0-9)
2104518	Quality System	3(3-0-9)
2104520	Visual Factory	3(3-0-9)
2104521	Computer Programming for Industrial Engineering	3(3-0-9)
2104523	Introduction to Stochastic Models	3(3-0-9)
2104524	Operations & Service Management	3(3-0-9)
2104525	Work Process Design and Improvement	3(3-0-9)
2104555	System Safety	3(3-0-9)
2104559	Risk Management for Industry	3(3-0-9)
2104601	Engineering Economic Analysis	3(3-0-9)
2104602	Analysis of Business System	3(3-0-9)
2104603	Advanced Quality Control	3(3-0-9)
2104604	Advanced Quality Management	3(3-0-9)
2104606	Advanced Industrial Organization	
	Management	3(3-0-9)
2104609	Reliability Theory in Engineering	3(3-0-9)
2104611	Inventory Analysis	3(3-0-9)
2104612	Computer Simulation Techniques	3(3-0-9)
2104613	Principle of Optimization	3(3-0-9)
2104615	Engineering Experimental Design	3(3-0-9)
2104616	Activity Scheduling	3(3-0-9)
2104617	Industrial Scheduling	3(3-0-9)
2104624	Factory and Production Management	3(3-0-9)
2104625	Computerized Statistical Data Analysis	3(3-0-9)
2104626	Materials and Processing	3(3-0-9)
2104627	Product and Production	

	Design	3(3-0-9)
2104637	Coordination and Communication	3(3-0-9)
2104640	Decision Analysis in Engineering	3(3-0-9)
2104642	Decision Support Systems	3(3-0-9)
2104644	Advanced Maintenance Management	
		3(3-0-9)
2104645	Applied Biomechanics	3(2-3-7)
2104646	Work Physiology	3(2-3-7)
2104647	Hazardous Material and Fire Protection Engineering	3(3-0-9)
2104648	Strategic Planning for Engineers	3(3-0-9)
2104650	Project Management Concepts	3(3-0-9)
2104671	Advanced Work Design	3(2-3-7)
2104677	Seminar in Safety Engineering	3(2-3-7)
2104691	Research Problems in Industrial Engineering I (OR techniques)	3(3-0-9)
2104692	Research Problems in Industrial Engineering II (Production techniques)	3(3-0-9)
2104693	Research Problems in Industrial Engineering III (Management Techniques)	3(3-0-9)
2104694	Research Problems in Industrial Engineering IV (Safety)	3(3-0-9)
2104711	Advanced Manufacturing Engineering	3(3-0-9)
2104723	Artificial Intelligence for Industrial Engineering	3(3-0-9)
2104741	Comparative Engineering Management	3(3-0-9)

Remark : The student can select other courses offered by the Industrial Engineering, which will be announced by Industrial Engineering Department.

2104811	Thesis	12 credits
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INDUSTRIAL ENGINEERING CURRICULUM OF MASTER'S DEGREE

COURSE NO.	SUBJECT	CREDITS	COURSE NO.	SUBJECT	CREDITS
FIRST SEMESTER			THIRD SEMESTER		
2104688	RES METHOD IEOM	3	2104811	THESIS	3
2104690	QUAN DATA ANAL IE	3	xxxxxxx	FREE ELECTIVES	<u>6</u>
xxxxxxx	APPROVED ELECTIVES	<u>6</u>			9
		12			
SECOND SEMESTER			FOURTH SEMESTER		
xxxxxxx	APPROVED ELECTIVES	3	2104811	THESIS	6
2104811	THESIS	3	xxxxxxx	FREE ELECTIVES	<u>3</u>
xxxxxxx	FREE ELECTIVES	<u>3</u>			9
		9			

