IZMIR INSTITUTE OF TECHNOLOGY
FACULTY OF ENGINEERING
DEPARTMENT OF CIVIL ENGINEERING
UNDERGRADUATE PROGRAM

COURSE CONTENTS

CHEM 121 General Chemistry I (3+0)3 5 Ects
Matter, its properties and measurement. Introduction to atomic theory, stoichiometry. The structural and chemical properties of matter. Gases, liquids and solids. Intermolecular forces. Atomic and molecular structure. Compounds, molecules and molecular formulas. Ions and ionic compounds. Atomic and electronic configurations and periodicity. Basic concepts of chemical bonding, ionic, covalent and metallic bonding.

CHEM 141 General Chemistry Laboratory I (0+2)1 2 Ects
Experiments complementary to the course material related to the topics discussed in CHEM 121 General Chemistry I lectures will be carried out in this laboratory section.

ENG 101 Development of Reading and Writing Skills I (3+0)3 3 Ects
The overall aim of this course is to develop freshman students' English academic reading and writing skills. The course also aims at equipping students with basic study skills they will need throughout their academic life. Students are encouraged to write and present what they read; therefore, speaking skills are introduced and make the students use them while presenting a topic.

ENG 102 Development of Reading and Writing Skills II (3+0)3 3 Ects
The overall aim of this course is to develop freshman students' English academic writing skills, evaluating original articles and to make them able to write an original article about their own opinions on that topic. Students are encouraged to present what they have written.

PHYS 121 General Physics I (3+2)4 7 Ects
Basic concepts of mechanics using vectors and calculus; Newton`s laws of motion; conservation of energy and momentum. Kinematics and dynamics of particle and rigid bodies undergoing rectilinear, rotational, and oscillatory motion. Gravitation. Laboratory experiments complement the lectures.

PHYS 122 General Physics II (3+2)4 8 Ects
Continuation of General Physics I. The fundamental laws of electricity and magnetism, including electromagnetic oscillation and applications to circuits and instruments. Coulomb`s law; electric fields; Gauss`s law; electric potential; capacitance. Simple circuits; RC circuits. Magnetic force; forces and magnetic dipoles; magnetic field; Faraday`s law; self-inductance. Laboratory experiments complement the lectures.

MATH 145 Calculus for Engineering and Science I (4+2)5 7 Ects
Functions; preliminaries. Limits and continuity. Differentiation. Applications of Derivatives; Extreme values of functions, the mean value teorem, monotonic functions and the 1st derivative test, concavity and curve sketching, optimization problems, indeterminate forms and L'Hopital's rule, antiderivatives. Integration; estimating with finite sums, the definite integral, the fundamental theorem of calculus, the substitution rule. Applications of Definite Integrals. Transcendental functions. Techniques of Integration. Conic sections and polar coordinates.

MATH 146 Calculus for Engineering and Science II (4+2)5 8 Ects
Infinite sequences and series, power series, Taylor and Maclaurin series. Vectors and the geometry of space; the dot product, the cross product, lines and planes in space, cylinders and quadric surfaces. Vector-valued functions and motion in space. Partial derivatives; functions of several variables, limits and continuity in higher dimensions, directional derivatives and gradient vectors, extreme values and saddle points, Lagrange multipliers. Multiple integrals; double integrals, double integrals in polar form, triple integrals in rectangular, cylindrical and spherical coordinates, substitutions in multiple integrals. Integration in vector fields; line integrals, vector fields, path independence, Green's theorem, surface area and surface integrals, Stokes' theorem, the Divergence theorem.

CE 101 Introduction to Civil Engineering   **(2+0)2**   **6 Ects**

The objective of the course is to introduce the civil engineering profession and civil engineering department to first year students. An orientation course to provide counsel to the students on the major areas of Civil Engineering including information on typical activity of civil engineers, integrated course sequences and content, and an introduction of the faculty. Professional engineering practice. Oral and written engineering communication. The students will have a better opinion of what civil engineering is and where they will get a formal civil engineering education.

