

Curriculum		T	P	ECTS
<b>1 st Semester</b>				
ME108	Computer Aided Solid Modeling	1	3	4,5
TURK201	Turkish I	3	0	3
MATH151	Calculus I	4	2	7
CMPE102	Computer Programming	2	2	4
ENG101	English For Academic Purposes I	4	0	3,5
HIST221	History of Civilization	3	0	3
PHYS101	General Physics I	3	2	6
<b>2 nd Semester</b>				
PHYS102	General Physics II	3	2	6
CHE105	General Chemistry	3	2	5
TURK202	Turkish II	3	0	3
MATH152	Calculus II	4	2	7
ENG102	English for Academic Purposes II	4	0	3,5
MATE207	Introduction to Materials Engineering	3	0	5
ENE102	Fundamentals of Energy Systems Engineering	1	0	1,5
<b>3 rd Semester</b>				
ENG201	English for Academic Purposes III	3	0	3
ENE203	Thermodynamics I	3	0	6
MATH275	Linear Algebra	4	0	6
ENE201	Energy Systems I	3	2	9
ME211	Statics and Strength of Materials	3	1	6
<b>4 th Semester</b>				
MECE204	Dynamics	2	2	6
MATH276	Differential Equations	4	0	6
ENG202	English for Academic Purposes IV	3	0	3
ENE202	Energy Systems II	3	2	5
ENE204	Thermodynamics II	3	0	5
EE234	Introduction to Electrical Engineering	3	1	5

**5 th Semester**

ENE399	Summer Practice I	0	0	10
IE220	Probability and Statistics	3	0	5
ENG301	English for Occupational Purposes I	3	0	3
AE307	Fluid Mechanics	3	1	6
ENE302	Heat and Mass Transfer	3	1	6
	Area Elective (5)	3	0	5
ENE303	Modeling, Analysis and Simulation	3	1	5

**6 th Semester**

ENG302	English for Occupational Purposes II	3	0	3
MECE306	Control Systems I	3	0	6
	Area Elective (1)	3	0	5
EE352	Electromechanical Energy Conversion	3	2	6
ENE306	Nuclear Energy	3	0	6
	General Elective	3	0	4

**7 th Semester**

IE305	Engineering Economy	2	0	5
ENE401	Energy Systems Design Project I	2	2	9
	General Elective	3	0	4
ENE499	Summer Practice II	0	0	10
	Area Elective (2)	3	0	5
HIST111	Principles of Atatürk and History of Turkish Revolution I (in English)	2	0	2
	Area Elective (6)	3	0	5

**8 th Semester**

HIST112	Principles of Atatürk and History of Turkish Revolution II (in English)	2	0	2
ENE406	Energy Management	3	0	6
	Area Elective (3)	3	0	5
	Area Elective (4)	3	0	5
	General Elective	3	0	4
ENE402	Energy Systems Design Project II	2	2	8

(1) ENE308, ENE312TE, AET305, AET306, AET315, AET316, AET325, AET326, AET405, AET406, AET415, AET416, E400, EE451, EE452, ENE310, ENE316, ENE409, ENE411, ENE413, ENE410, ENE412, ENE414, ENE416, ENE418, ENE420, ENE422, ENE424, ENE426, ENE430, ENE314, ENE428, ENE421, MECE422, ENE403, ENE305, ENE304, ENE493, ENE491, ENE404, ENE408, EE454, AE434,

(2) ENE312TE, ENE308, ENE412TE, ENE415, AET305, AET306, AET315, AET316, AET325, AET326, AET405, AET406, AET415, AET416, E400, ENE310, ENE316, ENE409, ENE411, ENE413, EE451, EE452, ENE410, ENE412, ENE414, ENE416, ENE418, ENE420, ENE422, ENE424, ENE426, ENE428, ENE430, ENE314, ENE421, ENE305, ENE403, ENE304, ENE491, ENE493, ENE404, ENE408, EE454, AE434,