TOTAL CREDITS FOR GRADUATION = 39

INDUSTRIAL ENGINEERING CURRICULUM OF DOCTORAL DEGREE

COURSE NO.	SUBJECT	CREDITS	COURSE NO.	SUBJECT	CREDITS
FIRST SEMESTER			FOURTH SEMESTER		
2104781	DOCTORAL SEMINAR IN INDUSTRIAL ENGINEERING I	(1)*	2104784	DOCTORAL SEMINAR IN INDUSTRIAL ENGINEERING IV	(1)*
2104828	DISSERTATION	<u>6</u>	2104828	DISSERTATION	<u>9</u>
		7			10
SECOND SEMESTER			SIXTH SEMESTER		
FIFTH SEMESTER					
2104782	DOCTORAL SEMINAR IN INDUSTRIAL ENGINEERING II	(1)*	2104785	DOCTORAL SEMINAR IN INDUSTRIAL ENGINEERING V	(1)*
2104828	DISSERTATION	<u>6</u>	2104828	DISSERTATION	<u>9</u>
		10			10
THIRD SEMESTER			SIXTH SEMESTER		
2104783	DOCTORAL SEMINAR IN INDUSTRIAL ENGINEERING III	(1)*	2104786	DOCTORAL SEMINAR IN INDUSTRIAL ENGINEERING VI	(1)*
2104828	DISSERTATION	9	2104828	DISSERTATION	<u>9</u>
2104897	QUALIFYING EXAM	<u>0</u>			10
		10			

TOTAL CREDITS FOR GRADUATION = 48

Remarks : (1)* Credits for this course are not assessed towards the degree program

(3)* Credits for this course are not assessed towards the degree program

**COURSE DESCRIPTIONS IN INDUSTRIAL ENGINEERING
(B.ENG.)**

2104204 General Manufacturing Process Lab

1(0-3-0)

Basic measuring equipment and general manufacturing process; drawing and reading designs for work operation: use of tools in designing and work operation and use of machine for manufacturing: turning machine, milling machine, drilling machine; designing and manufacturing parts and conclusion of work operation in the manufacturing process.

2104251 Introduction to Manufacturing Systems

2(2-0-4)

Manufacturing systems overview; systematic problem solving ; modeling in IE and performance measurement; basic IE tools and techniques; management concepts in manufacturing systems; push and pull manufacturing concepts; logistics and supply chain management.

2104252 Operations Management

2(2-0-4)

*Condition: Prerequisite 2104251 or
Consent of Faculty*

Operations strategies, inventory and distribution management, capacity management, aggregate planning, master production scheduling, material requirements planning, operation scheduling, project management.

2104253 Engineering Statistics I

3(3-0-6)

Basis Engineering in Descriptive statistics; probability; discrete probability distributions; continuous probability distributions; joint probability distributions; point estimation; interval estimation; hypothesis and statistical inference for one population; engineering applications.

2104254 Engineering Statistics II

3(3-0-6)

*Condition: Prerequisite 2104253 or
Consent of Faculty*

Basis Engineering in Hypothesis and statistical inference for two populations; analysis of variance; randomized blocks; latin square design; goodness of fit test; non-parametric statistics; linear regression analysis; time- series analysis; engineering applications.

2104255 Application Developing for Industrial Engineering

3(2-3-4)

*Condition: Prerequisite 2110101 or
Consent of Faculty*

Application Developing for Industrial Engineering; object-oriented programming; event-driven programming; application developing from data structure and algorithm; application design.

2104256 Quality Management

2(2-0-4)

Quality philosophy; quality management strategies: total quality management (TQM), Six Sigma; quality system management: ISO, Thailand Quality Award (TQA); problem solving tools; team building techniques; organizing for quality.

2104257 Manufacturing Processes

3(3-0-6)

Introduction to manufacturing industry; economic principles of manufacturing processes; mechanical characterization of materials; casting; metal forming: rolling, metal drawing, extrusion, forging, cold forming; machining: turning, shaping and planning, milling, grinding; non-traditional machining; metal cutting: tool shape, forces and power requirement in metal cutting; tool's life equations; power metallurgy and cutting tool material; welding technology and welding inspection; CNC technology.

2104258 Manufacturing Processes Laboratory

1(0-3-0)

Practice in manufacturing processes: machining and hand tools, heat treatment, welding and casting.

2104259 Operations Research

3(3-0-6)

Deterministic operations research in industrial engineering problem solving with emphasis on the use of mathematical models; linear programming; transportation model; and game theory.

