DEPARTMENT OF MECHANICAL ENGINEERING
2018 COURSE PLAN COURSE CONTENTS

FIZ1001 | PHYSICS 1
Physics and Measurement; Vectors; Motion in One Dimension; Motion in Two Dimensions; Newton’s Laws of Motion; Circular Motion and Other Application of Newton’s Laws; Work and Kinetic Energy; Potential Energy and Conservation of Energy; Linear Momentum and Collisions; Rotation of a Rigid Object About Fixed Axis; Simple Harmonic Motion; Newton’s Law of Gravity; Static Equilibrium and Elasticity, Thermodynamic’s Laws, / Heat Engines, Entropy, and the Second Law of Thermodynamics.

MAT1071 | MATHEMATICS 1

MAK1051 | COMPUTER AIDED TECHNICAL DRAWING
Standards / Geometric constructions / Introduction to CAD software / Multiview projection (orthographic presentations) / First angle projection (E-Method) / Third angle projection (A-Method) / Sectional views / Perspectives, Isometric, dimetric drawing / Scale / Conical tapers and slopes

MAK1061 | INTRODUCTORY COMPUTER SCIENCES
Computer Organization / Algorithms / Programming Languages and Data Structures: A Numeric Programming Language (MatLab/ MathCad) / Sample Applications

MDB1031 | ADVANCED ENGLISH I
Reading strategies Paragraph Organization Up-to-date texts that improve students’ world knowledge Vocabulary exercises

MAK1071 | INTRODUCTION TO MECHANICAL ENGINEERING AND ETHIC
Giving an overall introduction about mechanical engineering to the first year students. / Ethics in the profession

MAT1320 | LINEAR ALGEBRA
- Matrices: Definition of matrices, Types of matrices, matrix equality, Sum and difference of matrices, The product of scalar and matrix and their properties, Transpose of matrix and its properties. Some Special Matrices and Matrix Applications - Elementary row and column operations in matrices, Reduced row–echelon form, Rank of a matrix, The inverse of a square matrix. - Determinants: The determinant of a square matrix, Laplace's expansion, Properties of determinants - Sarrus rule, Additional matrix, Calculation of the inverse of a matrix with the aid of additional matrix - Systems of Linear Equations: Solving systems of linear equations with the aid of equivalent matrices, Linear homogeneous equations, Cramer's method, The solution with the help of coefficients matrix - Vectors: Vector definition, the sum of vectors, the difference, the analytical expression vectors, scalar product of vectors, properties of the scalar multiplication Scalar product and its features, the mixed multiplication and properties, and properties of double vector product, - Vector spaces: Definition of vector spaces and theorems, Subspaces, Span concept and fundamental theorems, Linear dependence and linear independence of vectors and some theorems about linear dependence and linear independence. - Bases and dimension concepts and fundamental theorems. Definition of coordinates and transition matrices and some theorems, - Eigenvalues and Eigenvectors: The Calculation of Eigenvalues and Eigenvectors of a square matrix, - The calculation of Inverse and power of a square matrix with the help of the Cayley-Hamilton theorem.
TDB1031 | TURKISH LANGUAGE 1

History and basic rules of Turkish language, reading exemplary literary and scientific texts.

FIZ1002 | PHYSICS 2

Electric Fields; Gauss’s Law; Electric Potential; Capacitance and Dielectrics; Current and Resistance; Direct Current Circuits; Magnetic Field; Sources of the Magnetic Field; Faraday’s Law; Inductance; Alternating Current Circuits; Electromagnetic Waves

KIM1170 | GENERAL CHEMISTRY

Substance, the atoms and atomic theory; chemical compounds, chemical reactions; thermochemistry; electronic structure of the atom; periodic table and periodic properties of elements; chemical bonding; Liquids and their intermolecular forces; solution and physical properties; chemical equilibrium; acids and bases; thermodynamic

MAT1072 | MATHEMATICS 2


MAK1072 | STATICS

Introduction to Mechanics/Statics of Particles/Rigid Bodies/Equivalent Systems of Forces/Equilibrium of Rigid Bodies/Distributed Forces/Centroids and Centers of Gravity/Analysis of Structures/Forces in Beams and Cables/Friction/Distributed Forces/Moments of Inertia/Method of Virtual Work
**MDB1032 | ADVANCED ENGLISH II**
Grammar exercises related to conjunctions and adjectives. Audio and visual texts for students with different learning types. Rewriting exercises. Paragraph Organization. Up-to-date texts that improve students' world knowledge. Vocabulary exercises.

