

T.R.
BILECIK SEYH EDEBALI UNIVERSITY
DEPARTMENT OF CHEMICAL AND PROCESS ENGINEERING
COURSE CONTENTS

1ST SEMESTER

ENF101 Basic Information Technology Usage

Basic information about computer systems, introduction to the computer hardware and software. WINDOWS operating systems, word processing, presentation, Spreadsheet and graphics, internet, e-mail and WWW information, HTML programs.

KIM101 General Chemistry I

Properties and measurement of materials. Atoms and atomic concept. Chemical compounds and reactions. Stoichiometry. Introduction to reactions in aqueous solutions, gases, thermochemistry, atomic electron structure, periodic table and some atomic properties. Chemical bonds I: Basic concepts. Chemical bonds II: Bond theories and molecular structure.

MAT101 Mathematics I

Single-Variable Functions, Limits and Continuity, Applications of Derivatives,, Curve Drawing, Asymptotes, Fundamental Teorem of Integral Calculus, Applications of Definite Integrals, Polar Coordinates, Transcendental Functions, Techniques of Integration, Indeterminate Forms and L'Hopital's Rule, Improper Integrals.

FIZ101 Physics I

Physics and measurement, vectors, motion in one dimension, motion in plane and space, circular motion and miscellaneous applications of Newton's laws, work and kinetic energy, potential energy and conservation of energy, linear momentum and collisions, rotation, rolling and angular momentum, static equilibrium and elasticity, vibrations, the universal law of gravitation

ENG101 English I

Basic English Grammar, Vocabulary, Reading ,Writing and Speaking skills.

MIM101 Computer Aided Technical Drawing

Introduction to computer aided technical drawing. Geometrical constructions. Principles of orthographic projection; projection of principal views from three dimensional models. Drawing techniques for basic manufacturing processes and standard features. Projection of third principal view from two given principal views; free hand drawing techniques. Three dimensional drawing techniques; simple shapes, inclined surfaces, skew surfaces. Principles of dimensioning. Principles of sectioning; full and half sections. Further work on sectioning, conventional practices. Screw threads and threaded fasteners.

ATA101 History of Ataturk's Principles and Revolutions I

Emergency of Modern Turkey, Thoughts and Principles

TRK101 Turkish Language I

What is language. Languages of the world. The place of turkish in these languages and its historical development. Nowadays problems of Turkish accompanied with current texts. Analysis of an essay with scientific context. Analysis of a column. Turkish as science language presantation studies accompanied by guide texts.

Elective Course (non-technical)

2nd SEMESTER

ENF102 Basic Computer Science and Programming Languages

FORTRAN programme language, data structure (algorithm and programming entry)

KSM102 Introduction to Chemical and Process Engineering

Definition of chemical engineering and its research interests. General information about Chemical Engineering. Chemical industry and its classification. Be shown chemical processes as a flow chart. Place of research and development in the chemical industry. Importance of process design and control in chemical industry. Separation processes be used. Fundamentals of mass and energy balances. General view to industrial wastes. Career planning.

MAT102 Mathematics II

Improper integrals. Sequences, limits, monotone sequences. Series with positive terms, series with arbitrary terms, absolute and conditional convergence, power series, Taylor and Maclaurin series. Vector calculus. Functions of multiple variables, limits, continuity, partial derivatives, chain rule, directional derivatives, maxima and minima, Lagrange multipliers, Taylor's formula. Double and triple integrals.

FIZ102 Physics II

Coulomb's law and the electric field, Gauss' law, electric potential, capacitance, Electric energy, and properties of insulators, current and resistance. Energy and current in DC circuits, the magnetic field, sources of the magnetic field, Faraday's law, inductance, magnetic fields in matter, electromagnetic oscillations and AC circuits, Maxwell's equations and electromagnetic waves.

