

APPENDIX 2: Curriculum of the Joint Program

Semester 1

Code	Title	Prerequisites	Lec	Tut	Lab	ECTS
NS104	General Chemistry		3	1	1	6
MATH101	Calculus I		3	2	0	6
NS102	Physics I		3	1	2	6
ELIT100	Academic English and Effective Communication		3	0	0	6
ENS221	Introduction to Engineering		3	0	0	3
ENS103	Introduction to Machine Design		2	0	1	3
Semester Total =						30

Semester 3

Code	Title	Prerequisites	Lec	Tut	Lab	ECTS
ME208	Dynamics	NS102	3	2	0	3
ENS202	Thermodynamics	NS102	3	2	0	6
ENS205	Materials Science	NS104	3	0	1	3
MATH202	Differential Equations	MATH101	3	2	0	6
ENS208	Introduction to Manufacturing Systems	ENS103	3	0	2	3
ME210	Strength of Materials I	ENS209	3	2	0	3
MATH203	Introduction to Probability and Statistics	MATH101	3	2	0	6
Semester Total =						30

Semester 5

Code	Title	Prerequisites	Lec	Tut	Lab	ECTS
MAK 229E	Fluid Mechanics II	ME304	2	1	0	4.0
MAK 313E	Heat Transfer	MATH101, NS102, ME304	3	1	0	5.5
MAK 339E	Machine Design I	ENS207, ENS205, ME211	2	3	0	5.5
MAK 333E	System Dynamics and Control	MATH202	3	1	0	5.5
MAK 353E	Manufacturing	ME206	3	1	0	5.0

Semester 2

Code	Title	Prerequisites	Lec	Tut	Lab	ECTS
MATH102	Calculus II	MATH101	3	2	0	6
NS122	Physics II	NS102	3	1	2	6
ENS209	Statics	MATH101	3	2	0	3
ENS213 / CS103	Programming for Engineers / Introduction to programming		3	2	0	6
MATH201	Linear Algebra	MATH101	3	2	0	6
ENS207	Engineering Graphics		1	2	0	3
Semester Total =						30

Semester 4

Code	Title	Prerequisites	Lec	Tut	Lab	ECTS
MATH205	Numerical Analysis	MATH202	3	2	0	6
ENS204	Thermodynamics II	ENS202	3	2	0	6
ENS203	Electrical Circuits I	NS122	3	2	0	6
ME304	Fluid Mechanics I	MATH202	3	2	0	6
ME211	Strength of Materials II	ME210	3	2	0	3
ME206	Engineering Materials	ENS205	3	0	0	3
Semester Total =						30

Semester 6

Code	Title	Prerequisites	Lec	Tut	Lab	ECTS
MAK 342E	Machine Design II	MAK 339E	2	2	0	4.5
MAK 324E	Theory of Machines	MATH201, ME208	2	1	0	4.0
MAK 312E	Measurement Systems	ENS202, ME210, ME304	2	0	2	4.5
EKO 201E	Economics		3	0	0	4.0
DAN 301E	Career Advising		0	2	0	1.0

Thermal Design Elective Course (ED)

Course Code	Course Title	Lec	Tut	Lab	ECTS
MAK 380E	Heat and Mass Exchanger Design	2	1	0	4.5
MAK 390E	Applied Heat Transfer	2	1	0	4.5
MAK 4040E	Steam Boiler Design	2	1	0	4.5

7th and 8th Semester Elective Courses (ED)

(Not all of these courses are offered every semester. Some of them are offered at autumn and some at spring.)

