



# **B.Sc. CURRICULUM COURSES**

**Civil Engineering  
Department**

College of Engineering / Civil of Engineering / First class

Code	Subject	First Course			Second Course			Unit No.
		Theor y	Prac.	Tut.	Theor y	Prac.	Tut	
CE101	Mathematics I	4	-	1	4	-	1	8
CE102	Engineering mechanics	4	-	1	4	-	1	8
CE103	Principle of computer Science	2	2	-	2	2	-	6
CE104	Engineering drawing	-	4	-	-	4	-	4
CE105	Engineering statistic	1	-	1	1	-	1	2
CE106	Engineering geology	1	-	1	1	-	1	2
CE107	Electrical Engineering	1	2	-	-	-	-	2
CE108	Descriptive geometry	-	-	-	-	2	-	1
CE109	Human right and Democracy	2	-	-	2	-	-	4
CE110	Arabic Language	-	-	-	1	-	-	1
Total		15	8	4	15	8	4	38

**CE101 Mathematics ( 4 / - / 1 )**

- matrices, matrices and determinants and their applications / eigenvalues and vectors of self-
- a review of calculus, coordinates, draw level, slope and straight line equations, functions and drawn, circles, parabolas, Altazhev, review the trigonometric functions, absolute value.
- goals, goals that have indefinitely
- derivatives, tilt, tangent line, the laws of derivation, speed and rates of change, derivatives of trigonometric functions, chain rule, implicit derivation, Wallace fractional, linear approximation and differentiation.
- applications of the derivative, rates of change, endings, large and small, the theory of the average value, draw a curved Palmstqh the first and second drawing functions fractional ideal, unlike derivatives, the initial value problems,
- integration, differentiation, integration, space, definite integral, fundamental theorem of integral calculus, non-specific integration, integration by substitution, numerical integration, introduction to exponential and logarithmic function.
- Applications of definite integral, area between curves, volumes of objects rotating, disk and Allowacher, cylindrical volumes, the length of the curve in the plane, the surface area of revolution.
- vague functions (transcendental), inverse functions and their derivatives, logarithmic function, exponential function, the derivation logarithmic, inverse

trigonometric functions and their derivatives and integrals related

- methods of integration, the basic laws of integration, partial integration, integration of trigonometric functions and relative and fractional

### **CE102 Engineering Mechanics ( 4 / - / 1 )**

- Introduction Static Engineering Mechanics (1 week)
- To provide the basic quantities and idealization of mechanics,
- To give a statement of Newton's Law of Motion and Gravitation,
  - To review the principles for applying the SI system of units,
- Force system, and Resultant (2 weeks)
  - To present methods for determining the resultants of forces and its location,
  - Your first step towards understanding how to work with forces will be learning to determine forces acting on objects in equilibrium.
- Moment of Force
  - To discuss the concept of moment of force and show how to calculate it,
- The Couples
  - To define the moment of couple,
  - To indicate how to reduce a simple distributed loading to a resultant force having a specified location.
- Equilibrium and Applications
- Introduce the concept of the free – body diagram for a particle, and to show how to solve particle equilibrium problems using the equations of equilibrium.
- Structure Analysis –Trusses (Joints method)
- Structure Analysis –Trusses (Sections method)
- Structure Analysis –Frames
- The Friction
  - To introduce the concept of dry friction and show how to analyze the equilibrium of rigid bodies subjected to this force.
- To investigate the concept of rolling resistance.
- The Center of Gravity, and Centroid
- Discuss the concept of the center of gravity, and centroid, and to show how to determine the location of center of gravity and centroid of bodies.
- The Moment of Inertia
- Mohr's Circle
- Introduction Dynamic Engineering Mechanics

### **CE103 Principle of Computer Science ( 2 / 2 / - )**

- general introduction about computers.
- parts of computer
- number systems (binary, decimal)
- windows operating system
- ms-dos operating system
- algorithms and flow charts
- microsoft word program
- microsoft power point program
- programming using fortran language (introduction and history)
- symbols used in fortran languages
- constants and variables
- statements in fortran:
  - (input, output) statement
  - control statements:
    - stop, end statements
    - unconditional goto statement
    - conditional goto statement
    - logical if statement
    - if--- then statement
    - if--- then –else statement
    - if--- then statement nested
    - arithmetic if statement
    - arithmetic operation
    - logical and relational operations
    - do—loop statement
    - conditions of do-loops statement.
    - 13-subscripted variables.
    - input, output statements of subscripted variables.
    - one dimensional subscripted variables
    - two dimensional subscripted variables
    - three dimensional subscripted variables
  - application and exercises
  - properties of matrices.
  - subprogram:
    - functions: built in functions
    - arithmetic statement function
    - external function
    - subroutines
    - applications and exercises



## CE104 Engineering Drawing ( - / 4 / - )

- Introduction and identify the graphic language in theory and practices
  - Graphic instruments and their uses.
  - How to use the drawing board, drawing sheet.
  - Drawing sheet out lines and title block.
- Types of lines in Engg. Drawing .
  - Full lines (visible out lines), Dashed lines (invisible out lines), center lines, dimensions lines, Section lines
  - Types of pencils used in Engg. Drawing
  - Exercises (Two sheets)
- Drawing of simple Engg. Shapes
  - Scales; definition and types: civil and mechanical.
  - Drawing some Engg. Simple shapes with variable scales.
  - Exercises in the use of instruments and scale, (Two sheets)
- Graphic Geometry
  - How to identify and uses of graphic geometry
  - To draw a line parallel to and a given distance from a line.
  - To divide a line to equal divisions.
  - To bisect a line.
  - To divide an angle into equal parts.
  - An arc tangent at right-angle corner, an arc tangent to two straight lines: acute and obtuse angles.
  - An arc tangent to a straight line and circle, two circles from inside and from out side .
  - An arc tangent to a line and passing through a point.
  - Exercises (Three sheets)
  - Construction of regular engineering shapes: regular and irregular triangles, the pentagon, hexagon, heptagon and octagon.
  - To construct the regular polygons inside and outside a circle.
  - Tangents and tangency points.
  - To draw a reverse or Ogee curve, Ellipse.
  - Ellipse construction by parallelogram method.
  - Ellipse construction by concentric circle method.
  - Ellipse construction by four-centered method.
  - Exercises (Three sheets)
- Orthographic Drawing and Sketching.
  - Types of projection.
  - Projection with parallel and perpendicular rays.
  - Projection with inclined rays.
  - Theory and details of the orthographic projection.
- Projection of third double corner

- Types of views in orthographic projection, Front view, Top view, Right side view, and left side view.
- The relative position of the six views.
- Exercises (four sheets)
- Projection of inclined surfaces with different details.
- Projection of cylinders
- Exercises (two sheets)
- Pictorial Drawing and sketching.
  - Types of pictorial drawings, isometric, diametric and trimetric.
  - Isometric axes.
  - The relationship between the given views and imagination drawing of the isometric body.
  - Exercises (three sheets)
  - Isometric bodies on inclined surfaces with different angles.
  - Exercises (three sheets).
- Missing third views of bodies
  - How to find the missing view from two given views.
  - Missing view with inclined surfaces.
  - Isometric drawing then, the missed view drawing
  - Exercises (three sheets)
- Dimension and notes.
  - Principles used in dimensioning.
  - Types of pencils used in dimensioning and notes writing.
  - Exercises (three sheets)
- Sectional Views.
  - Types of cutting planes: full section, offset section, half section, rotated section and removed section.
  - Principles used in sections.
  - Section-Lining (cross-hatching) in sectional views.
  - Parts not sectioned as webs, ribs, and lugs.
  - Cutting planes for alignment, aligned ribs, lugs and holes.
  - Drawing by using autocad drawing (2<sup>nd</sup>.Sem.)

