

**ISTINYE UNIVERSITY – Department of Industrial Engineering**

<b>Compulsory Courses</b>			
Course Code	Course Name	T+A	ECTS
ENS101	Calculus 1	2+2	5
Analytic geometry. Functions, graphs, limits and continuity. Derivatives, differentiation rules, chain rule, implicit differentiation. Applications of derivatives. Definite integrals, indefinite integrals. Applications of integrals. Transcendental functions.			
ENS103	Computational Thinking	3+2	6
Brief History of Computing, Data Representation, Number Representation and Computation, Representation of Text, Iteration and Recursion, Representation of Images, Representation of Sound, Cryptography, Machine Learning			
ENS105	Physics 1	4+1	6
Vectors. Motion in one and two dimensions. Newton's law and its applications. Work and energy. Conservation of mechanical energy. Momentum and motion of systems. Static equilibrium of rigid bodies. Rotation and angular momentum. Newton's law of universal gravitation.			
ENS107	Computer Literacy	2+2	4
History of computer systems, components of computers, computer networks, internet technology, e-mail and instant messaging, mobile and cloud services and computing, using various applications and services, MS-Office applications, making a presentation, writing a report, using spreadsheets, introduction to programming, Google apps and services: Docs, Sheets, Slides, Drive, Calendar, Keep, Scholar; Apple apps and services.			
ENS109	Engineering Design	3+0	4
Introduction; The Design Process; Innovative style; Brainstorming. Effective graphic and verbal communication of design ideas to groups and individuals, the process of doing research on engineering problems, finding information and assessing its validity, an overview of key achievements in the history of engineering. Case studies with ethical implications.			
ENS102	Linear Algebra with Applications	2+2	5
Systems of linear equations, matrix algebra, determinants, vector spaces and subspaces, basis and dimension, linear transformations, eigenvalues and eigenvectors, diagonalization, and orthogonality; singular-value decomposition.			
ENS104	Computational Mathematics	3+2	6
Introduction to the theoretical underpinnings of computer science and engineering. Propositional predicate logic, set theory, functions and relations, counting, mathematical induction, recursion, generating functions, graph theory and algorithms. Fundamentals of groups, rings, fields, number theory and cryptography. Computational tools such as Python, Sage, and Mathematica to illustrate properties the mathematical objects and structures.			
ENS106	Physics 2	4+1	6
The principles of electrical and electronical engineering and basic technology; application examples of the knowledge on engineering; electric machinery, power electronics, and electrical driving circuits.			
ENS108	Computer Aided Design	2+2	5
Introduction to computer aided technical drawing. Engineering sketching and drawing, geometric design, projections, views, perspectives, dimensioning, surface finishing symbols, tolerances, section views, general concepts in 3D modelling.			

ENS110	Calculus 2	2+2	5
Integration techniques, generalized integrals, sequences, infinite series, power series, parametric curves, polar coordinates and integration in polar coordinates.			
ENS201	Differential Equations	2+2	6
First and second order differential equations; separation of variables; linear differential equations; systems of first order equations; nonlinear differential equations and stability.			
ISE203	Engineering Economics	3+2	7
Engineering economic decisions; time value of money; cash flow analysis; the present value; rate of return; cost-benefit analysis; break-even analysis; evaluation of alternatives; sensitivity analysis of economic decisions; depreciation; decision-making under uncertainty; replacement analysis; applications using Excel spreadsheets.			
ISE207	Manufacturing Processes and Operations Analysis	3+2	6
Various manufacturing techniques such as Particulate Processing and Metal Forming along with Sheet Metalworking, Manual Work and Worker-Machine Systems, Assembly Lines, Logistics Operations, Project Management, Work Measurement Techniques, Time Study, Lean Production			
ENS202	Probability and Statistics	3+2	6
Sample space, probability, conditional probability, counting, combinatorics, discrete/continuous random variables, conditioning, independence, expectation, variance, covariance, Bayesian inference, sampling distributions, hypothesis testing, confidence intervals, and linear regression.			
ISE204	Database Systems	3+2	7
Introduction to Database Systems; Data Models; Relational Database Model; Entity Relationship (ER) Modeling; Advanced Data Modelling; Normalization; Structured Query Language (SQL); Advanced SQL; Database Design; Advanced Database Concepts			
ISE206	Modelling and Optimization I	3+2	7
Introduction to operations research and linear programming (LP) models; the graphical method and applications; interpreting graphical solutions; graphical sensitivity analysis; the simplex method and applications; interpreting simplex solutions; simplex sensitivity analysis; using computer software to solve LP problems; duality; transportation and assignment problems and their solution algorithms; network problems and their solution algorithms.			
ISE301	Modelling and Optimization II	3+2	7
Modeling integer programming problems, Branch & Bound Algorithm, Nonlinear Programming, Deterministic Inventory Models, Deterministic Dynamic Programming, Decision Analysis. Game Theory			
ISE303	Production Planning and Control	3+2	7
Overview of Production Planning and Control; Forecasting Fundamentals and Methods; Aggregate Production Planning (APP); Sales and Operations Planning; Master Production Schedule (MPS); Inventory Control and Management; Material Requirements Planning (MRP); Capacity requirements planning (CRP); Lean Production and Just-in-Time (JIT)			
ENS305	Machine Learning	3+2	6
Introduction to Machine Learning, Learning Problem, Supervised Learning, Artificial Neural Networks, Unsupervised Learning, Data Pre-processing			
ISE307	Summer Internship 1	0+1	1
Notifying the rules about the internship, evaluating and approving the internship applications, receiving the internship documents; evaluation of internship reports, evaluation of internship			