**MAK1062 | PROGRAMMING**

**MAK1052 | TECHNICAL DRAWING AND DESIGN**

**TDB1032 | TURKISH LANGUAGE 2**
Reading sample literary and contemporary texts. Oral and written expression.

**MAT2411 | DIFFERENTIAL EQUATIONS**

**MAK2011 | MEASUREMENT TECHNIQUES AND EVALUATION**

**MAK2061 | MATERIALS SCIENCE**

**MAK2071 | DYNAMICS I**

**MAK2081 | STRENGTH OF MATERIALS I**

**MAK2091 | THERMODYNAMICS I**

**MAK2101 NUMERICAL METHODS**

**MAK2112 FLUID MECHANICS I**
Basic concepts / Hydro-Aerostatics / Conservation equations in integral analysis / Bernoulli and Energy equations / Differential conservation equations and boundary conditions / Similitude and dimensional analysis / Viscous flow in pipes / Introduction to open channel flow / Introduction to turbomachinery

**MAK2122 MANUFACTURING PROCESSES I**
Introduction to manufacturing processes and concepts / Fundamentals of casting and casting processes / Fundamentals of plastic deformation and forming processes / Fundamentals of machining and machining processes / Fundamentals of joining and joining processes.

**MAK2132 FINITE ELEMENT METHODS IN MECHANICAL ENGINEERING**
1. Introduction 1.1 basic idea of the finite element method 1.2 Date of finite elements 1.3 Simple structure brought into line with finite elements 2. Introduction to the finite element types 3. Longitudinal element expressions with the energy method 3.1 Stiffness and Mass matrices 3.2 Application 4. Analysis Techniques 4.1 Modal Analysis 4.2 Harmonic Analysis 4.3 Transient Analysis 4.4 Applications 5. Torsion and Bending Elements expressions are obtained for the energy 5.1 Stiffness and Mass matrices 5.2 Applications 6. Introduction to Finite Element program 6.1 Software Applications 6.1 Software Applications

**MAK2142 THERMODYNAMICS 2**

**MAK2212 STRENGTH OF MATERIALS II**
Elastic Curve / Statically Indeterminate systems in bending / Normal Force + Bending / Normal Force + Torsion / Torsion + Shear / Bending + Torsion / Bending + Shear / Column Buckling

**MAK2172 DYNAMICS 2**

**MAK2162 INDUSTRIAL MATERIALS**

**MAK2152 STATISTICS IN ENGINEERING**
Definition of statistics, probability, some discrete and continuous probability distributions, expectation, sampling and estimation, experiments of hypotheses, regression and ANOVA

**MAK3001 WORKSHOP TRAINING**
Internship Workshop independently consists of four sections including Metal Forming, Welding, Chipless Forming, Casting. Students must be in at least two sections which mentioned above. Besides applications in the scope of these issues, students receive practical information in the fields of material and measuring techniques.

**MAK3091 MACHINE ELEMENTS I**
Design under dynamic loads / Shafts and axles / Shaft-Hub Joints / Key couplings / Pres fitting / Bolts, Nuts, Screws and Bolted Joints / Welded joints / Riveted joints / Brazing and adhesive joints/Springs

**MAK3271 HEAT TRANSFER 1**

**MAK3281** INTERNAL COMBUSTION ENGINES

**MAK3481** FUNDAMENTALS OF ELECTRIC AND ELECTRONICS
Energy Systems; DC Circuits; Kirchhoff Laws; Electrical Fields and Capacitors; Magnetic Fields; Induction Law; Force Formation; Electro-Chemical Actions; AC Circuits; Three Phase Systems; Electric Machines; Classical and Modern Speed Controls; Electronics, Sensors and Data Acquisition; AC Relay Circuits and Logic; Electrical Components.

**MAK3291** ENGINEERING ECONOMICS AND VALUES MANAGEMENT

**MAK3301** FLUID MECHANICS 2
General equation / Incompressible fluids / Potential streams / Carrier surfaces / Enclosed streams, General Waves / Viscous fluids / Definite solutions / Stokes and Usen Approaches / Boundary layer theory / Gas dynamics / Acoustics / Small disturbances / Shock waves.

**MAK3391** MANUFACTURING PROCESSES 2
Traditional and modern manufacturing technologies and general concepts; process characteristics in casting methods, defects and troubleshooting, processes and cost estimations in casting; process characteristics in forming methods, defects and troubleshooting, process and cost estimations in forming; process characteristics in machining methods, defects and troubleshooting, process and cost estimations in machining; process characteristics in joining methods, defects and troubleshooting, applications, processes and cost estimations in joining; powder metallurgy and process characteristics; micromanufacturing, nanomanufacturing, hybrid manufacturing; electroerosion, waterjet, laser cutting as modern manufacturing methods; manufacturing of micro electromechanical systems, lithographic methods, additive manufacturing are the subjects covered in this course.

**MAK3002** OCCUP. FIELD TRAINING I

**MAK3072** PROJECT 1
Fundamentals of machine design, conceptual design and innovation, design input parameters, reviewing fundamentals of related courses (such as Thermodynamics, Heat Transfer, Fluid Mechanics, Engineering Materials, Strength of Materials, 3D CAD), design process and preparing solid models/technical drawings, economical analysis and life estimation, project report and its presentation (powerpoint).