### **CE105 Engineering Statistic ( 1 / - / 1 )**

- The Role of Statistics in Engineering
  - Introduction.
  - Nature of statistical symbols.
  - Presentation of statistical symbols
  - Definitions
- Frequency Distributions
  - Frequency Distribution Table.
  - Cumulative Frequency Distribution Table .

- Graphical presentation: Frequency Distribution.
- Graphical presentation: Cumulative Frequency Distribution.
- Measures of central location
  - The Mean (Arithmetic, Geometric, Harmonic and Root mean squares).
  - The Median.
  - The mode.
- Measures of Dispersion or Variation
  - Range.
  - Mean Deviation.
  - Standard Deviation.
  - Variance.
  - Coefficient of variation.
  - Standard errors.
  - Standard error of the mean.
- Computer Application
  - Introduction to Origin Pro8.
  - Introduction to SPSS software.
  - Computer Application USING Origin Pro8.
  - Computer Application USING SPSS software.
- Random Variables and Probability Distributions
  - Introduction.
  - Random variables.
  - Probability Distributions.
  - Probability Distribution Function.
  - Probability Mass Function for Discrete.
  - Density Function for Continuous Random Variables.
- Discrete probability Distribution
  - Binomial Distribution.
  - Poisson Distribution.
- Continuous Probability Distribution(Gaussian or Normal Distribution)
  - Z. Distribution.
  - T distribution.
  - F distribution.
  - Chi – square distribution.
- Sampling Theory
  - sampling distribution of the mean.
- Estimation Theory
  - Introduction.
  - Point or Interval Estimation.
  - Confidence level in Estimation.
  - Interval for means.
  - The choice of sample volume.
  - Interval for differences between two sample means.



- Interval for Variance.
- Interval for proportion between two Variances.
- Statistical decision Theory
  - Test of Hypothesis Null and alternative.
  - Level of significance and The regions of rejection and acceptance .
  - Test of Means.
  - Test of differences between two sample means.
  - Test of Variance.
  - Test of proportion between two Variances.
  - Simple Regression and Correlation
  - Introduction.
  - Linear regression equation.
  - Linear correlation coefficient.
  - Test of significance of correlation coefficient.
  - Confidence interval for correlation coefficient.
  - Test of Chi – square distribution.
- Test of chi-square for two variable
- Test of chi-square for two variable

### **CE106 Engineering Geology ( 1 / - / 1 )**

- Introduction:
  - Engineering Geology Definition
  - Arabic Scientists Contributed in Geology
  - Relationship between Geology and Civil Engineering
- Our Global Earth and Composition of Earth Crust:
  - Internal Composition of Global Earth
    - Core
    - Mantle
    - Crust
- Minerals:
  - Type of Minerals
    - Non-Silicate Minerals
    - Silicate Minerals



- Physical properties of Minerals
- Light properties
- Stiffness properties
- Sensory properties
- Other properties
  - Crystal form of minerals
- Crystal Characteristics
- Similarity in the Crystals
- Crystals system
- Igneous Rocks:
  - Introduction
  - Types of Igneous Rocks
    - Extrusive Rocks
    - Intrusive Rocks
      - Classification of Igneous Rocks
- mode of formation
- Texture
- Mineralogical composition
- Chemical composition
  - Examples on Igneous Rocks
- Sedimentary Rocks:
  - Introduction
  - Formation factors of Sedimentary Rocks
  - Advantages of Sedimentary Rocks
  - Classification of Sedimentary Rocks
    - Mechanical or Clastic Sedimentary Rocks
    - Chemically formed Sedimentary Rocks
    - Organic Sedimentary Rocks
      - Examples on Sedimentary Rocks
- Metamorphic Rocks:
  - Introduction
  - Metamorphism factors
    - Heat
    - Pressure
    - Effective Fluids
      - Types of Metamorphism
- Contactor Thermal Metamorphism
- Regional Metamorphism
- Dynamic Metamorphism
  - Types of Metamorphic Rocks
- Foliation Rocks
- Non-Foliation Rocks
  - Examples on Metamorphic Rocks

- Weathering, Denudation and Soil Formation:
  - Introduction
  - Weathering
    - Mechanical Weathering
    - Chemical Weathering
  - Soil Formation
- Soil Definition
- Geological Classification of Soil
- Engineering Classification of Soil
  - Soil in Iraq
- Geological Structures and Earth Movements:
  - Introduction
  - Structural Geology
  - Geological Structures
    - Inclined Stratum
    - Unconformities
    - Folds
    - Faults
    - Joints
  - Effectiveness of Geological Structural on the Engineering Constructions
- Engineering Properties of Rocks:
  - Introduction
  - Physical or Index Properties of Rocks
  - Mechanical Properties of Rocks
  - Dynamic Properties of Rocks
- Site Investigation:
  - Introduction
  - Stages of Site Investigation
    - Reconnaissance of the area
    - Detailed Site exploration
    - Foundation exploration
      - Significance of connection between Engineering and Geological Investigation.
- Waters:
  - Introduction
  - Surface waters
  - Rivers
    - Nature of Rivers
    - Stages of River development
  - Ground water
    - Economical and Engineering Significance
    - Ground water sources
    - Types of Ground Storage

- Factors effect on the Ground water Flow
- Springs
- Types of Spring
- Topographic and Geological Maps:
  - Introduction
  - Topographic Maps
  - Significance of Topographic Map
  - Parts of Topographic Map
  - Properties of Contour Line
  - Drawing method of Topographic Profile from Contour Map
  - Scale
  - Geological Maps

### **CE107 Electrical Engineering ( 1 / 2 / - )**

General principals for electrical shocks protection, Electrical works and supply for buildings in general , Home-work problem for electrical installation electrical, Earth system for building in general, Conductive material, Insulated material, Protection system in electrical works in general , The importance of hawses electrical equipment and their distribution of inside the house , Practical, Lamps installation, Electrical bell - installation, Florescent cercuit installation , Two-way lamp-installation for stairs , Electrical iron cercuit installation, Checking cercuit installation, Hair driers cercuit installation

### **CE108 Descriptive Geometry ( - / 2 / - )**

- Theories of projection
- Projection of a point in the space on the main planes with practical problems
- The special cases of the straight line in the space with practical problems
- The usual cases of the straight line in the space with practical problems
- The Frontal straight lines and laminas with practical problems
- Projection of straight lines and Engineering regular Laminas on the Main and Auxilary planes then practical problems on the subject
- Projection of Engineering regular Bodies with practical problems

### **CE109 Human right and general freedoms ( 2 / - / - )**

Origins of human right and its progress in human history , Human rights – Limitation Definition and guarantee, General freedoms , General theory for general freedoms , Law system for general freedoms, Guarantee for general freedom , Concept of equality , Classification of general freedoms , Basic of personal

freedoms, Freedom of free travel (movement), Personal freedom , Work freedom , Possession freedom , Trade & Commercial freedom.

