DEPARTMENT OF METALLURGICAL AND MATERIALS ENGINEERING
COURSE CONTENTS
(FOR 2018 AND LATER)

FIRST YEAR

FALL SEMESTER

[YDI 107] ENGLISH-I
Course Content: Introduction to basic communication - expressing personal information (name, age, residence) and requesting similar information from others; expressing temporal concepts (months, days, seasons); time-related communication in formal and informal contexts; constructing statements about current actions in affirmative, negative, and interrogative forms; utilizing question words (Who, What, Where, When); using present simple tense for various communication purposes; discussing schedules and using time prepositions (in/on/at); expressing abilities using modal verbs (can/can't); appropriate usage of personal pronouns and possessive adjectives; expressing obligation and prohibition (must/mustn't/don't-doesn't have to); conveying possession (have got/has got); quantity-related questions and answers using appropriate determiners.

[MAT 161] MATHEMATICS-I
Course Content: Comprehensive study of number systems including complex numbers; function theory covering definition, classifications, and special functions; trigonometry and hyperbolic functions; calculus fundamentals including limits, continuity, and derivatives; optimization problems and graphical analysis; coordinate systems; differential calculus; integral calculus covering indefinite integration methods, definite integrals, and their applications in area and volume calculations; determination of arc length, center of gravity, and moment of inertia; matrix theory including types, rank operations, and determinants; systems of linear equations and Cramer's rule.

[FIZ 111] PHYSICS-I
Course Content: Fundamentals of measurement science; vector analysis; one-dimensional motion; two and three-dimensional motion studies; Newton's Laws of Motion and their applications; energy concepts including work, kinetic energy, and potential energy; conservation principles; multi-particle systems and center of mass analysis; momentum and collision studies; rotational mechanics including rolling motion and angular momentum; gravitational physics; equilibrium and elasticity; vibration and wave mechanics; harmonic analysis; practical applications.

[FIZ 105] PHYSICS LABORATORY-I
Course Content: Practical laboratory experiments covering fundamental measurements; constant acceleration motion; momentum conservation principles; equilibrium studies; friction analysis; rotational dynamics experiments; harmonic motion investigation; projectile motion analysis; collision studies (elastic and inelastic); moment of inertia determination; centripetal acceleration experiments; physical pendulum studies.

[KIM 105] CHEMISTRY-I
Course Content: Foundational concepts in chemistry and matter; atomic structure and theory; periodic table analysis and energy levels; chemical bonding theory; stoichiometric calculations; comprehensive study of states of matter (gases, liquids, solids); solution chemistry; reaction types and mechanisms; equilibrium principles; kinetics; acid-base chemistry and pH calculations; electrochemistry fundamentals; thermodynamic principles; materials science aspects including conductor, insulator, and semiconductor properties.

[KIM 109] CHEMISTRY LABORATORY-I
Course Content: Experimental studies in chemical equilibrium; purification through crystallization; solubility product determination of sparingly soluble solids; investigation of concentration and temperature effects on reaction rates; oxidation-reduction reactions; electroplating with copper; soap synthesis; basic nickel analysis procedures.

[MET 111] TECHNICAL DRAWING
Course Content: Introduction to geometric drawing; orthographic projection principles; isometric perspective techniques; sectional views; dimensioning methods; tolerance concepts including geometric and positional tolerancing; surface roughness specifications; technical drawing elements including screws, pins, keys, gear systems, and welded joints; working drawings; auxiliary views; assembly drawings.

[MET 113] INTRODUCTION TO METALLURGICAL AND MATERIALS ENGINEERING
Course Content: Engineering fundamentals and professional responsibilities; introduction to metallurgy, production metallurgy, and materials science; role of metallurgical and materials engineers in manufacturing; historical development of metallurgy; evolution of metallurgical and materials engineering education in Turkey; national raw material resources; Turkish foundry sector; career opportunities in metallurgical and materials engineering; ore preparation; metallurgical preprocessing; hydrometallurgy; pyrometallurgy; electrometallurgy.

