Form: Study Plan- Bachelors	Form Number	EXC-01-03-02A
	Issue Number and Date	2963/2022/24/3/2 5/12/2022
	Number and Date of Revision or Modification	2/(10/12/2023)
	Deans Council Approval Decision Number	50/2023
	The Date of the Deans Council Approval Decision	26/12/2023
	Number of Pages	32

1.	School	Engineering
2.	Department	Civil Engineering
3.	Program title (Arabic)	بكالوريوس الهندسة المدنية
4.	Program title (English)	Bachelor of Civil Engineering

5. Components of Curriculum:

The curriculum for the bachelor's degree in Civil Engineering consists of (163) credit hours distributed as follows:

Number	Type of requirement	credit hours
First	**University Requirements**	**27**
Second	**School Requirements**	**26**
Third	**Department Requirements**	**110**
Fourth	**Free Courses**	**–**
Total		**163**

6. Numbering System:

A- Department Number:

Department	Number
General	**0**
Civil Engineering	**1**
Architectural Engineering	**2**
Electrical Engineering	**3**
Mechanical Engineering	**4**
Chemical Engineering	**5**
Industrial Engineering	**6**
Computer Engineering	**7**
Mechatronics Engineering	**8**

B- Course number:

Domain Number	Domain Title	Domain Number	Domain Title
0	General	5	Structural Design
1	------	6	Water Resources
2	Project Management and Economy	7	Environmental Engineering
3	Geotechnical Engineering	8	Transportation and Surveying
4	Structural Analysis		

C- Course number consists of 7 digits:

School		Department		Level	Domain	Serial Number
0	**9**	**0**	**1**	**---**	**---**	**---**

First: University Requirements:

Compulsory Requirements					
(18 Credit Hours)					
No.	**Course Title**	**Course No.**	**Credit Hours**	**Prerequisites**	**Notes**
1	**Military Science**	**2220100**	**3**		
2	**National Culture**	**3400100**	**3**		
3	**Learning & Research Skills**	**3400101**	**3**	**3202099**	
				3201099	
				1932099	
4	**Communication Skills**	**3400102**	**3**	**3400101**	
5	**Introduction to Philosophy and Critical Thinking**	**3400103**	**3**	**3400101**	
6	**Human Civilization**	**3400104**	**3**		
7	**Campus Life and Ethics**	**3400105**	**(Zero credit; one-hour weekly meeting)**		

Preparation Program Requirements All students admitted to the university must apply for a degree examination in Arabic and English and the computer is prepared or approved by the university to determine their level. Based on the results of the examinations, either the student will study one or more of the requirements of the preparatory program					
(0 - 15 Credit Hours)					
No.	**Course Title**	**Course No.**	**Credit Hours**	**Prerequisites**	**Notes**
1	**Basics of Arabic**	**3201099**	**3**		**Pass/Fail**
2	**Arabic Languages Skills**	**3201100**	**3**	**3201099**	**Pass/Fail**
3	**Basics of English**	**3202099**	**3**		**Pass/Fail**
4	**English Language Skills**	**3202100**	**3**	**3202099**	**Pass/Fail**
5	**Basics of Computing**	**1932099**	**3**		**Pass/Fail**

Preparation Program Requirements

All students admitted to the university must apply for a degree examination in Arabic and English and the computer is prepared or approved by the university to determine their level. Based on the results of the examinations, either the student will study one or more of the requirements of the preparatory program

(0 - 15 Credit Hours)

No.	Course Title	Course No.	Credit Hours	Prerequisites	Notes
1	Basics of Arabic	3201099	3		Pass/Fail
2	Arabic Languages Skills	3201100	3	3201099	Pass/Fail
3	Basics of English	3202099	3		Pass/Fail
4	English Language Skills	3202100	3	3202099	Pass/Fail
5	Basics of Computing	1932099	3		Pass/Fail

Electives

(9 Credit Hours)

Elective courses: (9) credit hours to be chosen from the first, second and third groups mentioned below. The student has to choose one course from each of the groups.