**CE110 Arabic Language ( 1 / - / - )**

**College of Engineering / Civil of Engineering / Second class**

code	Subject	First Course			Second Course			Unit No.
		Theory	Prac.	Tut.	Theor y	Prac.	Tut	
CE201	Mathematics II	3	---	1	3	---	1	6
CE202	Strength of materials	3	---	1	3	---	1	6
CE203	Computer programming	1	2	---	1	2	---	4
CE204	Engineering survey	2	3	---	2	3	---	7
CE205	Materials technology	2	2	1	2	2	1	6
CE206	Fluid mechanics	2	1	1	2	1	1	5



CE207	Building construction	2	---	---	2	---	---	4
CE208	Air construction principles	2	---	---	---	---	---	2
Total		17	8	4	15	8	4	40

### CE201 Mathematics II ( 3 / - / 1 )

Review of conic sections, Hyperrbolic function, Partial differentiation, Multiple integrals, Vectors, Complex numbers, Differentiation equation , Series.

### CE202 Strength of Material ( 3 / - / 1 )

- Simple Stress
- Shearing stress
- Bearing stress
  
- Simple Strain
- Poisson's ratio
- Statically indeterminate members
  
- Torsion
  
- Shear And Moment In Beams
- Shear and moment diagrams
  
- Stresses In Beams
  
- Beam Deflections
- Combined Stresses
- The kern of a section
- Mohr's circle
- Reinforced Beams
- Columns
- Riveted And Welded Connection
- Structural riveted joints
- Eccentrically loaded riveted connections
- Welded connections
- Computer Applications

### CE203 Computer Programming ( 1 / 2 / - )

- The visual basic programming environment
- Starting a new project
- Working with standard projects
- Introduction to form
- Working with form
- Form projectiles
- Code form
- Events
- Form layout
- The project explorer
- The tool box
- The properties window
- Menu
- \*-working with controls
- The text box and comment button
- Properties      b-application examples      c-events
- Example of calculator (deal with text and comment button)
- The list box
- A-properties      b-application examples      c-events
- The combo box
- Properties      b-application examples      c-events
- Exam
- The option button
- Properties      b-application examples      c-events
- The check box and frame
- Properties      b-application examples      c-events
  
- The timer
- Properties      b-application examples      c-events
- The scroll bar
- A-properties      b-application examples      c-events
- Picture box and image box
- A-properties      b-application examples      c-events
- Drive list box ,directory list box , file list box
- A-properties      b-application examples      c-events
- Application example for display input data types in visual basic with tool box
- Application example for display loops in visual basic with tool box
- Application example for display array in visual basic with tool box
- Application example for display use array in visual basic language
- Files
- Types file in visual basic

- Opening and closing a file
- Reading from a file
- Writing to a file
- Getting the file name
- Example
- File application example
- Exam
- Graphics
- Form measurement
- Form coordinates
- The move method
- Drawing line
- Drawing circle
- Example in graphic (bending moment diagram)
- Example in graphic (moher circle)
- Example in graphic(drawing)

### **CE204 Engineering Survey ( 2 / 3 / - )**

- Definitions and basic terminology of Surveying.
  - Types of Surveying
    - Types of Errors
  - Mistakes, random, systematic
    - Scales
  - Methods of representing scale of the map
- -Tape measurements and corrections
  - Standard Length, Temperature, Sag, Slope, pull, Corrections
    - Tape traverse and corrections
  - Mapping small areas, Traverse correction using graphical method.
- -Leveling Principles
  - Definition, Composition of a level, Types of levels,
    - Setting up the level, HI and Rise and Fall methods
    - Earth curvature and atmospheric correction.
    - Reciprocal leveling
    - Check leveling and closing error.
    - Two peg test
- -Profiles and cross sections
  - Choosing the appropriate horizontal and vertical scales.
    - Contouring.
  - Contour Interval, Methods of contouring, How to interpolate the location of a contour line.
    - Theodolite for angular measurements

- Theodolite composition and parts. Centering and leveling. Reading the angle according to different types. Face Right and Face left readings for better angular precision.
- -Theodolite traverse
  - Loop and open traverses, Correcting angles, Compass rule for traverse correction.
    - Tacheometry using theodolites
- Stadia hairs. Finding distances and levels
  - Total Station Surveying
- EDM, microwave , lase and IR.
- The meaning of EDM Accuracy (ppm)
- Areas
  - Areas for regular and irregular figures.
  - Trapezoidal and Simpson rules.
  - Coordinates method.
  - The Planimeter
    - Volumes
- Method of longitudinal sections
- Method of cross sections
- Method of grid levels
- Method of contours.
- -Horizontal Curves.
- Curve definition and symbols, Types of Curves
- Method of taping
- Single theodolite method
- Two theodolites method.
  
- -Vertical Curves
  - Summit and Sag Curves
  - Parabolic formula for solution
  - -GPS principles

### **CE205 Material Technology ( 2 / 2 / 1 )**

- CEMENTS & ADMIXTURES: Portland cement – chemical composition – Hydration, Setting of cement – Structure of hydrate cement – Test on physical properties – Different grades of cement – Admixtures – Mineral and chemical admixtures.
- AGGREGATES: Classification of aggregate – Particle shape & texture – Bond, strength & other mechanical properties of aggregate – Specific gravity, Bulk density, porosity, adsorption & moisture content of aggregate – Bulking of sand –Alkali aggregate reaction – Thermal properties – Sieve analysis –



Fineness modulus – Grading curves – Grading of fine & coarse Aggregates – Maximum aggregate size.

- FRESH CONCRETE: Workability – Factors affecting workability – Measurement of workability by different tests – Effect of time and temperature on workability – Segregation & bleeding – Mixing and vibration of concrete – Steps in manufacture of co
- HARDENED CONCRETE: Water / Cement ratio – Abram's Law – Nature of strength of concrete – Strength in tension & compression – Factors affecting strength – Relation between compression & tensile strength - Curing.
- TESTING OF HARDENED CONCRETE: Compression tests – Tension tests – Factors affecting strength – Flexure tests – Splitting tests – Non-destructive testing
- methods.
- ELASTICITY, CREEP & SHRINKAGE: Modulus of elasticity – Dynamic modulus of elasticity – Poisson's ratio – Creep of concrete – Factors influencing creep – Relation between creep & time – Nature of creep – Effects of creep – Shrinkage – types of shrinkage.
- MIX DESIGN : Factors in the choice of mix proportions – Durability of concrete – Quality Control of concrete – Statistical methods – Acceptance criteria – Proportioning of concrete mixes by various methods by BS & ACI.
- SPECIAL CONCRETES: Light weight aggregates – Light weight aggregate concrete – No-fines concrete – High density concrete – Fibre reinforced concrete – Different types of fibres – Factors affecting properties of F.R.C – Applications – High performance concrete – Self consolidating concrete .