CE 102 Technical Drawing   **(2+2)3**   **5 Ects**

The objectives of this course are to enable the students to understand the general concepts of engineering drawing and general principles on a CAD and extend this knowledge to general use of CADs. An introductory course to provide orientation to the language of engineering graphics and interaction with integrated computer aided drafting. General Cad Terminology and CAD User Interface and Drawing Editor. Technical Drawing Concepts: Orthographic drawing, isometric and oblique projections and sectioning, basic dimensioning techniques, plotting and printing techniques. Introduction to model space and paper space concepts. Civil Engineering applications.

CE 104 Introduction to Computer Programming   **(2+2)3**   **6 Ects**

The objective of the course is to provide first knowledge and basic skill of programming. Introduction to programming concepts, using constants, variables, expressions and statements. Selection, repetition. Simple data structures and arrays. Functions and modular programming.

TURK 201Turkish Language I   **(2+0)0**   **2 Ects**

The course is organized in such a way that the students develop a consciousness of and an interest in Turkish language, which is the native language for most of the students.

TURK 202 Turkish Language II   **(2+0)0**   **2 Ects**

Grammatical and linguistic knowledge, poems, stories, novels and essays written by the Turkish writers who use the language most skillfully. Besides, some panels and conferences are held, related to the books selected.

TURK 203 Turkısh For Foreıgners I   **(2+0)0**   **2 Ects**

Turkish sound knowledge of basic level, simple sentence structures, establish a dialogue, introducing yourself

HIST 201 Principles of Atatürk I   **(2+0)0**   **2 Ects**

Discusses the modernisation of the Ottoman Empire during the nineteenth and early twentieth centuries, the spread of nationalism among its subject peoples, and the revolutionary changes in Ottoman institutions and society that led to the Empire's demise and the transitional period from the Empire to the national state and the foundation of the Turkish Republic following the national struggle led by Mustafa Kemal Atatürk.

HIST 202 Principles of Atatürk II   **(2+0)0**   **2 Ects**

Discusses major events that have taken place from 1923 to 1950, the structuring of the Republic of Turkey and the political, social, economic, and cultural revolutions introduced by Mustafa Kemal Atatürk.

HIST 203 Hıstory Of Turkısh Revolutıon I   **(2+0)0**   **2 Ects**

The modernization of the Ottoman Empire during the nineteenth and early twentieth century's, the spread of nationalism, and the revolutionary changes in Ottoman institutions and society that led to the Empire's demise, the transitional period from the Empire to the national state and the foundation of the Turkish Republic following the national struggle led by Mustafa Kemal Atatürk.

MATH 255 Differential Equations   **(4+0)4**   **6 Ects**

First order equations and various applications. Second order linear equations. Higher order linear differential equations. Power series solutions: ordinary and regular singular points. The Laplace transform: solution of initial value problems. Systems of linear differential equations: solutions by operator method, by Laplace transform. Fourier series and boundary value problems.

MATH 265 Basic Linear Algebra   **(3+0)3**   **4 Ects**

Matrices, determinants and systems of linear equations. Gaussian elimination. LU Decomposition. Vector spaces; subspaces, sum and direct sums of subspaces. Linear dependence, bases, dimension. rank and nullity, change of basis, canonical forms, inner product, Gram-Schmidt orthogonalization process, QR decomposition. Eigenvalues, eigenvectors, diagonalization, similarity. Quadratic Forms. Complex vector spaces, Complex eigenvalues, Unitary and Hermitian Matrices. Least-squares.

CE 203 Engineering Geology   **(2+2)3**   **4 Ects**

This course explores the fundamentals of geology applied to civil engineering problems. Topics include rock and mineral types, soil properties, rock mechanics, geologic structures, active tectonics and earthquake hazards, slope stability and landslides, groundwater, dams and tunnel and effect of geological factor on environmental and engineering structure. Team projects include classic engineering geology case studies and site assessment field investigations. Instruction is conducted through lecture and field trips.

CE 204 Engineering Surveying   **(2+2)3**   **4 Ects**

Basic surveying concepts, error and uncertainity, vertical and horizontal controls, distances, angles, conventional control surveys, control positions, survey instruments (simple/tacheometry), mapping techniques (triangulation/orthogonal), height measurements, area-volume calculations, satellite positioning, earthworks setting out, underground/tunnel surveying, marine surveying, photogrametry, application software:NETCAD.