SPRING SEMESTER

[YDI 108] ENGLISH-II
Course Content: Advanced sentence construction using 'there is/are'; quantifier usage with countable and uncountable nouns; spatial prepositions; making suggestions and requests; expressing preferences; frequency expressions; past tense usage with regular and irregular verbs; expressing cause and effect; comparative and superlative forms of adjectives and adverbs.

[MAT 162] MATHEMATICS-II
Course Content: Matrix-based solutions of linear equation systems; vector operations and spaces; linear transformations; analytical geometry; series analysis; function series expansions; Taylor and Maclaurin series; multivariable functions covering limits, continuity, and partial derivatives; total differentials; derivatives of composite, implicit, and inverse functions; multivariable optimization; applications of partial derivatives; Jacobians; multiple integrals; area and volume calculations; surface integrals; concepts of gradient, divergence, curl, and Laplace operators.

[FIZ 112] PHYSICS-II
Course Content: Coulomb's Law; electric fields; Gauss's Law; Faraday's Law; electric potential; current and resistance fundamentals; DC circuit analysis; magnetic fields; magnetic effects on current-carrying conductors; electromotive force; capacitance; properties of dielectrics; induction and transient currents; alternating currents and electromagnetic waves.

[FIZ 106] PHYSICS LABORATORY-II
Course Content: Basic measurements and Ohm's law; oscilloscope and signal generator applications; electric field line mapping; Kirchhoff's laws and Wheatstone bridge experiments; AC circuit analysis; capacitor charging and discharging studies; RC circuits; RL circuits; electron e/m ratio determination; transformer experiments.

[KIM 112] PHYSICAL CHEMISTRY
Course Content: Matter and energy relationships; properties of gases; heat and work concepts; thermochemistry; state functions; fundamental laws of thermodynamics (First, Second, and Third Laws); physical transformations of pure substances with phase diagrams; chemical kinetics; chemical equilibrium principles.

[MET 112] COMPUTER AIDED TECHNICAL DRAWING
Course Content: Introduction to two-dimensional drawing; line drawing techniques; drawing settings and configurations; drawing commands; editing commands; practical applications; hatching commands; text applications; layers; dimensioning commands; blocks; plotting; isometric drawings; two-dimensional drawing applications; introduction to three dimensions; solid model drawing commands; editing commands; surface modeling and rendering; three-dimensional drawing applications.

[MET 114] BASIC PROCESSING TECHNIQUES AND APPLICATIONS
Course Content: Simple machine part production using fundamental processing techniques including measuring methods, marking, cutting, filing, drilling, countersinking, and thread cutting. Metal technology measurement and control instruments with practical demonstrations. Hands-on introduction to metal processing tools and machinery working principles.

[MET 118] ELECTRICAL-ELECTRONICS KNOWLEDGE
Course Content: Electrical definitions and units; fundamental laws; circuit analysis methods; resistance circuits; inductance and capacitors; dynamic response characteristics; alternating current circuits; electrical measurement and instrumentation; chemical effects; transformers; generators and motors; semiconductor electronics including diode and transistor operational principles and basic applications; operational amplifiers and their applications; logic gates and their implementations.

SECOND YEAR

FALL SEMESTER

[TRD 209] TURKISH LANGUAGE-I
Course Content: Introduction to language concepts; language's role as a social institution in national life; relationship between language and culture; position of Turkish language among world languages; development and historical periods of Turkish language; current status and geographical distribution of Turkish; Turkish phonetics and classification of sounds; phonetic characteristics and rules of Turkish; syllable knowledge; spelling rules and applications; punctuation marks and their usage.

[AIT 209] PRINCIPLES OF ATATURK AND HISTORY OF REVOLUTION-I
Course Content: Purpose of studying Turkish Revolution History and Atatürk's principles; concept of revolution; factors leading to the collapse of the Ottoman Empire; dismemberment of the Ottoman Empire; Armistice of Mudros and subsequent events; condition of the country during occupations and Mustafa Kemal Pasha's response; Mustafa Kemal's journey to Samsun; opening of the last Ottoman Parliament; establishment of Turkish Grand National Assembly and its taking control of the Independence War.