(First Group)

No.	Course Title	Course No.	Credit Hours	Prerequisites	Notes
1	Great Books	3400107	3		
2	Islam and Current Issues	0400101	3		
3	Arab-Islamic Civilization	2300101	3		
4	Jordan: History and Civilization	2300102	3		
5	Jerusalem	3400108	3		

Electives					
(Second Group)					
No.	**Course Title**	**Course No.**	**Credit Hours**	**Prerequisites**	**Notes**
1	Legal Culture	1000102	3		
2	Environmental Culture	0300102	3		
3	Physical Fitness Culture	1100100	3		
4	Islamic Culture	0400102	3		
5	Health Culture	0720100	3		
Electives					
(Third Group)					
No.	**Course Title**	**Course No.**	**Credit Hours**	**Prerequisites**	**Notes**
1	Entrepreneurship & Creativity	3400109	3		
2	Foreign Language	2200103	3		
3	Electronic Commerce	1600100	3		
4	Social Media	1900101	3		
5	Appreciation of Arts	2000100	3		
6	Special Subject	3400106	3		
7	Administrative skills	1601105	3		

Second: School courses: (26) credit hours distributed as follows:

A. **Obligatory School courses: (26) credit hours**

B. **Elective School courses: (0) credit hours**

Obligatory School courses: (26) credit hours:

Course Number	Course Title	Contact Hours		Credit Hours	Prerequisite
		Theoretical	Practical		
0301101	Calculus (1)	3	-	3	-
0301102	Calculus (2)	3	-	3	0301101
0301201	Calculus (3)	3	-	3	0301102
0302101	General Physics (1)	3	-	3	-
0302102	General Physics (2)	3	-	3	0302101
0302111	General Physics Lab. (1)	-	3	1	0302101*
0302112	General Physics Lab. (2)	-	3	1	0302102*
0966111	Workshops	-	3	1	-
0904131	Engineering Drawing and Descriptive Geometry	3	-	3	-
0921420	Engineering Economy	2	-	2	Passing 90 Cr. Hrs.
1931102	Computer Skills for Scientific Faculties	3	-	3	01901099

*** Or Concurrent**

Third: Specialty courses: (110) credit hours distributed as follows:

A. **Obligatory specialty courses: (101) credit hours**
B. **Elective specialty courses: (9) credit hours**

Obligatory specialty courses: (101) credit hours:

Course Number	Course Title	Contact Hours		Credit Hours	Prerequisite
		Theoretical	Practical		
0301202	Engineering Math (1)	3	-	3	0301201
0303101	General Chemistry (1)	3	-	3	-
0303102	General Chemistry (2)	3	-	3	0303101
0333109	General Chemistry Lab. for None Chemistry Students	-	3	1	0303101*
0914223	Dynamics for Civil Engineers	3	-	3	0901241
0901230	Geology	3	-	3	-
0941231	Geotechnical Engineering	3	-	3	0901230, 0941242, 0901361
0931232	Geotechnical Engineering Lab.	-	3	1	0941231*
0901241	Statics	3	-	3	0301102, 0302101, 0904131
0941242	Strength of Materials	3	-	3	0901241
0951281	Surveying	3	-	3	0301102
0931282	Surveying Lab.	-	3	1	0951281*
0951301	Numerical Methods	3	-	3	0301202