ATA102 History of Ataturk's Principles and Revolutions II

Fronts in the War of Independence: Eastern Front, South Front, Western Front; On the

Western Front Warfare Made: İnönü Wars, Eskişehir-Kütahya War, Sakarya Battle, Commander-in-Chief Battlefield; Mudanya Ceasefire Agreement; The Lausanne Peace Treaty; Establishment of Democratic Law State: Law, Education, Economy and Social Life innovations made; Atatürk's Principles: Republicanism, Nationalism, Populism, Statism, Secularism, Revolutionism, General qualities of these principles. Qualifications and Priorities. Factual Improvements. Topics related to the Treaty of Lausanne. The problem of Mosul with England. About France Relations and Hatay Problem. Population exchange with Greece and Etabli Solution. Turkey with the Soviet Union. Developed Against Rising War Tehdidine Policy. Turkey's membership to the League of Nations. Balkan Pak. Sadabat Paktı. Montreux Bosphorus Convention. Developments in internal and external politics. Between 1960 -1980 in Turkey Political and Social Developments.

ENG102 English II

Learning reading strategies for various types of texts. Apply certain types of writing. Making grammar and vocabulary studies about the texts read. Different reading strategies use. Without disturbing and disrupting the communication, speak easily. The technical rules of writing and the structure of a written text determine the items. Extracting and rewriting a written piece. Other skill grammar rules that are integrated into the basic grammar rules and reinforce their structures. Learning by contexts and structural elements. in the course academic staff in the academic level and English speakers to follow and to participate in discussions during the course.

KIM102 General Chemistry II ve KIM104 General Chemistry Laboratory

Liquids, Solids and intermolecular forces, molecular geometry and hybridization. Solutions and physical properties. Chemical kinetics. Principles of chemical equilibrium. Acids and bases. Acid-base and solubility balances. Entropy and free energy. Electrochemistry. Experimental studies on KIM 101 and KIM 102 contents.

TRK102 Turkish Language II

Structure of Turkish: Voice, structure and sequence properties. Text analysis (Poetry). Text analysis (Story). Practices related to narration disorders. Report, Petition and CV writing

(Examples and applications). Scientific research and writing techniques. Practices for correcting language mistakes. Text studies, analysis. Oral presentation exercises.

Elective Course (non-technical)

3rd SEMESTER

MAT201 Differential Equations

Basic Concepts and Classifying Differential Equations, First-Order Separable and Exact D.E., First-Order Linear D.E. and its applications, Linear D.E. and Solution theory, Second-order and Higher Order Homogeneous Differential Equations with Constant Coefficients, Method of undetermined coefficients, change of variables, Initial value problems, Application of second order D.E., Laplace Transformations, Matrices and the Matrix Exponential, Numerical Methods for First-Order Differential Equations, Classifying Partial D.E., Partial D.E. and Engineering Applications.

KSM 201 Engineering Thermodynamics

Basic concepts of thermodynamics and the P-V-T behavior of pure substances; general energy balance, the first law of thermodynamics: closed systems and open systems, implementation of the second law of thermodynamics to closed and open systems, the concept of entropy in engineering applications

KIM 203 Analytical Chemistry

Analytical chemistry and classification of quantitative analysis methods, Errors in chemical analysis, Random errors in the analysis, The application of statistics to the examination and evaluation of data, Gravimetric analysis methods, Titrimetric analysis methods, Aqueous-solution chemistry, The effect of electrolytes on ionic balances, Application of equilibrium calculations to complex equilibrium, The theory of neutralization titrations, Applications of neutralization titrations, Precipitation titrimetry.

KIM205 Analytical Chemistry Laboratory

Group I Cations, Group II Cations, Group III Cations, Groups IV and V Cations, I-V Cation Analysis, Iron amount determination by gravimetric method, Sulphate amount determination by gravimetric method, Acid-base amount determination by titrimetric method, Chlorine amount determination by Mohr method, Hardness of water determination by EDTA titration.

KSM203 Basic Principles in Chemical and Process Engineering

Basic concepts, dimensions and unit systems. Introduction of processes. The process variables Examination. Classification of processes and establishment of substance balance in these systems. Single applications of matter equilibrium in quality systems. Applications on very high quality systems. The applications of matter equilibrium in recursive and short-pass systems. Reaction and applications of combustion in combustion systems. Energy balance. Nonreacting Applications of energy balance in systems. In reactive systems, applications. Substance and energy balance in non-adverse situation.

ENG201 Technical English I

Developing students' reading comprehension and writing skills with advanced grammar support. Critical and analytical thinking skills of the students are determined through selected reading pieces to develop, synthesize and evaluate ideas presented in reading to respond to them. To gain writing paragraphs ability.

