İzmir Institute of Technology

Faculty of Engineering

Department of Civil Engineering

Undergraduate Program Course Descriptions

(Valid for the 2024-2025 Academic Year and Beyond)

CHEM 121 General Chemistry I (3+0)3 - 5 ECTS

Matter, its properties, and measurement. Atoms and atomic theory. Chemical compounds. Chemical reactions. Reactions in aqueous solutions. Gases. Thermochemistry. Electrons in atoms. The periodic table and atomic properties. Chemical bonding. Liquids, solids, and intermolecular forces. Solutions and their physical properties.

CHEM 141 General Chemistry Laboratory I (0+2)1 - 2 ECTS

Experiments covering the topics in CHEM 121 General Chemistry I will be conducted by students in the laboratory course.

ENG 101 English Reading and Writing I (3+0)3 - 3 ECTS

Designed to equip students with academic reading skills and critical thinking abilities they will need throughout their academic lives. It also aims to develop their speaking skills by enabling them to present on topics they have read.

ENG 102 English Reading and Writing II (3+0)3 - 3 ECTS

Focused on enhancing students' reading and writing skills through the analysis of original articles and enabling them to write essays expressing their own opinions. Students are also expected to present these essays as projects and discuss them orally.

PHYS 121 General Physics I (3+2)4 - 7 ECTS

Fundamental concepts of mechanics through vector mathematical analysis; Newton’s laws of motion; conservation of energy and momentum; kinematics and dynamics of particles and rigid bodies undergoing uniform, circular, and oscillatory motion. The course is supported by applied laboratory experiments.

PHYS 122 General Physics II (3+2)4 - 8 ECTS

Continuation of General Physics I: Fundamental laws of electricity and magnetism with applications to electrical circuits, including electromagnetic oscillations. Coulomb's law; electric field; Gauss's law; electric potential; capacitance. Simple circuits; RC circuits. Magnetic forces, magnetic dipoles, magnetic field, Faraday's law, self-inductance. Supported by applied laboratory experiments.

MATH 141 Calculus I (3-2)4 - 5 ECTS

Functions. Limits and continuity. Derivatives. Applications of derivatives: Mean Value Theorem, Intermediate Value Theorem. Integrals. Applications of integrals: Volume, surface area, and arc length. Transcendental functions. Integration methods: Substitution, partial fractions, and trigonometric integrals.

MATH 142 Calculus II (3-2)4 - 6 ECTS

L'Hôpital's rule. Improper integrals: Convergence tests. Sequences and infinite series: Convergence tests. Polar coordinates. Multivariable functions and their derivatives. Double integrals, double integrals in polar coordinates. Prerequisite: MATH 141.

MATH 241 Calculus III (3-2)4 - 5 ECTS

Vector-valued functions and space curves, analysis of vector-valued functions, motion in space, multiple integrals over quadratic regions, integrals in polar, cylindrical, and spherical coordinates, change of variables in multiple integrals, vector fields, divergence and curl, line integrals: properties and applications, surface integrals, conservative fields, fundamental theorem of calculus, Green's theorem, Stokes' theorem, divergence theorem.
Prerequisite: MATH 142.

GCC101 Career Planning and Development (2+0)0 - 2 ECTS

The IYTE Career, Leadership, and Entrepreneurship Center (CLEC) provides activities to support students in developing their skills. The course includes organizing and coordinating online seminars, panels, and guest speaker events. CLEC's activities are designed to introduce basic tools and methods for professional job applications and raise awareness about using these tools effectively for career planning and development. Collaborating with the IYTE Alumni Office and Alumni Association, graduates share their diverse career experiences and introduce various work environments.

The course is divided into three modules:

- **Module 1:** Internal stakeholders, including CLEC, the Alumni Office, and course instructors, provide support for career planning and development activities.
- **Module 2:** Guest speakers, including IYTE alumni, student communities, and faculty members, discuss career opportunities at IYTE.
- **Module 3:** Panels and online seminars are organized with external stakeholders, including professionals from public and private sectors, academia, and NGOs, who share methods, tools, and experiences related to career development.