ISE302	Stochastic Models	3+2	7
Conditional probability and expectation, Markov chains, Poisson process, Modeling of queuing systems, stochastic dynamic programming, stochastic inventory models			
ISE304	Systems Simulation	3+2	7
Simulation modelling concepts and discrete event simulation, Random number and random variate generation, Selection of probability distributions for model inputs, Validation and verification, Output analysis, Comparison of alternative systems			
ISE306	Project Management	3+1	6
Project definition and project phases, Project organization structures, Work breakdown structure, Project time planning, Project resource planning, Project budget, Project risk analysis, Project evaluation and project closure			
ISE401	Capstone Project 1	3+2	7
A project carried out individually or in teams under the supervision of a faculty member on a problem proposed by a sponsoring organization, with realistic conditions and constraints. Provide and implement meaningful solution alternatives based on scientific and engineering knowledge; synthesize and make use of such knowledge.			
ISE403	Quality and Reliability Engineering	3+2	7
Methods and philosophy of statistical process control; Statistical tools for quality improvement; Control charts for process monitoring; Process capability analysis; Measurement systems analysis; Acceptance sampling techniques; Design of experiments			
ISE407	Summer Internship 2	0+1	1
Notifying the rules about the internship, evaluating, and approving the internship applications, receiving the internship documents; evaluation of internship reports, evaluation of internship			
ISE402	Capstone Project 2	3+2	7
Continuation of the project carried out individually or in teams under the supervision of a faculty member on a problem proposed by a sponsoring organization, with realistic conditions and constraints. Provide and implement meaningful solution alternatives based on scientific and engineering knowledge; synthesize and make use of such knowledge.			

Elective Courses			
ENT082	Supply Chain Management	2+2	5
Introduction to SCM, Different Levels of Decision-Making, Logistics and Supply Chains, Designing Operations, Managing Operations, Information Technology in SCM, SCM Performance Measurement, Forward and Backward Logistics, Open-loop and Closed-loop SCM, Sustainable and Circular SCM			
ENT084	Financial Engineering	2+2	5
Financial markets, derivative securities, risk management, mathematical models in finance. Foreign exchange, debt equity, commodity markets. Investing, trading, hedging arbitrage. Forwards, futures, options, swaps, exotic derivatives. Models of price dynamics, binomial model, introduction to Black-Scholes theory and Monte Carlo simulation.			
ENT087	Production and Operations Management	2+2	5
This course provides fundamental principles, theories, and practices of production and operations systems. For this purpose, a global view of production and operations, production, and operations strategies, managing projects, product strategies, production technologies, layout decisions, location decisions, managing inventory, supply chain management, logistics management, lean operations topics will be covered. The class time will include lectures on theoretical subjects as well as examples/cases drawn from the area of operational/industrial systems.			
ENT088	Facilities Design and Planning	2+2	5
Fundamentals of Facility Layout Design and Planning; Product design, Process design Schedule design; Flow systems, Activity relationships Space requirements; Personnel Requirements; Material Handling; Layout Planning Models and Design Algorithms; Warehouse Operations; Manufacturing Systems; Quantitative Facilities Planning Models; Evaluating and Selecting the Facilities Plan; Preparing, Presenting, Implementing, and Maintaining the Facilities			
ENT089	Sequencing and Scheduling	2+2	5
Scheduling theory, single machine scheduling, parallel machine scheduling, flow shop scheduling, job shop scheduling, project management scheduling, heuristics for solving scheduling problems (genetic algorithm, tabu search, simulated annealing)			
ENT090	Heuristic Optimization	2+2	5
Most recent meta-heuristic techniques using combinatorial and continuous samples. Simulated Annealing, Tabu Search, Genetic Algorithm, Ant Colony, Swarm Intelligence will be focused, an overview of other methods.			
ENT093	Multi-Objective Optimization	2+2	5
Classical methods for treating multi-objective problems will be presented, and their deficiencies will be clarified. Next, advanced methods, which are based on Pareto-optimality, will be presented. Leading algorithms will be presented and compared, such as: NSGA-II, SPEA-2, and MO-CMA-ES. Methods to compare algorithms will be detailed including test functions and measures to analyze the obtained approximated Pareto-optimal set and front. The numerical limitations of the presented algorithms will be clarified. Methods to cope with such limitations will be described and in particular how to handle the curse of dimensionality of the Pareto-front.			
ENT096	Inventory Models	2+2	5
Fundamental inventory control procedures and their usage, supply chain inventory management, implementation, and organizational aspects of inventory management. Warehousing and inventory management, materials handling, economic theories of inventory modeling and warehousing strategies, distribution and transportation, traffic management and distribution channels management.			