Elective Course(non-technical)

Technical Elective Course I, II

4th SEMESTER

KSM204 Fluid Mechanics

Basic concepts: the molecular basis of fluid mechanics, the physical and rheological properties of fluids; Balances in fluid mechanics: the conservation rules, rate equations, balances in micro and macro systems, the equation of continuity, mechanical energy conversions, mechanical energy balance in macro systems, force balance as a special case of momentum balance, linear and angular momentum balance in macro systems; shear stress for Newtonian and non-Newtonian fluids and derivation of velocity distribution equations with momentum balances in micro systems, flow in pipes: flow regimes, boundary layer theory, flow of compressible and incompressible fluids; design and control of flow systems, pipe coupling elements, piping and layout, flow control and measurement; transportation of fluids: pumps, compressors, fans.

KSM206 Chemical Engineering Thermodynamics

Thermodynamic property relations, Maxwell relations, relations between conceptual and measurable properties, general enthalpy and entropy correlations, fugacity and fugacity coefficient, vapor power cycles, gas fluid power cycles, refrigeration and gas liquefaction cycles.

KIM202 Physical Chemistry

General characteristics of gases and liquids; ideal gas law; state functions, kinetic theory of gases; Maxwell equations; phase rule, phase balance and diagrams; pure substances, two component and multi component systems; chemical equilibrium; electrochemistry.

KIM204 Organic Chemistry

Atomic structure and chemical bonding, Orbital hybridization and geometry of organic molecules, Organic reactions and reaction mechanisms, Substitution-elimination and addition reactions, Homoliz and Heterolysis, Unstable intermediates, Acidity and basicity, Isomerism,

Alkanes, Alkenes, Alkynes, Aromatic compounds, Halogen compounds, Alcohols and Phenols.

KIM206 Organic Chemistry Laboratory

General laboratory rules, Hazard classes and definitions, Rules to be followed when using a device/equipment, Simple distillation, Fractional distillation, Crystallization, Extraction, Alkyl halide synthesis, Ester synthesis, Cannizzaro reaction, Dye synthesis, Soap synthesis.

ENG202 Technical English II

Students will be able to learn the information and words they get from various sources, to write reports and consistent articles. In addition, to provide them with oral presentation techniques and principles that will enable them keep in touch with society.

Elective Course (non-technical)

Technical Elective Course I,II

5th SEMESTER

MSG101 Occupational Health and Safety I

Occupational health and occupational safety bases: Statistics on health and safety concepts, occupational accidents, occupational diseases and occupational accidents. Occupational health, work safety committees and tasks, SSK and health services. Factors that are harmful to the workplace. Environmental and personal control measures. Toxicology: Taking toxic substances into the body, body disposal and its effects. Some chemical substances: Properties and methods of protection. Material Safety Data Sheets (MSDS). Major industrial accidents and large industrial establishments: Large industrial accident examples of fire, explosion and spread of toxic vapors and lessons to be learned. Points to consider when designing and operating a safe factory: cost approach, process selection, selection of compatible materials,

characteristics of electrical installation and grounding, construction cycle, fire and escape routes, corrosion. Risk assessment: Analysis methods, HAZOP, HAZAN, error tree analysis and examples. Explosions and fires: Types of fire, gas and dust explosions, bursting of boiling liquids (BLEVE)

KSM301 Chemical Reaction Engineering

Rate expressions, isothermal and ideal batch and continuous flow reactors, design equations for batch and flow systems, multiple reactors, rate laws and stoichiometry, data analysis, steady state non-isothermal reactor design.

KSM303 Heat Transfer

Three Laws of Thermodynamics and Heat Flow, Heat Transfer Mechanisms: Conduction, Convection and Radiation, One and Multi-Dimensional Heat Transfer in Steady State, Heat Transfer in Cartesian, Cylindrical, and Polar Coordinates, Critical Radius and Isolation, Fin Effectiveness, Heat Transfer in Unsteady State, Heat Flow in Tubes and Channels, Dimensionless Numbers, Heat Exchangers

KIM303 Instrumental Analysis and Laboratory

Introduction to quantitative and qualitative analysis methods, Electromagnetic wave; material beam interaction, spectroscopic methods; Lambert-Beer absorption law, UV-Visible molecular absorption spectroscopy, IR spectroscopy, NMR spectroscopy, Atomic Absorption spectroscopy, Introduction to Chromatographic Methods, Gas Chromatography, Mass Spectroscopy, Gas Chromatography / Mass Spectroscopy.