2104351 Work Design

3(2-3-4)

Fundamentals of method, work and process analysis; line balancing; collection of operation data, process improvement through the use of flow process chart; operation process chart (assembly process chart), Gantt chart, multi-activity chart, motion Study (micromotion study), introduction to anthropometry, work physiology and biomechanics, macro and temporal ergonomics, guidelines for design and organization of work stations, guidelines for manual material handling and hand tools, guidelines for controls and displays, principles of motion economy, proposed method implementation, learning curves, stopwatch time study, performance rating and allowances, standard data and formulas, predetermined time systems, work sampling, indirect and expense labor standards.

2104352 Facility Design

3(3-0-6)

*Condition: Prerequisite 2104351 or
Consent of Faculty*

Introduction to facility design; importance and process of facility design; preliminary analysis of facility design: layout and related factors: products, processes, material handling, machine, man, selection of facility location.

2104353 Engineering Economy

3(3-0-6)

Interest formulation; time value of money; equivalent value and rate of return; project analysis and evaluation; breakeven point; sensitivity analysis; risk and uncertainty analysis; asset replacement decision; depreciation and tax.

2104354 Industrial Cost Analysis and Budgeting

3(3-0-6)

*Condition: Prerequisite 2104353 or
Consent of Faculty*

Fundamentals of financial reports; cost analysis for planning process; capital expenditure; cost control and opportunity loss management; capital rationing;

profitability analysis and decision making for investment in challenging projects under uncertainty and risk.

2104355 Computer and Information Technology for Industrial Engineering 2(1-3-2)

Condition: Prerequisite 2110101 or Consent of Faculty

Database system; network systems; information communication technology; network application development.

2104356 Quality Control 2(2-0-4)

Condition: Prerequisite 2104253 and 2104254 or Consent of Faculty

Quality control philosophy; methods of statistical quality control: control charts, process capability analysis, measurement system analysis, acceptance sampling; product reliability.

2104357 Engineering Experimental Design 3(3-0-6)

Condition: Prerequisite 2104254 or Consent of Faculty

Factorial design; 2^k factorial design; blocking and confound: fractional factorial design; factorial experiments with random factors; nested and split-plot design; non-linear regression analysis; response surface analysis.

2104358 Introduction to Safety Engineering 3(3-0-6)

Safety principles and safety standards; basic human anatomy; study of the following hazards: noise, chemicals, electricity, fire, radiation, machine tools and pressure vessels, work in hot environment; hazard prevention method; accident investigation techniques; safety law; principle of safety management; introduction to industrial psychology; laboratory and field trips.

2104359 Simulation Programming 3(3-0-6)

Condition: Prerequisite 2104253, 2104254 or Consent of Faculty

Probabilistic operations research in industrial engineering problem solving with emphasis on the use of simulation; queuing theory; and inventory model.

2104361 Industrial Engineering Laboratory 1(0-3-0)

Laboratory work related to design, assign, control, and evaluation of work considering productivity and quality aspects.

2104362 Industrial Engineering Laboratory II 1(0-3-0)

Laboratory work related to design, assign, control, and evaluation of work considering productivity, safety and cost aspects.

2104391 Materials Technology I 3(2-3-4)

Condition: Prerequisite 2104257 or Consent of Faculty

Various production techniques of material powders, manufacturing techniques of metal and ceramic components from powders, powder characterization techniques, mechanical properties of components in relation to micro-structure production and physical properties of inorganic glasses.

2104401 Co-operative Education 6(0-36-0)

Full-time job training in a real-life industrial environment; working as an organization's employee in the discipline associated with each student's curriculum and career goals.

2104408 Energy management in Industry 3(3-0-6)

Types of energy in industrial processes; laws related to energy consumption; energy saving measures; instruments and energy auditing; economic analysis and work standard for efficient energy usage.

2104409 Industrial Business Management 3(3-0-6)

Basic knowledge about Organization - Business - Industry - Supply Chain; changed directions of the world and industry and adaptation; strategic Management; innovation management; operations management; ,management and utilization of data / information / knowledge / information technology; project development and project management; leadership; change management; human resource management; good governance and risk management; virtue; ethics; code of conduct; social responsibility; business management according to the philosophy of Sufficiency Economy

2104414 CNC Turning Technology 3(3-0-6)

Introduction to CNC Turning, CNC Lathe Cutting Fundamentals, CNC Lathe Control and Operation, CNC Lathe Technical Data, CNC Lathe Rapid and Feed Moves, CNC Lathe Circular interpolation, Tool Nose Radius Compensation and Command of CNC lathe by CNC Lathe Fixed Cycles G70-G94 and others.