**MAK3172** MACHINE ELEMENTS II
Couplings/Theory of Lubrication and Lubricants / Sliding Bearings / Rolling Bearings / Belting / Chain Drives / Gears

**MAK3182** MACHINE DYNAMICS

**MAK3192** TURBO MACHINES

**MAK3262** MECHANICAL DESIGN TECHNIQUE I

**MAK4081** PROJECT 2
Fundamentals of machine design, conceptual design and innovation, design input parameters, reviewing fundamentals of related courses (such as Thermodynamics, Heat Transfer, Fluid Mechanics, Engineering Materials, Strength of Materials, 3D CAD), design process and preparing solid models/technical drawings, economical analysis and life estimation, project report and its presentation (powerpoint)

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<td>MAK4391</td>
<td>AUTOMATIC CONTROL 1</td>
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<tr>
<td>ATA1031</td>
<td>Principles of Atatürk and History of Modern Turkey I</td>
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<tr>
<td>MAK4451</td>
<td>MECHANICAL VIBRATIONS</td>
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<td>MAK4471</td>
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<td>MAK4002</td>
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<td>ATA1032</td>
<td>Principles of Atatürk and History of Modern Turkey II</td>
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<tr>
<td>MAK4462</td>
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<td>MAK4482</td>
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<tr>
<td>MAK4472</td>
<td>INDUSTRIAL HYGIENE and SAFETY 2</td>
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<tr>
<td>MAK3141</td>
<td>ENERGY ECONOMY 1</td>
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</table>

Introduction to Energy Economy, General Information, The Thermal Plant’s Components, Systems of Dimension and Unit, Efficiency and Power Equations, Specific Consumptions, Energy Balance Diagrams, Rankine Cycle, Efficiency Improvement Methods of Rankine Cycle, Inter-Heating (Reheat) and Applications, Turkey’s Energy Problems and Discussion, Effective Utilization of Energy
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<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>MAK3151</td>
<td>OPTIMIZATION IN ENERGY SYSTEMS</td>
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<tr>
<td></td>
<td>Basic concepts of optimization, Methods of optimizing energy systems, Objective function (thermodynamic, economic, thermo economy), Optimization methods, Linear Programming, Non-linear programming, Simplex method, Application of optimization on energy conversion plants</td>
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<tr>
<td>MAK3401</td>
<td>SOLID MODELING and RAPID PROTOTYPING</td>
<td>Elective 1-1</td>
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<tr>
<td></td>
<td>Introduction to solid modeling / Sketch drawing / Wireframe, Surface modeling / Solid modeling, Sweeping methods, splines / Modeling of fasteners / Tolerances and assembly / Technical drawing / STL files, 3D printing / Reverse Engineering</td>
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<tr>
<td>MAK3431</td>
<td>DIE CASTING OF NON-FERROUS METALS</td>
<td>Elective 1-1</td>
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<tr>
<td>MAK3441</td>
<td>WELDING TECHNIQUE</td>
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<tr>
<td>MAK3451</td>
<td>MACHINING</td>
<td>Elective 1-1</td>
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<td></td>
<td>Principles of machining and classification of machining processes, effective factors in machining, cutting tools and their materials, turning, shaping, drilling, milling, grinding, broaching, thread cutting, gear machining methods, manufacturing and operation times.</td>
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<tr>
<td>MAK3461</td>
<td>MECHANICS of METAL FORMING</td>
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<td>Plasticity / Cold and Hot Forming, Mechanical Principles of Forming / Staging (Number of Passes) / Mechanics of Plastic Deformation / Force, work and Heat Concepts in Metal Forming / Calculations in Forging, extrusion, rolling, drawing and sheet metal forming processes</td>
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<td>MAK3071</td>
<td>SYSTEM DYNAMICS AND SIMULATION</td>
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<td>Modelling, analysis and simulation of systems</td>
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<tr>
<td>MAK3081</td>
<td>ANALYTICAL MECHANICS</td>
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<td>MAK3471</td>
<td>VEHICLE CHASSIS AND SUB-SYSTEMS</td>
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<td>Road vehicles, light and heavy duty vehicles, Classification of road and off-road vehicles, Intended chassis types and their specifications, Mass production methods of vehicles, Definition of vehicle chassis, chassis platform and expectations, Suspension systems, Tire and dynamic tyre behaviour, rim and wheel carrier, wheel alignment, steering systems, powertrain systems, brake systems, vehicle dynamics and chassis control systems, Vehicle ergonomics requirements and interior component design, HVAC of vehicles, Active and passive safety fundamentals, Vehicle electronics</td>
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<tr>
<td>MAK3561</td>
<td>SENSORS and ACTUATORS IN VEHICLES</td>
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<tr>
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<td>Physical and Electrical measurement/ sensors and actuators used in vehicles/measurement and evaluation methods/Control</td>
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<tr>
<td>MAK3671</td>
<td>PRINCIPLES and APPLICATIONS of TRIBOLOGY</td>
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<td>MAK3191</td>
<td>GAS INSTALLATIONS</td>
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<td>Characteristics of Gas Pipes, Fittings, Valves and Assembly / Expansions in Gas Pipes and Methods for Avoiding / Installation Components and Assembly / Condensation and Corrosion in Installation and Methods for Avoiding / Heating Isolation of Installation / Dimensions of Installation and Equipments / Gas Installation under High Pressure / Gas Installation under Low Pressure / Steam Installation / Gas Installation / Applications and Examples</td>
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<tr>
<td>MAK3691</td>
<td>AIR QUALITY AND SANITARY AT INSTALLATIONS</td>
<td>Elective 1-1</td>
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**MAK3681 INSULATION IN HVAC** | Elective 1-1
---|---
Thermal Insulation Materials, Steam and Air Circuit Breakers / Heat Conduction and Radiation Insulation Methods / Economic and Critical Thickness / Plumbing Insulation / Insulation Construction / Waterproofing and Construction / Sound Insulation Materials, Rules, Construction

