Tarsus University
GRADUATE SCHOOL
Industrial Engineering

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# Course Content Report

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| LE 509 | SCIENTIFIC RESEARCH TECHNIQUES AND PUBLICATION ETHICS | 2 | 0 | 0 | 0.00 | 0.00 | Compulsory |

**Course Content**

In this course, basic information about scientific research principles, methods, process and techniques will be given to students.

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 500 | MSc. THESIS | 0 | 0 | 0 | 0.00 | 30.00 | Compulsory |

**Course Content**

After the completion of theoretical and practical courses under the supervision of a faculty member, the student will be able to carry out an independent study. During the thesis study, the student will be able to carry out studies under the supervision of his advisor for literature review, data collection and evaluation, analysis and presenting the results in writing.

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 801 | SPECIALIZATION FIELD COURSE | 4 | 0 | 0 | 4.00 | 0.00 | Compulsory |

**Course Content**

To convey to students who are at the thesis stage the knowledge, manners and experiences of the advisor in the scientific field in which she works, to provide students with scientific ethics and work discipline, and the ability to monitor and evaluate the current literature.

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 802 | SPECIALIZATION FIELD COURSE | 4 | 0 | 0 | 4.00 | 0.00 | Compulsory |

**Course Content**

To convey to students who are at the thesis stage the knowledge, manners and experiences of the advisor in the scientific field in which she works, to provide students with scientific ethics and work discipline, and the ability to monitor and evaluate the current literature.

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 501 | MSc. SEMINAR | 0 | 0 | 0 | 0.00 | 7.50 | Compulsory |

**Course Content**

After the completion of theoretical and practical courses under the supervision of a faculty member, the student will be able to carry out an independent study. During the thesis study, the student will be able to carry out studies under the supervision of his advisor for literature review, data collection and evaluation, analysis and presenting the results in writing.

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 502 | ADVANCED PRODUCTION SYSTEMS AND PRACTICES | 3 | 0 | 0 | 3.00 | 7.50 | |

**Course Content**

Flexible manufacturing systems, Group technology, Cellular manufacturing systems, Agile manufacturing systems, Lean manufacturing systems, Assembly lines, Transfer lines, Computer integrated manufacturing systems, Green manufacturing, Fractal layout, Distributed layout, Holonic layout, Modular layout, Reengineering, Concurrent engineering.

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 503 | ADVANCED SERVICE SYSTEMS AND PRACTICES | 3 | 0 | 0 | 3.00 | 7.50 | |

**Course Content**

Features of service systems, Role of service in economy, Optimization in service systems, Queuing models in service systems, Simulation models in service systems, Lean manufacturing in service systems, Inventory management in service systems, Information management in service systems, Supply chain management in service systems, scheduling in service systems, Process in service systems improvement, Quality management in service systems, Project management in service systems, Technology in service systems, Human resources and ergonomics in service systems.

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 504 | TIME SERIES ANALYSIS AND FORECASTING | 3 | 0 | 0 | 3.00 | 7.50 | |

**Course Content**

Data structures, forecasting methods, Moving environments and exponential smoothing methods, Time series and its components, Simple linear regression, Multiple regression analysis, Regression analysis in time series, Box-Jenkins (ARIMA) method, Qualitative forecasting methods, Analysis of forecasting errors, Managing the forecasting process , Autocorrelation and Partial Autocorrelation Functions.

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 505 | STOCHASTIC PROCESSES | 3 | 0 | 0 | 3.00 | 7.50 | |

**Course Content**

Introduction to Probability Theory, Random Variables, Conditional Probability and Conditional Expectation, Markov Chains, Exponential Distribution and Poisson, Continuous Markov Chain, Renewal Theory, Queuing Theory, Reliability Theory.

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 506 | MULTI CRITERIA DECISION MAKING | 3 | 0 | 0 | 3.00 | 7.50 | |

**Course Content**

Decision Making Process, Multi Criteria Decision Making Approaches, Decision Making Types, Multi Criteria Decision Making Methods (SWARA, AHP, ANP, TOPSIS, DEMATEL, VIKOR, MOORA, PROMETHEE, Data Envelopment Analysis), Application Examples

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 507 | QUEUING SYSTEMS | 3 | 0 | 0 | 3.00 | 7.50 | |

**Course Content**

Classification of queuing systems. Markov processes are discrete and continuous time. Birth and death processes. Markov queuing systems M / M / k / m. Little's formula. Bulk arrival and service systems. Non-Markov queuing systems. Semi-Markov processes. System M / G / 1 / oo (stationary regime, Pollaczek-Kninchin formula, dwell time and peak period). Systems G / M / 1 / oo and G / G / 1 / oo. Jackson's type queuing networks, equilibrium equations, constant distribution. Approximate methods in queuing models. Manufacturing, computer networks, information systems and simulation applications.