CE 205 Statistical Methods For Engineers   **(3+0)3**   **4 Ects**

Probability and random variables; basic concepts; hypotheses; Normal, continuous and discrete distributions; variability; expectations and moments; functions of random variables; inferences, estimations and model verifications; observed data and graphical representations; linear models and linear regression; correlations.

CE 221 Engineering Mechanics I: Statics   **(3+0)3**   **5 Ects**

Introduction to rigid body mechanics. Concepts of moment, couple, resultant. Equations of equilibrium, free-body diagram. Structural analysis of trusses and beams. Shear force and bending moment diagrams of beams. Moment and centroid of area. Moments of inertia, principal directions.
Prerequisite(s):MATH 145

CE 222 Engineering Mechanics II: Dynamics   **(3+0)3**   **5 Ects**

Nodal mass kinematics; Nodal mass motion; work and enegy; impuls and momentum; rigidbody kinematics; two and three dimensional motion of rigid bodies; Energy and momentum principles of rigid bodies; Mechanical vibrations; *Prerequisite(s):PHYS121*

CE 224 Mechanics of Materials   **(3+0)3**   **5 Ects**

Tension, compression, and shear; axially loaded members; Torsion of circular shafts; Equilibrium, compatibility, and constitutive relations; Stresses in beams; Analysis of stress and strain; Deflection of beams; Buckling of columns. *Prerequisite(s): CE 221*

CE 231 Engineering Economy   **(3+0)3**   **3 Ects**

Introduction to engineering economy. Interest and money-time relationship. Depreciation, valuation depletion. Basic methods for making economy studies. Risk-decision analysis. Selection between alternatives and the replacement problem. Applications related to various constructions projects. Quantity measurement and cost estimating of a building project.

CE 241 Materials Science   **(2+2)3**   **4 Ects**

General requirements for engineering materials. The structure of matter, atomic arrangements, structural imperfections, atom movements. Force, stress, deformation, strain, elastic and plastic behavior, brittleness, ductility, toughness, resilience, viscosity, rheological models, creep, hardness and fatigue.

CE 244 Materials of Construction   **(3+2)4**   **4 Ects**

Properties and behavior of basic construction materials such as ferrous and non-ferrous metals, clay products, timber, building stones, mineral aggregates, lime, gypsum, cements, pozzolans and concrete. Factors affecting their properties, pertinent standard specifications and tests, their use in constructions and production techniques.

CE 272 Fluid Mechanics   **(3+0)3**   **4 Ects**

Definitions, physical properties, Hydrostatics, Kinematics, Basic principles and methods of analysis, Principles of conservation of mass, momentum and energy, Bernoulli equation, Dimensional analysis and similitude.

CE300 Summer Practice I   **7 Ects**

The summer practice provides students a chance for observing engineering project implementation on site and be a part of an engineering team at work for a minimum period of 20 workdays, in which they would have opportunity to bridge the gap between the education they receive and the real life applications. A summer practice daily logbook needs to be kept during the summer practice, and should be submitted together along with a formal technical report providing the explanation of the work observed and tasks carried out during the internship.

CE 301 Numerical Methods in Engineering   **(3+0)3**   **3 Ects**

Solutions of system of linear equations, Iterative methods, Interpolation, Cubic Splines, Numerical differentiation, Numerical Integration, Numerical solution of nonlinear equations, Initial value problems, Numerical solution of ordinary differential equations, Finite difference method, Engineering application problems.
Prerequisite(s): MATH 145 and MATH 146.

CE 321 Introduction to Structural Mechanics   **(3+0)3**   **6 Ects**

Unsymmetrical bending of beams. Shear centre. Analysis of statically indeterminate structures. Work and energy principles. Principle of virtual work. Castigliano's first and second theorems. Analysis of determinate and indeterminate structures by the Force Method. *Prerequisite(s): CE 224.*

CE 322 Introduction to Structural Analysis   **(3+0)3**   **6 Ects**

Introduction to structural analysis. Virtual work principles. Displacement methods: Slope deflection, moment distribution, special topics. Stiffness method, derivation of element stiffness matrices, assembly procedures. *Prerequisite(s): CE 224.*

CE324 Fundemantals of Reinforced Concrete Design   **(3+0)3**   **6 Ects**

Mechanical behavior of concrete and reinforcing steel. Creep and shrinkage of concrete. Behavior and design of uniaxially loaded members, confinement. Behavior and design of reinforced concrete members under flexure. Behavior and design of reinforced concrete members under combined axial load and bending. Design of reinforced concrete members under combined bending and shear. Design of single and spread footings. *Prerequisite(s): CE 224.*

CE 332 Construction Engineering and Management   **(3+0)3**   **5 Ects**

Introductıon, techniques for financial and management control of construction projects, construction company financial control and accounting, project cost control, estimating and bid preparation, equipment management, computer and expert system applications to construction financial control.