(3) AET305, AET306, AET315, AET316, AET325, AET326, AET405, AET406, AET415, AET416, ME488, ENE430, IE314, ISE432, MFGE405, SE426, ENE312, MATE460, IE443, ENE308, IE322, MATE462, MECE422, MFGE420, MFGE481, MFGE482, SE375, CMPE468, SE446, MATE458, IE446, IE447, IE445, MECE322, EE449,

(4) ME408, ENE415, AET305, AET306, AET315, AET316, AET325, AET326, AET405, AET406, AET415, AET416, E400, ENE310, ENE316, ENE409, ENE411, ENE413, EE451, EE452, ENE410, ENE414, ENE416, ENE418, ENE420, ENE422, ENE424, ENE426, ENE428, ENE430, ENE314, ENE412, ENE421, ENE312, ENE403, ENE305, MECE422, ENE304, ENE493, ENE491, ENE404, ENE408, EE454, AE434,

(5) ENE312TE, ENE308, ENE412TE, ENE415, AET305, AET306, AET315, AET316, AET325, AET326, AET405, AET406, AET415, AET416, E400, ENE310, ENE316, ENE409, ENE411, ENE413, EE451, EE452, ENE410, ENE412, ENE414, ENE416, ENE418, ENE420, ENE422, ENE424, ENE426, ENE428, ENE430, ENE314, ENE421, ENE305, ENE403, MECE422, ENE304, ENE312, ENE493, ENE491, ENE404, ENE408, EE454, AE434,

(6) ENE312TE, ENE308, ENE412TE, ENE415, AET305, AET306, AET315, AET316, AET325, AET326, AET405, AET406, AET415, AET416, E400, ENE310, ENE316, ENE409, ENE411, ENE413, EE451, EE452, ENE410, ENE412, ENE414, ENE416, ENE418, ENE420, ENE422, ENE424, ENE426, ENE428, ENE430, ENE314, ENE421, ENE305, ENE403, MECE422, ENE304, ENE493, ENE491, ENE404, ENE408, EE454, AE434,

## General Electives

KOR201, GET304, GET305, GET306, GET307, GET314, GET315, GET316, GET317, GET324, GET325, GET326, GET334, GET335, GET336, GET344, GET345, GET346, GET354, GET355, GET364, GET374, GET384, GET394, GET404, GET405, GET406, GET414, GET415, GET416, GET424, GET425, GET426, GET434, GET436, ART271, ART201, ART221, ART222, ART223, ART224, ART225, ART251, ART252, ART291, ART292, FRE201, FRE202, FRE301, FRE302, FRE401, FRE402, GER201, GER202, GER301, GER302, GER401, GER402, HUM201, HUM211, JAP201, JAP202, JAP301, JAP302, RUS201, RUS202, RUS301, RUS302, SPAN201, SPAN202, SPAN301, SPAN302, ART202, CHIN201, PR492, MAN415, ART235, ART293, ART294, CHIN202, CHIN301, PR491, MAN428, MAN409, LAW250, CHIN302, ART282, ART284, ECON442, HUM212, ENE495, SPAN402, RUS402, ART287, ENE497, ART285, ART286, RUS401, SPAN401, ART288, ART297, ART289, HUM331, MAN374, KOR202, ART295, HUM291, ART261, ART298, HUM310, ECON318, ART266, KOR301, ART262, ART267, ART226, ART264, HUM202, ART227, HUM323, HUM322, ENG395, HUM319, MAN408, MAN313, ART228, PR419, HUM105, HUM412, ART270, ART265, MAN437, ART268, MAN414, MAN328, MAN412, ART269, GSM147, PR413,

## Area Elective Course List

AE 434	Electric and Hybrid Vehicles	(3-1)5
AET 305	Area Elective Course	(0-0)5
AET 306	Area Elective Course	(0-0)6
AET 315	Area Elective Course	(0-0)5
AET 316	Area Elective Course	(0-0)6
AET 325	Area Elective Course	(0-0)5