[MAT 215] LINEAR ALGEBRA
Course Content: Solution of linear equation systems (using Cramer's Rule, Inverse Matrix, reduction to normal form methods); matrix and determinant operations; eigenvalues and eigenvectors of matrices; linear transformations in linear spaces.

[IST 215] PROBABILITY AND STATISTICS
Course Content: Introduction to probability; discrete random variables; continuous random variables; two-dimensional distributions; introduction to estimation; statistical hypothesis testing; linear models.

[MET 225] MATERIALS SCIENCE-I
Course Content: Introduction to materials; atomic arrangement; lattice defects; diffusion; mechanical properties of materials; dislocations and strengthening mechanisms; deformation mechanisms; phase diagram concepts; Fe-C equilibrium diagram; composite materials; corrosion of materials.

[MET 213] ENGINEERING MECHANICS
Course Content: Forces; center of gravity and moment of inertia; support systems and equilibrium; truss systems; cables; friction; section effects and stress analysis.

[MET 229] COMPUTER AIDED DESIGN
Course Content: Text applications; layers; blocks; printer settings; dimensional tolerance; geometric and positional tolerance; surface roughness; screws; pins; keys; gears; welded joints; production drawings; auxiliary views; assembly drawings; introduction to three dimensions; solid model drawing commands; three-dimensional editing commands.

[MET 231] STRENGTH OF MATERIALS
Course Content: Geometric classification of bodies; fundamental principles of strength; stress; section effects and their determination by various methods; relationship between distributed load, shear force, and bending moment; section effects for frames and curved beams; section effects in non-planar systems; axial forces state; deformation (Hook's Law).

[MET 233] WELDING TECHNIQUES APPLICATIONS-I
Course Content: Introduction to electric arc, oxy-gas-soldering, and spot resistance welding methods; selection of welding parameters; welding positions; joint preparations; torch/burner/electrode movements; welding defects and prevention; welding safety; protective gases and their properties; weld seam forms theoretical knowledge. Practical applications of electric arc, oxy-gas-soldering, and spot resistance welding techniques for low carbon steels in horizontal, vertical, upward, downward, and overhead positions with various joint designs (butt, overlap, internal and external corner).

SPRING SEMESTER

[TRD 210] TURKISH LANGUAGE-II
Course Content: Composition knowledge; literary genres; scientific research and writing methods; writing rules; punctuation marks; sentence elements; sentence analysis and practice; narration and sentence structure problems and related studies.

[AIT 210] PRINCIPLES OF ATATURK AND HISTORY OF REVOLUTION-II
Course Content: Turkish revolutionary movements; political reforms; educational and cultural reforms; social, health, and economic reforms; economic reforms; Turkish foreign policy; foreign policy during 1923-1932 and 1932-1938 periods; foundations of Turkish revolution and Atatürk's principles; republicanism, nationalism, populism, revolutionism, statism, secularism.

[MAT 220] DIFFERENTIAL EQUATIONS
Course Content: First-order ordinary differential equations and engineering applications; linear differential equations and engineering applications; Green's functions; introduction to linear algebra; simultaneous linear differential equations; finite differences; mechanical systems and electrical circuits; Fourier series and integrals; Laplace transform; partial differential equations; wave equation derivation; D'Alembert solution; separation of variables method; numerical solution of partial differential equations; Bessel functions and Legendre polynomials; vector spaces and linear transformations; vector analysis; calculus of variations; complex variable analytic functions.

[MET 224] MATERIALS SCIENCE-II
Course Content: Solid solutions and solid solution strengthening; introduction to phase diagrams; equilibrium and non-equilibrium solidification of solid solution alloys; segregation; allotropic transformations; binary phase diagrams; phase diagrams containing three-phase reactions; Fe-Fe3C phase diagram; phase and structure transformations in Fe-C alloy system: transformation from austenite to pearlite, bainite and martensite; effects of alloying elements in steels; effects on equilibrium diagrams and cooling curves; structures and properties of alloyed steels; optical, thermal and electrical properties of materials; ceramics; polymers.