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 508 | ARTIFICIAL INTELLIGENCE AND PRACTICES | 3 | 0 | 0 | 3.00 | 7.50 | |

**Course Content**

Definition of artificial intelligence, basic concepts and techniques, Expert Systems and engineering applications, Fuzzy logic and engineering applications, Decision support systems and applications, Genetic algorithms and application examples, Artificial neural networks: Structure and basic elements of artificial neural networks, first artificial neural networks, artificial neural network models, feedback networks. Engineering applications of artificial neural networks

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 509 | PROCESS MANAGEMENT AND IMPROVEMENT | 3 | 0 | 0 | 3.00 | 7.50 | |

**Course Content**

Process, process types, process elements, Process management, stages of process management, Process improvement methods, Process modeling methods, Process capability indexes, Control diagrams, Six sigma approach, Failure mode and effects analysis, Quality function deployment, Value stream mapping.

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 510 | ADVANCED PROJECT AND ENGINEERING MANAGEMENT | 3 | 0 | 0 | 3.00 | 7.50 | |

**Course Content**

Business, Accounting, Generally Accepted Accounting Principles, Basic Accounting Equation, Financial Statements, Documents Used in Accounting, Account and Recording Methods, Current Asset Accounts, Operating Expenses and Income Accounts Recording Principles, Application Examples.

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 511 | OPERATIONS MANAGEMENT | 3 | 0 | 0 | 3.00 | 7.50 | |

**Course Content**

Introduction to operations management, Product and service concepts, Operations strategy and productivity, Production systems overview, Product design, Service design, Process design, Facility layout, Quality management, Statistical quality control, Capacity planning, Inventory management, Maintenance planning.

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 512 | SEQUENCING AND SCHEDULING | 3 | 0 | 0 | 3.00 | 7.50 | |

**Course Content**

Scheduling concepts, analyzing and solving of the sequencing and scheduling problems, deterministic models, deterministic single machine problems, parallel machine models, flow-shop models, flexible flow-shop models, job-shop models, open-shop models, meta-heuristic methods

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 514 | BLOCKCHAIN TECHNOLOGY | 3 | 0 | 0 | 3.00 | 7.50 | |

**Course Content**

Blockchain technology concept, history, Blockchain working logic, Blockchain 1.0, 2.0, 3.0, 4.0, Smart contracts, Overview of Blockchain usage, Supply Chain Management-Blockchain relationship, Blockchain's place in Sustainability, Application areas

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 515 | ANALYTICAL MODELS IN SUPPLY CHAIN | 3 | 0 | 0 | 3.00 | 7.50 | |

**Course Content**

Strategic importance of supply chain, Inventory Management models, Transportation models, Network Design, Traveling salesman problem, Vehicle routing problem, Facility Location Strategies, Supplier Evaluation, Value of information in supply chain, bullwhip effect

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 517 | STATISTICAL METHODS IN ENGINEERING | 3 | 0 | 0 | 3.00 | 7.50 | |

**Course Content**

Basic probability and statistics concepts, probability distributions, confidence intervals, hypothesis testing, sampling methods, statistical analysis of business performance data, regression models, use of statistical softwares, experimental design in product and process design.

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 518 | ADVANCED QUALITY ENGINEERING | 3 | 0 | 0 | 3.00 | 7.50 | |

**Course Content**

Business, Accounting, Generally Accepted Accounting Principles, Basic Accounting Equation, Financial Statements, Documents Used in Accounting, Account and Recording Methods, Current Asset Accounts, Operating Expenses and Income Accounts Recording Principles, Application Examples.

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 519 | MATERIAL REQUIREMENT AND PRODUCTION RESOURCES PLANNING | 3 | 0 | 0 | 3.00 | 7.50 | |

**Course Content**

Material Requirements Planning (MRP) / Capacity Requirements Planning (CRP) / Manufacturing Resource Planning (MRP II) / Enterprise Resource Planning (ERP) / Basic Philosophy of Enterprise Resource Planning II (ERPII) systems / Review of Current ERP II Software Applications

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 520 | MATERIAL HANDLING AND STORAGE SYSTEMS DESIGN | 3 | 0 | 0 | 3.00 | 7.50 | |

