ISTINYE UNIVERSITY FACULTY OF ENGINEERING

DEPARTMENT OF INDUSTRIAL AND SYSTEMS ENGINEERING

COURSE DESCRIPTIONS

1. Semester

Differential and Integral Calculus (2+2), 6
Analytic geometry, functions and limits, derivatives, techniques and applications of differentiation, logarithmic and trigonometric functions. Definite and indefinite integrals, techniques of integration, with applications in sciences and engineering.

Computational Thinking (3+2), 6
Introduction to the central idea of computational thinking as it applies to a wide variety of human endeavors, including natural and physical sciences; computational mathematics with Sage, Matlab, and Mathematica; introduction to programming with Python.

Engineering Physics (3+1), 6
Vectors. Motion in one and two dimensions. Newton's laws 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 universal gravitation.

Computing Literacy (2+2), 5
Email and IM usage and etiquette; Computer security basics; Mobile and Cloud computing basics; Google apps and services: Docs, Sheets, Slides, Drive, Calendar, Keep, Scholar; Apple apps and services.

Engineering Design (3+0), 5
Introduction; The Design Process; Creative style; Brainstorming. Effective graphic and verbal communication of design ideas to groups and individuals, Student will learn how to research an engineering problem, where to find information and how to assess its validity, Students will be give an overview of key achievements in the history of engineering. There will also be stories with ethical implications.

Turkish Language I (2+0), 2
To teach the importance of language in human and social life; showing the classification of languages and teaching of Turkish among the world languages; to teach the characteristics of Turkısh in terms of phonology, morphology, syntax; to analyze spelling and writing rules of Turkish.

2. Semester

Linear Algebra with Applications (2+2), 6
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.

Computational Mathematics (3+2), 7
A function approach integrating algebra, trigonometry, and differential calculus; properties and graphs of polynomial, rational, exponential, and logarithmic functions; properties and graphs of trigonometric functions; functions and limits; derivatives; techniques and applications of differentiation; logarithmic and trigonometric functions; Integral calculus, including definite and indefinite integrals; techniques of integration, with applications in social and life sciences.

Computer Aided Design (2+2), 5
Introduction to computer aided technical drawing. Basic drawing functions and multi-view projection. Sectioning and conventions. General concepts in 3D modelling. Creating parts in 3D design and solid modeling. Transfering 3D parts to drafting detailing. Assembly modelling and assembling parts. Surface modelling.

Electronic Physics and Systems (3+1), 6
In this course the principles of electrical and electronical engineering and basic technology will be introduced. Application examples of the knowledge on engineering will be given. In addition, electric machinery, power electronics, and electrical driving circuits will be introduced according to the mechanical engineering requirements

Human Body (2+2), 4
The structure and functions of macro molecules and proteins. The structures and functions of cells. Cellular respiration, transport, communication. Energy production, flow, use and photosynthesis. Human genetics and physiology. Biotechnology.

Turkish Language II (2+0), 2
To teach spelling, writing and punctuation rules, to teach basic elements of writing essays, to introduce Turkısh and World literary canons; to teach writing creative texts of literature especially story, poem and essay ; to teach writing scientific paper and texts; To analyse expression and punctuation disorders, to contribute lectures.

3. Semester

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

Introduction to Systems Engineering (3+2), 7
This course will offer an examination of the principles of systems engineering and their application across the system life cycle, from design to development, production and management. Special emphasis is given to concept exploration, requirements analysis and development, analysis of alternatives, preliminary design, integration, verification, and system validation.

Manufacturing Principles (3+2), 7
This course will introduce common manufacturing principles, including those of lean manufacturing, and provide several practical examples and demonstrations with regard to their application. A comparison of various principles based on the overarching principles of rate, quality, cost, flexibility and sustainability will also be covered.

General English I (2+0), 2
The English of the terms and concepts encountered in various branches of engineering are examined in depth, and for the proper use of these terms, Turkish-English bilingual translations are explained. English language training for students starts from simple forms and intended to develop over time.

