

**ÇANKAYA UNIVERSITY**  
**DEPARTMENT OF CIVIL ENGINEERING**  
**COURSE DESCRIPTIONS**

**FIRST YEAR**

**CE 102 - INTRODUCTION TO CIVIL ENGINEERING**

This course is an introduction to the principles, practice, concepts, applications, and terminology involved in civil engineering. Introduction to engineering and development of civil engineering, concept of unit, dimension, dimensional homogeneity, concept of scalar and vectorial quantities, coordinate systems, vector algebra, application of vector analysis for velocity, acceleration, force and moment, hydraulic engineering, structural engineering, materials of construction, steel structures, engineering mechanics, earthquake engineering, geotechnical engineering, transportation engineering, construction management (work schedule and programming), site planning and administration, construction machineries, principles relating to writing a report, paper or an article.

**CE 104 - ENGINEERING GEOLOGY**

The course covers the general information about engineering geology. The main procedure in formation of soil and rock and their types are studied. Earthquake and geological hazard concepts, geological and topographic maps are covered.

**CE 115 - COMPUTER AIDED DRAWING FOR CIVIL ENGINEERS**

The course mainly consists two parts. While the first part provides introduction and general information on AutoCAD, the second part is related with the basics of engineering drawing in civil engineering applications.

## **SECOND YEAR**

### **CE 209 - GEOGRAPHIC INFORMATION SYSTEMS**

Definition of the GIS, Components of a GIS, Maps and Their Influence on the GIS, Map Projection Systems, Spatial Data Models, Spatial Data Structures, Sources of Spatial Data, Spatial Database Models, Creation of a Spatial Database, GIS Database Applications, GIS Software and Hardware, Spatial Data Visualization, Symbolization of Spatial Data, Spatial Queries and Analysis, Civil Engineering Applications, Spatial Programming.

### **CE 221 - ENGINEERING MECHANICS: STATICS**

The course covers the following topics: introduction to rigid body mechanics, force vectors, concepts of moment, couple, resultant, equilibrium of particles, equilibrium of rigid bodies in two and three dimensions, free-body diagram, distributed forces, structural analysis of trusses and beams, axial, shear force and bending moment diagrams, area moment and centroid, moments and product of inertia.

### **CE 222 - ENGINEERING MECHANICS: DYNAMICS**

The course covers the following topics: kinematics of particles, kinetics of particles, Newton's law of motion, equation of motion, work, impulse, momentum, principle of work and energy, principle of impulse and momentum, angular momentum, angular impulse and momentum principle, planar kinematics of rigid bodies, planar kinetics of rigid bodies, introduction to vibration.

### **CE 224 - MECHANICS OF MATERIALS**

The course covers the following topics; stress and strain concepts, axial load, statically indeterminate axially loaded members, thermal stress, torsion, angle of twist, statically indeterminate torque-loaded members, bending, eccentric axial loading of beams, transverse shear, shear flow in built-up members, combined loadings, stress and strain transformation, deflection of beams, statically indeterminate beams. This course is the foundation stone for much of engineering sciences.

### **CE 242 - MATERIALS OF CONSTRUCTION**

The course covers the following topics; Production, types, uses in construction, properties and tests for these materials: lime, gypsum, hydraulic cements, mineral aggregates, concrete, clay products, ferrous metals, polymers, bituminous materials, timber. Constituents, theories of mix design, principal steps in production, physical and mechanical properties of concrete.

### **CE 270 - FLUID MECHANICS**

The course covers the following topics; Physical properties of fluids, hydrostatics, pressure distribution in a fluid at rest, measurement of pressure, hydrostatic forces on surfaces, buoyancy and stability of floating bodies, kinematics of fluids, classification of fluid flow, laws of nature, conservation of mass, momentum and energy principals for fluid flow, Bernoulli equation, energy and hydraulic grade lines, dimensional analysis and model similitude.