Course Code	Course Title	Lec	Tut	Lab	ECTS
MAK 4001E	Heat and Mass Transfer in Mini and Micro Scale Systems	2	1	0	4
MAK 4002E	Advanced Strength of Materials	2	1	0	4
MAK 4003E	Introduction to Biomechanics and Bioengineering	2	1	0	4
MAK 4004E	Introduction to Mechanics of Composite Materials	2	1	0	4
MAK 4005E	Mechanical Modeling in Nanoscale Systems	2	1	0	4
MAK 4006E	Alternative Fuels for IC Engines	2	1	0	4
MAK 4007E	Microsystem -MEMS Design	2	1	0	4
MAK 4008E	Driver Assistance Systems	2	1	0	4
MAK 4009E	Electric and Hybrid Electric Vehicles	2	1	0	4
MAK 4011E	Dynamics and Controls of Micro/Nano Scale Systems	2	1	0	4
MAK 4015E	Materials Selection in Design and Manufacturing	2	1	0	4
MAK 4016E	Hydraulic Machinery	2	1	0	4
MAK 4017E	Industrial Acoustics and Noise	2	1	0	4
MAK 4018E	Quality Control in Manufacturing	2	1	0	4
MAK 4019E	Plastics Engineering and Manufacturing	2	1	0	4
MAK 4020E	Agricultural Machinery	2	1	0	4
MAK 4021E	Machine Tools	2	1	0	4
MAK 4022E	Microprocessors and Applications in Engineering	2	1	0	4
MAK 4023E	Materials Handling	2	1	0	4
MAK 4025E	Engineering Design and CAD	2	1	0	4
MAK 4026E	Pumping Systems	2	1	0	4
MAK 4027E	Turbomachinery	2	1	0	4
MAK 4029E	Advanced Fluid Mechanics	2	1	0	4
MAK 4030E	Advanced Topics in Mechanical Design	2	1	0	4
MAK 4031E	Mass Transfer	2	1	0	4
MAK 4032E	Metal Forming	2	1	0	4
MAK 4033E	Gas Dynamics	2	1	0	4
MAK 4035E	Hydraulic and Pneumatic Circuits	2	1	0	4
MAK 4036E	Manufacturing Engineering and CAM	2	1	0	4
MAK 4037E	Computer Controlled System Design	2	1	0	4
MAK 4038E	Power Plants	2	1	0	4
MAK 4039E	HVAC Fundamentals	2	1	0	4
MAK 4041E	Mechanical Installation for Buildings	2	1	0	4
MAK 4042E	Gas Turbines	2	1	0	4

MAK 4043E	Fire Dynamics and Protection	2	1	0	4
MAK 4044E	Energy Management	2	1	0	4
MAK 4045E	Vehicle System Dynamics and Control	2	1	0	4

7th and 8th Semester Elective Courses (ED) (continued)

(Not all of these courses are offered every semester. Some of them are offered at autumn and some at spring.)

Course Code	Course Title	Lec	Tut	Lab	ECTS
MAK 4047E	Dynamic Systems Modelling and Simulation	2	1	0	4
MAK 4048E	HVAC Systems and Equipment Design	2	1	0	4
MAK 4049E	Control Elements and Applications	2	1	0	4
MAK 4050E	Optimization of Thermal Systems	2	1	0	4
MAK 4051E	Noise and Vibration in Vehicles	2	1	0	4
MAK 4052E	Building Automation	2	1	0	4
MAK 4053E	Vehicle Technology	2	1	0	4
MAK 4054E	Digital Control System Design	2	1	0	4
MAK 4055E	Fuel Economy in Road Vehicles	2	1	0	4
MAK 4056E	Control Systems Design	2	1	0	4
MAK 4057E	Vehicle Systems Design	2	1	0	4
MAK 4058E	Power Transmission in Vehicles	2	1	0	4
MAK 4059E	Precision Machine Design	2	1	0	4
MAK 4060E	Vibration Analysis by Finite Element Methods	2	1	0	4
MAK 4061E	Exhaust Gas Emmission	2	1	0	4
MAK 4062E	Railway Vehicles	2	1	0	4
MAK 4063E	Design of Internal Combustion Engines	2	1	0	4
MAK 4065E	Refrigeration	2	1	0	4
MAK 4066E	Vehicle Chassis and Body Design	2	1	0	4
MAK 4067E	Renewable Energy Systems	2	1	0	4
MAK 4068E	Fluid Power Control	2	1	0	4
MAK 4069E	Thermal Environmental Engineering	2	1	0	4
MAK 4070E	Internal Combustion Engines	2	1	0	4
MAK 4071E	Introduction to Robotics	2	1	0	4
MAK 4078E	Fundamentals of Mechanical Design	2	1	0	4
MAK 4079E	Thermodynamics of Biomolecular Systems	2	1	0	4

7th Semester Elective Courses (HSS)

(Note: Not all but some of these courses are offered every autumn semester.)