AET 326	Area Elective Course	(0-0)6
AET 405	Area Elective Course	(0-0)5
AET 406	Area Elective Course	(0-0)6
AET 415	Area Elective Course	(0-0)5
AET 416	Area Elective Course	(0-0)6
CMPE 468	Machine Learning for Engineers	(3-0)5
E 400	Undergraduate Research Project	(3-0)5
EE 449	Pattern Classification and Sensor Applications for Engineers	(3-0)5
EE 451	Power System Analysis	(3-0)5
EE 452	High-Voltage Techniques	(3-0)5
EE 454	Power Electronics	(3-2)5
ENE 304	Measurement and Instrumentation	(3-0)5
ENE 305	Combustion	(3-0)5
ENE 308	Solar Energy Technology	(3-1)5
ENE 310	Hydropower	(3-0)5
ENE 312	Wind Energy Technologies	(3-1)5
ENE 312TE	Wind Energy Technologies	(3-0)2
ENE 314	Geothermal Energy Technologies	(3-0)5
ENE 316	Reactor Design	(3-0)5
ENE 403	Power Transmission and Distribution	(3-0)5
ENE 404	Energy and Environment	(3-0)5
ENE 408	Modeling and Control of Engineering Systems	(3-1)5
ENE 409	Fossil Energy Resources (Oil, Gas and Coal) I	(3-0)5
ENE 410	Fossil Energy Resources (Oil, Gas and Coal) II	(3-0)5
ENE 411	Electrochemistry	(3-0)5
ENE 412	Fuel Cell Technologies	(3-0)5
ENE 412TE	Fuel Cell Technologies	(3-0)0
ENE 413	Global Finance	(3-0)5
ENE 414	Global Energy	(3-0)5
ENE 415	Energy Storage Technology	(3-0)5
ENE 416	Gas Hydrates	(3-0)5

ENE 418	Energy Laws and Regulations	(3-0)5
ENE 420	Bioenergy Technologies	(3-0)5
ENE 421	Hydrogen Technology	(3-0)5
ENE 422	Optimization in Energy Systems	(3-0)5
ENE 424	Energy and Environment Economics	(3-0)5
ENE 426	Nuclear Technology	(3-0)5
ENE 428	Power Plant Engineering	(3-0)5
ENE 430	Energy Systems in Buildings	(3-0)5
ENE 491	CO_OP Practice I	(3-0)5
ENE 493	CO_OP Practice II	(3-0)5
IE 314	Project Management	(3-0)5
IE 322	Industrial Engineering Practices in Energy Sector	(3-0)5
IE 443	Occupational Health and Safety	(3-0)5
IE 445	Technology Management	(3-0)5
IE 446	Innovative Products Services and Systems	(3-0)5
IE 447	Technology Entrepreneurship	(3-0)5
ISE 432	Innovation and Entrepreneurship in IT	(3-0)5
MATE 458	Materials for Catalysis and Fuel Cells	(3-0)5
MATE 460	Biomaterials	(3-0)5
MATE 462	Nanomaterials	(3-0)5
ME 408	Thermal Systems Design	(3-0)6
ME 488	Production Design and Prototyping	(1-4)5
MECE 322	Multidisciplinary Design in Engineering	(2-2)5
MECE 422	Multidisciplinary Engineering Design	(2-2)5
MFGE 405	Rapid Prototyping	(3-0)5
MFGE 420	Project Management in Manufacturing	(3-0)5
MFGE 481	Nanofabrication	(3-0)5
MFGE 482	Introduction to CAD/CAM	(2-1)5
SE 375	3D Modeling, Animation and Game Design	(2-2)5
SE 426	Emerging Technologies	(2-2)5
SE 446	Introduction to Bioinformatics	(3-0)5

## Course Descriptions

AE 307      Fluid Mechanics      (3-1)6

Introduction to basic concepts of fluid mechanics; properties of fluids; pressure and fluid statics, fluid kinematics, Bernoulli and energy equations, momentum analysis of flow systems, dimensional analysis and modeling, internal flow, external flow ? drag and lift.