CE 101 Introduction to Civil Engineering and Sustainability (2+0)2 - 6 ECTS
This course introduces students to the main disciplines of civil engineering, typical areas of activity, the curriculum, and faculty members. It emphasizes the importance of civil engineering in the context of sustainability and provides an overview of professional engineering. The course also focuses on the significance of written and oral communication in engineering, enabling students to understand the role of civil engineers and the education they receive.

CE 102 Technical Drawing (2+2)3 - 5 ECTS
This course aims to teach students the principles of technical drawing and computer-aided design (CAD). Topics include engineering graphics, orthographic drawing, isometric and oblique projections, sectioning, basic dimensioning, drawing, and printing techniques. The course introduces model space and paper space concepts, with applications relevant to civil engineering.

CE 122 Statics (2+2)3 - 6 ECTS
Introduction to rigid body mechanics. Concepts of moments, resultants, and force couples. Equilibrium equations and free-body diagrams. Structural analysis of trusses and beams. Shear and bending moment diagrams for beams. Centroids and moments of areas. Moments of inertia and principal axes.

TURK 201 Turkish Language I (2+0)0 - 2 ECTS
This course aims to help students understand the structure and functioning of their native language, fostering an appreciation and awareness of Turkish. It introduces the features and rules

of Turkish through examples, helping students develop vocabulary via written and oral texts. It also aims to instill habits of critical, analytical, creative, and constructive thinking.

TURK 202 Turkish Language II (2+0)0 - 2 ECTS
This course focuses on building correct and effective sentences by identifying their elements and importance. It includes reading and analyzing literary and intellectual works, practicing rhetoric, and exploring written composition types. It raises awareness of language errors and aims to improve students' ability to speak and write clearly and effectively, using selected texts from Turkish and world literature.

TURK 203 Turkish for Foreigners I (2+0)0 - 2 ECTS
Basic Turkish phonetics, simple sentence structures, establishing dialogues, self-introduction.

TURK 204 Turkish for Foreigners II (2+0)0 - 2 ECTS
Continuation of basic Turkish phonetics, simple sentence structures, dialogues, and self-introduction.

HIST 201 Atatürk's Principles and History of Reforms I (2+0)0 - 2 ECTS
Covers the modernization process of the Ottoman Empire in the 19th and early 20th centuries, the collapse due to nationalist movements, and the revolutionary changes in Ottoman institutions and society. It also focuses on the political events leading to the transition from empire to a nation-state and the foundation of the Republic of Turkey under Mustafa Kemal Atatürk.

HIST 202 Atatürk's Principles and History of Reforms II (2+0)0 - 2 ECTS
Explores the political, social, economic, and cultural transformations within Turkey following its foundation, along with domestic and foreign political events. Evaluates these changes in light of Atatürk's reforms and principles, with relevance to contemporary issues.

HIST 203 History of the Turkish Revolution I (2+0)0 - 2 ECTS
Discusses the modernization process of the Ottoman Empire, the spread of nationalism, revolutionary changes in Ottoman institutions and society, and the political events leading to the establishment of the Republic of Turkey under Mustafa Kemal Atatürk.

HIST 204 History of the Turkish Revolution II (2+0)0 - 2 ECTS
Analyzes the political, social, economic, and cultural transformations of Turkish society under

the framework of Atatürk's reforms. Evaluates the internal and external political developments during this period in the context of their relevance to current challenges.

MATH 255 Differential Equations (4+0)4 - 6 ECTS
Covers first-order differential equations and their applications, second-order linear equations, higher-order linear equations, power series methods (ordinary and singular points), Laplace transforms, systems of linear differential equations, Fourier series, and boundary value problems.