## **CE206 Fluid Mechanics ( 2 / 1 / 1)**

- Static fluid
- Static forces on submerged surfaces
- Pressure at point
- Basic equation for static fluid
- Types of pressure
- Pressure measurement
- Fluid properties
- Fluid definition
- Units and dimensions
- Viscosity
- Density
- Specific volume
- Specific weight

- Bulk modulus of elasticity
- Surface tension
- Newton's law in viscosity
- Forces on submerged plain surfaces
- Forces on submerged curved surfaces
- Buoyancy and flotation
- Stability of submerged and floating bodies
- Accelerated fluids
- Kinematics of fluid motion/ types of flow
- Mass conservation law/ continuity equation
- Energy conservation law/ bernolli's equation
- Application of bernolli's equation
- Analysis of free liquid jet
- Computing the head of pump and turbine in pipe lines
- Study the flow throw orifice in a tank
- Flow measurement
- Flow rate measurements
- Venture meter
- Orifice meter
- Nozzle meter
- Pitot tube
- Sluice gate
- Weirs
- Momentum conservation law/ momentum equation
- Applications of momentum equation
- Computing the force exerted by fluid on pipe bends, enlargements, contractions and distributors
- Computing the force exerted by liquid on the structures in the open flow
- Study the flow through hydraulic jump
- Calculate the force exerted by a free jet on the surface
- Flow of real fluids in pipes
- Real fluid
- Laminar flow
- Turbulent flow
- Reynold's number
- Head loss
- Sheer stress
- Velocity distribution in laminar flow
- Darcey equation
- Effect of boundary surface roughness on head loss due to friction
- Minor head losses in pipe lines
- Pipes in parallel

- Kinematic similarity
- Dynamic similarity
- Pipe in series
- Branching pipes
- Flow in open channels
- Critical flow, subcritical flow and supercritical flow
- Uniform flow equation
- Chezy equation
- Manning equation
- Best hydraulic and economic section
- Similarity
- Geometrical similarity
- Flow around immersed bodies

### **CE207 Building Construction ( 2 / - / - )**

- Introduction
- It includes the necessary procedures for executing any engineering project which consists of putting the opinion of the project and all required details about it, required engineering designs, methods of executing, in addition to that, types of buildings according to the method of executing based on the structured design.
- Earth Works
- It includes the methods which are used in excavations (Manual excavation and Mechanical excavation) and the aim of each machine for cutting and transporting according to the nature of soils, methods which are used for drying the site of project and lowering the water table, Earth Works includes earth filling, materials which are used for earth filling in addition to that, compacting of the earth filling and the mechanical equipment which are used in large projects and inside buildings.
- Footing and Foundation
- Types of footings (wall footing, strip footing, isolated footing, combined footing, cantilever footing, continuous footing, raft footing, buoyancy foundation, piers), settlement of foundation, types of settlement.
- Piles
- Uses of piles, classification of piles according to the method of transferring the loads to the soil, types of piles according to its materials, precast concrete piles, prestressed precast concrete piles, piles cast in place. steps performing this type of piles, timber piles, steel piles, sheet piles.
- Concrete Works
- Transporting of concrete, methods which are used in transporting concrete (wheel barrow, concrete damper, truck mixer, tower cranes and portal cranes, concrete pumps, placement of concrete on forms and without forms, notes which take in to account during the placement of



concrete, compaction of concrete, methods which are used in compaction of concrete, manual compaction, mechanical compaction by using vibrators and finally finishing the surfaces of concrete.

- Brickwork and Blockwork
- Introduction which includes types of bricks, method which is used in manufacturing of clay brick, types of clay brick, properties and specifications of bricks, masonry blocks, brickwork, types of bond (heading bond, stretching bond, English bond, Flemish bond, double Flemish bond, single Flemish bond, hollow bond, garden wall bond, and pattern bond), method of wall construction, toothing racking, thickening, factors affecting the compressive strength of masonry walls, determination the thickness of walls according to structural and non structural requirements, pointing and jointing, types of strucks, mortars and binders, its good properties, types of mortars which include cement mortar, cement-lime mortar, lime mortar, gypsum mortar, clay mortar, and their good and poor properties, selection of mix proportion.
- Masonry Works
- It includes the construction of walls by using stone, Forms resulting from preparation of stones, construction of walls with flat surface stone, coating of walls with marbles and another building stones, construction of ordinary walls by using another type of stone (random rubble, squared rubble), finishing the joints of walls, types of mechanical bond which are used in construction of masonry walls.
- Forms Work
  - Type of forms (timber forms, steel forms, plastic forms) component of timber forms, factors affecting the design of form, , failures of forms, stripping time of forms.
- Beams and Columns
- Labels of beams, steel beams, steel trusses, types of steel truss, reinforced concrete beam, drawing of longitudinal and cross sections of continuous reinforced concrete beams, composite beam cross section drawing , columns, classification of steel columns, boundary condition of the columns ends, concrete columns and sketches.
- Floors And Roofs
- Type of loads applying on floors and roofs, Type of floors (jack arching, reinforced concrete floors), Type of reinforced concrete floors (one way slab, two way slab, flat slab, ribbed slab, waffle slab and concrete joists floor), floor and roof finishes, floor finishes using concrete (cast in place, precast), floor finishes using tiles ( cast in place, precast), floor finishes using ceramic tiles.
- Damp Proofing
- Effects of dampness on buildings, sources of dampness, damp proofing materials and its good properties, types of damp proofing materials (fibrous asphalt felt, slate, asphalt, ceramic tile, glazed brick, lead sheet, asphaltic paints, copper sheet, water proofers, polythene, asphaltic mastics, epoxy resin sand,



plastic materials), methods used for stopping the dampness in plain and inclined roofs. Treatment of ground floors , walls and basements.

- Finishing of Walls And Ceilings
- Finishing the interior walls, by using plastering, aim of plastering, nature of the finishing. Number of plastering layers, initial treatment of walls, ordinary plastering, rendering with stretch edge timber. Notes about plastering, ceramic tiles finishing, roof plastering, cement plastering of exterior walls and roofs finishing. Ordinary cement plastering, rendering with stretch edge timber. Final surface plastering (fair and coarse faces). Marblex. Marble coatings, paints, types of paints, painting.
- Doors and Windows
- Types of doors according to their places, opening and materials, timber doors, paneled door, flush door with detailed sketches, windows, components of window, types of windows according to the movement of their sashes, dimensions of windows, glaze, types of glazes.
- Means of moving between levels
- Stairs, dimension of stair and steps, method of drawing the longitudinal section ,examples about straight stair, types of stairs according to their shapes, notes bout stairs, balustrade.
- Joints in Buildings
- Construction joints, types of Construction joints with detailed sketches, expansion joints(limitations of using expansion joints), calculation the wide of expansion joints, methods of expansion joints treatment.

## **CE208 Air Conditioning Principles ( 2 / - / - )**

Definition (dry- bulb, wet bulb, humidity, humidification) , Heat transfer-conduction, convection, radiation, Primary heat load calculation, Primary cooling load calculation, Heat transmission from deferent wall material and class , Air-conditioning equipment, Cooling by air cooler, Summary and example for cooling & heating.