MAT301 Numerical Analysis Methods

Solutions of linear and nonlinear equations and systems of equations, interpolation, integration, differentiation and system of ordinary differential equations with numerical methods.

Elective Course (non-technical)

Technical Elective Course I, II, III

6th SEMESTER

MSG102 Occupational Health and Safety II

Occupational health and occupational safety bases: Statistics on health and safety concepts, occupational accidents, occupational diseases and occupational accidents. Occupational health, work safety committees and tasks, SSK and health services. Factors that are harmful to the workplace. Environmental and personal control measures. Toxicology: Taking toxic substances into the body, body disposal and its effects. Some chemical substances: Properties and methods of protection. Material Safety Data Sheets (MSDS). Major industrial accidents and large industrial establishments: Large industrial accident examples of fire, explosion and spread of toxic vapors and lessons to be learned. Points to consider when designing and operating a safe factory: cost approach, process selection, selection of compatible materials, characteristics of electrical installation and grounding, construction cycle, fire and escape routes, corrosion. Risk assessment: Analysis methods, HAZOP, HAZAN, error tree analysis and examples. Explosions and fires: Types of fire, gas and dust explosions, bursting of boiling liquids (BLEVE)

KSM302 Mathematical Modeling

Advantages and basic principles of mathematical analysis, Basis of mathematical model equations; Establishment of mathematical models of chemical and physical processes; Modeling of heat transfer, mass transfer and fluid mechanics questions; Modeling of systems with chemical reactions and solving the systems together with conservation of mass and energy; Strategies for simplifying mathematical models; Solutions of mathematical modeling equations by numerical methods; Statistical analysis of mathematical models.

KSM304 Mass Transfer

Diffusivity, molecular diffusion and Fick's laws. Mass transfer coefficients in laminar and turbulent flows. Interface mass transfer. Mass transfer theories. Analogies. Continuous and stage operations. Gas absorption and distillation.

KSM326 Engineering Economics

Basic principles of economy and consumer economy. Supply-demand relationships, flexibility, and market equilibrium. Chemical engineering economy and production. Market research and pre-feasibility report. Cost estimates; Factors affecting investment and production cost, capital investment estimates, production. Cost estimation, cost, profit and profit, Project design and cost determination. Interest. Depreciation. Market research and pre-feasibility report presentation. Profitability analysis. Comparison of investment options

KSM200 Internship I

Elective Course (non-technical)

Technical Elective Course I,III

7th SEMESTER

KSM 431 Separation Processes

Evaporation, Types of Evaporation Equipment, Calculation Methods for Single and Multiple Evaporators, Drying, Equipment Types for Drying, Equilibrium Moisture Content of Materials, Calculation Methods for Constant-rate and falling-Rate Drying Periods, Liquid-Liquid and Fluid-Solid Separation Processes, Introduction to Adsorption Process, Batch and Fixed-Bed Adsorption Processes, Ion-Exchange Processes, Single- and Multiple-Stage

Liquid-Liquid Extraction, Solid-Liquid Leaching Processes, Crystallization, Crystallization Theory and Calculations

KSM403 Process Engineering and Design I

Equipment design and determination of optimum operating conditions. Designing units of process: heat exchangers, compressors, various reactor types, separation processes (gas-liquid, liquid-liquid), heat and mass transfer units.

KSM405 Process Control

Design issues of controlling process: Design requirements and controlling design principles of a chemical process. Modeling dynamic behavior of process: Development of mathematical model equations, input-output model equations, degrees of freedom. Analysis dynamic behavior of process: Analysis of nonlinear models, transfer functions of model equations, dynamic behaviors of first order systems, behaviors of second and higher order systems. Analysis and design of control systems: Introduction to feedback control systems, dynamic behavior in feedback control processes, stability analysis of feedback control systems, Bode analysis Criteria. Advanced control systems: Dead time reduction method, Cascade control, selective control systems, forward feeding and proportional control, synthesis of alternative control systems in complex processes (multi-unit and multi-input).