## **THIRD YEAR**

### **CE 200 - SUMMER PRACTICE I**

Subjects that are acceptable for summer practice: Surveying, time-keeping, checking and testing construction materials, assisting resident engineers. Preparing quantity and cost estimates, unit price estimates, civil engineering drawings and graphs. Use of computers in elementary civil engineering operations, taking part in construction work. The department may organize a compulsory, collective Summer Practice Program where feasible. (20 working days).

### **CE 301 - NUMERICAL METHODS FOR CIVIL ENGINEERS**

The course covers the following topics: approximations and error, roots of equations, solving systems of linear equations, curve fitting and interpolation, numerical differentiation and integration, solving ordinary differential equations and partial differential equations. The applications of listed topics are carried out using MATLAB.

### **CE 331 - CONSTRUCTION MANAGEMENT**

This course covers following topics; Profile of the construction sector; company and site organization and types of contracts. Construction projects; estimating, tendering, planning and execution. Professional responsibility and engineering ethics. Productivity, quality, health and

safety issues. Construction equipment; selection criteria, hourly cost determination and output analysis of excavators.

### **CE 352 - TRANSPORTATION ENGINEERING**

This course covers the following topics: Introduction to transportation systems, Planning and management techniques, Vehicles, network and terminals as components of transportation systems engineering, Geometric Design of transportation facilities emphasizing land transportation, Introduction to models of traffic flow. Traffic analysis at intersections Basic definitions and computations of level of service.

### **CE 361 - GEOTECHNICAL ENGINEERING**

This course covers the following basic concepts: Overview of geotechnical engineering, Phase relationships; index properties and classification of soils, Compaction of soils, Effective stress theory, Permeability of soils, Consolidation theory, Concept of shear strength of soils.

### **CE 362 - FOUNDATION ENGINEERING**

This course covers the following basic concepts: General Principles of Foundation Design, Site Exploration & Soil Testing (In-situ & Lab), Shallow Foundations, Deep Foundations, Earth Retaining Structures & Lateral Earth Pressures.

### **CE 371 – HYDRAULICS**

General characteristics of flow in closed conduits (laminar and turbulent flows, entrance region and fully developed flow), head losses in pipes, friction energy loss, minor energy loss, computation of flow in a single pipe, pipeline systems (pipes in series, pipes in parallel), multiple reservoir systems (branching pipes and junctions), pipe network (Hardy-Cross method), gravity pipe lines, pumps and pump-pipeline systems, open channel flow (types of open channel flows, pressure and velocity distributions), open channel flow equations (Manning Formula, Chezy formula), specific energy, specific force, Froude number, states (regimes) of open channel flows, hydraulic jump, gradually varied flows, types of slopes, longitudinal flow profiles, design of open channel flows (hydraulically best section, design of erodible and non-erodible channels)

### **CE 372 - WATER RESOURCES ENGINEERING**

Engineering economy in water-resources planning, hydrological cycle, measurements of precipitation, evaporation, evapotranspiration, surface runoff, hyetograph etc., hydrograph, unit hydrograph, hydrograph analysis, S-curve, intensity, frequency and probability analysis, estimation methods relating to discharge and return period of a storm, infiltration indexes, synthetic unit hydrograph, stream flow measurement, groundwater, aquifer, movement of groundwater, Darcy law, wells, multiple well systems (superposition of wells), reservoir, determination of reservoir capacity, reservoir sedimentation and life span of a reservoir, dams, types of dams and spillways, energy dissipating structures (hydraulic jump and stilling basin types) stability analysis of a gravity dam and an earth-fill dam, flood routing.

### **CE 381 - STRUCTURAL ANALYSIS**

The course covers the following topics; Introduction, Review of Statically Determinate Structural Systems, Calculation of structural deformations, Analysis of Statically Indeterminate Structures with Slope-Deflection Method, Moment Distribution Method and Matrix Displacement Method (Stiffness Method).

### **CE 382 - REINFORCED CONCRETE STRUCTURES**

The course covers the following fundamental topics for reinforced concrete theory: Mechanical behavior of concrete in uniaxial and multi-axial states of stress. Time-dependent behavior of concrete. Mechanical behavior of reinforcing steel. Behavior and strength of uniaxially loaded members; confinement. Behavior and strength of members in pure bending. Behavior and strength of members under combined bending and axial load. Behavior and strength of members under combined shear and bending.