Code	Subject	First Course			Second Course			Unit No.
		Theor y	Prac.	Tut.	Theor y	Prac.	Tut	
CE301	Engineering analysis and numerical methods	2	1	1	2	1	1	5
CE302	Theory of structures	3	---	1	3	---	1	6
CE103	Soil mechanics	2	1.5	1	2	1.5	1	5.5
CE104	Reinforced concrete	3	---	1	3	---	1	6
CE305	Highway Engineering	2	1.5	---	2	1.5	---	5.5
CE306	Environmental engineering	2	1	---	2	1	---	5
CE307	Hydrology	2	---	---	---	---	---	2
CE108	Hydraulic structures	---	---	---	2	---	---	2
CE309	Management and economy	2	---	---	2	---	---	4
Total		18	5	4	18	5	4	41

### CE301 Engineering Analysis and Numerical Methods ( 2 / 1 / 1 )

#### a. Engineering Analysis

- Linear differential equations :
- Homogeneous linear differential equations of second order
- Homogeneous equations with constant coefficients
- General solutions, initial value problems
- Equations of order n with constant coefficients
- Nonhomogeneous equations
- Nonhomogeneous equations solving by the method of undetermined coefficients
- Applications
- Forced oscillations
- Analysis of beams
- Analysis of beams rest on elastic foundation
- Analysis of beam-column
- Buckling of columns

- System of differential equations
- Solution of system of equations using the operator D
- Applications
- Fourier series
- Periodic functions
- Trigonometric series
- Fourier series
- Function of any period  $p=2l$
- Even and odd functions
- Half-range expansions
- Applications
- Analysis of simply supported beams.
- Represent the concentrated load by half-range sine series
- Analysis of beams rest on elastic foundation
- Analysis of beam-column
- Buckling of columns
- Forced oscillations
- Partial differential equations :
- Basic concepts
- One dimensional wave equation
- Free longitudinal vibrations of prismatic beams
- One dimensional heat equation
- One dimensional Consolidation equation
- Free transverse vibrations of prismatic beams
- Two dimensional Laplace equation

b. Numerical Methods

- Numerical Methods In General
- Introduction
- Solution of Equations by Iteration
- Interpolation
- Numerical Integration and Differentiation
- Numerical methods In Linear Algebra
- System of Linear Equation, Gauss Eliminations
- System of Linear Equation, LU Factorization
- System of Linear Equation, Solution by Iteration
- Method of Least Squares
- Numerical Methods for Ordinary Differential Equations
- a- Methods for First- Order D.E



- b- Methods for Second- Order D.E
- Numerical Methods for Partial Differential Equations
- a- Numerical Methods for Elliptic p.d.e
- b- Neumann and Mixed Problems
- c- Irregular Boundary
- d- Methods for Parabolic Equations
- d- Methods for Hyperbolic Equations

### **CE302 Theory of Structures ( 3 / - / 1 )**

- Introduction
- Stability and determinacy of structures
- Statically determinate beams
- Statically determinate trusses
- Statically determinate rigid frames and composite structures
- Approximate analysis for statically indeterminate structures
- Elastic deformation of structures, conjugate-beam method
- Method of virtual work (unite-load method)
- Castigliano's first theorem
- Analysis of statically indeterminate beam by the method of consistent deformations
- Analysis of statically indeterminate rigid frames and trusses by the method of consistent deformations
- Analysis of statically indeterminate beam by the method of least work
- Analysis of statically indeterminate rigid frames and trusses by the method of least work
- Analysis of statically indeterminate composite structures by the method of least work
- Analysis of statically indeterminate beams and rigid frames without joint translation by the slope-deflection method
- Analysis of statically indeterminate rigid frames with one,two and several degree of freedom of joint translation by the slope-deflection method
- Fixed-end moment ,stiffness, distribution factor and distribution of external moment applied to a joint
- The process of locking and unlocking :one joint
- The process of locking and unlocking :two joint
- Analysis of statically indeterminate rigid frames with one degree of freedom of joint translation by moment distribution
- Analysis of statically indeterminate rigid frames with two degree of freedom of joint translation by moment distribution
- Analysis of statically indeterminate rigid frames with several degree of freedom of joint translation by moment distribution



- Influence line for statically determinate structures
- Moving concentrated loads: criteria for maxima
- Absolute maximum bending moment
- Influence line for statically indeterminate structure, Maxwell's law, Betti's law
- Influence lines as deflected structures: the Muller-Breslau principle
- Stiffness method in structure analysis .

### CE303 Soil Mechanics ( 2 / 1.5 / 1 )

- Introduction to soil engineering
  - Processes of weathering (Factors Influencing Weathering, Classification soil according to formations).
  - Soil formation.
  - Composition & structure of soil.
  - Soil structures types.
  - Cohesive & cohesionless soil.
  - Clay mineralogy (Gravitational & Surface force, bounds between materials, main group of clay minerals ,Flocculation, Dispersion, Diffuse double layer ,Exchangeable cation, Cation exchangeable capacity (CEC), Dipolar nature of water, Characterization of clay soil water system, General clay minerals properties), & effect of water on its consistency.
  - Composition of soil (Weight-volume, Unit weight, void ratio, porosity, degree of saturation, moisture content, and common relationships among them, specific gravity).
- Physico-mechanical properties of soil
  - Index properties(consistency of soil Atterberg limits, Activity of clay, relative density, Sensitivity, flow index, relative density, Hydrometer analysis ).
  - Classification ( Soil classification systems, AASHTO classification system, Unified classification system, Textural classification system , MIT classification system ).
- Hydraulic properties of soil
  - Permeability(Bernoulli's equation, Darcy's law, Coefficient of permeability, Laboratory determination of coefficient of permeability, Determination of permeability in the field. Factors affecting permeability of soil, Horizontal and vertical permeability) .
    - Flow of water in soils (Laplace's equation of continuity, Flow nets, flow lines, equipotential lines, calculation of seepage quantity from flow net, flow net for anisotropic soil, determination of seepage pressure , determination of uplift pressure, seepage flow through homogenous earth dams, quick

condition and boiling, exit gradient, piping adjacent to sheet piles, control of piping conditions, control of seepage under dams, seepage through earth dams, method of location phreatic line, Filters and design of filters).

- Capillarity rise in soils.
- Soil improvement
  - Problematic soil.
  - Mechanical stabilization and compaction (General principles, compaction theories, main variables of compaction, compaction curve, Laboratory tests, Structure of compacted cohesive soils, Effect of compaction on properties of cohesive soils, Field compaction, Determination of field unit weight of compaction).
  - Soil stabilization methods (General principles, most effective stabilization method for different soil types).
  - Introduction to cement, lime and asphalt stabilization methods.
- Stresses within soil mass (total & effective)
  - Internals Stresses within the soil mass.
  - External Stresses due to different loaded areas.
- Point load, several point loads, line load.
- Stresses due to uniform strip load.
- Stresses due to uniformly loaded area.
- NewMark chart
- Approximate method for stress distribution
- Pressure bulb.
  - Stresses in the zone of capillary.
- Hydro- mechanical properties of soil
  - Compressibility of soil (settlement due to load application).
  - Settlement analysis (immediate, consolidation, and secondary consolidation settlement).
  - The consolidation process (mechanism of consolidation, spring analogy, consolidation process, consolidation theory).
  - Consolidation ( Fundamentals of consolidation, One-dimensional laboratory consolidation test, Void ratio-pressure plots, pre consolidation pressure, Normally under and over-consolidated clays, Calculation of consolidation settlement, Compression Index (Cc), Swelling Index, Coefficient of compressibility and volume compressibility).
  - Calculation of secondary settlement.
  - Time rate of consolidation.
- Determination of coefficient of consolidation
- Time factor
- Degree of consolidation
- Calculation of settlement at certain time

- Shear strength of soil
  - Factors affecting shear strength of soils, calculation of normal and shear stress on any plan, characteristics of failure plan, presentation of failure plan on Mohr circle, characteristics obtained from Mohr circle, Mohr envelope for different test conditions.
  - Mohr theory of failure & Mohr diagram for stress.
  - Tests to determine shear strength of parameters.
  - Shear strength of cohesive soil.
  - Shear strength of cohesionless soil.
  - Mohr-Coulomb failure criteria, Shear strength determination in the laboratory.
- Earth pressure of soils
  - Coefficient of lateral earth pressure.
  - Lateral earth pressure at rest.
  - Active earth pressure.
  - Passive earth pressure.
  - Rankine's theory.
  - Coulombs theory.
- Stability of slopes
  - Factor affecting slope stability.
  - Factor of safety.
  - Stability of infinite slopes.
  - Analysis of finite slopes (Method of Slices analysis ,Effective Stress Analysis by Bishop's Method, location of the most critical circle).
- Computer application
  - Using program designed in Visual Basic to estimate lateral earth pressure.
  - Using Geo-slope Software in seepage, consolidation, and slope stability problems.
- Hint: Introduce students to some of the programs used in the field of soil mechanics, any programming languages and also used Geo-slope Software in or any other software in some applications of soil mechanics for examples (stress distributions, settlement, consolidation, Slope stability, Seepage).