CE 203 Engineering Geology (2+2)3 - 4 ECTS
Introduces the significance of geology in civil engineering, including rocks and minerals, soil properties, rock mechanics, geological structures, active tectonics, earthquake risks, slope stability, landslides, groundwater, and applications in dams and tunnels. Emphasizes the influence of geological factors on the environment and engineering structures, with fieldwork applications.

CE 204 Surveying (2+2)3 - 4 ECTS
Focuses on basic measurement concepts, errors, and uncertainties, vertical and horizontal controls, distances, angles, classic control measurements, mapping techniques, elevation calculations, area-volume computations, satellite positioning, earthworks, subsurface/tunnel measurements, marine surveys, photogrammetry, and practical software applications like NETCAD.

CE 205 Statistical Methods for Engineers (3+0)3 - 4 ECTS
Covers probabilities and random variables, fundamental concepts, hypotheses, normal, continuous, and discrete distributions, variability, expectations, random variable functions, inferences, estimations, and model validation. Topics include graphical data representation, linear models, linear transformations, and correlation analyses.

CE 224 Strength of Materials (2+2)3 - 5 ECTS
Tension, compression, and shear; axially loaded members, torsion; equilibrium and compatibility relationships; stresses in beams; stress and strain analysis; deformation of beams; buckling of columns. **Prerequisite:** CE 122

CE 231 Engineering Economy (3+0)3 - 3 ECTS
Introduction to engineering economy, time value of money, fundamental economic methods,

risk-decision analysis, selection and replacement problems. Applications in construction projects, quantity takeoff, and cost estimation.

CE 232 Construction Engineering (3+0)3 - 5 ECTS
Introduction to financial and operational planning in construction projects, financial control and accounting of enterprises, project cost control, bid preparation, equipment organization, and the use of computer-aided and expert systems for construction cost management.

CE 240 Basic Computer Programming (2+2)3 - 5 ECTS
Teaches fundamentals of computer programming, including constants, variables, commands, selection, repetition, basic data structures, functions, and modular programming.

CE 241 Materials Science (2+2)3 - 4 ECTS
General properties of engineering materials, atomic structures, defects, atomic movements, stress, strain, elastic and plastic behavior, brittleness, ductility, toughness, viscosity, rheological models, creep, hardness, and fatigue.

CE 244 Construction Materials (3+2)4 - 4 ECTS
Properties and behavior of construction materials such as ferrous and non-ferrous metals, clay materials, timber, stone, aggregates, lime, plaster, cement, pozzolans, and concrete. Factors affecting their properties, relevant standards and tests, usage in structures, and production techniques.

CE 272 Fluid Mechanics (3+0)3 - 4 ECTS
Definitions, physical properties, hydrostatics, kinematics, fundamental principles and analysis methods, conservation of mass, momentum, and energy principles, Bernoulli's equation, dimensionless analysis, and model theory.

CE 300 Summer Internship I - 7 ECTS
Students observe and participate in the practical application of their academic knowledge on a construction site. Emphasis is placed on relating project work to site implementation and engineering practices. Internship lasts a minimum of 20 working days, requiring a daily log and a technical report detailing the activities performed.

CE 307 Numerical Methods and Linear Algebra in Engineering (4+0)4 - 5 ECTS
Solving linear systems of equations, iteration methods, interpolation, numerical differentiation, numerical integration, numerical solutions of non-linear equations, ordinary differential equations, boundary and initial value problems, finite difference methods, and applications in engineering. **Prerequisite:** MATH 241

CE 321 Introduction to Structural Mechanics (3+0)3 - 6 ECTS
Asymmetric bending of beams, shear center, analysis of statically indeterminate structures, work and energy principles, virtual work theorem, Castigliano's theorems, analysis of statically determinate and indeterminate structures using force methods. **Prerequisite:** CE 224

CE 322 Introduction to Structural Analysis (3+0)3 - 6 ECTS
Introduction to structural analysis, virtual work, and energy principles; displacement methods including slope-deflection and moment distribution; special topics; stiffness method: formation of element stiffness matrices and global system matrices. **Prerequisite:** CE 224