KSM407 Chemical Engineering Laboratory I

Temperature measurement and calibration/ Viscometer/ Osborne-Reynolds system/ Distillation/ Gas-liquid absorption/ Sedimentation tank/ Solid-liquid extraction/ Disc mill and sieve

KSM409 Graduation Project

A Project will be conducted to enable students to apply their theoretical background. Projects will be determined by assigned faculty members in the 7th semester and will be conducted by student in the 7th and 8th semester.

KSM300 Internship II

Technical Elective Course III,IV

8th SEMESTER

KSM402 Process Optimization

Nature of Optimization Problems, Developing Models for Optimization, Formulation of Objective and Constrained Functions, Optimization Theory and Methods, Optimization of Unconstrained Functions: One Dimensional Search, Unconstrained Multivariable Optimization, Linear Programming and Applications in Chemical Engineering

KSM404 Process Engineering and Design II

Design, equipment selection and determination of the dimensions of a chemical process with a complete investigation of the process economically.

KSM408 Chemical Engineering Laboratory II

Temperature control module/Rotary shaft-Laboratory flocculator/Concentric tube heat exchanger/Liquid phase reactor/Aeration/Fixed-fluidized bed reactors/Computer controlled friction loss in tubes/Steam boiler

KSM410 Undergraduate Research Project

Education of students on a selected topic in Chemical and Process Engineering by employing them in a research in which theoretical, experimental and computer skills are evaluated.

Technical Elective Course III,IV

TECHNICAL ELECTIVE COURSE I

KSM420 Packaging and Storage of Food

Packaging materials and properties. Packaging material selection criteria and food packaging interactions. Packing tightness and test methods. Packaging methods and applications in the food industry. The importance of storage, the factors causing deterioration in foodstuffs, structural factors, enzymes, respiration, germination, preservatives, external factors, chemical and biological factors, temperature change, color, sensory changes and other manifestations and storage systems.

KSM418 Quality Safety in Food Industry

The importance of quality control; Quality control applications design in enterprises; Standards and Specifications. The distribution of responsibilities in food quality control in Turkey, legal practices, problems and solutions. Basic concepts related to quality control: Quality control concept, Total quality control structure, Quality control functions, Planning, monitoring; Quality characteristics of food, measurement of quality characteristics;; Quality costs: Prevention costs, expertise costs, failure costs, total quality costs, costs, quality safety; HACCP applications; ISO applications.

KSM414 Introduction to Polymer Technology

Solid Polymeric Structures. Polymer Morphology. First and Second Degree Transitions in Polymeric Materials. Effects of Glass Additives and Some Additives on Glass Transition Temperature. Molecular Conformation in Amorphous Polymers. Introduction to Elasticity. Viscous Flow, Modeller and Viscosity Measurement of Polymers. Introduction to viscoelasticity. Visco-Elastic Behavior Models. Time-Temperature Equivalence-Boltzman Supervision Principle. Polymer Melt Rheology. Extrusion. Injection Molding. Other Processing Techniques.

KSM411 Food Additives

Classification of additives. Properties and uses of additives used in food industry. Toxicological effects of additives. regulations and legislation in Turkey

KSM321 Check-in Ceramic Chemistry

KSM325 Introduction to Petrochemical Technologies

Formation, production and composition of petroleum, structure of refinery and its processes, distillation of crude oil, naphta hydrogenation unit, cracking and catalytical cracking, reforming and other oxidizing processes, facilities and finishing processes, production of lubricating oil, waxes and asphalts, refinery wastes.

KSM322 Environmental Chemistry and Technology

Atmosphere, Atmosphere Pollution and Ozone Layer, Nitrogen Oxides (NO_x) and Their Effects. Hydrocarbons (HC), Halocarbons (XC) and Their Effects. Carbon Monoxide (CO) and Its Effects. Sulfur Oxides (SO_x) and Their Effects. Particles and Their Effects. Temperature Inversion and Greenhouse Event. Water Pollution, Water Quality Standards. Biological degradation and water pollution. Detergents. Petroleum and Synthetic Organic Pollutants. Wastewater and Treatment. Solid Waste. Noise Pollution.