2104415 CNC Machining Technology 3(3-0-6)

Introduction to CNC turning centres, CNC turning fundamentals, CNC turning centre cutting fundamentals, CNC turning centre control and operation, CNC turning centre technical data, CNC turning centre rapid and feed moves, CNC turning centre circular interpolation, CNC cutter diameter compensation, CNC canned cycles and CNC canned cycles G84, G86, and G76.

2104424 Applied Ergonomics 3(2-3-4)

Science of motion; biomechanics; 2-D analysis; problems of neck, shoulder, wrist, elbow, lower back, using a goniometer and EMG; psychophysics principles; fatigue and motivation; factory survey; work design; doing term projects, and presentation.

2104425 Maintenance Engineering 3(3-0-6)

Maintenance concepts; terotechnology; preventive maintenance; corrective maintenance; maintenance organization planning and control of maintenance activities; materials and spare part management; reliability and failure statistics; application of waiting line theory to maintenance problem, critical part scheduling, measurement and evaluation maintenance performance; depreciation causes; machine and equipment inspection.

2104426 Co-operative Education 3(0-18-0)

Full-time job training in a real-life industrial environment; working as an organization's employee in

the discipline associated with each student's curriculum and career goals.

2104429 Applications of Operations Research 3(3-0-6)

Condition: Prerequisite 2104259 and 2104359 or Consent of Faculty

Applications of Operations Research techniques: Linear Programming, Integer Programming, Stochastic Programming, and Simulation to solve real-world problems of industrial organizations.

2104431 Automation 3(2-3-4)

Basic concepts of automation systems in manufacturing industry; equipment in automation systems: pneumatics, hydraulics, sensor; logical control; industrial robot technology; control theory.

2104432 Introduction to Cognitive Ergonomics 3(3-0-6)

Specialty the inter-discipline of design and system development that are involved with humans to make the systems more effective and more robust, focusing on amplifying human capability in performing cognitive work by integrating technical functions with human cognitive processes to create efficient and reliable systems.

2104456 Ergonomics 3(2-3-4)

Introduction to Ergonomics; human body as a working system (i.e. bones, joints, muscles, metabolism); anthropometry; work demand evaluation and factory inspection using biomechanics and physiology method; displays and controls; introduction to human information processing.

2104459 Value Engineering 3(3-0-6)

Introduction to value engineering methodology; application for value engineering technique to product design; procurement and manufacturing in order to reduce cost without loss of quality.

2104463 Project Feasibility Study 3(3-0-6)

Condition: Prerequisite 2104353 or Consent of Faculty

Study key factors crucial to decision making in industrial investment.

2104491 Industrial Engineering Pre-Project 1(0-2-1)

Problem framework; guidelines for problem solving and solutions to the problems in an industrial engineering project.

2104493 Special Problems in Industrial Engineering III 3(2-3-4)

Study or investigation of special problems assigned by the instructor with the consent of the head of the departmental.

2104494 Advanced Topics in Industrial Engineering III 3(3-0-6)

Study of current interesting topics and new development in industrial engineering.

2104495 Advanced Topics in Industrial Engineering I 3(3-0-6)

Study of current interesting topics and new development in industrial engineering.

2104496 Advanced Topics in Industrial Engineering II 3(3-0-6)

Study of current interesting topics and new development in industrial engineering.

2104497 Special Problems in Industrial Engineering I 3(2-3-4)

Study or investigation of special problems assigned by the instructor with the consent of the head of the department.

2104498 Special Problems in Industrial Engineering II 3(2-3-4)

Study or investigation of special problems assigned by of the instructor with the consent of the head of the department.

2104499 Industrial Engineering Project 3(0-9-0)

Practical interesting project or problems in various fields of industrial engineering assigned by the instructor.

COURSE DESCRIPTIONS IN INDUSTRIAL ENGINEERING (M.ENG., PH.D.)