CE 324 Fundamentals of Reinforced Concrete Design (3+0)3 - 6 ECTS
Mechanical behavior of structural concrete and steel, shrinkage, and creep in concrete. Design and behavior of reinforced concrete members under axial, bending, and combined loads; shear and flexural behavior; design of individual and continuous footings. **Prerequisite:** CE 224

CE 351 Introduction to Transportation Engineering (2+2)3 - 5 ECTS
Overview of transportation systems, including vehicles, networks, terminals, and stations. Design of transport services for road, rail, port, and airport engineering. Traffic flow models, intersection analysis, level of service definitions, and planning and operational techniques.

CE 361 Soil Mechanics I (3+2)4 - 5 ECTS
Formation and classification of soils, physical properties of granular and cohesive soils, water flow through soils, stress distribution, deformation analysis, and soil strength. Includes laboratory and field test methods for determining soil properties.

CE 362 Foundation Engineering I (3+0)3 - 5 ECTS
Soil investigation and sampling, stress distribution in soils, settlement, and bearing capacity of soils. Principles of foundation engineering, shallow and deep foundations, lateral earth pressure, retaining structures, supported excavations, and slope stability. **Prerequisite:** CE 361

CE 371 Hydromechanics (3+2)4 - 4 ECTS

Introduction to hydrostatics, fundamental equations and their applications, pipe hydraulics, and open channel flow. **Prerequisite:** CE 272

CE 372 Engineering Hydrology (3+0)3 - 5 ECTS

Hydrological cycle, precipitation, surface runoff, evaporation, transpiration, hydrograph analysis, hydrological routing, statistical methods in hydrology, and groundwater hydrology.

CE 374 Introduction to Coastal Engineering (3+0)3 - 5 ECTS

Phenomena, definitions, and symbols; fundamental equations and boundary conditions; linear wave theory; changes in wave form in coastal waters; wave generation in seas; types of coastal structures.

CE 383 Construction Site Internship (0+0)0 - 7 ECTS

A minimum 20-working-day internship at a building construction site, observing the practical application of theoretical knowledge, recording observations in a daily log, and preparing a technical report summarizing observed applications and tasks performed.

CE 385 Geotechnical Field Internship (0-0)0, 7 ECTS

Working as an intern engineer for at least 20 workdays on a site where geotechnical applications are carried out. Observing the application of theoretical knowledge learned during the courses in the field. Keeping a daily log of observations and tasks, and preparing a technical report during the internship.

CE 387 Transportation Field Internship (0-0)0, 7 ECTS

Working as an intern engineer for at least 20 workdays on a site involving the construction and application of transportation structures and systems, such as roads, highways, and railways. Observing how theoretical knowledge learned during the courses is applied in the field. Keeping a daily log of observations and tasks, and preparing a technical report during the internship.

CE 389 Water Structures Field Internship (0-0)0, 7 ECTS

Working as an intern engineer for at least 20 workdays on a site involving the construction of water structures, such as dams, canals, and coastal structures. Observing the application of theoretical knowledge learned during the courses in the field. Keeping a daily log of observations and tasks, and preparing a technical report during the internship.

CE 393 Construction Materials Field Internship (0-0)0, 7 ECTS

Working as an intern engineer for at least 20 workdays on a site related to the production and application of construction materials. Observing how theoretical knowledge learned during the courses is applied in the field. Keeping a daily log of observations and tasks, and preparing a technical report during the internship.

CE 391 Fundamentals of Structural Dynamics (3-0)3, 5 ECTS

Basic concepts related to dynamic analysis, dynamic behavior of single-degree-of-freedom systems, free and forced vibrations (undamped and damped), response spectra, dynamic behavior of multi-degree-of-freedom systems, modal superposition method.