ENT097	Multi-Criteria Decision-Making	2+2	5
Introduction to MCDM; Decision-Making Problem Structuring and Applications; SAW; AHP; ANP; TOPSIS; BWM; WSM; GP; Lexicographic method; $\epsilon$ -constraint method; Sensitivity Analysis; Decision-making under risk and uncertainty			
ENT098	Numerical Methods and Programming	2+2	5
Introduction to numerical methods, Introduction to mathematical modeling and programming, error analysis-cutting and rounding errors, Root finding methods, Numerical linear algebra-Gaussian elimination, LU decomposition, inverse matrix, Gauss / Siedel, Approximate expression of functions-least squares, interpolation, Numerical integral and derivative-trapezoidal rule, Simpson's rules, Gauss Legendre.			
ENT099	Quantitative Analysis	2+2	5
Quantitative Analysis, Model Building, Decision Making without Probabilities, Decision Making with Probabilities, Decision Trees, Utility Theory, Project Management, Inventory Management, QM for Windows V5			
ENT100	Introduction to Dynamic Programming	2+2	5
Introduction to Optimization; Prototypical Example(s) for Dynamic Programming; Structure of Dynamic Programming Problems; Equipment replacement, distribution of effort, and production planning problems; Knapsack, multi-dimensional state, and traveling salesperson problems; Probabilistic Dynamic Programming; Dynamic Programming Applications; Solving Dynamic Programming Examples using Microsoft Excel			
ENT108	Operations Research Modeling Applications	2+2	5
Introduction to Optimization; Linear Programming; Simplex Method; Simplex Method; Introduction to AMPL; Production Models using AMPL: Maximizing profits; Diets, Blending, and Scheduling: Minimizing costs; Transportation, Assignment, and Minimum; Cost Flows; Multicommodity and multiperiod models; Simple Sets and Indexing; Compound Sets and Indexing; Parameters and Expressions; Specifying Data; Network Linear Programs; Review			
ENT117	Time Series Analysis and Forecasting	2+2	5
Introduction to both standard and advanced time series analysis and forecasting methods. Graphical techniques and numerical summaries are used to identify data patterns such as seasonal and cyclical trends. Forecasting methods covered include Moving averages, weighted moving averages, exponential smoothing, state-space models, simple linear regression, multiple regression, classification and regression trees, and neural networks. Measures of forecast accuracy are used to determine which method to use for obtaining forecasts for future time periods.			
ENT119	Sustainable Systems Engineering	2+2	5
Brief history of sustainability. Principles of sustainability. Industrial, economic, environmental, agricultural, and urban sustainability. Sustainable development. Environmental ethics. Systems view of sustainability. Techniques for modelling complex systems. Criticism and the more negative connotations of sustainability. Globalization and issues of the post-globalized world.			
ENT121	Introduction to Stochastic Processes	2+2	5
Stochastic processes involve sequences of events governed by probabilistic laws. Many applications of stochastic processes occur in biology, medicine, psychology, finance, telecommunications, insurance, security, and other disciplines. This course introduces the basics of applied stochastic processes such as Markov chains (both discrete-time and continuous-time), queuing models, and renewal processes. Software is used to solve real-world problems with an emphasis on interpretation of results and the role of stochastic processes in management decision-making.			