[MET 226] CASTING TECHNOLOGIES AND APPLICATIONS
Course Content: Metal casting and general principles; studies on parts to be cast; gating in casting; risers, feeders, and coolers; mold and sand molding techniques; sand molding with simple shaped part models; metal melting and casting process applications; cores and core making materials and core baking; melting and casting of ferrous and non-ferrous metals and alloys; implementation of various molding and casting methods such as full mold (model melting), shell mold, etc.

[MET 228] PHASE DIAGRAMS
Course Content: Importance of phase diagrams; basic concepts related to phase diagrams: alloy, component, system, and phase; single-phase and multi-phase metals; methods for determining phases; conditions for determining phase diagrams; information obtainable and non-obtainable from phase diagrams; mixing of substances: limited and unlimited solubility, insolubility and examples; single phase diagrams of pure metals; pressure-temperature phase diagrams; importance of their use and example pressure-temperature phase diagrams; Gibbs Phase Rule; example applications for pure substances and binary components; solidification stages in metals; homogeneous and heterogeneous nucleation; crystal growth in liquid metal and formation of grain structure.

[MET 230] MATERIALS TESTING METHODS AND APPLICATIONS
Course Content: Introduction; destructive tests: tensile test, hardness test, impact tests; non-destructive tests: liquid penetrant, eddy current, magnetic test, ultrasonic test, radiographic test, visual test; testing methods, reporting and evaluation of results.

[MET 232] METALLURGICAL THERMODYNAMICS
Course Content: Definition of thermodynamics; thermodynamic quantities; physicochemical thermodynamic laws; units; unit conversion; states of matter and state relationships; rules and laws related to liquids, solids, and gases; concepts; cycles; relationships between equilibrium constants; reaction types and rates; cycles; laws of thermodynamics; energy concepts; energy conversions; cycles and reversibility; thermodynamic probability; molar heat; enthalpy; entropy; Gibbs free energy; Helmholtz free energy concepts; applications to metallurgical reactions; thermal heat concepts and application; changes with pressure, temperature and concentration.

[MET 234] WELDING TECHNIQUES APPLICATIONS-II
Course Content: Industrial welding methods including MIG, MAG, TIG, Submerged Arc, Flash Butt, Stud, Electron Beam, Electro-Slag, Thermite, Plasma, Laser and Underwater welding, along with solid-state welding methods like Friction Welding, Diffusion Welding, Friction Stir Welding, Ultrasonic, Cold Pressure and Explosive welding. Theoretical and practical applications of these techniques.

THIRD YEAR

FALL SEMESTER

[MET 301] CORROSION AND SURFACE PROTECTION
Course Content: Definitions; types of corrosion; metallic coatings; organic protective layers; corrosion retarding measures and application methods; electrical protection methods; surface layer formation; surface treatments; galvanizing techniques; protection methods based on corrosion type.

[MET 303] PHYSICAL METALLURGY
Course Content: Atomic vacancies and defects; diffusion and its mechanisms; interfaces and their classification; homogeneous and heterogeneous nucleation; solidification of metals and alloys; recovery and recrystallization; precipitation and precipitation hardening; diffusion-controlled grain growth; martensitic transformations; applications of physical metallurgy.

[MET 305] CERAMIC MATERIALS
Course Content: Introduction and classification; polymorphism and atomic bonds in ceramics; ceramic crystal structures; ceramic phase diagrams; composition calculations in phase equilibrium diagrams; physical, thermal, and mechanical properties of ceramics; electrical, magnetic, and optical properties of ceramics; sintering of ceramics; grain growth; sintering control; ceramography; mechanical processing and wear of ceramics; application areas of ceramics; quality control of ceramics.