**Course Content**

Material handling concept/ Material handling purposes/ Material handling equipment/Material handling system design/ Equipment selection in material handling system/ Flow patterns/ Packaging/ Automatic guided vehicles (AGV) / Application Examples in the Literature

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 521 | MAINTENANCE PLANNING AND RELIABILITY | 3 | 0 | 0 | 3.00 | 7.50 | |

**Course Content**

Definition of Preventive and Corrective Maintenance Activities, Maintenance Management Organizations, Maintenance Request and Work Order Management, Maintenance Planning and Scheduling, Preventive Corrective Maintenance, Reliability Centered Maintenance, Spare Part Inventory Management and Purchasing, Total Productive Maintenance, Computer Aided Maintenance Management Systems, Reporting And Maintenance Analysis

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 522 | ADVANCED DESIGN AND ANALYSIS OF EXPERIMENTS | 3 | 0 | 0 | 3.00 | 7.50 | |

**Course Content**

Fixed, mixed and random effects models. Completed and incomplete block designs. Row-column designs. Randomization, blocking, balanced incomplete block designs. Factorial experiments. Effect mixing and fractional factorial designs. Orthogonal and balanced columns. Optimal fractional factorial designs. Latin squares. Nested (slotted) designs. Split lines designs. Cross designs. Covariance analysis. Iterated dimensions design and optimality of designs. Rotatable and blocking in output surface designs. First and second order response surface models. Taguchi methods. Time component data and generalized estimation equations. Mix designs. Model misidentification and its consequences.

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 523 | RISK MANAGEMENT | 3 | 0 | 0 | 3.00 | 7.50 | |

**Course Content**

Risk – Basic Concepts and Principles, Risk Management Process, Qualitative Risk Assessment Methods, Quantitative Risk Assessment Methods, Risk Assessment in Business Life

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 524 | HEURISTIC AND META-HEURISTIC METHODS | 3 | 0 | 0 | 3.00 | 7.50 | |

**Course Content**

Introduction to Heuristics, Classical Structure Heuristics, Classical Recovery Heuristics, Lagrangian Relaxation, Simulated Annealing, Tabu Search, Neural Networks, Genetic Algorithms, Ant Colony Optimization.

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 525 | GAME THEORY | 3 | 0 | 0 | 3.00 | 7.50 | |

**Course Content**

Introduction, Why study Game Theory? Brief history, Assumptions of game theory, Classification of games, Completely Informational Stationary Games: Fundamental theory and Nash Equilibrium, Completely Informational Stationary Games: Applications and mixed strategies, Completely Informational Stationary Games: Mixed strategies and existence of Nash equilibria, Fully Information Dynamic Games: Exact and Two-stage games with perfect information and complete and imperfect information, Dynamic Games with Perfect Information: Repetitive games and dynamic games with complete but imperfect information, Static Games with Imperfect Information: Bayesian games and Bayesian Nash equilibrium, Static Games with Imperfect Information: Mixed strategies and a bidding, Dynamic Games with Imperfect Information: Perfect Bayesian balance and signal games, Case Study;- Finance, Accounting, Operations Management and Information Systems, Franchise decisions, Cooperative games and business strategies, practice of bargaining

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 526 | DATA MINING | 3 | 0 | 0 | 3.00 | 7.50 | |

**Course Content**

Standard data mining techniques: classification, clustering, aggregation, prediction, text mining, link analysis; Visual data mining; Bayesian estimation, neural networks, decision network, Similar metrics, Boosting, bagging etc.; Regression and Logistic Regression, business intelligence softwares, forecasting methods for identifying trends and seasonality; data warehouse structures

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 527 | SUSTAINABLE SYSTEM ENGINEERING | 3 | 0 | 0 | 3.00 | 7.50 | |

**Course Content**

Sustainability concept, history, importance, Sustainable development goals, Economic, Social, Environmental sustainability, Urban sustainability, Life cycle assessment, Sustainable Energy Action plans, Climate change studies, Carbon Footprint, Waste Management applications and their relations with industrial engineering.

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 528 | ADVANCED LINEAR ALGEBRA | 3 | 0 | 0 | 3.00 | 7.50 | |

**Course Content**

Matrices and Vectors, Basic Matrix Operations, Determinant, Matrix Inversion, Solutions of Linear Equations, Level in Matrices, Special Matrices and Gradients, Vector Space, Spanning Sets, Orthogonal Vector Spaces, Matrix Factorization, Linear Transformation, Eigenvalue, Eigenvector, Characteristic Polynomials, Special Matrices , Single Value Decomposition, Jacobi Diagonalization.