**MAK3961 ADVANCED THERMODYNAMICS** | Elective 1-1
---|---

**MAK3181 SANITARY INSTALLATIONS** | Elective 1-1
---|---

**MAK3201 REFRIGERATION TECHNIQUES** | Elective 1-1
---|---
Fundamentals of Refrigeration and Refrigerations Applications

**MAK3882 ENERGY ECONOMY 2** | Elective 1-2, 1-3
---|---

**MAK3372 HYDRAULIC MACHINERY** | Elective 1-2, 1-3
---|---
Introductions and General Information/Load Losses in pipelines/Pump Characteristics/Euler Laws/The Design of Runner Impeller/ The Design of Volute/Pump Characteristic Curves/Dimensionless Numbers/Similarity and Model Theory of Hydraulic Machines/Cavitations of Hydraulic Machines/ Hydraulic Turbine/Pelton Turbine/Francis and Kaplan Turbines

**MAK3812 RENEWABLE ENERGY SYSTEMS** | Elective 1-2, 1-3
---|---
The distribution of energy production and consumption in the world and in Turkey, according to sources, energy production and consumption of renewable energy and environmental issues arising from the evaluation of this aspect / Solar Energy/ Geothermal Energy / Wind Energy / OTEC / Wave Power / Tidal Energy / Biomass Energy.

**MAK3402 COMPUTER AIDED DESIGN** | Elective 1-2, 1-3
---|---
Definition of design , Design process and design criterion, hardware and software for CAD, design content, techniques for parametric design and solid modelling, assembly and assembly mates, Technical drawings, mechanical analysis of solid parts, 3d printing

**MAK3452 STEEL CONSTRUCTIONS** | Elective 1-2, 1-3
---|---
Types of steel constructions, loading conditions, connection elements, static and dynamic analysis.

**MAK3462 GRAVITY CASTING OF FERROUS METALS** | Elective 1-2, 1-3
---|---

**MAK3472 MACHINING OF INDUSTRIAL MATERIALS** | Elective 1-2, 1-3
---|---
Principles of Cutting and machining. Relations of Machinability and cutting parameters, tool life, cutting forces and power chip control , surface integrity. Machining of ferrous and non- ferrous materials, plastics, ceramics, composites Industrial applications.

**MAK3502 QUALITY IN INDUSTRY** | Elective 1-2, 1-3
---|---
Quality Concept, Quality Techniques,Quality Control, Inspection and Tests, Quality Assurance, Quality Improvement, Quality Planning, Quality Costs, Total Quality Management, Quality Standards, Documentation of the Quality Management, Interior Audit, Certification, Process Control, Quality Circles, Data Collection and Analysing, Calibration, Quality Improvement Methods, ISO 9000 Standards.

**MAK3572 MATERIAL SELECTION IN MECHANICAL ENGINEERING** | Elective 1-2, 1-3
---|---
Corrosion Resistance and Prevention of Corrosion / Importance of Basic Coefficients in Materials Selection / Materials Selection for Main and Auxiliary Machine Components