Course Code	Course Title	Lec	Tut	Lab	ECTS
SNT 101E	Looking at the Art of Sculpture	3	0	0	4
SNT 102E	Photography	3	0	0	4
SNT 103E	Drawing	3	0	0	4
SNT 104E	Mythology and Art	3	0	0	4
SNT 105E	Film Art	3	0	0	4
SNT 106E	Traditional Turkish Art&Crafts	3	0	0	4
SNT 107E	Ancient Civilizations in Anatolia	3	0	0	4

SNT 108E	Ceramic	3	0	0	4
SNT 109E	Gravure	3	0	0	4
SNT 111E	Fashion Design and Art	3	0	0	4
SNT 112E	Theater	3	0	0	4
SNT 113E	Art and Interpretation	3	0	0	4
SNT 114E	Contemporary Art	3	0	0	4
SNT 115E	Modernity and Visual Culture	3	0	0	4
SNT 116E	The Art of Communication	3	0	0	4
SNT 117E	Jazz Appreciation	3	0	0	4
SNT 118E	Archaeology of Music	3	0	0	4
SNT 119E	History of Popular Music	3	0	0	4
SNT 121E	World Music Cultures	3	0	0	4
SNT 122E	Ceramic Art	3	0	0	4
SNT 123E	Film Making	3	0	0	4
SNT 123E	Film Production	3	0	0	4
SNT 211E	Istanbul:History ,Art and Society	3	0	0	4
SNT 212E	Art,Culture and Society	3	0	0	4
SNT 213E	Music Cultures of Turkey	3	0	0	4
SNT 214E	Performance, Music and Dance	3	0	0	4
SNT 215E	Balkan Musics	3	0	0	4
SNT 226E	Philosophy of Art	3	0	0	4
SNT 227E	Sound and Society	3	0	0	4
SNT 228E	Music and Politics	3	0	0	4

8th Semester Elective Courses (HSS)

(Note: Not all but some of these courses are offered every spring semester.)

Course Code	Course Title	Lec	Tut	Lab	ECTS
BEB 120E	Sports and Sciences	3	0	0	4
BEB 121E	Sports and Technology	3	0	0	4
HUK 201E	Labor Law	3	0	0	4
HUK 211E	Social Security Law	3	0	0	4
HUK 212E	Syndicate and Collective Bargaining Law	3	0	0	4
HUK 213E	Occupational Safety and Health Law	3	0	0	4
HUK 214E	Protection of Technological Innovations	3	0	0	4
ING 103A	Creative Writing	3	0	0	4
ING 103AC	Urban Ecology	3	0	0	4
ING 103AD	Advanced English for Engineers	3	0	0	4
ING 103B	Business English	3	0	0	4
ING 103C	Great Moments in Science	3	0	0	4
ING 103ES	Intercultural Citizenship in International Education	3	0	0	4
ING 103G	Business Communications	3	0	0	4
ING 103H	Public Presentations	3	0	0	4
ING 103I	Short Stories	3	0	0	4
ING 103L	Mythology	3	0	0	4
ING 103N	Film Studies	3	0	0	4
ING 103O	Psychology	3	0	0	4