CE 400 Summer Internship II 7 ECTS

During the internship, students must observe the office workflow and perform assigned tasks using the knowledge they have gained from their undergraduate studies. The internship duration must be at least 20 workdays. A daily log must be maintained, and a technical report detailing the work performed must be submitted.

CE 402 Civil Engineering Project Course (0-6)3, 12 ECTS

Students will carry out the analysis and design of a real-life project that requires expertise from multiple civil engineering fields. The goal is to ensure that students can apply the knowledge and skills they have gained in a multidisciplinary civil engineering project within a team setting. Students will be divided into teams and will work on assigned projects under the supervision of faculty members.

CE 421 Steel Structures Design Principles (3+0)3, 4 ECTS

Analysis and design of trusses, beams, and column elements, as well as bolted and welded joints.
Prerequisite: CE 224

CE 471 Water Resources Engineering (3+0)3, 4 ECTS

Introduction to water resources systems, dams, spillways, energy dissipators, water supply, irrigation, and drainage.
Prerequisite: CE 371

CE 445 Earthquake-Resistant Design Principles (2+2)3, 5 ECTS

Basic concepts of dynamic analysis, dynamic behavior of single-degree-of-freedom systems, free

and forced vibrations (undamped and damped), response and design spectra, dynamic behavior of multi-degree-of-freedom systems, equivalent earthquake loads, and modal superposition methods.
Prerequisite: CE 324, CE 391

TECHNICAL ELECTIVE COURSES

CE 404 Structural Engineering Design (3+0+6), 12 ECTS
Involving students in structural engineering design and emphasizing interdisciplinary planning, coordination, communication, technical report writing, and the importance of ethics. Integrating knowledge, ideas, and concepts from previous structural engineering courses into a comprehensive design effort. Students will formulate and solve design problems in an open-ended solution space.
Prerequisite: At least one technical elective design course in structural engineering.

CE 406 Geotechnical Engineering Design (3+0+6), 12 ECTS
Involving students in geotechnical engineering design and emphasizing interdisciplinary planning, coordination, communication, technical report writing, and the importance of ethics. Integrating knowledge, ideas, and concepts from previous geotechnical engineering courses into a comprehensive design effort. Students will formulate and solve design problems in an open-ended solution space.
Prerequisite: At least one technical elective design course in geotechnical engineering.

CE 408 Transportation Engineering Design (3+0+6), 12 ECTS
Involving students in transportation engineering design and emphasizing interdisciplinary planning, coordination, communication, technical report writing, and the importance of ethics. Integrating knowledge, ideas, and concepts from previous transportation engineering courses into a comprehensive design effort. Students will formulate and solve design problems in an open-ended solution space.
Prerequisite: At least one technical elective design course in transportation engineering.

CE 410 Construction Materials Engineering Design (3+0+6), 12 ECTS
Involving students in construction materials engineering design and emphasizing

interdisciplinary planning, coordination, communication, technical report writing, and the importance of ethics. Integrating knowledge, ideas, and concepts from previous construction materials engineering courses into a comprehensive design effort. Students will formulate and solve design problems in an open-ended solution space.
Prerequisite: At least one technical elective design course in construction materials engineering.

CE 412 Water Structures Engineering Design (3+0+6), 12 ECTS
Involving students in water structures engineering design and emphasizing interdisciplinary planning, coordination, communication, technical report writing, and the importance of ethics. Integrating knowledge, ideas, and concepts from previous water structures engineering courses into a comprehensive design effort. Working on methodology to formulate and solve design problems in an open-ended solution space.
Prerequisite: At least one technical elective design course in water structures engineering.

CE 414 Structural Management Engineering Design (3+0+6), 12 ECTS
Involving students in structural management engineering design and emphasizing interdisciplinary planning, coordination, communication, technical report writing, and the importance of ethics. Integrating knowledge, ideas, and concepts from previous structural management engineering courses into a comprehensive design effort. Working on methodology to formulate and solve design problems in an open-ended solution space.
Prerequisite: At least one technical elective design course in structural management engineering.