KSM313 Food Processing

Compositions of Foods and Their Importance in Terms of Nutritional Physiology. Food Process Quality and Effective Factors. Food Processing and Storage Methods. Physical Properties of Foods. Rheological Properties and Importance of Food Processing. Storage of Foods and Quality Changes.

KSM315 Introduction to Biotechnology

Historical development of biotechnology; relation with other disciplines; definition and scope of fermentation and biotechnology; raw materials, classification of microorganisms used in biotechnology and their growth kinetics;. basic principles of bioreactors; the factors which affect oxygen transfer in bioreactors; fermentation techniques; enzymes; the structure and activity of enzymes, the factors which affect activity; production and isolation of industrial enzymes and products, application areas; the future of industrial enzymes and biotechnology

KSM316 Quality, Environment And Safety

The effects of chemical processes. Turkish environmental law and regulations. Environmental management systems. ISO 14000 standards. Total Quality Management. ISO 9000 standards. EFQM Health and safety issues in the chemical industry. Management of hazardous and hazardous wastes. Chemistry waste management in industry.

KSM318 Fuel And Energy Technologies

Energy, energy sources, primary energy sources, crude oil, coal, natural gas, renewable energy sources, physical operation on applying crude oil, natural gas, conversion processes, cracking, reforming carbonization and gasification processes, heating value, tests on applying liquid fuels.

KSM412 Solid Waste Management

Classification of Solid Waste; Composting of Industrial Wastes, Recycling of Industrial Wastes, Recycling of Industrial Wastes, Evaluation of Industrial Wastes, Improvement of Industrial Wastes, Improvement of Industrial Wastes, Industrial Wastes, Industrial Wastes, Contents of Domestic Wastes, Evaluation of Solid Domestic Wastes, Metal Wastes, Plastic Wastes, Non-metallic Inorganic Wastes Alleviation.

TECHNICAL ELECTIVE COURSE II

KSM 362 Computer Applications in Chemical Engineering

Introduction to MATLAB Programming, MATLAB Programming and Algorithms, Solution to Linear Equations, Solution to Nonlinear Equations, Introduction to Regression Analysis, Linear Curve Fitting, Nonlinear Curve Fitting, Numerical Derivation, Numerical Integration, Solution to Differential Equations: Analytical and Numerical Solutions, Symbolic Operations

TECHNICAL ELECTIVE COURSE III

KSM416 Reactor Design

Basic Concepts in Chemical Reactor Design. Design Principles of Homogenous Reactors in Isothermal and Nonisothermal Conditions. Ideal Discrete, Piston Flow and Mixing Reactors. Semi-Continuous Reactors. Deviations from Ideal Situation. Heterogenous and Catalytic Reactions.

KSM 423 Corrosion

Cost and oxidation of corrosion, Principles of electrochemical corrosion: Thermodynamics and kinetics of corrosion, Polarization types and Tafel equality. Corrosion test methods and passivity. Corrosion types: Galvanic, preferential, gap and cavity corrosion, erosion, fretage, cavitation and microbiological corrosion, stress corrosion, hydrogen embrittlement, fatigue corrosion. Corrosion protection methods: Protective coatings, cathodic and anodic protection. Corrosion-friendly design methods, Socio-economic and social dimension of corrosion.

KSM433 Process Engineering Design, Simulation and Applications

Chemcad interface (the workspace, the explorer pane, the palette pane, the messages pane); Changing the color scheme of an existing palette; Changing the order of UnitOp icons in a palette; Removing UnitOp symbols from a palette; Creating a custom palette; Using a custom color scheme to change UnitOp symbol colors Unitop; The main menu, The toolbar; Customizing Chemcad Window; Viewing and hiding screen elements; Resizing and moving items; Flowsheet drawing tools; Building and using a basic simulation; Selecting engineering units; Selecting chemical components; Selecting k-value and enthalpy options; Manually selecting thermodynamics setting; Drawing the flowsheet; Defining streams; Thermodynamic properties; Stream composition; Total flow properties; Specifying equipment parameters; Using Chemcad for high-fidelity modeling; Introduction to equipment sizing; High-fidelity modeling and sizing for common UnitOps; Strategies for dynamic simulations, Setting up dynamic operation; Output and Reports; Modelling various examples about main chemical engineering processes such as heat exchanger, liquid-liquid extraction, absorption, distillation, batch reactor, continuous stirred tank reactor, stoichiometric reactor, etc.