### **CE304 Reinforce Concrete ( 3 / - / 1 )**

- Introduction and preliminaries.
  - Using reinforced concrete (Factors influencing concrete material, mechanical properties of concrete, and steel reinforcement).



- Method used to estimate the mechanical properties (compressive and tensile strength of concrete)
- Methods of design and requirements.
- Analysis using the working stress method.
  - Fundamental assumptions.
  - Stresses in reinforced concrete beam.
  - Analysis of rectangular Uncracked sections.
  - Analysis of rectangular beams in the working conditions.
  - Equilibrium method and method of transformed section
  - Analysis of cracked rectangular beam.
  - Analysis of T-beam.
  - Analysis of beams by the exact method.
  - Sections of special shapes.
- Design using the working stress method.
  - Rectangular beam. Balanced section design.
  - Design of under reinforced concrete beam.
  - Design of over reinforced concrete beam.
  - Design of double reinforced concrete beam.
  - Design of T –section reinforced concrete beam
  - Design of one way reinforced concrete slabs.
  - Design of special shapes reinforced concrete beam.
- Flexural strength of beams and one way slabs.
  - Fundamental assumptions.
  - Equivalent rectangular stress block.
  - The balanced rectangular beam.
  - Maximum and minimum reinforcement ratios.
  - Analysis of singly reinforced rectangular sections.
  - Under reinforced beams.
  - Over reinforced beams.
  - Analysis of one way slabs.
  - Analysis of rectangular doubly reinforced beams.
  - Analysis of T- beams.
  - Analysis of special beam shapes.
- Design by strength design method.
  - Design of singly reinforced rectangular sections.
  - Design of double reinforced rectangular sections.
  - Design of T – beams.
  - Design of special beam shapes.
  - Reinforcing vertical faces for deep beams.
- Midyear Exam
- Beam design for shear.
  - Shear stresses in homogeneous beams.
  - Behavior of beams without shear reinforcement.
  - Transfer of shear forces in reinforced concrete beams.



- Critical section for calculation of nominal shear strength.
- Shear strength of beams without shear reinforcement.
- Continuous beams, low density concrete, role of shear reinforcement.
- Shear strength of shear reinforcement.
- Spacing for shear reinforcement.
- Minimum and maximum limits for shear reinforcement.
- ACI code requirements for shear strength of beams.
- Shear in one way slabs.
- Shear strength of joists.
- Interaction of shear forces, moments and axial forces.
- Shear and axial torsion.
- Beams of varying depth.
- Beam design for torsion
  - Torsional stresses in elastic homogeneous sections.
  - Torsional stiffness of homogeneous sections.
  - Effect of torsion stiffness on compatibility torsion.
  - Plastic torsional stresses in homogeneous sections.
  - Behavior of beams under combined loading.
  - Strength of sections under combined torsion and shear.
  - Torsional strength of concrete and web reinforcement according to ACI code.
  - Torsional strength of concrete.
  - Combined torsional and shear strength of concrete according to ACI code.
  - Torsional strength of web reinforcement.
  - Longitudinal reinforcement for torsion.
  - Minimum limits for torsional reinforcement according to ACI code.
- Analysis and design of short columns.
  - Behavior of axially loaded short columns.
  - Interaction of bending moment and axial loads.
  - Nominal axial load capacity and ACI code maximum axial load capacity.
  - Balanced strain condition for rectangular sections.
  - Distributed reinforcement.
  - Unsymmetrical reinforcement.
  - Lateral ties and spiral reinforcement.
  - Limits on reinforcement ratio.
  - Analysis of section in compression control region (Equilibrium method, Whitney formula for compression failure, Straight line formula for compression failure).
  - Analysis of section in tension control region (Equilibrium method, approximate formulae for tension failure).
  - Design of rectangular sections for strength.

- Using interaction diagram for analysis and design.
- Circular spirally reinforced columns.
- Biaxial bending and compression (Bresler reciprocal method, Parme load contour method).
- Analysis and design of long columns.
  - Centrally loaded columns.
  - Braced and unbraced frame.
  - Effective length factor for columns.
  - ACI procedure for classifying columns.
  - Magnification of moment for slender columns.
  - ACI method for moment magnification.
  - Moment magnification for braced columns.
  - Moment magnification for unbraced columns.
  - Minimum eccentricity in design.
- Development and splicing of reinforcement.
  - Anchorage or development bond.
  - Flexural bond.
  - Determination of bond strength.
  - The nature of bond failure.
  - Reasons for not using flexural bond stresses in strength design.
  - Basic development length for tension reinforcement.
  - Modification factor for basic development length.
  - Critical sections for development of reinforcement.
  - Bundled bars.
  - Anchorages of torsion bars by hooks.
  - Anchorages of reinforcement at simple supports and points of inflection.
  - Bars cut – off for moments.
  - Required area of steel curves
  - ACI requirements for extending bars.
  - Development length for compression reinforcement.
  - Development of web reinforcement.
  - Splicing of reinforcement.
  - Tension lap splices.

### **CE305 Highway Engineering ( 2 /1.5 / - )**

- Introduction to highway engineering
- Highway survey and location
- Highway operation, characteristics of the driver, pedestrian
- Characteristics of vehicles
- Factors influencing highway design
- Design elements of the cross section

- Stopping sight distance
- Passing sight distance
- Turning radius
- Horizontal alignment
- Compound and reverse horizontal curves
- Transition curves
- Sight distance on circular curves
- Pavement widening
- Superelevation
- Vertical alignment
- Minimum length of vertical curves
- Unsymmetrical vertical curves
- Soil engineering for highway design
- Classification of soils for highway use
- Soil surveys for highway constructions
- Roadway design for unusual soil conditions
- Mineral aggregate for bituminous pavement
- Special soil tests for pavement design
- Construction for the roadbed, fills and embankment
- Mass diagram
- Subbase and base course layers
- Construction of Subbase and base course layers
- Bituminous materials, sources, description and uses
- Properties of asphalt materials
- Tests for asphalt materials
- Asphalt mixtures
- Principles for design of flexible pavements
- Causes of pavement failure
- AASHTO flexible pavement design method
- Asphalt Institute flexible pavement design method
- Preparation of bituminous mixtures
- Placing of bituminous mixtures
- Principles for design of rigid pavements
- Stresses on rigid pavements
- PCA rigid pavement design method
- Joints in concrete pavements
- Steel reinforcing in rigid pavement
- Superpave system, selection of materials
- Volumetric trial mixtures design in Superpav



Introduction: What's the environmental engineering

Introduction to chemistry & microbiology in environmental engineering: Concept of mass transfer - application of mass transfer concept in environ. eng. - concept of mass balance - application of mass balance in environmental eng.