CE 351   Introduction to Transportation Engineering   (2+2)3   5 Ects
Introduction to transportation systems. Vehicles, network, terminals and stations as components of transportation systems engineering. Design of transportation facilities with respect to highway, railway, port and airport engineering. Operations planning of transportation systems and traffic engineering. Models of traffic flow. Traffic analysis at intersections. Basic definitions and computations of level of service. Planning and management techniques.

CE 361 Soil Mechanics I   (3+2)4   5 Ects
Soil formation and identification. Physical and mechanical properties of granular and cohesive soils. The nature and flow of water in soils, stress distribution, analysis of deformation and stregth of soils. Site investigation techniques. Laboratory testing and evaluation of soil composition and properties.

CE 362 Foundation Engineering I   (3+0)3   5 Ects
Soil exploration and sampling. Stress distribution in soils. States of equilibrium, bearing capacity of soils and settlement of structures. Principles of foundation engineering. Design of shallow and deep foundations (piles and caissons). Lateral earth pressures, retaining walls, braced excavations, and slope stability.
Prerequisite(s): CE 361.

CE 371 Hydromechanics   (3+2)4   4 Ects
Introduction, Hydrostatics, Basic equations and their applications, Pipe flow, Open channel flow.
Prerequisite(s): CE 272.

CE 372 Engineering Hydrology   (3+0)3   5 Ects
Hydrologic cycle, Precipitation, Streamflow, Evaporation and transpiration, Streamflow hydrographs, Hydrologic routing, Stochastic hydrology, Groundwater hydrology.

CE400 Summer Practice II   7 Ects
The summer practice provides students a chance for practical training in an engineering office environment to observe the operation in design process and resume some responsibilities to be part of the engineering team in the office for a minimum period of 20 workdays. A summer practice daily logbook needs to be kept during the summer practice, and should be submitted together along with a formal technical report providing the explanation of the work observed and tasks carried out during the internship.

CE 421 Fundamentals of Structural Steel Design   (3+0)3   4 Ects
Analysis and desgin of tension members, beams, columns, and bolted and welded connections.
Prerequisite(s): CE 224.

CE 471 Water Resources Engineering   (3+0)3   4 Ects
Introduction to water resources, Dams, Spillways, Energy dissipation facilities, Water supply, Irrigation and drainage.
Prerequisite(s): CE 371.

TECHNICAL ELECTIVE COURSES

CE 422 Structural Design: Concrete Structures   (3+0)3   5 Ects
Structural elements. Design of two way slabs. Shear walls. Foundations. Structural safety. Structural systems. Approximate methods for structural analysis. Design procedures for gravity and seismic loads. Design codes. Software use in structural analysis and design.
Prerequisite(s): CE 324.

CE423 Introduction to Structural Dynamics   (3+0)3   5 Ects
Dynamic equilibrium equations. Single and multi degree of systems under harmonic, periodic and general dynamic loading. Energy methods. Modal analysis. Earthquake response of structures.
Prerequisite(s): CE 222.

CE424 Introduction to Earthquake Resistant Design   (3+0)3   5 Ects
Mechanisms and characteristics of earthquake ground motions. Intensity and magnitude measurement of earthquakes. Linear response of SDOF systems. Elastic response and design response spectra. Free and forced vibration analysis of frame structures. Modal analysis and equivalent static lateral force methods. Design codes and applications.

CE 425 Structural Analysis   (3+0)3   5 Ects
System modelling; Coordinate axes and their transformation; End forces and end displacements; Stiffness matrices; Transformation matrices; Structural stiffness matrix assembly; Constraint handling; natural frequency calculation; Earthquake structural analysis.