*** Or Concurrent**

Course Number	Course Title	Contact Hours		Credit Hours	Prerequisite
		Theoretical	Practical		
0951331	Foundation Engineering	3	-	3	0931232
0941341	Structures (1)	3	-	3	0941242
0951342	Structures (2)	3	-	3	0941341
0941351	Properties of Concrete	3	-	3	0941242
0941352	Properties of Concrete Lab.	-	3	1	0941351*
0901361	Fluid Mechanics	3	-	3	0301202, 0914223
0931362	Engineering Hydraulics	3	-	3	0901361
0941363	Engineering Hydraulics Lab.	-	3	1	0931362*
0931371	Drinking Water Engineering	3	-	3	0931362
0931401	Statistics and Probability	3	-	3	0301102
0941421	Contracts, Specifications and Quantity Surveying	3	-	3	0931451
0931451	Reinforced Concrete (1)	3	-	3	0941352, 0941341
0931452	Reinforced Concrete (2)	3	-	3	0951342*, 0931451
0951453	Steel Structures	3	-	3	0951342
0951464	Engineering Hydrology	3	-	3	0931362, 0931401
0941471	Wastewater Engineering	3	-	3	0931371, 0303102
0901472	Environmental Engineering Lab.	-	3	1	0333109, 0941471*
0941482	Pavement Design	3	-	3	0901484, 0941231, 0931451
0931483	Pavement Lab.	-	3	1	0941482*
0901484	Highway Engineering	3	-	3	0931282
0951521	Construction Management	2	-	2	0941421

Course Number	Course Title	Contact Hours		Credit Hours	Prerequisite
		Theoretical	Practical		
0901572	Environmental Engineering	3	-	3	0941471
0951581	Traffic Engineering	3	-	3	0931401, 0901484
0901598	Capstone Project (1)	1	-	1	Passing 120 Cr. Hrs.
0901599	Capstone Project (2)	2	-	2	0901598
0951500	Employability Readiness and Field Training	5	-	5	Passing 120 Cr. Hrs.

*** Or Concurrent**

Fourth: Elective specialty courses: (9) credit hours:

Course Number	Course Title	Contact Hours		Credit Hours	Prerequisite
		Theoretical	Practical		
0941303	Computer Applications in Structural Engineering	3	-	3	0931452
0901322	Introduction to Remote Sensing (RS) and Geographic Information System (GIS)	3	-	3	0931282
0901337	Building Construction	3	-	3	0931451
0931431	Earth Retaining Structures	3	-	3	0941331
0901503	Integrated Solid Waste Management	3	-	3	0941471
0901506	Air Pollution Control	3	-	3	0941471
0931522	Construction Methods	3	-	3	0901420
0931523	Project Management	3	-	3	Passing 90 Cr. Hrs.
0901534	Introduction to Soil Improvement	3	-	3	0951331
0941541	Structures (3)	3	-	3	0951342
0941551	Reinforced Concrete (3)	3	-	3	0931452
0901552	Prestressed Concrete	3	-	3	0931452
0931553	Introduction to Earthquake Engineering	3	-	3	0931452
0901555	Bridge Engineering	3	-	3	0951453, 0931452
0951561	Hydraulic Structures	3	-	3	0951464
0941562	Water Resources Engineering	3	-	3	0951464
0941563	Stormwater Drainage	3		3	0951464

0901573	Environmental Impact Assessment	3	-	3	0901572*
0901574	Water Reuse Engineering	3	-	3	0931471
0931582	Transportation Engineering	3	-	3	0901484, 0951581
0901585	Railway Engineering	3	-	3	0901484
0901595	Special Topics in Civil Engineering	3	-	3	Passing 120 Cr. Hrs.

*** Or Concurrent**

Fifth: Courses offered by other faculties and departments

Course Number	Course Title	Contact Hours		Credit Hours	Prerequisite
		Theoretical	Practical		
0301101	Calculus (1)	3	-	3	-
0301102	Calculus (2)	3	-	3	0301101
0301201	Calculus (3)	3	-	3	0301102
0301202	Engineering Math (1)	3	-	3	0301201
0302101	General Physics (1)	3	-	3	-
0302102	General Physics (2)	3	-	3	0302101
0302111	General Physics Lab. (1)	-	3	1	0302101*
0302112	General Physics Lab. (2)	-	3	1	0302102*
0303101	General Chemistry 1	3	-	3	-
0303102	General Chemistry 2	3	-	3	0303101
0333109	General Chemistry Lab. for None Chemistry Students	-	3	1	0303101*
0914223	Dynamics for Civil Engineers	3	-	3	0901241
0904131	Engineering Graphics	3	-	3	-
0966111	Workshops	-	3	1	-
1931102	Computer Skills for Scientific Faculties	3	-	3	1901099