[MET 307] HEAT TREATMENTS AND APPLICATIONS
Course Content: Definition of heat treatment; purposes; heat treatment furnaces; considerations in heat treatment applications; types of annealing; hardenability and through-hardening; surface hardening treatments without changing composition (furnace, flame, induction, immersion, and laser surface hardening); surface hardening treatments with composition change (carburizing, nitriding, carbonitriding, boriding); isothermal T.T.T. and continuous T.T.T. (temperature-time-transformation) diagrams; annealing types using these diagrams; heat treatment of low carbon steels; heat treatment of high carbon steels; heat treatment of non-ferrous metals; heat treatment of alloy steels; heat treatment of cast iron; heat treatment of Hadfield steels; heat treatment of high-speed steels; theoretical and practical heat treatment applications; evaluation of experiments.

[MET 309] HEAT AND MASS TRANSFER
Course Content: Introduction to heat transfer and types (conduction, convection, and radiation definitions); units; one, two, three-dimensional heat conduction equations; boundary conditions; thermal contact resistance; critical insulation radius; finned surfaces; transient heat conduction; steady-state heat conduction; convective heat transfer and types; turbulence concept; equations of motion; energy equation; dimensionless parameters; boundary layer equations; boiling and condensation; heat exchangers; mass transfer.

SPRING SEMESTER

[MET 340] CHEMICAL METALLURGY

Course Content: System energy; enthalpy; examples of visible and latent heats; standard reaction heat; standard reaction heat at constant pressure and volume; combustion heat; calorific value; example problems; heat balance calculations in chemical processes; examples; metallurgical fuels; classification; solid fuels; liquid fuels and problem solutions; gas fuels; types and fuel selection; physical and chemical transformations; decomposition reactions; oxidation reactions; reduction reactions; formation reactions; displacement reactions.

[MET 304] MATERIALS CHARACTERIZATION APPLICATIONS

Course Content: Material characterization sample preparation techniques; macro examination; sample preparation for macro examination; fracture and fracture surface examination; optical microscopy; micro examination; specimen sampling; cutting; mounting; grinding; polishing and etching; optical microscope examination; structure analysis in single and dual phase materials; microstructures of iron and cast iron materials; metal and alloy microstructures and phase diagram relationships; quantitative metallography; electron microscopes (TEM, SEM) and materials characterization; X-ray production and properties; X-ray diffraction analysis.

[MET 306] METAL FORMING TECHNIQUES AND APPLICATIONS

Course Content: Plastic forming fundamentals; hot and cold plastic forming applications; workshop conditions, equipment, tools, molds, and presses used in hot and cold forming; properties of annealing tools; hot forming applications including free forming, open die forging, closed machine die forging, hot extrusion (forward and backward extrusion), and rolling operations; cold forming applications including press drawing, deep drawing, cold rolling, metal spinning, wire drawing, etc.

[MET 308] POWDER METALLURGY METHODS AND APPLICATIONS

Course Content: Introduction to powder metallurgy; definitions; application areas; powder production methods; atomization; granulation; reduction; powder preparation; powder characteristics; pressing operations; press selection and practical demonstration of mold preparation; sintering atmosphere; furnaces; sintering temperature and time; production cycles; infiltration; powder metallurgy applications; machining operations on powder metallurgy products.

[MET 310] COMPOSITE MATERIALS

Course Content: Introduction to composites; properties; surface treatments; reinforced materials; dispersion strengthened materials; TD-nickel; fiber reinforcement; composite strengths; resin characteristics; composite material usage in modern automotive industry and spacecraft; comparison of composites with metallic materials; other areas where they are used and replacing traditional materials.

Technical Elective Courses (Students select according to their interests)

SOCIAL ELECTIVE COURSES (Third Year)

[MET 341] FACTORY ORGANIZATION AND MANAGEMENT
Course Content: System, production system, and factory concepts; selection of factory location including regional selection, location and position selection; factors affecting site selection and methods used; workplace layout and material flow; workplace layout planning objectives; factory building; workflow types; workplace layout types; job-based arrangement; flow-based arrangement; cellular arrangement; fixed position arrangement; material flow systems including AGVS, conveyors, robots; material storage and warehousing systems.