KSM306 Fundamentals of Materials Science

Introduction to materials science; Classification of materials; Electronic structure of atom and bonding; Crystal structures of solids and crystal geometry; Solidification; Imperfections in solids; Diffusion; Metals; Engineering alloys; Ceramic materials; Polymers; Composites; Material characterization techniques; Economic, environmental, and societal issues in materials science

KSM309 Engineering Mechanics

Basic Principles of Static, Force and Equilibrium, Bearing Systems, Sectional Effects, Normal Force and Uniaxial Stress, Moment of Inertia, Bending, Torsion, Composite Strengths, Elastic Curve, Kinematic, Movement of Material Moment, Solid Cismin Movement.

KSM311 Electrical and Electronic Information

Electronic circuits: Electric circuits, star and triangle connections and problems. Direct current and alternating current. Electric energy sources and power plants. Conductors. Contactor. Magnetic field theory, Magnetic field strength, Direct current and Alternative current. Electrokinetics.

KSM314 SOLID AND LIQUID FUEL PRODUCTION PROCESSES

Introduction to fuel science (world fossil energy reserves, historical perspective of fuels); oil shales, coal, biomass definition and terminology, mineral matter, macerals, thermodynamics and kinetics for solid fuel gasification, pyrolysis process; coal liquefaction, asphaltite structure, conversion and characterization, principal analytical methods; environmental aspects of fuel science, combustion mechanism of solid fuels, combustion systems, and airborne emissions.

KSM320 Unit Operations in Food Processing

Food Emulsions and Properties. Extraction Methods. Supercritical Extraction in Food Industry. Drying Theory and Equipment. Freeze Drying. Dried Fruits and Vegetables. Cooling Cycle. Cooling tower. Cold Storage of Foods (Preweathering, Cold Storage, Controlled Atmosphere Storage, Modified Atmosphere Packaging). Freeze Processing of Foods. Cold Chain Systems. Design of Cold Air Plants.

KSM417 Catalysis and Catalytic Processes

Classification of Surfaces, Surfaces and Interfaces, Exterior Surfaces, Thin Films, Inner Surfaces and Microporous Particles, Clean Surfaces, Thickness of Surface Layers, Surface Science Techniques, Catalytic Homogeneous Catalysis, Acid-base Catalysis, Heterogeneous Catalysis, Heterogeneous Catalysis Mechanism, Contact Contact Method , Catalyst Poisons, Biocatalysis, Environmental Catalysts and Photocatalysts, Catalysis, Quality of Catalysts, Selectivity, Catalysts Used in the Industry, Kinetics of Heterogeneous Catalysis, Delayed Surface Reactions, Adsorption, Adsorption of Gases by Adhesion, Adsorption Types,

Isotherms, Catalysis Reactors.

KSM421 Process Instrumentation

Introduction to measurement, type of measuring instruments and performance characteristics, measurement faults in process, calibration of measuring sensors and measuring instruments, measurement systems reliability and selection of measuring instrument, measurement sensors and measurement devices, temperature measurement, pressure measurement, flow measurement, level measurement.

KSM328 Chemical Process Technologies

Analysis of chemical processes; examination of chemical processes including raw materials, energy, by products and end products, examination methods; characteristics of some production processes (water technologies, coal technologies, cement technologies, glass industry, industrial gases technologies, soap technologies, detergent technologies, sugar technologies, paper technologies iron-Steel industry); new chemical technology can be developed.

TECHNICAL ELECTIVE COURSE IV

KSM432 Sustainable Industrial Systems

Sustainability and Sustainable Development. Life Cycle Assessment (LCA). Carbon footprint. Life Cycle Analysis Modelling (CCaLC). Sustainability of different production systems and examples of implementation: Energy sector, Food industry, Chemical industry, Automotive industry. Economic Sustainability. Social Sustainability. Multi Criteria Decision Analysis – MCDA

NON-TECHNICAL ELECTIVE COURSES

TOS114 Research Methods

Methodology, Research Methods and Data Collection, Analysis of Data, Evaluation and Conclusion, Writing Rules of Scientific Researches, Scientific Publications and Publishing, Researcher and Ethical Principles, Knowledge, Science and Scientific Method, Determination of Research Subject and Decision Making, Literature Scanning and Research Proposal , Basic Statistics Methods.