AE 434                  Electric and Hybrid Vehicles                  (3-1)5

Electric vehicle components; history of electric vehicles; types of electric vehicles; batteries and battery modeling; alternative energy sources and stores (photovoltaics, flywheels, capacitors, fuel cells); DC and AC electric motors, brushed DC motors, and brushless electric motors; power electronics and motor drives; electric vehicle drivetrain.

CHE 105      General Chemistry      (3-2)5

Matter and measurement, atoms, molecules and ions, stoichiometry: calculations with chemical formulas and equations, oxidation-reduction reactions, thermochemistry, electronic structure of atoms, periodic properties of the elements, basic concepts of chemical bonding, molecular geometry and bonding theories, gases, intermolecular forces, liquids and solids, chemical kinetics, chemical thermodynamics, electrochemistry.

CMPE 102 Computer Programming (2-2)4

The objective of this course is to provide the basics of programming concepts using Python programming language and enable students to gain experience in laboratory environment.

CMPE 468      Machine Learning for Engineers      (3-0)5

Artificial intelligence, machine learning, supervised and unsupervised learning, binary classification, multiclass classification, regression, clustering, model evaluation.

E 400	Undergraduate Research Project	(3-0)5
-------	--------------------------------	--------

Rigorous scholarly research, research methodologies, review of background knowledge, academic reading.

EE 234 Introduction to Electrical Engineering (3-1)5

Definition of current, voltage, resistance, power, Kirchoff laws and resistive DC circuits, Thevenin and Norton equivalents, AC circuits, phasors, filters, reactive power, three-phase circuits and power, overview of combinational and sequential digital circuits and examples, diodes and transistors.

EE 352 Electromechanical Energy Conversion (3-2)6

Electric machinery fundamentals, magnetic circuits and materials, electromechanical energy conversion principles, transformers: the ideal transformer, practical transformers, special transformers, three-phase transformers; DC Machines; DC generators, DC motors, DC motor starters, variable speed control of DC motors, synchronous machines: synchrono

EE 449	Pattern Classification and Sensor Applications for Engineers	(3-0)5
--------	--	--------

Sensors, general information about sensor types and sensor working principles; what is a pattern; pattern classification applications; theory and methods of pattern classification; feature extraction and selection; MATLAB Classification Learner Tool; analysis and performance of classifiers; RFID basics.

EE 451                      Power System Analysis                      (3-0)5

Basic concepts in power systems, current and voltage relations on a transmission line, the single-line diagram, per-unit quantities, impedance and reactance diagrams, the admittance model and network calculations, the impedance model and network calculations, power flow analysis, symmetrical faults, symmetrical components, unsymmetrical faults, pow

EE 452                      High-Voltage Techniques                      (3-0)5

Mechanisms of electrical breakdown in gases, in solid and liquid dielectrics and practical aspects, vacuum insulation, standard impulse voltages, discharge time, breakdown due to pollution.

EE 454                      Power Electronics                      (3-2)5

Power electronic semiconductor devices, calculation of losses in power semiconductor devices, snubber design, heat sink design, design of snubber circuits, gate drive circuits and isolation, AC choppers, single-phase and three-phase rectifiers, switch mode power supply topologies., inverters.

ENE 102                      Fundamentals of Energy Systems Engineering                      (1-0)1.5

Energy, energy systems, energy resources, fossil, renewable and nuclear sources, energy conversion and transportation, environment, climate change, carbon capture.

ENE 201                      Energy Systems I                      (3-2)9

Working principles and calculations of hydrogen energy, solar, wind, hydro, geothermal, wave and biomass energy, environmental effects.

ENE 202                      Energy Systems II                      (3-2)5

Nuclear energy sources, coal, natural gas and oil; operating principles and basic information of fuels and combustion technologies, steam, gas and nuclear power plants; the environmental impact of conventional energy sources.