ING 103P	Poetry	3	0	0	4
ING 103SC	Science Communication: Theory and Practice for Engineers	3	0	0	4
ISL 465E	Introduction to Entrepreneurship and Innovation	3	0	0	4
ISL 478E	Entrepreneurship	3	0	0	4
ITB 020E	Formations of Modernity	3	0	0	4
ITB 037E	Knowledge, Language and Logic	3	0	0	4
ITB 087E	Media and Society	3	0	0	4
ITB 094E	International Relations&Globalization	3	0	0	4
ITB 095E	Technology, Policy and Law	3	0	0	4
ITB 143E	Durell and Said: Orientalism Practice and Theory	3	0	0	4
ITB 151E	Human Resources and Management	3	0	0	4
ITB 171E	Science, Technology & Society	3	0	0	4
ITB 179E	Literatures of Intimate Separacies: Vizyenos,Seyfettin,Armen	3	0	0	4
ITB 201E	Introduction to Humanities & Social Sciences	3	0	0	4
ITB 202E	World History	3	0	0	4
ITB 203E	Sociology	3	0	0	4
ITB 204E	Political Science	3	0	0	4
ITB 205E	Philosophy	3	0	0	4
ITB 206E	Issues in World Politics	3	0	0	4

8th Semester Elective Courses (HSS)

(Note: Not all but some of these courses are offered every spring semester.)

Course Code	Course Title	Lec	Tut	Lab	ECTS
ITB 207E	Ottoman History	3	0	0	4
ITB 208E	Formations of Modern Turkey	3	0	0	4
ITB 209E	Turkey in World Affairs	3	0	0	4
ITB 211E	Istanbul:History,Art and Society	3	0	0	4
ITB 212E	Art,Culture and Society	3	0	0	4
ITB 213E	Topics in Literature and Society	3	0	0	4
ITB 215E	Topics in History and Society	3	0	0	4
ITB 216E	Economy and Society	3	0	0	4
ITB 217E	Engineering Ethics	3	0	0	4
ITB 218E	History of Science and Technology	3	0	0	4
ITB 219E	Ethics	3	0	0	4
ITB 220E	Psychology	3	0	0	4
ITB 221E	Anatolian Archaeology	3	0	0	4
ITB 222E	City and Society	3	0	0	4
ITB 224E	Environment and Society	3	0	0	4
ITB 226E	Philosophy of Art	3	0	0	4
ITB 227E	Political Theory	3	0	0	4
ITB 228E	Gender Studies	3	0	0	4
ITB 230E	Disaster Awareness	3	0	0	4
ITB 233E	Anthropology	3	0	0	4
ITB 234E	The Rise of Civilizations	3	0	0	4

International Undergraduate Joint Program in Mechanical Engineering between Istanbul Technical University, Turkey and International University of Sarajevo, Bosnia And Herzegovina

COURSE DESCRIPTIONS

Compulsory Courses at IUS

ELIT100 Academic English and Effective Communication ECTS 6 (3+0+0)

The course designed to teach the organizational and critical thinking skills necessary for logical written expression. The course focuses on writing a research paper of at least 3000 words based on sound scholarly sources on a topic of interest related to a student's field by conforming to the APA standards of writing without committing plagiarism. In this course the whole research process is taught step by step through skills including research, source selection, choice of topic, construction and defense of a thesis statement, citing sources, outlining, organizing a "References" page and note taking. Critical elements of the course are instruction in paraphrasing and summarizing techniques, use of quotations and the incorporation of these research findings in the paper together with the inclusion of personal comments, avoidance of plagiarism and conforming to ethical rules.

ENS103 Introduction to Machine Design ECTS 3 (2+0+1)

The course provides a comprehensive guide for the student toward successful design development. Fundamentals are emphasized throughout; so, the approach described provides a sound basis for design courses that help students move quickly and effectively into design practice. For the creation and reading of engineering drawings, it teaches concepts such as perspective, projection, sectioning, tolerance, assembly with applications.

ENS202 Thermodynamics ECTS 6 (3+2+0)

Properties of pure substances. Ideal and real gases. Energy, heat, work. Conservation of energy. Application on systems and control volumes. Heat engine. Second law of thermodynamics. Carnot principles. Clausius inequality. Principle of the increase of entropy. Exergy, second law analysis.