TOS111 History of Science

Science in ancient civilizations, science in ancient civilizations (ancient Greek), Science in ancient civilizations (Hellenistic period and Romans), science in medieval Europe, science in Islamic world, Renaissance and modern science (astronomy, chemistry, medicine and life) Renaissance and Modern Science (Galileo Galilei, Isaac Newton), Age of Enlightenment and Science (18th century astronomy, mathematics and physics), Enlightenment and Science (revolution in Lavoisier and chemistry), Industrial Revolution and Science Evolutionary Theory and Darwin), Industrial Revolution and Science (Microbiology and Gene Theory), Contemporary Science (Einstein Revolution), Contemporary Science (Quantum Theory and the Birth of Atomic Physics), Contemporary Science (Quantum Theory and the Birth of Atomic Physics).

TOS213 Ceramic Technology and Application

Introduction of ceramic materials and raw materials and classification according to usage. Methods and techniques of production of ceramic raw materials, application. Purpose, methods and practices of ceramic forming - glazing applications

TOS201 Marketing

The topics of marketing, scope, development, marketing environment, strategic marketing, marketing information system and marketing research, consumer markets and consumer

behavior, industrial markets and industrial buyer behavior, market segmentation, target market selection and demand forecasts. Marketing Protection staff (product, promotion, distribution, price), service marketing, internet marketing, direct marketing.

TOS203 Behavioral Sciences

Classical and modern management theories. Human relationship. Organizational process. Power and authority. Organization psychology. The management and motivation of the members of the organization. Groups in organizations. Leadership. Organizational activity.

TOS205 Public Relations

Definition, importance and development of public relations, aims related to public, organization of public relations, management of public relations, communication tools related to public and effective presentation techniques.

TOS207 Labor Law

The birth of labor law, the basic concepts of labor law, the obligations arising from service act, structure, variety service, cause of labor, employer, subcontractor, workplace, service relationship that leads to the birth of service relationship, end of term, employer's legal responsibility, worker health, basic concepts, union, collective bargaining, strike, lockout.

TOS209 Public Personnel Management

Personnel management principles, objectives. Separation of public-private personnel management. Serving staff. The rights, obligations, prohibitions, classification, evaluation, promotion, encouragement, pricing, discipline, prosecution, end of duty of public personnel.

TOS211 Engineering Ethics

Introduction of profession ethic, Codes of profession ethic, ethic in design, responsibility of

business life, solution techniques of ethic problems, risk, safety and accident, responsibility in scientific research, responsibility in experimental study, authorization and responsibility in published results of research, relationships in industry and university, environment ethic, relationship of engineer and public.

TOS 224 Ecology

What is ecology (Ecology is studied at many levels, including organism, population, community, ecosystem, and biosphere)? Ecology types. Ecological levels. Basic ecological concepts: individual, organism, population, community, ecosystem, biosphere, habitat, ecological niche etc. as. Ecological factors, Ecosystem types: Land, sea and freshwater ecosystems. Biogeography, Migration, Behavior (social behavior), Biology. Carbon footprint. Atmosphere. Life cycles.

TOS121 Environment and Energy

The meaning, purpose, scope and function of environmental education; Events and studies leading to the origin and development of environmental education; Environmental education approaches; Environment and environmental problems; Environmental legislation, Environmental pollution: air, water (lake, stream, groundwater, sea), soil, noise, visual, light, electromagnetic pollutions; Environment items and systems: ecosystems and their properties, food chain and energy flow, matter cycling (carbon, phosphorus, nitrogen, water, oxygen, sulfur); The presence of water and soil in the World and Turkey; Biodiversity, Energy and energy types (such as motion, *heat*, *light*, *electrical*, chemical, *nuclear energy*, and gravitational); Energy and environment; Energy resources in the world (fossil, renewable); Laws of thermodynamics; Energy conversions; Projections of energy sources; Electricity and heat energy conversions; Fossil energy sources problems; Environmental impacts of climate change; Ozone layer depletion; Burning of fossil fuels; Carbon footprint and international carbon trade; Carbon balancing.