2104505 Machinery and Instrument Appraisal 3(3-0-9)

Importance of appraisal for machines; equipment and instruments; life cycle of machinery; conditions and efficiency of machinery; factor effects to appraisal; step of appraisal; engineering economy; reporting case studies.

2104506 Engineering Project Management 3(3-0-9)

Project management models; project initiation; project planning, organization, scheduling and control; resource and cost management; risk management; project termination; project management information system; case study.

2104507 Logistics and Supply Chain Management 3(3-0-9)

Definition of logistics and supply chain management; distribution network design; distribution strategies production-inventory models; transportation design; coordination and information technology; international issues.

2104509 Warehouse and Warehousing Management 3(3-0-9)

Condition : Prerequisite 2104252 and 2104524 Consent of Faculty

The role of the warehouse; warehousing decisions; warehousing operations; materials handling and packaging.

2104511 Introduction to Virtual Environments 3(3-0-9)

Theory, development, and applications of virtual reality (VR) technology for the generation of the virtual environments (VE); human-computer interaction based on the 5 basic senses of human perception; use of 3D software and some scripting language to generate models in the CAVE system; application of VR technology in product and production design and others.

2104512 Production and Operations Management Information Systems 3(3-0-9)
Condition : Prerequisite 2104252 or 2104524 or Consent of Faculty

Information strategy, business information systems, ERP, system analysis and design, database for production and operations management, information systems for production and operations management and control; systems implementation; systems operation and support, case studies.

2104513 Industrial Engineering Integration 3(3-0-9)
Condition : Prerequisite 2104252 or Consent of Faculty

Work in the manufacturing systems, servicing system and business system; Components of the management and control systems, core processes and supporting systems; design of organization structure, products, facilities, transformation process, supporting system and detail operation ; operation and monitoring, evaluation, reviews and improvement.

2104515 Responsible Care 3(3-0-9)

Importance of Responsible Care (RC), A history of RC principles, laws, rules and standards, cooperation among organizations : producers, distributors, users, transporters, disposers, RC organizational structure, necessary internal activities for RC, emergency response, data managing and reporting concerning environment, health and safety.

2104516 Quality Improvement 3(3-0-9)
Condition: Prerequisite 2104254 or 2104690 or Consent of Faculty

Quality improvement based on Six Sigma approach; improvement project selection; steps for quality improvement; tools for quality improvement; appraisal of return on quality investment in quality improvement project.

2104518 Quality System 3(3-0-9)

Concept of quality system; several types of quality system, design and application of quality system in manufacturing or service industry; evaluation; analysis and improvement of quality system.

2104520 Visual Factory 3(3-0-9)

Meaning and principles of visual factory; need for communication in a factory; traditional methods for communication in a factory; key elements of a visual factory: workplace organization and standardization; visual displays; visual controls; good visual communication; visual production control; visual quality

control; process indications; and implementing visual communication.

2104521 Computer Programming for Industrial Engineering 3(3-0-9)

Practical Computer programming including database implementation, graphic user interface (GUI), network programming.

2104523 Introduction to Stochastic Models 3(3-0-9)
Condition: Prerequisite 2104253 or 2104690 Consent of Faculty

Unconditional and conditional probability; discrete models; evaluation of complexity of problems; partitioning problems; use of statistics in decision making; systematic approach for problem solving.

2104524 Production and Service Management 3(3-0-9)

Work study; production time improvement; flow process chart; Therblig symbol; work measurement; time study; skill and effort rating; standard time; man machine Chart; motion and time study; Gang process chart; human factor integration and cognitive science; reengineering.

2104525 Work Process Design and Improvement 3(3-0-9)
Condition: Consent of Faculty

Design Layout and Routing, Material Handling Method Study; Analysis & Improvement Standard Method Work & Motion, Motion Economy Work Measurement; Standard Time in Work Element Level and Motion Level Safety and Environment of Work Human Factor; Manual Work, Cognitive Work, Hand Tools Design, Workstation Design, Psychophysics, Job Analysis and Job Evaluation, Incentive and Work Payment, Shift Management and Cost; Unit Cost & ABC Analysis.

2104548 Strategic Planning for Engineers 3(3-0-9)

Strategic planning process; analytical techniques used in formulating plans; concepts of manufacturing strategy.