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<td>SPECIAL WELDING TECHNIQUES</td>
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<tr>
<td>MAK3592</td>
<td>METAL FORMING MACHINES AND AUTOMATION</td>
<td>Elective</td>
<td>1-2, 1-3</td>
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<td></td>
<td>Traditional (forging, rolling, extrusion, sheet metal forming) and Special (flexible forming, multi point dieless tooling, flow forming, ultrasonic forming, micro sheet metal forming, hydroforming) metal forming processes, machines, equipments, tooling and numerical approaches for tooling.</td>
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<tr>
<td>MAK3602</td>
<td>MECHATRONIC SYSTEMS</td>
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<tr>
<td>MAK3652</td>
<td>PROJECT MANAGEMENT IN ENGINEERING</td>
<td>Elective</td>
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<td>Projects, project management / Definitions, concepts, phases / Project Manager / Project Management Process / Project Initiation / Project Planning; High-level Planning, Detailed Planning, Network (PERT) Charts, Critical Path Method (CPM), Gantt Charts, Building Effective Teamwork / Project Execution; Managing communications, quality, cost, time and risk / Project Closeout</td>
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<tr>
<td>MAK3662</td>
<td>FARM MACHINERY</td>
<td>Elective</td>
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<td>Farm tractors, Tractor mechanics, Soil structure, Soil cultivation tools and machines</td>
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<tr>
<td>MAK3692</td>
<td>STRENGTH OF MATERIALS III</td>
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<td>Shear Center / Curved Beams / Beams on the elastic foundation /Thick Walled Cylinders / Energy Methods and Applications</td>
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<td>MAK3672</td>
<td>ENGINE DYNAMICS</td>
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<td>Kinematics of Crank-Connecting Rod Mechanism, Kinematics of Piston/Kinematics of Connecting Rod/Reduction of Masses, Forces caused by the Moving Engine Parts/Engine Balancing/General Engine Dynamics.</td>
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<td>MAK3782</td>
<td>AUTOMOTIVE CONTROL SYSTEMS AND MODELING</td>
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<td>Engine management and emission control / Modeling and analysis of powertrain / Modeling and analysis of vehicles</td>
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<td>MAK3792</td>
<td>WEAR TRANSFER 2</td>
<td>Elective</td>
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<td></td>
<td>Basic concepts in CFD / Classification of partial differential equations / Finite difference method / Finite volume method / Stability Analysis / Grid generation / Computer graphics / Commercial codes</td>
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<td>MAK3482</td>
<td>OTTO ENGINE TECHNOLOGY</td>
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<td>Mixture formation in spark ignition engines, carburation, carburettors, working process in an simple carburettor, Calculations of the air/fuel ratio, tunings that must be added to the simple carburettor, Insufficiencies of Carburettors, stratified-charge engines, fuel injection and its systems, Mixture-characteristics and technological advantages of gasoline direct injection systems, Comparison of gasoline direct injection systems with conventional fuel injection systems,Principles of ignition, factors effecting ignition advance, ignition systems, spark plugs.</td>
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<td>MAK3352</td>
<td>COMPUTATIONAL FLUID MECHANICS</td>
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<td>MAK33792</td>
<td>HEAT TRANSFER 2</td>
<td>Elective</td>
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<td></td>
<td>Engine management and emission control / Modeling and analysis of powertrain / Modeling and analysis of vehicles</td>
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[MAK3802] HEATING AND VENTILATION

Elective 1-2, 1-3

[MAK3272] AIR CONDITIONING I
Psychrometry and Thermodynamics of Moist Air / Air Conditioning Systems / Air Handling and Conditioning Equipment / Summer Air Conditioning and Heat Gain Calculations / Winter Air Conditioning / Humidifying Processes and Cooling Towers / Heat Recovery Systems / Applications and Case Studies

Elective 1-2, 1-3

[MAK3682] PROCESS TECHNIQUES

Elective 1-2, 1-3

[MAK4181] ANALYSIS OF ENERGY GENERATION SYSTEMS
Basic concepts / energy generation system components / energy generation systems / Energy analysis of energy generation system / exergy analysis / exergy analysis of energy generation system / thermoeconomii / exergoeconomii / exergy costs

Elective 1-4, 1-5

[MAK4461] GAS TURBINES
The principle of gas turbines operating / The basic equations of Thermodynamics and gas dynamics / Gas turbines classification and application areas / Gas Cycles / Ideal Brayton Cycle / Actual Brayton Cycle / Maximum net work / intercooling and reheating / Gas turbine applications.

Elective 1-4, 1-5

[MAK4911] CONSTRUCTION OF TURBO MACHINERY
Thermodynamics Calculations, Manufacturing, Materials of Turbo Machinery Parts, Strength and Dimension of Turbo Machinery Parts.

Elective 1-4, 1-5

[MAK4401] HYDRAULICS AND PNEUMATICS SYSTEMS
Fundamental of Hydraulics, Hydraulics Fluids and their specifications, hydraulics cylinders, pumps: types and calculations, valves, hydraulics systems design, basic concepts of Pneumatic, pneumatic valves, pneumatic circuits and systems, pneumatic control systems.

Elective 1-4, 1-5

[MAK4481] MECHANICAL DESIGN TECHNIQUE II

Elective 1-4, 1-5

[MAK4491] MATERIALS HANDLING SYSTEMS I
Design and selection of materials handling systems.

Elective 1-4, 1-5

[MAK4501] COMPUTER AIDED MANUFACTURING
Hardware and software for Computer Aided Manufacturing (CAM) and their properties, computer aided techniques and CAM, numerical controlled machine tools, manufacturing systems and CAM, modeling with CAD/CAM programs, selection of process parameters and tooling, tool paths and tool paths generation algorithms, machining strategies, post processor and graphical simulation of machining.