ENE 203                      Thermodynamics I                      (3-0)6

Basic concepts and definitions, properties of a pure substance, equations of state, work and heat interactions, first law of thermodynamics, internal energy and enthalpy, second law of thermodynamics, entropy, reversible and irreversible processes, thermodynamic analysis of processes, third law of thermodynamics.

ENE 204                      Thermodynamics II                      (3-0)5

Property relations for pure substances, ideal gases, mixture of ideal gases, and atmospheric air; steam power cycles, refrigeration cycles, spark-ignition and compression-ignition engines, and turbine cycles.

ENE 302                      Heat and Mass Transfer                      (3-1)6

Basic concepts of heat transfer, mechanisms of heat transfer (conduction, convection, radiation), steady and transient conduction, numerical methods in heat conduction, forced and natural convection, boiling and condensation, heat exchangers, radiation heat transfer, mass transfer.

ENE 303            Modeling, Analysis and Simulation            (3-1)5

Translational mechanical systems, state-variable equations, inputoutput equations, matrix formulation, block diagrams and computer simulation, rotational mechanical systems, electrical systems, Laplace transform solutions of linear models.

ENE 304            Measurement and Instrumentation            (3-0)5

Importance of experiments in engineering, experimental methods, basic concepts, measurement and dynamic response; statistical analysis of experimental data, error types and error analysis, uncertainty, probability, chi-square test, least square methods, coefficient of correlation; measurement of basic electrical quantities, pressure, flow, tempera

ENE 305            Combustion            (3-0)5

Gaseous, liquid, and solid fuels, thermodynamics and kinetics of combustion, adiabatic flame temperature, combustion of gaseous and vaporized fuels, combustion of liquid fuels, combustion of solid fuels.

ENE 306            Nuclear Energy            (3-0)6

Atomic energy, radioactivity, nuclear processes, neutron-atom interactions, nuclear fission and fusion reactions, basic principles of neutron diffusion theory, nuclear energy systems, nuclear heat energy and applications, nuclear power plants.

ENE 308            Solar Energy Technology            (3-1)5

Introduction to solar energy conversions, fundamentals of solar radiation, methods of solar collection and thermal conversion, solar heating systems, solar thermal power, capturing solar energy through biomass.

ENE 310            Hydropower            (3-0)5

The hydropower theory, reaction turbines, hydroelectric systems, hydropower regulations and efficiency, hydroelectric energy productions.

ENE 312            Wind Energy Technologies            (3-1)5

Wind characteristics, wind energy, wind turbines, design of wind turbines, projecting, planning and economy, wave energy and wave energy conversion systems.

ENE 312TE        Wind Energy Technologies            (3-0)2

Rüzgar nitelikleri, rüzgar enerjisi, rüzgar türbinleri, rüzgar türbinlerinin tasarımı, projelendirilmesi, planlaması ve ekonomisi, dalga enerjisi ve dalga enerjisi dönüşüm sistemleri.

ENE 314            Geothermal Energy Technologies            (3-0)5

Thermal structure of the Earth, heat transfer, geothermal systems and resources, exploration techniques, thermal energy of the oceans.





ENE 410 Fossil Energy Resources (Oil, Gas and Coal) II (3-0)5

Definition of coal and coal properties, role of coal properties on consumption, utilization of Turkish hard coal, lignite and wastes, coal to liquids, mining, CO<sub>2</sub> reduction, natural gas, ethics.

ENE 411 Electrochemistry (3-0)5

General electrochemical concepts; introduction to electrochemistry; thermodynamics; electrode potentials; galvanic and electrolytic cells; the cell potential of an electrochemical cell; electrode kinetics; reversible reactions; irreversible reactions; dynamic electrochemistry; mass transport; migration; convection; diffusion layers; conductivity an

ENE 412 Fuel Cell Technologies (3-0)5

Introduction: fuel cell operating principles, history, types, components and systems; fuel cell thermodynamics and electrochemistry: Nernst equation, Tafel equation, cell voltage, fuel cell efficiency and losses for operational fuel cell voltages; proton exchange membrane fuel cells: components and system, construction and performance, critical issues and recent developments; fuel cell stack design and calculations; hydrogen production, storage, safety and infrastructure; balance of fuel cell power plant

ENE 412TE Fuel Cell Technologies (3-0)0

Yakıt hücrelerinin elektrokimyası ve termodinamiği, katı oksit hücreler, asit ve alkalın hücreler, biyoyakıt hücreler ve enerji uygulamalarındaki kullanımı.