Ataturk's Principles and History of Turkish Revolution I (2+0), 2
The Collapse of the Ottoman Empire, Tanzimat and Reform Edict, I. and II. Constitutional Era, Tripoli and Balkan Wars, Worl War I, Mudros Armistice, War of Independence; Amasya Circular, National Congresses, Establishment of Turkish Grand National Assembly, Declaration of Republic

Manifest of Istinye I (0+1), 1

4. Semester

Probability Theory and Stochastic Processes (2+2), 5
The course will cover basic concepts and methods from the probability theory. Special attention is given to multivariate distributions and ordering & classification of random variables that are useful in modelling business processes. The later parts of the course will explore a number of useful classes of stochastic processes including discrete-time Markov chains, Poisson processes and Brownian processes.

Vector Calculus (2+2), 6
Calculus of functions of several variables; vector-valued functions; scalar and vector fields; integration along paths, double and triple integrals; integration over surfaces and applications of integrals; integral theorems of vector calculus; infinite series; Fourier series; integrals and transforms; partial differential equations

Operations Research I (3+2), 7
This course aims to teach modelling concepts, linear programming models, simplex and dual simplex methods, duality and sensitivity analysis; transportation and assignment problems, integer programming, and basic problems in network theory – with the help of computer programs, such as Lindo and Solver.

General English II (2+0), 2
The English terms and concepts encountered are examined in depth and Turkish-English bilingual translations are used in order to use the concepts correctly. To be able to master professional English language, the students are informed about grammatical structures of sentences, spelling and pronunciation.

Ataturk's Principles and History of Turkish Revolution II (2+0), 2
Revolutions in Turkish politics, political parties and multi-party system attempts, revolutions in law, reorganization of public life, reforms in economics, Turkish foreign policy 1923-1938, Turkish domestic and international politics in post-Atatürk era.

Manifest of Istinye II (0+1), 1

5. Semester

Operations Research I (3+2), 7
This course aims to guide students in formulating integer problems and finding appropriate solutions, algorithms or heuristics to solve them, teach students how to tackle non-linear and dynamic programming problems, and introduce multi-criteria and multi-objective decision problems.

Quality Engineering and Reliability (3+2), 7
The course offers an integrated analysis of the reliability and quality control functions in manufacturing. Statistical process control, acceptance sampling, process capability analysis, reliability prediction, design, testing, failure analysis and prevention, maintainability, availability, and safety are discussed. Qualitative and quantitative aspects of statistical quality control and reliability are introduced in the context of manufacturing.

Cost Analysis (3+2), 7
The aim of this course is to introduce the basics of financial and cost accounting. The course covers financial statements and transactions, adjusting and closing entries, preparation of balance sheet, income and flow of funds statements, inventory valuation and depreciation methods, definition of costs and different costing methods.

6. Semester

Operations Research II (3+2), 7
This course is a continuation of the course with the same title that takes place in the first semester and covers more advanced issues such as Karush-Kuhn-Tucker (KKT) optimality conditions, direct search and gradient methods; deterministic and probabilistic dynamic programming; Markov chains; Markovian decision process; Poisson process and queueing models.

Production Planning and Control (3+2), 7
The course aims to teach the concepts such as production, production systems production management, and production planning. Further topics include, but are not limited to, demand forecasting, inventory control systems, production scheduling, material requirements planning, capacity planning, line balancing and facility layout planning.

Manufacturing Processes (3+2), 7
The course will cover basic manufacturing processes such as casting, forming, machining and welding, and other topics related to the use of various equipment, tools and machineries in manufacturing. The course will also touch upon issues such as interaction between materials, design, and manufacturing method, and the economics of manufacturing, analysis of manufacturing processes, as well as process design.