2104555 System Safety 3(3-0-9)

Human Error; System Safety Design Requirements; Hazard Identification; Analysis and Resolution; Hazard Resolution Matrix; Preliminary Hazard Analysis (PHA); Failure Modes and Effects Analysis (FMEA); Event Trees; Fault Trees; Fault Classification; Fault-Tree Construction; Direct Evaluation of Fault Tree; Fault Trees Evaluation by Cut Sets.

2104559 Risk Management for Industry 3(3-0-9)

Introduction to Risk Management; types and classification of Risk from both internal factor and external factor with cover production industry and service industry; tools and techniques for Systems/Process Analysis and Internal Control System Setting in order to reduce and prevent failure of the designed System supported by ICT as a monitoring tool.

2104601 Engineering Economic Analysis 3(3-0-9)

*Condition: Prerequisite 2104353 or
Consent of Faculty*

Theoretical foundations and advanced topics in engineering economic analysis; investment project evaluation in industrial and engineering works under conditions of uncertainty; analysis of capital budgeting decisions.

2104602 Analysis of Business System 3(3-0-9)

Business enterprises; business area; business components; product/services; business plan; concepts of business system strategies: marketing, production, and financial strategies; strategic management; performance measurement by Key Performance Indicator (KPI) and the Balanced Scorecard approach; improvement tools; improvement methods and process; quality systems and quality award.

2104603 Advanced Quality Control 3(3-0-9)

*Condition: Prerequisite 2104690 or
Consent of Faculty*

Principles practice of quality control in industry; administrative and engineering aspects of quality control program.

2104604 Advanced Quality Management 3(3-0-9)

Theory, principles, concepts of quality system development including Quality Control, Quality Inspection, Quality Assurance, Quality Improvement, Quality Management, Quality Enhancement and Innovation; analysis and design of quality problem solving approach.

2104606 Advanced Industrial Organization and Management 3(3-0-9)

Management science; information systems for executive; strategic management; job and organization design; managerial decision making process; leadership in organization and organization communication; financial analysis; case analysis; production control.

2104609 Reliability Theory in Engineering 3(3-0-9)

*Condition: Prerequisite 2104690 or
Consent of Faculty*

Reliability analysis with emphasis on the exponential, weibull, gamma, lognormal and extreme value distributions; reliability of systems; redundancy; maintainability and availability.

2104611 Inventory Analysis 3(3-0-9)

*Condition: Prerequisite 2104690 or
Consent of Faculty*

Development of models of deterministic and stochastic inventory systems; derivation of optimal decision rules for the timing and size of replenishment orders; application of dynamic programming and markov chains in the modeling of dynamic systems.

2104612 Computer Simulation Techniques 3(3-0-9)

*Condition: Prerequisites 2104690 or
Consent of Faculty*

Application of simulation techniques to optimization of large scale operations; construction of simulation models; validation of simulation models; limitations of simulation techniques; programming with simulation languages.

2104613 Principle of Optimization 3(3-0-9)

Linear programming; the simplex method: big M and two-phase method; sensitivity and duality; integer linear programming and branch and bound method; goal programming; nonlinear programming: convex and concave functions, one variable, unconstrained with several variables, steepest ascent, Lagrange multipliers, Khun -Tucker conditions; intro to heuristic search.

2104615 Engineering Experimental Design 3(3-0-9)

Applications of experimental design to engineering Problems. Emphasis on the methods of experimental set up, data collection, and data analysis.

2104616 Activity Scheduling 3(3-0-9)

Principle of activity scheduling selection and application of appropriate models to deal with scheduling problems.

2104617 Industrial Scheduling 3(3-0-9)

*Condition: Prerequisite 2104616 or
Consent of Faculty*

Concepts of industrial scheduling; single machine scheduling with both types of performance measures: tardiness based and utilization based measures; flow shop scheduling; parallel machine scheduling and batch sequencing; network based scheduling; job shop scheduling and open shop scheduling

2104624 Factory and Production Management 3(3-0-9)

Emphasis on small industrial management; project management; plant site, layout and tool selection; types of production processes and their control; use of budgets for decision making and integrating the roles of various units.