CE 422 Structural Design: Concrete Structures (3+0)3, 5 ECTS
Structural elements. Two-way slab design. Shear walls. Foundations. Structural safety. Structural systems. Approximate structural analysis methods. Design principles for vertical loads and seismic loads. Design codes. Computer use in structural analysis and design.
Prerequisite: CE 324.

CE 425 Structural Statics (3+0)3, 5 ECTS
Modeling of structural systems; Axial assemblies and transformations; End forces and displacements; Stiffness matrices; Transformation matrices; System stiffness matrix and loading vectors; Boundary conditions; Free vibrations of bar systems; Seismic calculations of bar systems.

CE 426 Matrix Methods in Structural System Analysis (3+0)3, 5 ECTS
Definition of matrices and basic methods; Matrix relationships between end forces and end displacements in finite elements; Matrix displacement method; Application of the matrix displacement method to two- and three-dimensional systems; Matrix force method; Analysis of nonlinear systems with material and geometry changes, finding buckling loads; Dynamic analysis of structural systems under external effects, seismic calculations.
Prerequisite: CE 301.

CE 428 Structural Design: Steel Structures (3+0)3, 5 ECTS
Design of steel structures, beams, columns, composite beams, welded beams, and connections.
Prerequisite: CE 421.

CE 429 Computer Applications in Structural Engineering (3+0)3, 5 ECTS
Procedural and event-based programming. Introduction to visual programming. Applications in structural mechanics. Programming basics for numerical modeling of structural systems and finite element methods. Use of commercial software for structural analysis and design.

CE 430 Reinforced Concrete (3+0)3, 5 ECTS
Behavior of reinforced concrete elements. Deformation characteristics under axial and bending loads. Design against shear and torsion. Slab design using yield line theory. Reinforcement extensions and bond. Anchorage. Seismic design principles. Repair and strengthening of reinforced concrete elements.
Prerequisite: CE 324.

CE 441 Concrete Technology (3+0)3, 5 ECTS
Properties of materials forming concrete (cement, mineral and chemical additives, aggregates, and water). Fresh concrete properties (workability, consistency, shrinkage, hardening, setting time, air content, unit weight, uniformity, mixing, transportation, placement, compaction, and curing). Hardened concrete properties: Strength and durability.
Prerequisite: CE 244.

CE 442 Structural Materials Design (2+2)3, 5 ECTS
Design principles for cement-based materials, normal and special concretes. General properties of engineering materials. Laboratory-based design of selected construction materials to meet

specified performance characteristics (e.g., low cost, high workability, high strength, or high durability under harsh conditions).

CE 443 Introduction to Historical Building Materials (3+0)3, 5 ECTS
Properties of historical building materials such as wood, lime, plaster, clay, pozzolana, and stone. Types of construction materials used in different civilizations. Laboratory techniques used in the analysis of historical building materials.

CE 451 Transportation Systems Planning and Analysis (3+0)3, 5 ECTS
Development of transportation supply-demand models. Analysis of cost functions and cost determination methods. Supply-demand integration for transportation network equilibrium. Simulation and optimization approaches for equilibrium. Evaluation of alternative transportation systems. Transportation arrangements in inefficient or highly competitive environments. Cost and demand conditions of well-regulated and efficient industries, capacity calculations for transportation systems.
Prerequisite: CE 352.

CE 452 Road and Airport Pavement Materials (3+0)3, 5 ECTS
Chemical and physical properties, production, classification, sources, and use of asphalt. Asphalt testing. Classification of mineral aggregates, their properties, and related tests. Asphalt-aggregate combinations and their applications in design. Asphalt pavement mix design for road and airport pavements.
Prerequisite: CE 351.