ENE 413 Global Finance (3-0)5

Financial and global importance of energy services and markets, benefits and barriers to liberalizing energy, integrated energy service companies, corporate financing and capital structure issues.

ENE 414 Global Energy (3-0)5

Effective energy management, energy auditing, economic analysis, business environment for energy industry, technological change in business.

ENE 415 Energy Storage Technology (3-0)5

Basic concepts and definitions, energy storage systems and types, chemical energy storage, batteries and battery types, thermal energy storage methods, thermal energy storage and solar energy, sensible thermal energy storage, latent thermal energy storage, phase change materials, stratification in sensible heat storage systems, modeling of latent h

ENE 416 Gas Hydrates (3-0)5

Hydrate types and formers; hand calculation methods; computer methods; inhibiting hydration formation with chemicals; dehydration of natural gas; combatting hydrates using heat and pressure; physical properties of hydrates, phase diagrams; water content of natural gas, the most complete guide available on natural gas hydrates.

ENE 418 Energy Laws and Regulations (3-0)5

An introduction to energy law and regulation in Turkey, energy market, nuclear safety regulations, renewable energy regulations and distributed generation, environmental impact assessment regulation, smart grid.

ENE 420      Bioenergy Technologies      (3-0)5

Biomass as an energy source, photosynthesis of biomass, its conversion related properties, physical conversion processes, thermal conversion, synthetic oxygenated liquid fuels.

ENE 421      Hydrogen Technology      (3-0)5

Properties of hydrogen, production of hydrogen from fossil fuels and biomass, hydrogen as fuel, electrolysis, hydrogen storage, applications.

ENE 422 Optimization in Energy Systems (3-0)5

Fundamentals of optimization, graphical optimization, linear and nonlinear programming, unconstrained and constrained optimization, global optimization, MATLAB applications, case studies in energy systems engineering.

ENE 424      Energy and Environment Economics      (3-0)5

Energy market; mechanisms, analysis, trading, costs, pricing, emissions, transmission and distribution.

ENE 426      Nuclear Technology      (3-0)5

Nuclear materials, nuclear power plants and their types, nuclear processes, nuclear fusion reactions, nuclear energy systems, nuclear protection and shielding, enrichment.

ENE 428      Power Plant Engineering      (3-0)5

Analysis and design of steam supply systems, electrical generating systems, and auxiliary systems; nuclear, fossil, hydraulic and renewable energy sources, power plant efficiency and operation.

ENE 430      Energy Sytems in Buildings      (3-0)5

Building structure, heating, ventilation and air conditioning, the calculation of heat loss and insulation surfaces, water, fuel and electricity consumption in buildings, the national and international standards and regulations on energy efficiency in buildings.

ENE 491      CO OP Practice I      (3-0)5

Understanding energy efficiency and management technologies, the energy quality and importance of electricity, monitoring and measuring methods and energy saving.

ENE 493      CO OP Practice II      (3-0)5

Renewable energy sources and alternative systems, theoretical knowledge about energy management, economics and policy in these systems, applications

ENE 499 Summer Practice II (0-0)10

A minimum of thirty working days summer practice especially in the energy related sectors such as power stations, energy producing centers or producers of energy related machine or apparatus such as wind



IE 220                      Probability and Statistics                      (3-0)5

Introduction to probability and statistics; random variables and probability distributions; expected value; sampling distributions; one and two sample estimation problems; test of hypotheses; simple linear regression.