2104625 Computerized Statistical Data Analysis 3(3-0-9)

*Condition: Prerequisite 2104690
or Consent of Faculty*

Use of computer for research design, data collection planning, data preparation, data analysis.

2104626 Materials and Processing 3(3-0-9)

Types and characteristics of materials; manufacturing processes; mechanical, physical, and chemical analyses of materials.

2104627 Product and Production Design 3(3-0-9)

*Condition: Prerequisite 2104626
or Consent of Faculty*

The design of product for optimal production cost under specified tolerance; analysis of factors of production and processes.

2104637 Coordination and Communication 3(3-0-9)

Relationships among communication, coordination and contradiction in organization; negotiation; public speaking; communication in business ethics of industrial entrepreneurs.

2104640 Decision Analysis in Engineering 3(3-0-9)

Analysis of decisions in engineering and industry under uncertainty; decision tree analysis, expected monetary value and expected utility ; expected value of perfect information and sampling information; basis for expected utility theory; rating and ranking of alternatives using multiple criteria ; case studies.

2104642 Decision Support Systems 3(3-0-9)

Taxonomy of decision support systems (DSSs); a framework of the development of DSSs; multi-criteria decision methodology; components of an architecture for DSS; an approach for an integrated DSS for strategic planning; executive information and support systems; group decision support system; intelligent DSS; using DSSs in various situations.

2104644 Advanced Maintenance Management 3(3-0-9)

Framework of maintenance management (MM); maintenance philosophies; interaction between production management and maintenance philosophies; maintenance management decision making; balancing between preventive and corrective maintenance; performance evaluation; computerized maintenance management system; ISO9000 and ISO14000 compliance.

2104645 Applied Biomechanics 3(2-3-7)

Applying biomechanics in order to design and develop work tasks, work places and tools based on ergonomics, which considers human strength as the first priority.

2104646 Work Physiology 3(2-3-7)

Applying physiology in order to design and develop work tasks, work places, tools and working environments or exhaustion based on ergonomics which considers human endurance as the first priority.

2104647 Hazardous Material and Fire Protection Engineering 3(3-0-9)

Evaluation ,design, development of a workplace under a risk of fire and hazardous material based on engineering rules, which covers a protection and stop the hazardous events with consideration of safety management and safety engineering usage.

2104648 Strategic Planning for Engineers 3(3-0-9)

Strategic planning process; analytical techniques used in formulating plans; concepts of manufacturing strategy.

2104649 Cognitive Ergonomics 3(2-3-7)

Specialty inter-discipline of design and system development that are involved with containing humans to make the systems more effective and more robust, focusing on amplifying human capability in performing cognitive work by integrating technical functions with human cognitive processes to create efficient and reliable systems.

2104650 Project Management Concepts 3(3-0-9)

Introduction to engineering project management including overview and concepts of project management, planning successful projects, implementing, executing and closeout.

2104660 Stochastic Models for Financial Engineering 2(2-0-6)

Probability; random variables; probability distributions; discrete-time Markov chain; Poisson process; normal distribution; continuous-time Markov chain; Martingale; random walk; Brownian motion.

2104661 Statistical Methods for Financial Engineering 2(2-0-6)

Random sample; estimation and forecasting; confidence intervals; hypothesis testing; goodness of fit test; maximum likelihood estimators; general method of moments; volatility estimation; linear regression analysis.

2104662 Optimization for Financial Engineering 2(2-0-6)

Local and global optimality; linear programming; simplex algorithm; linear duality; sensitivity; nonlinear programming; Newton's method; Kuhn-Tucker conditions; saddle point conditions; convergence of algorithms; portfolio optimization.

2104663 Time-Series Analysis for Financial Engineering 2(2-0-6)

ARMA, ARIMA, ARCH, GARCH processes for univariate and multivariate variables; unit root and cointegration; vector autoregression.

2104664 Statistics for Financial Engineering 3 (3-0-3)

Asymptotic properties of estimators; sampling statistics; hypothesis testing; linear regression; weighted linear regression; endogeneity problems and instrumental variable estimation; maximum likelihood estimators; nonlinear regression; Wald test; likelihood ratio test; general method of moments; information criteria.