7. Semester

Capstone Project I (3+2), 7
This no-lecture course includes an appropriate design project with all the design phases starting from project selection to completion and presentation, and which leads the students use the knowledge they gained during their tenure in the department and gain complete design experience. In this course, design of a machine, system or process is conducted in the framework of an open-ended engineering problem and a team of students develops the solution.

Project Management I (3+2), 7
This course is designed to provide a systematic approach that includes various technical and managerial aspects of project management and will help students gain a fundamental understanding of the concept of project management in engineering. Topics will vary from creating new project ideas to project selection and evaluation, project organization, planning, budgeting, scheduling, monitoring, controlling, auditing, and termination. Students will also understand the importance of costs and money, risks, leadership, and environmental assessment in managing engineering projects.

Manifest of Istinye III (0+1), 1

8. Semester

Capstone Project II (3+2), 7
This no-lecture course includes an appropriate design project with all the design phases starting from project selection to completion and presentation, and which leads the students use the knowledge they gained during their tenure in the department and gain complete design experience. In this course, design of a machine, system or process is conducted in the framework of an open-ended engineering problem and a team of students develops the solution.

Project Management II (3+2), 7
As a continuation of Project Management I, this course aims to equip students –in a more applied sense– with advanced tools used in project management. This includes the examination of various project management approaches and tools, illustrated through case studies and examples of best

practices, and getting acquainted with the most recent software and technology for project management.

Manifest of Istinye IV (0+1), 1

DEPARTMENT ELECTIVE COURSE DESCRIPTIONS

Directed Research (2+2), 5
The students are involved in projects that are going on research centers. They are required to attend meetings, develop code, help to build devices, and give presentations as needed. The lecturer covers basic research techniques, search, writing papers in LaTeX, and working with data.

Engineering Ethics (2+2), 5
The origins of ethical thought; ethical principles and basic theories; personal, academic and professional ethics for engineers; environmental ethics; ethical implications of technology, computer ethics; ethics in research and experimentation.

Engineering Economics (2+2), 5
The course will cover cash flow diagrams, interest factors and their use, nominal and effective interest rates, continuous compounding, present worth and capitalized cost analysis, uniform annual cash flow analysis, rate of return analysis, cost/benefit ratio analysis, payback period analysis, replacement analysis, breakeven analysis, capital budgeting, sensitivity analysis and decision trees, Investment analyses under uncertainty.

Multiple Criteria Decision Making (2+2), 5
This course will cover topics such as discrete and continuous multiple criteria problems, solution methods for multiple criteria decision making problems, methods of generating non-dominated solutions, interactive approaches, multiple criteria ranking and sorting techniques, and multiple criteria decision making applications.

Advanced Operations Research (2+2), 5
This advanced course is an overview of optimization, simulation, stochastic and multi-objective models, various application areas, and underlying assumptions. The course will also cover critical technical considerations of optimization models, typical implementation problems, as well as practical points and obstacles encountered in applying operations research models to real life problems.

Logistics and Supply Chain Management (2+2), 5
This course surveys operations research models and techniques developed for a variety of problems arising in logistics. The focus will be on fundamentals of supply chain management and enterprise resources planning, aggregate production planning, lot sizing models; operations scheduling; materials management, distribution system management, and implementation of logistics and supply management strategies.

Data Mining (2+2), 5
This course will examine methods that proved to be useful in recognizing patterns and making predictions. We will review applications and provide an opportunity for hands-on experimentation with data mining algorithms. At the end of the course students will have developed an understanding of the strengths and limitations of popular methods to solve regression and classification problems in data mining.

Data Analytics and Visualization (2+2), 5
This course aims to help students make sense of data and improve their data-based digital storytelling skills for effective communication. To accomplish those goals, the course starts with the conceptualization of empirical research, and concludes with visual display of research findings to target audiences. It provides students with practical skills in analytics and visualization.

Information Systems Engineering (2+2), 5
This course will present a framework for enterprise information systems. This will include, among others, requirements definition, enhanced entity relationship modelling, logical modelling, structured query language, relational models, referential integrity, relational algebra and relational calculus, relational database design, as well as functional dependency and normal forms.