ENS203 Electrical Circuits I ECTS 6 (3+2+0)

In this course, the principles and basic technology of electrical and electronics engineering will be introduced. Examples of related engineering applications will be given. In addition, electrical machinery, power electronics, and electrical driving circuits will be introduced within the scope of mechanical engineering requirements.

ENS204 Thermodynamics II ECTS 6 (3+2+0)

Gas, vapor and combined power cycles. Cogeneration. Refrigeration cycles. Gas mixtures. Gas-vapor mixtures and air-conditioning. Chemical reactions. Chemical and phase equilibrium.

ENS205 Materials Science ECTS 3 (3+0+1)

Introduction to materials science and classification of atomic structures of the materials. Crystal structures and imperfections. Mechanical and physical properties of the engineering materials. Solid-state diffusion. Phase diagrams and solidification. Ferrous / non-ferrous alloys and heat treatment. Electrical, optical, thermal and magnetic properties associated with electron band structures of the materials. Metallic corrosion and prevention from corrosion. Principle

geomaterials, their properties and application areas. Deterioration of geomaterials.

ENS207 Engineering Graphics **ECTS 3 (1+2+0)**

Technical drawing in engineering. Meanings of line types. Lettering. Fundamentals of dimensioning. Principles of projection. Orthographic views. Section views. Isometric perspectives. Surface finishing symbols. Symbols of materials. Mechanical assembly drawing. Fasteners. Welding symbols. Limits and fits. Geometric tolerances.

ENS208 Introduction to Manufacturing Systems **ECTS 6 (3+1+1)**

Course is designed to introduce manufacturing equipment used in machining, forming, casting and welding processes and hands-on practice on various manufacturing processes and equipment. The main goals of the course are: (1) To introduce the student into the practice of project work, manual and computer technical drawing practice. (2) To get experience in planning and implementing a workshop project within a team. (3) To develop the student's creative and intellectual abilities. A contest is held at the end of the course to assess the group projects.

ENS209 Statics **ECTS 3 (3+2+0)**

Basic principles. Force vector. Equilibrium of particle. Moment of a couple. Equilibrium of rigid body. Planar forces. Center of gravity. Pappus-Guldinus theorem. Distributed loads and hydrostatic forces. Supports and support reactions. Gerber beam. Frames. Trusses. Friction. Virtual work.

ENS213 Programming for Engineers **ECTS 6 (3+1+1)**

Programming for engineers. Introduction to scientific and engineering computing. Introduction to program computing environment. Variables. Operations and simple plot. Algorithms and logic operators. Flow control. Errors and source of errors. Functions. Linear algebra applications. Solving equations applications. Polynomials examples. Curve fitting applications. Interpolation applications. Numerical integration applications. Symbolic mathematics. Ode solutions with built-in functions.

ENS221 Introduction to Engineering **ECTS 3 (3+0+0)**

Introduction of the Engineering Programs and the regulations. Engineering profession and the place of engineering in fields. Development of engineering. Engineering ethics. Contribution of engineering to the solution of societal problems. Principal application areas of engineering.

MATH101 Calculus I **ECTS 6 (3+2+0)**

Functions of a single variable. Limits and continuity. Derivatives. Applications of derivatives. Sketching graphs of functions. Asymptotes. Integration. Fundamental theorem of calculus. Applications of integrals. Polar coordinates. Transcendental functions. Techniques of integration. Indeterminate forms. L'Hopital's rule.

MATH102 Calculus II **ECTS 6 (3+2+0)**

Improper integrals. Infinite sequences and series. Vectors in space. Vector-valued functions. Multivariable functions and partial derivatives. Multiple integrals. Integration on vector fields.