IE 305                      Engineering Economy                      (2-0)5

Economic analysis for engineering and managerial decision-making; cash flows, effect of time and interest rate on money and physical assets; methods of evaluating alternatives: present worth, future worth, annual worth, rate-of-return and benefit/cost ratios; depreciation and taxes; effects of inflation.

IE 314                      Project Management                      (3-0)5

Elements and phases of project management; functions (planning, staffing, scheduling, monitoring, and control) and techniques (CPM, PERT, etc.) of project management; software tools for project management; project cost control and time/resource management; leadership styles, conflict and risk management.

IE 322                      Industrial Engineering Practices in Energy Sector                      (3-0)5

The impact of energy in today's world; principles of energy planning and utilization; the drives of energy supply and demand; the role of an engineer in energy industries for management, resource planning and utilization; sustainability as a driving force for energy planning; common concepts in energy management; a paradigm of decision making: conventional versus new energy resources including nuclear and renewable energy; economical evaluation of energy investments,

IE 443                      Occupational Health and Safety                      (3-0)5

Basic information on occupational health and safety, principles and legislations, occupational health and safety requirements to be applied in the workplace, occupational accidents, risk assessment and occupational audits; a proactive approach to occupational health and safety.

IE 445                      Technology Management                      (3-0)5

The topics covered

- a) identifying the strategic issues in technology management (TM);
- b) identifying the issues in organizing TM functions and related human element ;
- c) identifying the issues in TM-Activities and Tools
- d) being able to identify, formulate and solve TM problems.

IE 446                      Innovative Products Services and Systems                      (3-0)5

Innovation, innovative products, services and systems; innovative organizations, products, services and systems or any topic involving design, development and innovation.

IE 447                      Technology Entrepreneurship                      (3-0)5

Technology Entrepreneurship course aims to enable students to learn variety of basic areas and concepts of entrepreneurship including idea generation, business plan creation, venture financing sources, marketing and go to market strategies and to apply the concepts learned through real life cases and a term project.

ISE 432                      Innovation and Entrepreneurship in IT                      (3-0)5

Introduction to entrepreneurship, recognizing opportunities and generating ideas, feasibility analysis,

developing an effective business model, industry and competitor analysis, writing a business plan, preparing the proper ethical and legal foundation, assessing a new venture's financial strength and viability, building a new-venture team, working with disciplinary teams, working with interdisciplinary teams, getting financing or funding.

MATE 207      Introduction to Materials Engineering      (3-0)5

Historical perspective and classification of materials; atomic structure and theory; bonding in solids; the structure of crystalline solids; fundamental mechanical properties of materials; phase diagrams; thermal processing of metal alloys; properties and use of ceramics, glasses and composites; material selection; design and economical considerations

MATE 458      Materials for Catalysis and Fuel Cells      (3-0)5

Fundamentals of catalysis and catalytic reactors; catalyst synthesis methods; properties of catalytic materials and basic characterization methods; catalyst structure activity relationship fundamentals of electro-catalysis, photo catalysis, different types of fuel cells, and materials used for these applications; existing technology applications; future trends and emerging technologies

MATE 460      Biomaterials      (3-0)5

Definition of biomaterial, biocompatibility, host response, synthetic and biological materials, synthetic biomaterial classes, polymers in the body, implant factors, host factors, categories of biomaterial applications, evaluation of biomaterials, historical evaluation of implants, current work in biomaterials, motivation for future directions, current trends. Properties of materials; bulk properties of materials, mechanical properties of materials; comparison of common surface analysis methods;

MATE 462      Nanomaterials      (3-0)5

Nanotechnology fundamentals, history, applications and novel materials; synthesis and application of nanomaterials and their application in industry in relation to existing technology applications; future trends and emerging technologies.

MATH 151      Calculus I      (4-2)7

Preliminaries, limits and continuity, differentiation, applications of derivatives, L'Hopital's Rule, integration, applications of integrals, integrals and transcendental functions, integration techniques and improper integrals, sequences.