[MET 343] PROJECT MANAGEMENT
Course Content: Project, project management, project requirements, project stakeholders, project plan, project life cycle, idea development, control and monitoring, project budget creation, human resources management, project success criteria, project support, entrepreneurship, entrepreneurial intention and purpose, innovation, business establishment, entrepreneurial risks.

[MET 345] LOGISTICS PURCHASING
Course Content: Teaching students about logistics and marketing relationships in the world and Turkey, including developments in this field. The course covers strategic planning and marketing management processes; consumer and market management processes; product diversity and market segments; product positioning and targets; marketing plans; pricing, directing and promotion decisions; market control in line with strategic processes of general transportation concept, logistics and supply chain management services marketing.

[MET 347] PROFESSIONAL ENGLISH-I
Course Content: Introduction to materials science; comparison of materials science with materials engineering; materials selection; terms for academic presentation; abbreviations for academic purposes; properties of materials; structure; terms for academic writing; descriptions of figures; terms for reading diagrams and formulas; production and performance; classification of materials; introduction to metals; mechanical properties of metals; important properties for manufacturers; metal alloys; English to Turkish translation of scientific articles.

[MET 349] ENTREPRENEURSHIP-I
Course Content: What is entrepreneurship? Entrepreneurship and economic development; evaluation of entrepreneurship in Turkey.

FOURTH YEAR

FALL SEMESTER

[MET 411] GRADUATION PROJECT
Course Content: Project concepts, research, experimentation and observation, reporting, etc. Project topic determination, project proposal development, project management (planning, proposal, time management, cost). Project execution.

[MET 413] TRIBOLOGY
Course Content: Dry friction; friction theories; wear and wear mechanisms; wear control; lubrication; lubricants; Stribeck curves; effect of surface treatments on wear; bearing materials.

[MET 415] NON-FERROUS METALS METALLURGY
Course Content: History, physical and chemical properties, alloys, standards, raw material sources, world and Turkey production/consumption values, application areas of metals like Cu, Pb, Zn, Al, Pt; production and refining techniques from primary and secondary sources; production flow charts; furnaces, converters, leaching, sedimentation, cementation, distillation and electrolysis reactor and equipment selection used in production; justification of this selection within process flow chart in terms of suitability and capacity.

[MET 417] WELDING METALLURGY AND TECHNOLOGY
Course Content: Classification of welding methods; gas fusion welding; electric arc welding; welding electrodes; thermal cutting methods; electric resistance welding; submerged arc and gas metal arc welding methods; friction welding; electron and laser beam welding; other welding methods; soldering methods; metal spraying; welding defects; residual stress and distortions; welding metallurgy; changes occurring in weld zone and heat affected zone; weldability of steels; carbon equivalent; welding of unalloyed, low-alloy and high-alloy steels; welding of stainless steels; welding of non-ferrous metals; pre- and post-weld heat treatments; corrosion in welded joints; hydrogen embrittlement and brittle fracture in welding.

[MET 449] ORE PREPARATION TECHNIQUES AND APPLICATIONS
Course Content: Mineral, ore and ore preparation concepts; relationship and control between metallurgy and ore preparation; particle size analysis; crushing and crushers; grinding and mills; industrial screening; classification; gravity concentration; heavy medium separation; flotation; magnetic and electrostatic separation; chemical enrichment.

[MET 425] IRON-STEEL METALLURGY AND APPLICATIONS
Course Content: Iron ores; pelletizing, sintering and baking of ores; iron production in blast furnace; principles of steel production; converters; deoxidation; removal of gases; continuous casting; rolling; rolled products; alternative steel production methods.

EIGHTH SEMESTER

[MET 460] WORKPLACE EDUCATION
Course Content: Students will receive workplace education in the relevant sector throughout the eighth semester.

[MET 462] WORKPLACE TRAINING
Course Content: Students will receive workplace training in the relevant sector throughout the eighth semester.

[MET 464] PROFESSIONAL PRACTICE I
Course Content: Evaluation of the 20-working-day construction site internship completed by department students at the end of the 4th semester and the 20-working-day office internship completed at the end of the 6th semester.