MATH201 Linear Algebra **ECTS 6 (3+2+0)**

Matrices and system of equations. Systems of linear equations. Row echelon form. Matrix algebra. Elementary matrices. Determinants. The determinant of a matrix. Properties of determinants. Cramer's rule. Vector spaces. Definition of vector space. Subspaces. Linear independence. Basis and dimension. Change of basis. Row space and column space. Linear transformations. Matrix representations of linear transformations. Orthogonality. The scalar product. Orthogonal subspaces. Inner product spaces. Orthonormal sets. Gram-schmidt

orthogonalization. Eigenvalues and eigen vectors. Diagonalization.

MATH202 Differential Equations

ECTS 6 (3+2+0)

First order differential equations. Second order linear equations. Higher order linear equations. Series solutions of second order linear equations. The laplace transform. Systems of first order linear equations.

MATH203 Introduction to Probability and Statistics

ECTS 6 (3+2+0)

Product rule. Permutation. Combination. Concept of probability (kolmogorov axioms). Conditional probability and independency. Random variables. Probability density function. Distribution function. Discrete distributions: Bernoulli, Binomial ve Poisson. Continuous distributions: normal, Gamma, exponential. Expectation. Moment generating function. Mean, variance and standart deviation. Covariance. Correlation. Chebchev's inequality. Estimator and its properties. Maximum likelihood estimators. Confidence intervals. Hypothesis testing. One and two sample test for means. Regression.

MATH205 Numerical Analysis

ECTS 6 (3+2+0)

Description of numerical methods and applications of them particularly in engineering. Error analyses in numerical methods. Analytical solutions. Numerical methods for the solution of systems (linear and nonlinear). Approximation methods. Interpolation. Linear regression. Numerical integration.

ME206 Engineering Materials

ECTS 3 (3+0+0)

Classification of engineering materials. Iron and steel production. Types and use of steel and cast iron. Heat treatment of metals and alloys. Non-ferrous metals and alloys and their use in engineering applications. Types, properties, principal uses and manufacturing techniques of ceramics, polymers and composite materials. Failure of materials. Non-destructive testing of materials. Materials selection in engineering design.

ME208 Dynamics

ECTS 3 (3+2+0)

Kinematics of particles; velocity and acceleration in rectangular, cylindrical, spherical and normal and tangential coordinates. Rectilinear motion. Relative motion. Kinetics of particles; Newtons law of motion. Equation of motion. Work. Impulse. Momentum. Principle of work and energy, principle of impulse and momentum. Angular momentum, angular impulse and momentum principle. Kinetics of systems of particles. Planar kinematics of rigid bodies, instantaneous center of rotation. Planar kinetics of rigid bodies. Three-dimensional kinematics of rigid bodies. Three-dimensional kinetics of rigid bodies.

ME210 Strength of Materials I

ECTS 3 (3+2+0)

Basic concepts of solid mechanics. Mechanical properties of materials. Axial loading. Shear stresses and shear loading. Bending. Deflection of beams.

ME211 Strength of Materials II

ECTS 3 (3+2+0)

Torsion. Buckling of columns. States of stress and strain. Criteria for failure. Combined loading. Fatigue.

ME304 Fluid Mechanics I

ECTS 6 (3+2+0)

Basic concepts and definitions. Fluid kinematics. Fluid statics. Manometers and pressure measurements. Hydrostatic forces on immersed bodies. Solid body translation and rotation. Integral equations of conservation of mass, momentum and energy for systems and control volumes. Reynolds transport theorem. Bernoulli equation and its applications. Continuity.

Derivation of conservation equations in differential form. Navier-Stokes equations and their applications. Stream function and flow potential. Dimensional analysis and similarity.

NS102 Physics I

ECTS 6 (3+1+2)

Vectors. Motion in one and two dimensions. Newton's laws and its applications. Work and energy. Conservation of mechanical energy. Momentum and motion of systems. Static equilibrium of rigid bodies. Rotation and angular momentum. Newton's law universal gravitation.