CE 426 Theory of Matrix Structural Analysis   (3+0)3   5 Ects
Matrix Algebra; Relation among members end forces and end displacements; Displacement method; Application of the matrix displacement method to two and three dimensional systems; Matrix force method; Nonlinear Analysis for geometric nonlinear systems, material nonlinearities, and calculation of buckling loads; Structural analysis due to external dynamic loads, earthquake effects.
Prerequisite(s): CE 301.

CE 428 Structural Design: Steel Structures   (3+0)3   5 Ects
Design of steel buildings, beam columns, composite beams, plate girdersi and connections.
Prerequisite(s): CE 224.

CE 429 Computer Applications in Structural Engineering   (3+0)3   5 Ects
Procedure- and event-oriented programming. Introduction to visual programming. Applications for structural mechanics problems. Programming considerations for the numerical modeling of structural systems and the finite element method. Commercial software for analysis and design of structures.

CE 430 Reinforced Concrete   (3+0)3   5 Ects
Behavior of reinforced concrete members. Deformation characteristics under axial and flexural loads. Analysis and design for shear and torsion. Design of slabs using yield line theory. Development and splices of reinforcement. Anchorage. Seismic design considerations. Repair and strengthening of reinforced concrete members.
Prerequisite(s): CE 324

CE 441 Concrete Technology   (3+0)3   5 Ects
Properties of concrete making materials (cements, mineral and chemical admixtures, aggregates and water). Properties of fresh concrete (workability, consistency, bleeding, stiffening, setting, air content, unit weight, uniformity, batching, mixing, conveying, placing, compaction and curing). Properties of hardened concrete: Strength and durability.

CE 442 Construction Materials Design   (2+2)3   5 Ects
Principles of mix-design of cementitious materials, ordinary and special concretes. General requirements for engineering materials. Laboratory work on the design of selected construction materials having predefined performance requirements, such as low cost, high workability, high strength or high durability against severe exposure conditions.

CE 443   Introduction to Historical Construction Materials   (3+0)3   5 Ects
Properties of historical construction materials such as wood, lime, gypsum, clay, pozzolan, building stone etc. Types of construction materials used by different civilizations. Laboratory research techniques in the analysis of the historical construction materials.

CE 451 Planning and Analysis of Transportation Systems   (3+0)3   5 Ects
Planning of Transportation systems. Development of transportation demand and supply models. Analysis of cost functions and cost estimating methods. Merging supply and demand models for network equilibration. Simulation and optimizing approaches for equilibrium. Evaluation of alternative transportation systems. Transport regulation in an inefficient or in an excessive competitive environment. Cost and demand conditions of a good regulated industry. Capacity calculations of transportation systems.
Prerequisite(s): CE 351.

CE 452 Highway and Airport Pavement Materials   (3+0)3   5 Ects
Chemical and physical properties of asphalt. Its production, classification, sources, and uses. Tests on it. Classification and properties of mineral aggregates and related tests on them. Asphalt-aggregate combinations and their applications for design. Asphalt paving mix-design for highway and airport pavements.
Prerequisite(s): CE 351.

CE 453 Highway, Railway, Port and Airport Design   (3+0)3   5 Ects
Planning of highways, geometric design of highways. Aggregate testing. Types of roads and pavements. Low coast, stabilized and bituminous roads. Design of flexible and rigid pavements. Drainage and maintenance. Cuts and fills. Geometric design of railways. Railway surveying. Railway infrastructure design. Track maintenance. Highway and railway design on bridges and

CE454 Traffic Engineering   (3+0)3   5 Ects
 Time – space diagrams, speed estimations. Investigating relationships among traffic volume – speed – density. Deterministic and stochastic models of traffic processes. Queue length and delay estimations. Signalized intersections and design methods. Capacity analysis for different types of roadways. Traffic management techniques. Softwares for traffic predictions.

CE 461 Soil Mechanics II   (2+2)3   5 Ects
Stress path dependent behavior and consolidation. Shear strength and compaction. Soil plasticity, suction and capillarity. Soil-structure interaction. Computational methods in soil mechanics. Laboratory testing and evaluation of soil composition and properties. *Prerequisite(s): CE 361.*

CE 462 Introduction to Soil Dynamics   (3+0)3   5 Ects
Earthquakes and ground vibrations. Shear modulus and damping in soils. Study of soil behavior under dynamic loading conditions. Response of soil layers to earthquake motions. Stability of slopes and dams under seismic loads. Mononobe-Okabe active earth pressure theory. Field and laboratory techniques for determining dynamic soil properties and liquefaction potential.
Prerequisite(s): CE 361.