## **FOURTH YEAR**

### **CE 300 - SUMMER PRACTICE II**

Subjects that are acceptable for summer practice: Surveying, time-keeping, checking and testing construction materials, assisting resident engineers. Preparing quantity and cost estimates, unit price estimates, civil engineering drawings and graphs. Use of computers in elementary civil

engineering operations, taking part in construction work. The department may organize a compulsory, collective Summer Practice Program where feasible. (20 working days).

### **CE 415 - CIVIL ENGINEERING DESIGN I**

This course focuses on preparation of project design, data gathering, theoretical analysis, technical report preparation and writing, evaluation of data and information, principles of project design relating to civil engineering structures. At the end of the course students prepare and submit project reports and they are evaluated by the lecturer.

### **CE 416 - CIVIL ENGINEERING DESIGN II**

This course is the continuation of CE 415. This course focuses on preparation of project design, data gathering, theoretical analysis, technical report preparation and writing, evaluation of data and information, principles of project design relating to civil engineering structures. At the end of the course students prepare and submit project reports and they are evaluated by the lecturer.

### **CE 481 - STEEL STRUCTURES**

Types and mechanical properties of structural steel, structural systems, failure criteria. Design approaches and design codes, load combinations. Design of tension members. Local buckling of columns and the design of compression members. Design of beams under combined stresses, and beam columns. Bolted and welded connections.

### **ELECTIVE COURSES**

#### **CE 302 - COMPUTER APPLICATIONS IN CIVIL ENGINEERING**

This course covers following topics; Introduction to computer applications in civil and environmental engineering. Integration of design, data management, computer programming and problem-solving skills with computer tools and techniques. Topics include systems analysis, database management, computer programming and data structures.

#### **CE 332 – PROJECT MANAGEMENT IN CIVIL ENGINEERING**

This course covers following topics; definition of a construction project, the construction project life-cycle, contracting, contract management, human resources; project management organization,

role of information and communications in project management, project finance and feasibility, planning and scheduling techniques for a construction project, project monitoring and control, procurement management, site management, quality management, uncertainty and risk management.

### **CE 344 - AIRPORT ENGINEERING**

Overview of construction materials. Data acquisition and identifying critical data related to concrete components. Important concepts for engineered concrete components and related test data. Analysing data on construction materials using graphical visualization. Developing graphical user interfaces for automatization of tasks related to construction materials. Computer applications applied to other construction materials including steel and timber.

### **CE 350 - AIRPORT ENGINEERING**

Airport Engineering encompasses the planning, design, and construction of terminals, runways, and navigation aids to provide for passenger and freight service.

### **CE 364 – LANDFILL DESIGN**

This course will equip students with a basic geo-environmental engineering background that they could apply in the industry or academia. The course content includes key principles and up-to-date technologies to manage waste (municipal and hazardous) produced by humans on this planet and design landfills accordingly based on environmental and governmental regulations. The topics to be covered include the evaluation, site assessment of waste landfills, selection of geotechnical design properties, and detailed knowledge on leachate collection and removal systems.

### **CE 374 – GROUNDWATER ENGINEERING**

Introduction to groundwater engineering. Sources of groundwater, aquifers, groundwater exploration, movement of groundwater, Darcy law, governing equations of groundwater, wells in confined and unconfined aquifers, superposition of multiple wells, image method, well and filter design, drainage of wetland, drainage of foundation of construction, flow-net.

### **CE 426 – FINITE ELEMENTS IN STRUCTURAL MECHANICS**

This course covers the following topics; a review of matrix algebra, beam theory and governing equations, matrix structural analysis; work, potential and kinetic energy, and variational and energy methods; finite elements, finite element formulations, isoparametric finite elements, isoparametric finite element formulations, variation, variational formulations of the finite element method and some applications in structural mechanics.