Advanced Simulation (2+2), 5
This course will focus on statistical matters related to simulation. Emphasis is placed on the analysis of the statistical nature of simulation. Probability distributions are examined for appropriateness and data fit. Time permitting, the course will look at the solutions of industrial problems by means of simulation techniques.

Financial Engineering (2+2), 5
This course is an introduction to financial markets and instruments, derivatives, risk management, and quantitative models in finance. Particular applications to foreign exchange, debt, equity and commodity markets will also be covered. The students are aimed to develop an understanding of the pricing and hedging of forward and futures contracts, options, swaps and other exotic derivatives. An introduction to Black-Scholes theory, mean-variance analysis, numerical methods will also be provided.

Strategic Management (2+2), 5
The course aims to help students understand the basic concept of strategic thinking and formulate strategies for sustainable competitive advantage. They will learn how to measure corporate as well as individual performance in implementation of management strategies. Time permitting, theoretical overview will be enriched by success and failure stories.

Decision Support Systems (2+2), 5
The course includes a brief introduction of database management systems, optimization techniques, spreadsheet based optimization, and review of relevant AI techniques that would be crucial to develop the model base; knowledge acquisition and knowledge representation, probabilistic and approximate reasoning. The course will also include the discussion of DSSs for a number of application domains, chosen to illustrate principles of system development, such as the health care, portfolio optimization, as well as production and distribution systems.

Stochastic Processes (2+2), 5
An introduction to mathematical modelling, analysis, and solution procedures applicable to uncertain (stochastic) service and production systems. Methodologies covered include probability theory and stochastic processes. Applications relate to design and analysis of problems, capacity planning, inventory control, waiting lines, and system reliability and maintainability.

Enterprise Resource Planning (2+2), 5
Enterprise resource planning (ERP) is an integrated information system that manages internal, external resources including suppliers, employees, customers, and partners. The course provides students with an understanding of how firms consolidate all business operations (i.e., manufacturing, finance and accounting, sales and marketing, and human resources) into a centralized database, and facilitate information flows among all business functions, turn them into innovative business decisions.

Quality Management (2+2), 5
This course addresses the strategic role of quality in business and industry. It focuses on management's role in achieving quality excellence, the structures and systems needed to support a total quality strategy, and the main statistical and analytical tools for achieving quality improvement and control.

Special Topics in Industrial Engineering (2+2), 5
This course will include the study of a selected (advanced) topic of contemporary interest in the field of industrial engineering.

Nonlinear Programming (2+2), 5
The course covers both theoretical and computational methods to solve non-linear optimization problems – i.e. when at least one constraint or objective function is not linear. Topics include convex analysis, optimality conditions, unconstrained and constrained optimization, Newton's method, Lagrange multipliers, search algorithms for unconstrained and constrained problems, as well as barrier and penalty methods.

Database Management (2+2), 5
This course is intended to give students a solid background in database management systems and techniques. Topics include data modelling, database design theory, data definition and manipulation languages, storage and indexing techniques, query processing and optimization, concurrency control and recovery, and database programming interfaces.

Systems Simulation (2+2), 5
This course is about the application of discrete-event simulation to industrial settings. Areas covered include system structure, system analysis, model construction, data collection, and computer simulation languages. The application of simulation technique to facilities layout for manufacturing is also covered. Other topics include random number and random variate generation, inverse transformations, goodness of fit tests, as well as analysis of simulation output and model validation.

Material Science (2+2), 5
Introduction to materials science and classification of atomic structures of the materials. Crystal structures and imperfections. Mechanical and physical properties of the engineering materials. Solid-state diffusion. Phase diagrams and solidification. Ferrous / non-ferrous alloys and heat treatment. Electrical, optical, thermal and magnetic properties associated with electron band structures of the materials. Metallic corrosion and prevention from corrosion. Principle geomaterials, their properties and application areas. Deterioration of geomaterials