Elective 1-4, 1-5

[MAK4541] ADDITIVE MANUFACTURING
Principles of additive manufacturing methods / Classification of additive manufacturing technologies / Materials used in additive manufacturing technologies / Stereolithography (SLA) / Digital Light Processing (DLP) / Selective Laser Sintering – Melting (SLS-SLM) / Electron Beam Melting (EBM) / Fused Deposition Modelling (FDM) / Inkjet / Laminated Object Manufacturing (LOM) / Other Processes / Process parameters / Industrial applications of additive manufacturing, novelties and developments.

Elective 1-4, 1-5

[MAK4561] PLASTIC MATERIALS AND FORMING
Pressure Forming, Thermal Forming, Rolling, Casting, Joining, Machining, Design Techniques, Faults In Forming, Standards of Plastic Materials

**MAK4941 | JIGS AND FIXTURES**
Manufacturing Quality and Effecting Factors/ Types and Functions of Jigs and Fixtures/ Supporting and Locating Principles / Clamping and Workholding Principles / Classification, Design and Manufacturing of Jigs and Fixtures/ Festing and Clamping Principles and Methods/ Mechanical Analysis of Jig and Fixtures Systems

**MAK4681 | DIE MANUFACTURING TECHNIQUE**

**MAK4071 | MECHANISMS I**
Mechanism Technique Main Concepts, Element Pairs, Kinematic Chains, Degrees of Freedom, Mobility, Four Bar Mechanism and Grashoff's Theorem, Binding Angles, Velocities and Accelerations.

**MAK4521 | RAILWAY SYSTEMS**

**MAK4921 | DIESEL ENGINE TECHNOLOGY**

**MAK4571 | ENGINE CONSTRUCTION**
Parameters in engine construction / Piston / Connecting Rod / Crank/ Engine Block / Cylinder Head / Guides / Valves / Cam Shaft/Cooling and Lubrication/ Developments and new applications in Internal Combustion Engines

**MAK4581 | Vehicle Aerodynamics**

**MAK4931 | VEHICLE PROPULSION DYNAMICS AND POWERTRAIN SYSTEMS**
Motion resistances, axle loads, parameters effecting the tire-road friction coefficient, motion diagram, cruise analyses at different propulsion power and different road conditions, vehicle stability at cornering, vehicle propulsion limits, transmission system, clutches, gearboxes, differential, knuckles

**MAK4591 | MECHANICAL SYSTEMS AND COMPONENTS IN THE SMART BUILDINGS**

**MAK4901 | STEAM BOILERS**

**MAK4601 | ENERGY MANAGEMENT I**
**MAK4402** | **ENERGY STORAGE SYSTEMS**  
Elective 1-6, 1-7, 1-8  
Introductory and advanced knowledge about Energy Storage Technologies, Different types of energy storage systems, mechanical, electrochemical and thermal energy storage systems, energy and exergy analysis of charging and discharging cycles of storage, Environmental impact of storage systems, the importance of energy storage in solar energy production, pumped hydroelectric storage compressed air, hydrogen storage systems, Describing sensible and latent heat storage systems, Economical aspects of energy storage systems, renewable energy storage techniques, Low-carbon energy systems with energy storage systems.

**MAK4942** | **POWER PLANTS**  
Elective 1-6, 1-7, 1-8  
Hydraulic power plants plants with using coal, fuel-oil, diesel engine, gas turbine plants, combined plants, nuclear power plants.