CE 463 Foundation Engineering II   (3+0)3   5 Ects
Shallow and deep foundations. Footing types and their design. Piles and pile foundations, types of piles, pile foundation design. Types of sheet pile walls. Types and design of caissons. Underpinning of existing structures.
Prerequisite(s): CE 362.

CE 464 Soil Modeling and Computational Soil Mechanics   (3+0)3   5 Ects
Basic formulation of static and dynamic soil behavior, constitutive laws for geologic media, a generalized model for description of soil behavior by visco-plasticity, numerical and physical modeling, stability analyses by plasticity theory, flow through porous media, introduction to static and dynamic FEM analyses, introduction to TALREN, PLAXIS and FLAC programs.   *Prerequisite(s): CE 301, CE 361.*

CE 472 Computer Applications in Water Resources   **(3+0)3**   **5 Ects**
Software and computer tools relevant to hydraulic engineering problems including design of orifices and weirs, water level computations, drainage inlet design, culvert hydraulics, pressure piping systems and water quality analysis, and storm sewer design.
Prerequisite(s): CE 272, CE 301

CE 473   Design of Water Distribution Systems   **(3+0)3**   **5 Ects**
Pumps, valves, friction loss, Water transmission by pipelines, Design of pipelines, Hydraulics, operation and design of water distribution systems, Municipal water requirements, extension of population, Hardy-Cross method, Newton-Raphson method. *Prerequisite(s) :* CE371

CE 474 Introduction to Groundwater Flow Modeling   **(3+0)3**   **5 Ects**
Basic concepts of groundwater modeling. Fundamentals of mathematical models. Governing equations of groundwater flow. Review of modeling techniques and their comparison. Analytical models. Numerical models by finite differences. Application of selected models. *Prerequisite(s) : CE301, CE372.*

CE 475   Design of Hydraulic Structures   **(3+0)3**   **5 Ects**
Hydraulic design of intake structures, Spillways, Dams, Stilling basins and energy dissipators, Hydraulic design of urban drainage systems.
Prerequisite(s): CE371, CE471

CE 476 Groundwater Monitoring and Assessment   **(3+0)3**   **5 Ects**
Fundamental concepts, hydrologic cycle, ground water, aquifer types, differential equations of confined and unconfined aquifers. Well hydraulics. Analytical and graphical solution. Modeling of ground water flow. Construction of wells. Management of ground water: Ground water budget, concepts of basin yield, basin management, artificial recharge, Hidrogeochemistry. Surface and subsurface investigations of ground water. Saline water intrusion in aquifers.
Prerequisite(s) : CE371.

CE 477 Planning and Development of Hydropower Structures   **(3+0)3**   **5 Ects**
Hydropower engineering concepts; Design criteria; Dams; Design of spillways and other structures; hydraulic turbines; Planning and design of pumped storage plants; Physical model.

CE 478 Introduction to GIS applications in Water Engineering   **(3+0)3**   **5 Ects**
GIS Fundamentals, applications and software, GIS Data, GIS in hydrology: Digital Elevation Models (DEMs), Delineating streams and watersheds, Estimating runoff curve numbers, Stormwater management, GIS based mapping applications: Water distribution systems, Wastewater systems.

CE 479   Coastal Hydraulics   **(3+0)3**   **5 Ects**
An introduction to coastal hydraulics, basic wave mechanics, the Small Amplitude Wave Theory, refraction, shoaling, diffraction and reflection of waves, wave breaking phenomenon. Wave-structure interactions. Wave Climate and Statistics .Coastal currents, principles of coastal sediment transport**.**

CE 480 Design Of Coastal Structures   **(3+0)3**   **5 Ects**
 Wave Climate, design wave, wave forces on vertical walls, rubble mounds and circular cylinders, design of harbour structures;quays, piers, gravity and floating breakwayers. design of breakwater lay-out and harbour tranquillity. Design of seawalls, revetments and groins. design of concrete block quaywalls, sheet pile walls and piled quay walls. Seismic design.