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 529 | TECHNOLOGY ENTREPRENEURSHIP | 3 | 0 | 0 | 3.00 | 7.50 | |

**Course Content**

Entrepreneurship and entrepreneurship ecosystem, Entrepreneurship in Turkey, Risks in entrepreneurship, Effects of social behaviours on entrepreneurship, Technological product breakthroughs subject to entrepreneurship, Commercial product tracking via Trademap, Feasibility for investment, New ideas in entrepreneurship, Creative thinking techniques, Entrepreneurship in businesses, Project management and components, Access to funding sources, Canvas business model, Preparing individual young entrepreneurship file

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 530 | LINEAR PROGRAMMING AND NETWORK OPTIMIZATION | 3 | 0 | 0 | 3.00 | 7.50 | |

**Course Content**

Introduction to Operations Research; Introduction to Linear Programming; Linear Programming and Modeling; Graphical Solution Method of Linear Programming Problems; Simplex Method and Application Types; Duality and Sensitivity Analysis; Transport Models; Network Models.

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 531 | INTEGER AND NON-LINEAR PROGRAMMING | 3 | 0 | 0 | 3.00 | 7.50 | |

**Course Content**

Binary Programming and Applications, Representation of Integer Programming with Binary Programming, Branch-and-Bound Method, Branch-and-Cut Method, Unconstrained Optimization, Gradient Methods, Newton Method, Gauss-Newton Method, Convex Sets, Functions and Optimizations, Lagrange Factor Theory, Karush-Kuhn-Tucker Conditions, Barrier and Interior Point Methods.

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 532 | ADVANCED COMPUTER PROGRAMMING | 3 | 0 | 0 | 3.00 | 7.50 | |

**Course Content**

Introduction to Python and Preparation of Necessary Packages, Data Storing Types (List, Set, Dictionary, Tuple, etc.) in Python, Data Reading/Writing in Python, Classification of Optimization Models, Examining and Selecting Open Source and Commercial Problem Solving Tools, Gurobi Python Syntaxing, Pyomo Module, Interpretation and Reporting of Optimization Outputs, Presentation in Matplotlib Module.

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 516 | SIMULATION AND PRACTICES | 3 | 0 | 0 | 3.00 | 7.50 | |

**Course Content**

Introduction to Simulation, Probability and Statistics, Queuing Systems, Input Data Analysis, Setting Up a Simulation Model, Output Analysis, General Introduction of Simulation Software and Commands, Sample Models in Simulation Software, Analysis of Studies Using Simulation

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 533 | SUSTAINABLE LOGISTIC AND SUPPLY CHAIN MANAGEMENT | 3 | 0 | 0 | 3.00 | 7.50 | |

**Course Content**

Green Supply Chain Management, Closed Loop Supply Chain, Reverse Supply Chain concept, Sustainability concept, Sustainability and Logistics relationship, Basic Logistics Activities, Sustainable Supply Chain Management, Supply Chain Performance Measurement (SCOR Model, Balance ScoreCard Model), Performance Evaluation Process, Circular Economy Model

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 534 | DEEP LEARNING | 3 | 0 | 0 | 3.00 | 7.50 | |

**Course Content**

History and theoretical advantages of deep learning, Basic artificial neural network architectures and learning algorithms that can be used for deep learning, Organization of Distributed Models, Optimization Techniques for Training Deep Models, Convolutional networks, Feedback and recursive networks, Autoencoders and Linear Factor Models, Learning by Representation , Deep Productive Models – Boltzman Machines.

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 535 | FUZZY SET THEORY | 3 | 0 | 0 | 3.00 | 7.50 | |

**Course Content**

Fuzzy logic and fuzzy sets, Fuzzy probability and likelihood, Fuzzy decision making, Fuzzy linear programming, Fuzzy multivariate decision making, Fuzzy decision making, Fuzzification

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 536 | LEAN MANUFACTURING TECHNIQUES AND APPLICATIONS | 3 | 0 | 0 | 3.00 | 7.50 | |

**Course Content**

Overview of Production Systems, Lean Production Concept, History of Lean Production, Lean Production Philosophy, Lean Production Techniques, 5S/Visual Management, Kanban, Kaizen, SMED, Value Stream Mapping, TPM, POKE-YOKE, JIDOKA, Lean Production Case Studies

| Course Unit Code | Course Name | T | U | L | Credit | ECTS | Type |
|---|---|---|---|---|---|---|---|
| IE 537 | ALTERNATIVE TRANSPORTATION METHODS | 3 | 0 | 0 | 3.00 | 7.50 | |

**Course Content**