**MAK4404** | **ENERGY PLANTS AND OPERATING**  
Elective 1-6, 1-7, 1-8  
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Type</th>
<th>Credits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAK4152</td>
<td>COMPRESSORS</td>
<td>Elective 1-6, 1-7, 1-8</td>
<td></td>
<td>Introduction, compressors type / thermodynamic of compressors / design of reciprocating compressor / radial flow compressors / multi stage compressors / non-dimensional quantities and compressors characteristic / axial-flow compressors / elementary theory / axial compressors characteristic</td>
</tr>
<tr>
<td>MAK4492</td>
<td>NUCLEAR POWER PLANTS</td>
<td>Elective 1-6, 1-7, 1-8</td>
<td></td>
<td>Energy sources and nuclear energy / Mass-energy conversion and atomic reactions / Fusion and fission energies / Radioactivity / Nuclear reactor physics / Chain reaction and multiplication factor / Neutron loss and critical conditions / Calculation of critical dimensions / Introduction to nuclear power reactors / Classification of power reactors and technical properties / Main elements of power reactors / Operational characteristics of reactors / Nuclear fuel cycles / Economic and ecologic study of nuclear energy</td>
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<tr>
<td>MAK4502</td>
<td>COSTRUCTION ELEMENTS</td>
<td>Elective 1-6, 1-7, 1-8</td>
<td></td>
<td>1. Basic theory and applications of CAD in mechanical engineering 2. Design of basic mechanical and hydraulic system by using construction elements 3. Applications.</td>
</tr>
<tr>
<td>MAK4522</td>
<td>MACHINE ELEMENTS III</td>
<td>Elective 1-6, 1-7, 1-8</td>
<td></td>
<td>Corrected gears, spiral gear mechanism, worm and gear mechanism, Gear sequences</td>
</tr>
<tr>
<td>MAK4982</td>
<td>MATERIALS HANDLING SYSTEMS I</td>
<td>Elective 1-6, 1-7, 1-8</td>
<td></td>
<td>Design and selection of materials handling systems used in industry</td>
</tr>
<tr>
<td>MAK4542</td>
<td>CNC MACHINE TOOLS AND PROGRAMMING</td>
<td>Elective 1-6, 1-7, 1-8</td>
<td></td>
<td>Numerical control and its principles, control systems, construction properties of CNC machine tools, manual programming, computer aided programming for CNC turning and milling.</td>
</tr>
<tr>
<td>MAK4562</td>
<td>COMPUTER AIDED DESIGN IN MANUFACTURING</td>
<td>Elective 1-6, 1-7, 1-8</td>
<td></td>
<td>Principles of Industrial Design / Classical and Modern System in Industrial Design / Computer Aided Drawing, Test and Finite-Element Analysis Techniques in the Application of Computer Aided Design / Usage and Application of FEA Programs / Modelling in Design Programs, Solid and Surface Applications and Selection of Material and Manufacturing Process</td>
</tr>
<tr>
<td>MAK4282</td>
<td>COMPOSITE MATERIALS IN MANUFACTURING</td>
<td>Elective 1-6, 1-7, 1-8</td>
<td></td>
<td>Composite Materials, Definition and Signification/ Matrix and Reinforcement Materials/ Interface Interaction Between Matrix and Reinforcement, Mechanical Properties, Comparing With Other Materials/ Manufacturing, Properties and Application Areas of MMC/ Manufacturing, Properties and Application Areas of PMC/ Manufacturing, Properties and Application Areas of CMC/ Destructive and Non-Destructive Tests for Composite Materials / Corrosion Behavior of Composite Materials</td>
</tr>
<tr>
<td>MAK4292</td>
<td>PLASTIC PROCESSING MACHINES AND PLANTS</td>
<td>Elective 1-6, 1-7, 1-8</td>
<td></td>
<td>Plastic injection molding, plastic extrusion, blow molding, thermoforming and other plastic manufacturing techniques, parameter selection according to the method, related machines and equipments, plastic processing plants.</td>
</tr>
<tr>
<td>MAK4582</td>
<td>INTRODUCTION TO NANOMATERIALS</td>
<td>Elective 1-6, 1-7, 1-8</td>
<td></td>
<td>Introduction: Nano, Nanotechnology and Nanomaterial concepts / Nanoscale phenomena / Classification of nanomaterials / Nanostructures according to materials / Nanostructures according to morphology</td>
</tr>
</tbody>
</table>
Nanostructures according to functions
- Composite nanostructures
- Mechanical properties of nanomaterials
- Electrical and thermal properties of nanomaterials
- Magnetic, optical and kinetic properties of nanomaterials
- Application areas of nanomaterials
- Laboratory culture and safety issues in nanomaterial studies
- Environment and human health relations of nanomaterial studies, law issues and ethicalness

### MAK4702 Robot Jointing Techniques
**Elective 1-6, 1-7, 1-8**

### MAK4592 MECHANISMS II
**Elective 1-6, 1-7, 1-8**
Cam Mechanisms, Motion Charts, Profiles Determination of Cam, Cam mechanisms and constructions, mechanisms, Power Transmission, Special Mechanisms

### MAK4052 AUTOMATIC CONTROL 2
**Elective 1-6, 1-7, 1-8**
Feed forward/backward control systems

### MAK4062 INDUSTRIAL CONTROL APPLICATIONS
**Elective 1-6, 1-7, 1-8**
Evaluation and development of control techniques and elements used in the industry

### MAK4082 INDUSTRIAL ACOUSTICS AND NOISE
**Elective 1-6, 1-7, 1-8**
The definition of noise, measurement of noise, determination of the industrial noise sources and noise isolation.

### MAK4092 INTRODUCTION TO ROBOTICS
**Elective 1-6, 1-7, 1-8**
Introduction/Kinematic Analysis/Reverse Kinematic Analysis/Dynamic Analysis / Inverse Dynamic Analysis/Elastic Robot Arm Kinematics/Path Planning

### MAK4602 INTRODUCTION TO CONTINUUM MECHANICS
**Elective 1-6, 1-7, 1-8**

### MAK4652 ALTERNATIVE VEHICLE PROPULSION SYSTEM
**Elective 1-6, 1-7, 1-8**
Introduction to hybrid electric vehicles, history of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, modern power transmission systems related to energy sources, conventional vehicles, basis of vehicle performance, hybrid drive system topologies, power flow control in hybrid drive systems, fuel efficiency analysis, basic electric concepts, power flow control in electric drive system, fuel efficiency analysis, hybrid and electric vehicles, configuration and control of DC motor drives, control of induction motor drive, permanent magnet motor drives, drivers, Battery-based energy storage and analysis, fuel-cell based energy storage and analysis, Super Capacitor based energy storage and analysis, Flywheel based energy storage and analysis, hybridization of different energy storage devices. Matching the electric machine with the combustion engine (ICE), sizing the drive motor, sizing the power. A Hybrid Electric Vehicle Design (HEV), Battery Electric Vehicle Design (BEV)