[MET 466] PROFESSIONAL PRACTICE II
Course Content: Evaluation of the 20-working-day construction site internship completed by department students at the end of the 4th semester and the 20-working-day office internship completed at the end of the 6th semester.

TECHNICAL ELECTIVE COURSES (Fourth Year)

[MET 419] SURFACE TREATMENTS
Course Content: Classification of surface treatments; surface preparation techniques; electrolytic and electroless coatings; conversion coatings; hot dipping; metal spraying; plasma spraying; organic coatings; vacuum techniques; chemical vapor deposition; physical vapor deposition; laser surface modification; surface treatments and environment; quality control of surface treatments; characterization of coatings.

[MET 421] DIFFUSION THEORY
Course Content: Diffusion equations, first and second Fick's laws; solutions for variable diffusion coefficient; atomic theory of diffusion; random walk and diffusion coefficient; random walk problem; diffusion in non-uniform concentration regions; Kirkendall effect; Darken analysis; phenomenological equations; diffusion in multi-phase binary systems; variation of diffusion coefficient in binary systems; diffusion in non-metallic materials.

[MET 423] STEEL SELECTION
Course Content: Introduction and developments in steel grades and objectives of modern steel production; dual phase steels used in automotive industry; relationship between vehicle weight reduction and fuel consumption; microalloyed steels, production stages and general application areas; controlled rolling process applied to microalloyed steels; maraging steels; new generation steels and automotive industry; IF steels; TRIP steels; new generation martensitic and TWIP steels; modern steels used in structures; high temperature and corrosion resistant steels.

[MET 427] THERMAL OPTICAL AND PHOTONIC PROPERTIES OF MATERIALS
Course Content: Electromagnetic radiation; interaction between solids and photons; optical properties of materials including refraction, reflection, absorption, transparency, color, interference; electronic processes caused by electromagnetic radiation in solids including X-ray fluorescence, luminescence, phosphorescence, thermal emission, photoconductivity; applications including fiber optics, emitters, lasers, optical detectors; thermal properties of materials including heat capacity, thermal expansion, thermal conductivity, thermal stresses; applications, bimetallic strips, thermal shock resistant materials, ceramic-metal joints, cryogenic materials.

[MET 429] SUPERALLOYS
Course Content: Definition of superalloys; production methods; areas of application; implementations; failure analysis.

[MET 431] BIOMATERIALS
Course Content: Biomaterials: Materials manufactured and processed for use in repairing or supporting diseased or injured tissue in human body reconstruction.

[MET 435] WELDING CONSTRUCTION
Course Content: Design capabilities of welded joints; cost and work safety principles.

[MET 437] METALLURGICAL DESIGN OF STEELS
Course Content: Steel and classification; general properties of steels and expectations from steels; relationships between microstructure and mechanical properties; carbon steels; alloy steels; low alloy high strength steels; super strength steels; stainless steels; special steels.

[MET 439] TOTAL QUALITY MANAGEMENT
Course Content: Total quality management; quality; TSE quality definition; design quality; conformance quality; objectives of total quality management; purpose of total quality management training; quality policy and objectives; process management; customer awareness concept; quality measurement methods; statistical methods; leadership and management; ways to motivate people; employee happiness and productivity; spiritual and material happiness; strategic planning; performance management concept; quality circles concept; duties of total quality management.

[MET 443] INDUCTION AND METAL MELTING TECHNIQUES
Course Content: Electric furnaces; induction furnaces; lining, operation and sintering of induction furnace; transport ladles; cupola furnace; chemical experiments; coloring; theoretical definition of melting process and melting safety; melting defects and precautions; recognition of furnace types; furnace repair.