CE 453 Road, Railway, Port, and Airport Design (3+0)3, 5 ECTS
Road planning and geometric design of roads. Aggregate testing. Pavement and road types: Simple, stabilized, and bituminous roads. Flexible and rigid pavement design. Drainage and maintenance. Excavations and embankments. Railway geometric design. Railway control. Design of railway infrastructure. Track maintenance. Road and railway design for bridges and tunnels. Design of stations and depot areas. Railway switches and signaling. Design of metro lines and trains. High-speed trains and their infrastructure. Magnetic levitation trains (Maglev). Port planning and design. Breakwater, quay, and coastal protection system design. Airport planning and design. Terminal buildings, ventilation, and paved areas design.
Prerequisite: CE 351.

CE 454 Traffic Engineering (3+0)3, 5 ECTS

Road-time curves, speed calculations. Investigation of relationships between traffic volume, speed, and density. Deterministic and stochastic traffic models. Queue length and delay calculations. Signalized intersections and design methods. Capacity analysis for different road types. Traffic management techniques. Software used in traffic forecasting.

CE 461 Soil Mechanics II (2+2) 3 5 ECTS

Soil behavior under stress and consolidation. Shear resistance and compaction. Soil plasticity and capillarity. Soil-structure interaction. Determining soil properties through laboratory tests. Prerequisite: CE 361

CE 462 Introduction to Soil Dynamics (3+0) 3 5 ECTS

Earthquakes and soil vibrations. Shear modulus and damping. Soil behavior under dynamic loading. Response of soil layers during seismic motion. Stability of slopes and dams under seismic loading. Mononobe-Okabe active earth pressure theory. Determining dynamic soil properties and liquefaction potential using field and laboratory techniques. Prerequisite: CE 361

CE 463 Foundation Engineering II (3+0) 3 5 ECTS

Shallow and deep foundations. Types of foundations and their design. Pile and pile foundations, pile types, and pile foundation design. Sheet pile design. Types and design of caissons. Foundation strengthening for existing structures. Prerequisite: CE 362

CE 464 Soil Modeling and Computational Soil Mechanics (3+0) 3 5 ECTS

Basic formulations of static and dynamic soil behavior, laws for geological environments, soil behavior modeling with visco-plasticity, sensitivity of soil with plasticity theory, flow in rough and permeable media, introduction to static and dynamic analysis using finite element methods, TALREN program for slope analysis using limit equilibrium, and programs like PLAXIS and FLAC that use finite element methods. Prerequisite: CE 301, CE 361

CE 472 Computer Applications in Water Resources (3+0) 3 5 ECTS

Design of spillways and weirs, water level calculations, drainage design, culvert hydraulics, pressurized pipe systems, and water quality analysis, stormwater drainage. Prerequisite: CE 272, CE 301

CE 473 Design of Water Distribution Systems (3+0) 3 5 ECTS
Pumps, valves, and head loss. Water transmission through pipes. Design of pipe systems. Hydraulics, operation, and design of water distribution systems. Urban water demand and population growth models. Hardy-Cross method. Newton-Raphson method. Prerequisite: CE 371

CE 474 Introduction to Groundwater Flow Modeling (3+0) 3 5 ECTS
Fundamental concepts of groundwater modeling, basics of mathematical models, groundwater flow equations, model techniques, and their interrelationships, analytical models, numerical models, and application of selected models. Prerequisite: CE 301 and 372

CE 475 Hydraulic Structure Design (3+0) 3 5 ECTS
Hydraulic design of water intake structures, spillways, dams, stilling basins, and energy dissipaters, hydraulic design of urban sewer systems. Prerequisite: CE 371, CE 471

CE 476 Groundwater Monitoring and Evaluation (3+0) 3 5 ECTS
Basic concepts, hydrological cycles, groundwater, aquifer types, equations for unconfined and confined aquifers, well hydraulics, analytical and graphical solutions, groundwater flow models, well construction, groundwater protection, groundwater budgeting, protection zones, sustainability of basins, artificial recharge, hydrogeochemistry, surface and groundwater research, freshwater-saltwater intrusion. Prerequisite: CE 371

CE 477 Design and Planning of Hydroelectric Energy Structures (3+0) 3 5 ECTS
Hydroelectric energy, design criteria, dams, spillways, and other structures, hydraulic turbines, planning and design of pumped storage power plants, physical modeling.