### MAK4662 EXPERIMENTAL METHODS FOR MECHANICAL ENGINEERS
**Elective 1-6, 1-7, 1-8**
Engineering measurement terms, precision, accuracy, calibration, experimental data error, statistical and continuity analysis, basic electrical measurement systems, distance and area measurements, ie pressure, flow and temperature measurements, force, torque and strain measurement, motion and vibration measurements, the air pollution measurement, Dynamometers, Control systems, data collection and processing, measurement system design for a problem

### MAK4672 VEHICLE VIBRATIONS
**Elective 1-6, 1-7, 1-8**
Vibration and Noise assessment criteria/ Noise and vibration signals, Vehicle Vibration and noise sources, Perception of noise and vibration, Road induced noise and vibration/ Single degree of freedom systems, Vibration Analysis, Modal behaviours of vehicle structure, Vehicle suspension modes, Suspension of vehicle body, Structural dynamics measurement parameters, Structural dynamics measurement parameters, Tyre characteristics/ Tyre forces and moments, Road inputs/ vehicle response / ride dynamics models/Midterm exam, Ride dynamics modelling and analysis

### MAK4972 VEHICLE AND ENVIRONMENT
**Elective 1-6, 1-7, 1-8**
The effects of Motor Vehicles on environment and human/ Pollutant effects/ Classification of the Pollution caused by the vehicles/ The methods used to obstruct the formation of pollutants and/or reduce the amount of pollutants/ Standards

### MAK4962 BRAKING DYNAMICS AND BRAKING SYSTEMS IN ROAD VEHICLES
**Elective 1-6, 1-7, 1-8**
Legislative regulations, Classification of the brake systems/Principles of braking/Physics of braking and stopping distance/Braking Performance/Optimum brake forces/Hydraulic brake systems/Pneumatic brake systems/ Driving Safety.
**MAK4682 | FUELS COMBUSTION**  

**MAK4922 | CLEANING AND PURIFICATION TECHNOLOGIES**  
Fresh Water Quality and Standards / Fresh Water Treatment / Aeration / Coagulation-Flocculation / Precipitation / Filtration / Chemical Precipitation / Disinfection / Ion Exchanging / Adsorption / Treatment Technologies / Chemical Treatment Systems / Biological Treatment Systems

**MAK4892 | BUILDING AUTOMATION AND ENERGY MANAGEMENT**  

**MAK4192 | ENERGY MANAGEMENT 2**  

**MAK4902 | SOLAR ENERGY AND HEAT PUMP SYSTEMS 2**  

**MAK4302 | HVAC SYSTEM EQUIPMENTS**  
Air conditioning apparatus and equipment / Air Handling Units / Chillers / Cooling Towers / Heat Recovery Devices / Comfort Modules / Fan and Hüzreleri / Filters / Heating and Cooling Coils / Field Elements and Automatic Control

**MAK4882 | TEST, ADJUSTMENT AND COMMISSIONING AT HVAC SYSTEMS**  

**MAK4692 | HEAT AND MASS TRANSFER IN MINI/MICRO-SYSTEMS**  
Overview of microscale heat and mass transfer, electrohydrodynamics processes (MEMS), single and two-phase flows in microchannels, micro heat exchangers, the use of elektrohidro dinamik (EHD) techniques

**MAK4482 | ENGINEERING SYSTEM OPTIMIZATION**  
Design of Engineering Systems / Fundamental Engineering Background / Mathematical Background / One Dimensional Unconstrained Optimization / Multidimensional Unconstrained Optimization / Constrained Optimization / Dynamic Behaviour of Systems / Reliability of Design / Special Engineering Applications

**MAK4912 | DRYING**  
Drying Systems and Utilizations / Mass Transfer for Drying Systems / Dryers / Drying Systems Design

**MAK4202 | PROCESS CONTROL 2**  

**MAK4242 | THERMAL PROCESS TECHNIQUES 2**  

**MAK2100 | HISTORY of MACHINE TECHNOLOGY**  
Migrations / Technology in the cave life / Mesopotamia and the Middle East civilizations / Common technologies / Classical Period - Born of science and art / Technology & Engineering / Military weapons, Mining / Transmission mechanisms / Energy Systems /
Middle ages - Science in the Islamic empire / Middle Ages - Technology / Renaissance in Europe: Science and Technology - Science men / Trials / Through to real machinery: first atmospheric steam machines, Manufacturing Technology / Steam Power: Effects of inventions in the world political and social.

*ITB*, *MDB* and *BED* courses can be seen in Bologna Web site.