MATH 152      Calculus II      (4-2)7

Infinite series, vectors in the plane and polar coordinates, vectors and motions in space, multivariable functions and their derivatives, multiple integrals: double integrals, areas, double integrals in polar coordinates, triple integrals in rectangular, cylindrical and spherical coordinates, line integrals, Independence of path, Green's theorem.

MATH 275      Linear Algebra      (4-0)6

Linear equations and matrices, real vector spaces, inner product spaces, linear transformations and matrices, determinants, eigenvalues and eigenvectors.

MATH 276      Differential Equations      (4-0)6

First-order, higher-order linear ordinary differential equations, series solutions of differential equations, Laplace transforms, linear systems of ordinary differential equations, Fourier analysis and partial differential equations.

(1-3)4.5

(3-1)6

(3-0)6

(1-4)5

(2-2)6

(3-0)6

(2-2)5

(2-2)5

(3-0)5

## Energy Systems Engineering Program Curriculum and Course Description

additive manufacturing technologies, stereolithography, fused deposition modeling, laminated object manufacturing, selective laser sintering, direct metal laser sintering, casting processes for rapid prototyping, investment casting, rapid tooling, reverse engineering.

MFGE 420      Project Management in Manufacturing      (3-0)5

Project management standards; project, portfolio, program and operation management concepts; managing participation, teamwork, and conflict; need identification and assessment, problem definition; creativity and idea generation; methods and tools of functional/physical/task decomposition; mind mapping; planning methods; cost estimation and budgeting; time management and scheduling; project quality management; resource allocation; project risk management techniques; project execution, monitoring techniques

MFGE 481      Nanofabrication      (3-0)5

Fabrication of metallic nanomaterials, manufacturing of carbon based nanostructures, nanostructured systems from low-dimensional building blocks, characterization techniques and manufacturing methods, proximity effect.

MFGE 482      Introduction to CAD/CAM      (2-1)5

Introduction to CAD, overview of geometric modeling techniques (wireframes, boundary representation, constructive solid geometry and hybrid modelers), parametric and variation modeling, parametric modeling of curves and surfaces (Bezier, B-spline and NURBS), introduction to CAM, CNC part programming, machining strategies, cutting tool selection, tool path generation, post-processing.

PHYS 101      General Physics I      (3-2)6

Measurement, motion along a straight line, vectors, motion in two and three dimensions, force and motion I, force and motion II, kinetic energy and work, potential energy and conservation of energy, center of mass and linear momentum, rotation, rolling, torque, and angular momentum, equilibrium and elasticity.

PHYS 102      General Physics II      (3-2)6

Electric charge, electric fields, Gauss' law, electric potential, capacitance, current and resistance, circuits, magnetic fields, magnetic fields due to currents, induction and inductance.

SE 375      3D Modeling, Animation and Game Design      (2-2)5

Introduction to modeling bases, an overview of the design of the model, selection of the appropriate modeling technique; transforming the model into simulation and animation; overview of simulation and physics engine; control of model and animation with peripherals; overview of peripherals; interactive project construction with the selection of appropriate peripherals; 3D modeling for 3D printers; artificial organ design with 3D printers; industrial product design with 3D printers;

SE 426      Emerging Technologies      (2-2)5

What is an "Emerging Technology", disruptive technologies; identification of disruptive technologies; the 3D printing revolution; the evolution of technology; the nature of innovation; combination and structure; phenomena, domains and problem-solving; origin of technologies; technological revolution; economic revolution; forecasting.

SE 446      Introduction to Bioinformatics      (3-0)5

DNA and protein sequence alignment, phylogenetic trees, protein structure prediction, motif finding, microarray data analysis, gene/protein networks.



TURK 201      Turkish I

(3-0)3

The alphabet; giving and asking personal information, ordering food and drink, telling the time, talking about habits, talking about family, talking about clothes, etc.

TURK 202      Turkish II

(3-0)3

Vocabulary, structure and communicative skills at beginners level; various themes such as transport, travel, dates, holidays, money, and shopping.