Water quality management: Water systems

Water quality in rivers: Parameters of organic content of water quality - dissolved oxygen and biological oxygen demand - pollution transport process

Water quality in lakes: Lakes characteristics - stratification & turnover - biological eutrophication - pollution transport process

Ground water quality: Characteristics - pollution transport process in soil

Water treatment: Characteristics - water quantity - water treatment methods.

Wastewater treatment: Quantity & characteristics of wastewater - pre treatment units - primary treatment units - secondary treatment units

Air pollution: Air pollutants and standards - effect of air pollutants - atmospheric dispersion - air pollution control

Thermal pollution: Sources of the thermal pollution – effect of thermal pollution – thermal pollution control

Solid Waste management: Perspective – collection – disposal

Noise pollution: Sources of noise pollution – effect of noise – transmission of sound

Hazardous waste: Definition of hazardous waste

### **CE307 Hydrology ( 2 / - / - )**

Introduction , the hydrological cycle , practical application of hydrology in engineering , source of data, Precipitation , Type of gauges , Abstraction from precipitation (evaporation, infiltration) , Measurement of flow in rivers , Run off hydrograph methods of estimating, annual run off , hydrograph of storm, the factors affecting flood hydrograph, Floods , rational method, design flood, design storm, Flood routing. Storage routing, channel routing, ground water.

### **CE308 Hydraulic Structures ( 2 / - / - )**

Introduction, theory of creep under the structures and its problems , The hydraulic jump and its advantage in the design of hydraulic structures, Design of regulator, Siphons and submerged weirs, Spillway, Culverts and canals falls.

### **CE309 Management and Economy ( 2 / - / - )**

Engineering Management, Introduction, Types of engineering management, Construction Management, Stages of Project Optimization , Optimization through project Program, Linear Programming, Simplex method , Cost Estimating, Progress Curve, Decision Tree, Program Evaluation and Review Technique, Construction



Contracts, Obligations of Owner, Engineer and Contractor, Construction Problems and Judgment, Practical: Package “Primavera Project Planner version 3“ , Engineering Economy, Preface, Engineering relations , Economic Comparison between alternatives, Economic Appraisal of Projects, Depreciation, Inflation.

**College of Engineering / Civil of Engineering / Fourth class**

code	Subject	First Course			Second Course			Unit No.
		Theor y	Prac.	Tut.	Theor y	Prac.	Tut	
CE401	Reinforced concrete design	3	---	1	3	---	1	6
CE402	Foundation engineering	3	---	1	3	---	1	6
CE403	Steel design	2	---	---	2	---	---	4
CE404	Traffic engineering	2	---	---	2	---	---	4
CE405	Sanitary engineering	2	---	1	2	---	1	4
CE406	Estimation	2	---	---	---	---	---	2
CE407	Construction method s	---	---	---	2	---	---	2
CE408	Construction drawing	---	2	---	---	---	---	1
CE409	Architecture design	2	---	---	---	---	---	2
CE410	Computer application	1	1	---	1	1	---	3
CE411	Construction Enterprises	---	---	---	2	---	---	2
CE412	Engineering project	1	3	---	1	3	---	4
Total		18	6	3	18	4	3	40

### CE401 Reinforced Concrete Design ( 3 / - / 1 )

- Design introduction of reinforced concrete structures
  - Design of R.C. one way slabs and continuous beams
  - Effective spans and deflection limits (minimum depth limits)
  - ACI code coefficient methods for moments and shear.
  - Design area of steel reinforcement and minimum area for shrinkage and temp. in slab and flexure for beams.
  - Approximate bent or cutoff points and maximum spacing for main and secondary reinforcement .
  - Beam loads and critical moment and shear sections in beams.
  - Detailing for reinforcement continuous beams and slabs.
- Two way edge supported slabs
  - Minimum slab thickness.
  - Direct design method and limitations.
  - Total static moment (panel moment)
  - Middle and edge strip width and moment distribution.
  - Check for shear strength and flexure and calculation of steel reinforcement, checking minimum area and max spacing.
  - Design for beam supporting two way slabs.
  - Design by moment coefficient method.
- Flat slabs and flat plates
  - Minimum thickness of beamless slab according to ACI code.
  - Effective span length and minimum drop panel dimension.
  - Check for punching shear strength and diagonal shear.
  - Application of direct design method.
  - Design of flexural reinforcement at all critical moment section. Check the minimum and maximum spacing.
  - Design by moment coefficient method.
  - Openings in flat slab construction .
  - Detailing of reinforcing steel considering minimum extension bars lengths.
- One way ribbed slabs
  - Code limitations and dimension.
  - Diagonal shear, solid part.
  - Design for steel reinforcements in ribs and topping slab.
  - Hollow block floor.
  - Voided slabs, equivalent rib width.
- Design of reinforced concrete stairs

- Stair types and stair limitations.
- Design stairs mainly reinforcement in transverse direction.
- Design stairs longitudinally reinforced.
- Effective spans, loading and moment calculation.
- Yield line theory of slab analysis
- yielding slabs and development of plastic hinges.
- Guide lines to established patterns of yield lines and axis of rotations slabs
- Analysis by equilibrium method.
- Virtual work method.
- Isotropically and orthotropically reinforced slabs.
- Components of work methods.
- Different types of loading.
- Circular and polygon slab panels.
- slabs with large opening.
- Optimization method for load calculation.
- Multistory building frames
  - Behavior of building frames under partial gravity loads.
  - Methods of maximum stress calculation in beams and columns of multistory building frame.
  - stresses produced from wind load.
  - computer programs used in analysis and design of multistory.
  - Sub – frames analysis by ACI codes.
- Precast construction
  - Precast construction advantages and disadvantages.
  - Prefabricated elements, dimension limitations.
  - Types of joints connections.
  - Shear friction theory.
  - Design of brackets and corbels.
  - Design of precast beam end bearing.
- Design of reinforced concrete bridges
  - Type of loading used for bridges design.
  - Design of slab bridge and edge beam.
  - Deck girder bridges, span length, minimum depth, loading criteria.
  - Shear and flexural stress calculation at different sections along the span.
  - Design for deck reinforcement, girders flexural and diagonal reinforcement.
  - Design for exterior girders and intermediate diaphragms.
- Prestressed Concrete
  - The principles of prestressing, theory and method of load applying.
  - Material properties and types, prestressed and ordinary steel high strength concrete.
  - Types and methods of prestressing.
  - Stress analysis at different load stages.



- Principles limit stress at initial and after losses.
- Cracking, cracking load and factor against cracking.
- Ultimate strength of prestressed concrete and factor of safety.
- Types of losses in prestressed concrete.
- Lump sum estimation and detailed estimation of losses in prestressed concrete.
- Reinforced concrete on ground water tanks
  - Circular water tanks.
  - Design of rectangular water tanks.

### **CE402 Foundation Engineering ( 3 / - / 1 )**

- The First Course:
- Introduction and general information ( Definitions and types )
- Site investigation and soil report procedures.
- Bearing capacity of clay and sand, bearing capacity of swelling and collapsing soil, bearing capacity of rock.
- Stresses and settlement calculation.
- Structural design of spread footing, wall footing, footing subjected to moment, raft foundation, pile cap and design of plain concrete footing (unreinforced footing).
- Examination of 1<sup>st</sup> semester No.1 and No.2.
- The Second Course:
- Pile foundations (general).
- Bearing capacity of single pile in clay.
- Bearing capacity of single pile in sand.
- Bearing capacity of pile group.
- Bearing capacity of pile subjected to negative skin friction.
- Bearing capacity of pile subjected to tension force.
- Bearing capacity of pile subjected to moment
- general discussion for piles
- Lateral earth pressure.
- Methods of earth pressure estimation.
- types of retaining structures (general and limitations).
- weak : Design of gravity and cantilever retaining walls.
- Design of sheet piles and excavation braced.