### **CE 441 – CEMENT BASED MATERIALS**

Cement, aggregates and admixtures for concrete, properties of concrete in fresh and hardened state, types and various aspects of concrete, durability characteristics of concrete, future of concrete studies and environmental aspects of concrete as a construction material.

### **CE 444 – MATERIALS FOR INFRASTRUCTURAL APPLICATIONS**

Mechanical and durability properties of conventional construction materials that are used in the current and past infrastructural systems. An analysis of infrastructural systems in the light of necessary materials properties, properties of advanced materials and composites emerged as potential infrastructural materials and their feasibility analysis.

### **CE 448 – SPECIAL TOPICS IN CIVIL ENGINEERING (CONSTRUCTION MATERIALS)**

Special topics in civil engineering relating to the field of construction materials.

### **CE 451 – TRAFFIC ENGINEERING AND MANAGEMENT**

Introduction to fundamentals of urban and rural traffic engineering, including data collection, analysis, and design focusing rural traffic operations. Traffic engineering studies, traffic control devices, capacity and level of service analysis of freeways and urban streets.

### **CE 454 – HIGHWAY MATERIALS AND MIX DESIGN**

Description of payments, features of pavements, construction of asphalt and concrete pavements, materials of layers, mix design, standards, flexible pavements, rigid pavements, subgrade soil, soil



stabilization, aggregates for concrete and asphalt mixes, asphalt and emulsion, maintenance and rehabilitation of pavements

### **CE 456 – SPECIAL TOPICS IN CIVIL ENGINEERING (TRANSPORTATION)**

Special topics in civil engineering relating to the field of Transportation.

### **CE 462 - DEEP EXCAVATIONS AND RETAINING STRUCTURES**

This course is an introductory course on the design of retaining structures for deep excavations. The course content includes types of retaining walls, water pressure acting on earth retaining systems and related problems, lateral earth pressure acting on earth retaining systems, lateral supporting elements: Ground anchors, struts and soil nails. The design details covered in the course includes: Types, components, production and installation, dimensioning, bearing capacity, corrosion protection, testing and pre-stressing of ground anchors. Lateral and vertical displacements of adjacent ground. Modes of failure of retaining systems. Sloped excavations in soil and rock. Instrumentation and monitoring of deep excavations. Soil nailing: system description and design.

### **CE 463 – PILE FOUNDATIONS**

The course is designed to provide students with the necessary background to evaluate, analyze and design pile foundations for different soil conditions. This course covers the following topics: Pile types, bearing capacity of piled foundations, settlement of piles and lateral capacity of piles.

### **CE 464 – SPECIAL TOPICS IN CIVIL ENGINEERING (GEOTECHNIC)**

Special topics in civil engineering relating to the geotechnical field.

### **CE 465 - SLOPE STABILITY IN SOILS**

The course is designed to provide students with the necessary background to evaluate, analyze and if required to mitigate natural and man-made slopes. This course covers the following topics: Types of landslides; factors affecting the stability of landslides including seepage; evaluation of

shear strength parameters for the evaluation of slope stability; planning of field investigations; the limit equilibrium method for the analysis of slope stability; alternative stabilization methods; slope monitoring techniques, seismic slope stability analyses and rock slope stability and stabilization techniques.

### **CE 466 – INTRODUCTION TO ROCK MECHANICS**

This 3-credit hour introductory course is on the basic subjects of Rock Mechanics which is an applied branch of Geotechnical Engineering. The course topics include physical properties of intact rocks and rock masses, characterization of rock materials, stresses and strains, effective stresses, deformability and strength characteristics of rock materials and masses, failure criteria, field and laboratory testing, thermal, mechanical and hydraulic properties of rocks. Special attention is also attributed to the application of Rock Mechanics for engineering applications/purposes such as foundations of engineering structures on rocks, deep excavations, and underground openings in rocks and/or underground storage together with rock slope stability.

### **CE 468 – INTRODUCTION TO GROUND IMPROVEMENT TECHNIQUES**

This course is an introductory course on ground improvement techniques for problematic soils. The course content includes site investigation techniques, laboratory and in-situ soil testing techniques and ground improvement techniques. The improvement techniques covered in this course are surface and deep compaction; soil stabilization with admixtures; deep mixing method; preloading and vertical drains, dewatering; in-situ densification; geotextiles and reinforced earth.