NS104 General Chemistry

ECTS 6 (3+1+1)

The scope of chemistry and stoichiometry. Atoms and the atomic theories. The periodic table and some atomic properties. Chemical bonding. Molecular geometry. Gases and gas laws. Liquids. Solids. Solutions and their physical properties. Thermochemistry. Principles of chemical equilibrium. Acids and bases. Thermodynamics.

NS122 Physics II

ECTS 6 (3+1+2)

Coulomb's law and electrical field. Gauss's law. Electrical potential. Capacitance. Electrostatic energy and properties of insulators. Current and resistance. DC circuits. The magnetic field. Sources of magnetic field. Faraday's law. Inductance. Magnetic field in the matter. Electromagnetic oscillations and AC circuits. Maxwells equations and electromagnetic waves.

Compulsory Courses at ITU

ATA 101E History of Turkish Revolution I

ECTS 2.0 (2+0+0)

A definition of Revolution/Renovation. The aim and the importance of the Turkish history of renovation. The reason for the decline. Efforts to save the Ottoman Empire. Intellectual currents. The First World War. Mustafa Kemal in Anatolia and the Congresses. The opening of the Great Turkish National Assembly. Independence war. National and international policy. The Mudanya treaty. Lousanne conference.

ATA 102E History of Turkish Revolution II

ECTS 2.0 (2+0+0)

The declaration of the Republic and politic, social and cultural revolutions and economic breakthroughs. Constitutional solutions to the problems related to the Lausanne Conference. Reactions to the new governmental structure. Atatürk s foreign policy to inspire confidence in the future of Turkey. Trials in and transition to the multi-party system. Democratic Party and post period. Kemalism, the Principles of Atatürk

DAN 301 Career Advising

ECTS 1.0 (0+2+0)

This course is designed to improve students' awareness of their interests, skills, values and preferences and to help them shape and develop future-oriented academic and/or industrial career goals and career plans.

EKO 201E Economics

ECTS 4.0 (3+0+0)

Introduction to the principles of micro and macroeconomics. The fundamental problems of economies. The modeling of household and firm behaviors. Market structures. The principles of public finance. The modeling of macroeconomics in an international context

MAK 229E Fluid Mechanics II

ECTS 4.0 (2+1+0)

Viscous Flow in pipes and ducts. Laminar and turbulent boundary layers. Major and minor losses in pipes. Flow over immersed bodies. Boundary layer equations. Potential flow. Introduction to CFD. Compressible flow. Fluid machinery. Water hammer.

MAK 312E Measurement Systems**ECTS 4.5 (2+0+2)**

Basic concepts in measurement. Error and error analysis. Probability and statistics for uncertainty and confidence analysis of experimental data. Static calibration. Digital data acquisition. Dynamic system response. System identification. Signal conditioning. Spectrum analysis. Bridge circuits and variable impedance devices. Modulation. Noise and noise rejection. Report writing and presentation. Methods and sensors for basic analog electronics. Displacement, pressure, flow, temperature, heat, force, strain, vibration and sound measurements

MAK 313E Heat Transfer**ECTS 5.5 (3+1+0)**

Mechanisms of heat transfer. Steady and transient heat conduction in solids, solution methods. Laminar and turbulent forced convection and natural convection. Phase change heat transfer. Heat exchangers. Radiation heat transfer.

MAK 315E Mechanical Vibrations**ECTS 4.0 (2+1+0)**

Basics concepts. Undamped, damped and forced vibrations of single-degree-of-freedom (d.o.f) systems. Vibration measuring instruments. Vibration isolation. Vibrations of two-d.o.f systems. Dynamic vibration absorber. Free and forced vibrations of multi-d.o.f systems. Approximate methods in natural frequency calculation. Modal analysis. Whirling motion and critical speed of shafts.

MAK 324E Theory of Machines**ECTS 4.0 (2+1+0)**

Mechanisms, kinematic diagrams, kinematic chains and mobility. Some basic mechanisms. Kinematic analysis and synthesis of mechanisms. Mechanism design methods. Review of some fundamental principles of mechanics. Static balance of machinery. Machine equation of motion and its implementation. Fundamental problems of machinery dynamics. Speed fluctuations and flywheel calculation. Calculation of joint and bearing forces in machines. Shaking forces and mass balance. Balancing of rigid rotors.