### **CE403 Steel Design ( 2 / - / - )**



- Behaviour and properties of structural steel. Stress-strain relationships in structural steel- Elastic and plastic design method.
- Behaviour and properties of structural steel. Loads and resistance factor design.- Steel sections properties (AISC-specification).
- Tension members. Allowable stresses and loads.
- Tension members. Net areas.
- Tension members. Design of tension members
- Design of Trusses. Load.
- Design of Trusses. Design of sheet
- Design of Trusses. Design of purline and sag rods.
- Design of Trusses. Bolted and welded connection.
- Compression member. Interdiction to compression member. - The AISC formulas
- Compression member. Design of compression member under axial forces.- Effective column length.
- Compression member. Column base plate for axial loaded column.
- Compression member. Design of columns under combined bending and axial load using AISC formulas.
- Compression member. Moment resisting column plate
- Midyear Exam
- Design of beams. Beam specification and braced length.
- Design of beams. Flexural member including unbraced beams.
- Design of beams. Design of laterally unsupported beams according to AISC Specification.
- Design of beams. Beam-bearing plate
- Design of composite beam. Specification and Criteria.
- Design of composite beam. Design of composite beam according to AISC specification.
- Built-up beam and plate girder. Specification and Criteria.
- Built-up beam and plate girder. Design of Built-up beam and plate girder.
- Gantry crane girder. Specification and Criteria.
- Gantry crane girder. Design of gantry crane girder.
- Plastic analysis and design. Theory of plastic analysis.
- Plastic analysis and design. Collapse of mechanism to AISC requirement.
- Plastic analysis and design. Design of beam according to AISC requirement.
- Plastic analysis and design. Plastic analysis of frames.
- Final Exam

#### **CE404 Traffic Engineering ( 2 / - / - )**

Traffic Science , Road User , Vehicles Types, performance characteristics, Barreling Distance...etc., Roadway Geometric Design Travel Time and Delay Study

, Spot Speed Study , Traffic Volume Studies , Traffic Safety , Traffic Flow Parameters study , Capacity and level of service Study and Analysis , Urban Transportation Planning (UTP) Process , Airport Planning and Design , Railway Planning and Design , Design of street lightening , Design of street marking.

### **CE405 Sanitary Engineering ( 2 / - / 1 )**

- Types of Water Resources and Estimation of Ground Water Discharge.
- Quality of water supply, its standards
- Population Forecast , water supply consumption and demand.
- Intake Unit (Types and design), PPT show
- Flocculation and Coagulation unit (theory and design)
- Sedimentation Unit (theory and design)
- Discrete and flocculent settling, Design of Clarriflocculation unit, PPT show
- Filtration unit( theory, Types, and design)
- Disinfection unit, PPT show
- Storage of water, Service storage tank
- Distribution of water, Types of networks, types of pipes
- Flow in network
- Design of network and pipes
- Design of network and pipes also, fitting of network and maintenance
- Calculation of discharge in sanitary sewers
- Design of sanitary sewers
- Calculation of discharge in storm sewers
- Design of storm sewers
- Concept and Calculation of partial flow in sewerage.
- Design of Combined sewer system
- Strength of sewers pipes, PPT show
- Characteristics and variation of wastewater
- Design and types of equalization tanks
- Preliminary treatment(Racks, comminuting and Grit removal units)
- Hindered and Compression Settling
- Secondary Treatment, (attached growth processes )
- Suspended growth processes (types and design of A.S)
- Tutorials and discussions (PPT show)

### **CE406 Estimation ( 2 / - / - )**

Introduction & definition, Construction materials quantities, Kinds of estimation , Quantity computation for different construction , Earth work estimation ( cut & fill),

Reinforcing steel computations , Engineering specification of works & materials,  
Preparing quantities & costing tables , Application.

## **CE407 Construction Methods ( 2 / - / - )**

### Introduction

- Engineer and Construction
- Construction Industry
- types of construction contractors
- Engineer and economic construction engineering evaluation
- A study Engineering Rating
- Examples of engineering study Rating
- rolling resistance
- the impact of the degree of effort on the road a mile Jeralmtalob
- The effect of surface slope to set the location of hole supply
- traction of the machines
- consolidate and Haddl soil
- Definitions
- swelling and contraction
- soil types
- soil tests
- consolidation of soil
- Specifications Haddl soil
- types of machines Haddl
- Soil tractors and machines similar to it
- uses tractors
- types of tractors
- regression

### Alqashtat and calculation of productivity

- the types and volumes Alqashtat
- the size of Alqashth
- Run Alqashth
- The time course of Qashth Alqashtat improve productivity and increase
- drilling machines
- hoes mechanism
- rigs Naaourah
- rigs Maharia
- hoes
- trenching machines
- foundations injection
- the need for injections
- investigate the need to appoint to the injection of the foundations
- materials used in the process of injection
- preparation for injection
- injection pressure



- injection Balsment, asphalt, mud, chemicals Balmoud

templates of concrete structures

- Introduction
- the requirements and the cost of templates
- Materials templates
- size of the templates
- the pressure resulting from the vertical templates Khersanaaly
- templates for walls, columns, ceilings, thresholds, floors
- Raising the templates

Safety engineering projects

### **CE408 Construction Drawing ( - / 2 / - )**

General review of the engineering drawing with an introduction to the topic, R.C. slabs - one way , tow ways, Beams - simply supported and continuous beams, R.C. of slabs and beams concerning certain project., R.C. stairs ( with the descriptions of different types), R.C. footing with the descriptions of different types ( i.e wall footings, isolated column footings, continuous footing and combined types), Detailing of small house with its full details i.e: plan, elevation, sections doors and windows and its structural details.

### **CE409 Architectural Design ( 2 / - / - )**

Introduction , the characteristics of design, Design elements, Design principles, Spatial relation ships, Spatial organization, Proportion and scale, Dimensions & measurements in residential spaces, Zoning of function , Analysis of one family plans, Circulation , designing one family house (project (Architectural space, designing one family house ) project, Final presentation of the project.

### **CE410 Computer Application ( 1 / 1 / - )**

An introduction to Windows system , Microsoft Word, Microsoft Excel, Internet Explorer, Methods of Structural Analysis, Direct stiffness method, Structural Analysis and design Program STAAD III ver. 21-: , Editor Input method, Graphical User Interface, Engineering Drawing AutoCAD 2000.

### **CE411 Construction Enterprises ( 2 / - / - )**

- Preface; Companies Types according to Islamic and local Laws.

- Basic of companies establishment, including the occupational relationships, and matrix and project oriented types. (4 hrs.)
- Economic Appraisal between construction projects, including P.W. method, IRR method, and B/C method. then conduct feasibility study for the projects with application.
- Time Schedule for projects with using a primavera project planner package for construction management.
- Decision Theory (decision tree) to assess and optimize the best decision among many choices according to historical records.
- Value Engineering, principles, types, evaluating and application.