### **CE 472 – SEDIMENT TRANSPORT**

Properties of sediment, shape factor, fall velocity, types of sediment transport, suspended sediment concentration distribution in one dimensional flow, suspended sediment concentration in a two-dimensional stream flow, sediment movement at the bed, initiation of particle movement, critical shear stress and Shields diagram, bed forms and their resistance to flow, bed load computation methods, measurement of sediment transported in streams, computation of total sediment load transported in a stream, reservoir sedimentation, scouring at hydraulic structures and bridge piers, scouring due to jets, river training and protection structures against scouring, sediment control structures for intakes, design of a settling basin.

### **CE 473 - WATER SUPPLY AND WASTE WATER**

Introduction to water supply on a sewerage system, sources of water, water intake types, treatment of water, determination of water demand, prediction of population, determination of reservoir capacity, mass-curve, water supply lines, pipe networks, disposal of wastewater, computation of waste water (sewerage) system, computation of rain water drainage.

### **CE 475 – DIMENSIONAL ANALYSIS AND THEORY OF HYDRAULIC MODELS**

The course covers the following topics: fundamental principles of dimensional analysis, dimensions and units, general transformation of units of measurement, dimensional homogeneity, Buckingham's II Theorem, complete set of dimensionless products in fluid mechanics, geometric-kinematic- dynamic-complete and incomplete similarities, distorted modeling, modeling of closed- conduit and free-surface flows, similarity in sediment transport.

### **CE 476 – SPECIAL TOPICS IN CIVIL ENGINEERING (HYDRAULICS)**

Special topics in civil engineering relating to the field of hydraulics.

### **CE 477 – DESIGN OF HYDRAULIC STRUCTURES**

The course covers the following topics: Introduction to hydraulic structures and dam design concepts. Design of; diversion structures, bottom outlets, spillways and energy dissipaters and intake structures. Hydraulic losses, vortex formation, control gates and valves.

### **CE 482 – DESIGN OF TALL BUILDINGS**

This course provides an introduction to fundamental principles of designing tall buildings. Specific topics of this course include: tall building concept, design philosophy, height and structural form, wind effect, earthquake loadings, tall building behaviour of: rigid frames, braced frames, in-filled frames, shear walls, wall-frames, tubular and hybrid mega systems, stability, overall buckling analysis, P-Delta analysis, case studies, computer applications.

### **CE 483 – ADVANCED STRUCTURAL ANALYSIS**

This course covers advanced methods in structural analysis in 2D and 3D. In this course special structural analysis techniques such as static condensation, rigid end zones, member end releases

are discussed. The students are introduced to the use and the theoretical background of commercial structural analysis software.

#### **CE 484 – PRE-STRESSED CONCRETE FUNDAMENTALS**

This course introduces the fundamental mechanics of pre-stressing and its applications to concrete structural elements. In this course, pre-stress losses, flexural and shear design of pre-stressed concrete structural members, deflection calculations are discussed.

#### **CE 485 – INTRODUCTION TO STRUCTURAL DYNAMICS**

The course is a prelude to more advanced courses in earthquake engineering and structural dynamics. Its outline consists of: Dynamic disturbances. Equations of motion for single and multi-degree of freedom systems. Applications in structural analysis. Earthquake response of structures.

#### **CE 486 – EARTHQUAKE RESISTANT DESIGN OF BUILDING STRUCTURES**

This course covers the following topics: introduction to earthquake engineering, characteristics of ground motions, response analysis of single and multi-degree of freedom systems, introduction to seismic building codes, strength and ductility concepts, lateral load resisting systems, analysis of buildings using equivalent static method, response spectrum analysis, design of reinforced concrete buildings, capacity design, introduction to performance-based design and evaluation.

#### **CE 488 – SPECIAL TOPICS IN CIVIL ENGINEERING (STRUCTURE)**

Special topics in civil engineering relating to the field of structure.