CE 478 Introduction to GIS Applications in Water Engineering (3+0) 3 5 ECTS
Basic concepts of GIS, applications, and software. GIS data, GIS applications in hydrology, digital elevation maps, determining drainage networks in basins, predicting watershed flow numbers, flood management, GIS-based map applications, water distribution systems, wastewater systems.

CE 479 Coastal Hydraulics (3+0) 3 5 ECTS
Introduction to coastal hydraulics. Basic wave mechanics. Short amplitude wave theory. Wave refraction, shoaling, diffraction, reflection, and breaking. Wave-structure interaction. Wave

climate and statistical analysis. Coastal currents. Principles of sediment transport along the coastline.

CE 480 Design of Coastal Structures (3+0) 3 5 ECTS
Wave climate, design waves, wave forces on vertical and sloped breakwaters, design of harbor structures; piers, jetties, floating and traditional breakwaters, breakwater layout design, harbor turbulence, pile and concrete pier design, earthquake design.

CE 482 Design of Coastal Protection Structures (3+0) 3 5 ECTS
Wave climate, wave overtopping, wave pressure and forces, coastal protection structures, seawalls, groins, revetments, breakwaters (either detached or submerged), coastal sand nourishment.

CE 483 Structural Office Internship (0-0) 0 7 ECTS
Working as an intern engineer for at least 20 workdays in a structural design office. Observing the application of theoretical knowledge learned in the courses. Keeping an internship journal documenting the observed practices and preparing a technical report.

CE 485 Geotechnical Office Internship (0-0) 0 7 ECTS
Working as an intern engineer for at least 20 workdays in a geotechnical design office. Observing the application of theoretical knowledge learned in the courses. Keeping an internship journal documenting the observed practices and preparing a technical report.

CE 487 Transportation Office Internship (0-0) 0 7 ECTS
Working as an intern engineer for at least 20 workdays in a transportation design office. Observing the application of theoretical knowledge learned in the courses. Keeping an internship journal documenting the observed practices and preparing a technical report.

CE 489 Water Structures Office Internship (0-0) 0 7 ECTS
Working as an intern engineer for at least 20 workdays in a water structures design office (such as dams, canals, and coastal structures). Observing the application of theoretical knowledge learned in the courses. Keeping an internship journal documenting the observed practices and preparing a technical report.

CE 505 Open Channel Hydraulics (3-0) 3 8 ECTS

Energy and momentum principles. St. Venant equations. Flood routing. Flow in non-prismatic sections. Flow over a weir. Characteristic method. Explicit and implicit numerical methods. Stability of numerical schemes.

CE 520 Prestressed Concrete Elements (3-0) 3 8 ECTS

Theory, applications, and limitations of prestressed concrete systems. Composite construction. Continuous span theory.

CE 544 Stability of Soils (3-0) 3 8 ECTS

Stability and design of slopes, embankments, retaining walls, deep excavations, anchors, ties, bored piles, reinforced concrete or cast-in-place displacement excavations, control of groundwater table effects.

CE 551 Optimization and Design (3-0) 3 8 ECTS

Introduction to operational research. Techniques for optimal resource utilization. Linear programming, dynamic programming, and nonlinear programming. Applications in water quality, air quality, and waste management.

CE 571 Artificial Intelligence Methods in Engineering (3-0) 3 8 ECTS

The aim of this course is to introduce the fundamental concepts of artificial intelligence methods, such as neural networks, fuzzy logic, and genetic algorithms, and their use in solving various engineering problems.

CE 578 Marine Renewable Energy (3-0) 3 8 ECTS

Marine renewable energy, wave energy, wave energy converters, power transmission systems, tidal energy, offshore wind energy, combined systems.