MAK 333E System Dynamics and Control**ECTS 5.5 (3+1+0)**

Introduction to system dynamics and control. Transfer function of linear systems. Linearization. Transient response analysis. Stability analysis. Basic control algorithms and structures. PID tuning methods. Frequency response analysis. Basic controller design methods and examples.

MAK 339E Machine Design I**ECTS 5.5 (2+3+0)**

Mechanical engineering design process and importance of machine elements knowledge in this process. Fundamentals of design and applications of machine elements. Welded, soldered, adhesive bonded, riveted joints. Shaft-hub connections. Bolted joints and power screw mechanisms. Pins, knuckles, springs, shafts and axles, coupling and clutches. Lubricants and lubrication theory. Sliding and rolling bearings.

MAK 342E Machine Design II**ECTS 4.5 (2+2+0)**

Fundamentals of speed reduction mechanisms. Kinematics and geometry of gears. Spur, helical, bevel, spiral and worm gear mechanisms. Belt drive and chain mechanisms.

MAK 353E Manufacturing Processes**ECTS 5.0 (3+1+0)**

Principles and classifications of processes in manufacturing. Advantages, limitations and comparisons of materials processing. Design and manufacturing, selection of process. Casting, welding, forming, machining, and powder metallurgy. Manufacturing of polymer and composites parts. Ceramic part manufacturing. Rapid prototyping.

MAK 404E Mechanical Engineering Laboratory**ECTS 5.0 (1+0+3)**

Experiment design. System experiments on basic fields of mechanical engineering (thermal

systems, hydraulic systems, automotive systems, mechanical vibrations and Acoustics, controls, manufacturing, and strength of materials). Realizing experiments in groups. Analysis of experimental data and presentation of results in written reports.

MAK 405E Innovative Design Methods in Mechanical Engineering **ECTS 3.0 (1+2+0)**

Fundamentals of engineering design. Determination of requests for design. Analysis of requests. Product idea formation. Industrial and intellectual property rights. Patents. Innovative solution search techniques. Functional synthesis or design. Selection of optimal solution. Utility value analysis.

MAK 4901E Mechanical Engineering Design I **ECTS 7.0 (1+4+0)**

This course includes an appropriate design project with all the design phases starting from project selection to completion and presentation, and which leads the students use the knowledge they gained during their tenure in the department and gain complete design experience. In this course, design of a machine, system or process is conducted in the framework of an open-ended engineering problem and a team of students develops the solution. Design calculations, parametric analysis and optimization, materials selection, technical drawings and solid modelling, economic analysis are all requirements for an acceptable project.

MAK 4902E Mechanical Engineering Design II **ECTS 9.0 (1+8+0)**

This course and MAK 4901E can either be performed as two separate capstone design projects with similar methodology as described for MAK 4901E; or can be accomplished in an integrity by realizing the design from the MAK 4901E course, producing a prototype of the design, conducting performance tests and optimizing it, and obtaining a final prototype.

TUR 101 Turkish I **ECTS 2.0 (2+0+0)**

Definition of language. Language and thought. Language and culture. World languages (in point of origin and structure). The significance of turkish language among world languages. The historical development of turkish language. The structure of turkish language. Turkish phonetics. Today's turkish language. The act of writing and the rules of writing (orthography). Spelling rules. The right expression of thought. Scientific language and turkish as a scientific language. Turkish poetry and poetry language.

TUR 102 Turkish II **ECTS 2.0 (2+0+0)**

Written expression. Method and planning of written expression. Writing exercise. Scientific texts (article-report-critic). Official texts (petition-resume). Genres of literature. Essay. Column. Travel writing. Biography. Story. Novel. Verbal literature. Verbal expression and communication.