2104671 Advanced Work Design 3(2-3-7)

An advanced study of work design and methods of improving human work; factors affecting work such as fatigue, learning and physical capacity.

2104677 Seminar in Safety Engineering 3(2-3-7)

Intensive study of safety programs in industrial organization; critical discussion and review of existing working conditions in industry; case studies and factory tours used as means to recognize safety problems; analysis and discussion of solutions to the problems required as well as reports.

2104684 Technology and Innovation Management 3(3-0-3)

Key issues and core concept of technology and innovation management, develop a framework for innovation strategy, in search of innovation, technology and innovation selection, techniques and tools for effective implementation of innovation, the management of operations, execution of innovation, manufacturing and commercializing science and technology based ideas.

2104688 Research Methodology in Industrial Engineering and Operations Management 3(3-0-9)

Research philosophy; epistemology; ontology; qualitative and quantitative research methodology in IE&OM; research proposal; literature review; research topic; research design; bibliography; research presentation.

2104690 Quantitative Data Analysis for Industrial Engineering 3(3-0-9)

Probability theory and statistical inference used in engineering applications; random variables and distributions, probability models, jointly distributed random variables, parameter estimation and sampling distribution, confidence intervals, hypothesis testing, simple and multiple linear regression models, analysis of variance for design of experiments, non-parametric statistics.

2104691 Research problems in Industrial Engineering I (OR Technics) 3(3-0-9)

Interesting problems in industry (OR techniques); current knowledge that helps solve the problems, searching for and sharing of knowledge that helps solve the problems.

2104692 Research problems in Industrial Engineering II (Production Techniques) 3(3-0-9)

Condition : Consent of Faculty

Interesting problems in industry (Production techniques); current knowledge that helps solve the problems, searching for and sharing of knowledge that helps solve the problems.

2104693 Research problems in Industrial Engineering III (Management Techniques) 3(3-0-9)

Interesting problems in industry (Management techniques); current knowledge that helps solve the problems, searching for and sharing of knowledge that helps solve the problems.

2104694 Research problems in Industrial Engineering IV (Safety Techniques) 3(3-0-9)

Condition : Consent of Faculty

Interesting problems in industry (Safety techniques); current knowledge that helps solve the problems, searching for and sharing of knowledge that helps solve the problems.

2104711 Advanced Manufacturing Engineering 3(2-3-7)

Recent advances in engineering materials and processing; cost and value engineering as related to material and processing system selection and specification; computer controls of machines and processes in manufacturing systems; industrial robotics and flexible assembly; laboratory assignments.

2104723 Artificial Intelligence for Industrial Engineering 3(3-0-9)

Application of artificial intelligence techniques to industrial engineering problems, with emphasis on expert systems, neural networks, fuzzy logic, genetic algorithm, simulated annealing, and their hybrid forms.

2104741 Comparative Engineering Management 3(3-0-9)

Analysis and comparison of western and eastern practices in engineering management in the areas of manufacturing, marketing and technology strategy; effects of differences in national and organizational cultures; case studies.

2104781 Doctoral Seminar in Industrial Engineering I 1(1-0-3)

Literature survey and discussion of academic development and recent applications in industrial engineering.

2104782 Doctoral Seminar in Industrial Engineering II 1(1-0-3)

Literature survey and discussion of academic development and recent applications in industrial engineering.

2104783 Doctoral Seminar in Industrial Engineering III 1(1-0-3)

Literature survey and discussion of academic development and recent applications in industrial engineering.

2104784 Doctoral Seminar in Industrial Engineering IV 1(1-0-3)

Literature survey and discussion of academic development and recent applications in industrial engineering.

2104785 Doctoral Seminar in Industrial Engineering V 1(1-0-3)

Literature survey and discussion of academic development and recent applications in industrial engineering.

2104786	Doctoral Seminar in Industrial Engineering VI	1(1-0-3)
	Literature survey and discussion of academic development and recent applications in industrial engineering.	
2104811	Thesis	12 credits
	Research and report of research results in industrial engineering.	
2104828	Dissertation	48 credits
2104894	Doctoral Dissertation Seminar	0(0-0-0)
2104897	Qualifying Examination	0(0-0-0)