[MET 445] SURFACE PROTECTION METHODS
Course Content: Definition and importance of corrosion; chemical and electrochemical corrosion; corrosion mechanisms; environmental effects in corrosion formation; types of corrosion; galvanic, crevice, pitting, intergranular, selective, erosion and stress corrosion and hydrogen damage; corrosion tests; corrosion prevention methods; inhibitors; cathodic and anodic protection; material selection for corrosion protection; high temperature corrosion;

oxidation and its kinetics; oxidation resistant metals and alloys; effect of design on corrosion resistance.

[MET 447] METALLURGICAL FAILURE ANALYSIS
Course Content: Material behavior under stress; deformation and fracture; types of fracture and influencing factors; impact testing; failure and failure analysis; methodology; types of failure related to process and material; industrial failure analysis examples.

[MET 453] STRUCTURE AND PROPERTIES OF OXIDES-SILICATES
Course Content: Crystal structure and phase transformations in oxides and silicates; role of oxide and silicate systems in metallurgical processes.

[MET 455] BIOCERAMICS
Course Content: Introduction to bioceramics; structure of ceramics and glasses; use of ceramics as biomaterials. Types of bioceramics: bioinert, bioactive, bioresorbable ceramics; bioactive glass and glass-ceramics; clinical applications; bioceramic coating processes; hydroxyapatite coatings; bioactive glass; alumina-zirconia.

[MET 457] STRUCTURAL CERAMICS
Course Content: Introduction to structural ceramics and their applications (ceramics used in heat engines, bearings, metal processing operations, wear-resistant parts, bioceramics, military applications); transformation toughening mechanism and examples; microstructure-performance relationships; fracture toughness; creep properties; design concept and conceptual design of structural ceramics; Weibull analysis; carbides (silicon carbide, etc.); nitrides (silicon nitride, SiAlON, etc.); oxides (alumina, zirconia, etc.) and other important structural ceramic groups.

[MET 461] CERAMIC SENSOR MATERIALS
Course Content: Introduction to sensor concepts; types of materials used in sensors and their classification; application areas of ceramic sensor materials; development and characterization of sensor ceramics.

[MET 463] CERAMIC PROCESS TECHNIQUES
Course Content: Definition and classification of ceramic materials; basic information about ceramic production; production of ceramic powders; shaping of ceramic powders; full density processes; testing methods for ceramic materials; application areas of ceramic materials; advanced ceramic materials.

[MET 465] INTERMETALLIC COMPOUNDS
Course Content: Intermetallics (compounds between metals) (NiAl and Ni3Al compounds, Al3Ta and Re3Nb/W2Hf and Co2Zr/Nb6Fe7 and W6Co7); production and properties of intermetallic materials; application areas of intermetallic materials (energy storage, automotive, aerospace, batteries, corrosive environments).

SOCIAL ELECTIVE COURSES

[MET 370] BUSINESS LAW
Course Content: Subject and characteristics of business law; emergence and development of business law; basic principles of business law; sources of business law; basic concepts of business law; scope of labor law; service contract; working hours; paid holidays; leave; collective labor law; trade unions; collective agreement; disputes; strike; lockout.

[MET 372] MANAGEMENT SOCIOLOGY
Course Content: Management and human relations in management; goal setting and/or policy determination in management; managerial planning and human problems in planning; organization and organizing; human behavior in management; characteristics of modern bureaucracy; cultural dimension of bureaucracy-politics relationship; operation and management of public administration in Turkey.

[MET 374] ENGINEERING ETHICS
Course Content: Introduction; sources of morality; social moral rules; engineer's work area and engineering ethics; engineering profession and responsibility consciousness; computer ethics; manager and engineer relationship; employee rights; risk and work safety; patent and intellectual property rights; international ethics; analysis of moral problems; relationships with professional organizations.

[MET 376] PROFESSIONAL ENGLISH-II
Course Content: Introduction to ceramics; structure of ceramics; properties of ceramics; useful expressions for figures and solids; introduction to polymers; properties of polymers; polymer production; introduction to composites; introduction to advanced materials; semiconductors; smart materials; nanotechnology.

[MET 378] ENTREPRENEURSHIP-II
Course Content: Project support organizations; innovation; scientific activities in entrepreneurship; business establishment process and basic steps; implementation studies.