*** Or Concurrent**

Sixth: Advisory Study Plan:

First Year

(First) Semester			(Second) Semester		
Course Number	**Course Title**	**Credit Hours**	**Course Number**	**Course Title**	**Credit Hours**
0301101	Calculus (1)	3	0301102	Calculus (2)	3
0302101	General Physics (1)	3	0302102	General Physics (2)	3
0302111	General Physics Lab. (1)	1	0302112	General Physics Lab. (2)	1
0303101	General Chemistry (1)	3	0303102	General Chemistry (2)	3
0333109	General Chemistry Lab. for None Chemistry Students	1	0904131	Engineering drawing and Descriptive Geometry	3
3400101	Learning and Research Skills	3	3400102	Communication Skills	3
0966111	Workshops	1			
3400105	Campus Life and Ethics	0			
Total		**15**	**Total**		**16**

Second Year

(First) Semester			(Second) Semester		
Course Number	**Course Title**	**Credit Hours**	**Course Number**	**Course Title**	**Credit Hours**
0301201	Calculus (3)	3	0301202	Engineering Math. (1)	3
0901230	Geology	3	0951281	Surveying	3
0901241	Statics	3	0931282	Surveying Lab.	1
1931102	Computer Skills for Scientific Faculties	3	0914223	Dynamics for Civil Engineers	3
3400100	National Culture	3	0941242	Strength of Materials	3
			2220100	Military Science	3
Total		**15**	**Total**		**16**

Third Year

(First) Semester			(Second) Semester		
Course Number	**Course Title**	**Credit Hours**	**Course Number**	**Course Title**	**Credit Hours**
0951301	Numerical Methods	3	0941231	Geotechnical Engineering	3
0941341	Structures (1)	3	0931332	Geotechnical Engineering Lab.	1
0941351	Properties of Concrete	3	0951342	Structures (2)	3
0941352	Properties of Concrete Lab.	1	0931362	Engineering Hydraulics	3
0901361	Fluid Mechanics	3	0941363	Engineering Hydraulics Lab.	1
0931401	Statistics and Probability	3	0931451	Reinforced Concrete (1)	3
			3400103	Introduction to Philosophy and Critical Thinking	3
Total		**16**	**Total**		**17**

Fourth Year

(First) Semester			(Second) Semester		
Course Number	**Course Title**	**Credit Hours**	**Course Number**	**Course Title**	**Credit Hours**
0931371	Drinking Water Engineering	3	0941421	Contracts, Specifications, and Quantity Surveying	3
0921420	Engineering Economy	2	0931452	Reinforced Concrete (2)	3
0951453	Steel Structures	3	0951464	Engineering Hydrology	3
0901484	Highway Engineering	3	0941471	Wastewater Engineering	3
---	University Elective	3	0901472	Water Treatment Lab.	1
---	Elective Specialty Course	3	0911482	Pavement Design	3
			0931483	Pavement Lab.	1
Total		**17**	**Total**		**17**

(Summer) Semester		
Course Number	**Course Title**	**Credit Hours**
0951500	Employability Readiness and Field Training	5

Passing 120 Cr. Hrs.

Fifth Year

(First) Semester			(Second) Semester		
Course Number	**Course Title**	**Credit Hours**	**Course Number**	**Course Title**	**Credit Hours**
3130951	Foundation Engineering	3	0951581	Traffic Engineering	3
0951521	Construction Management	2	---	Elective Specialty Course	3
0901572	Environmental Engineering	3	3400104	Human Civilization	3
---	Elective Specialty Course	3	---	University Elective	3
---	University Elective	3	0901599	Capstone Project (2)	2
0901598	Capstone Project (1)	1			
Total		**15**	**Total**		**14**

Course Description

0301101 Calculus (1) (3 Cr. Hrs.)

Prerequisite: (---)

Functions: domain, operations on functions, graphs of functions, trigonometric functions, limits: meaning of a limit, computational techniques, limits at infinity, infinite limits, continuity, limits and continuity of trigonometric functions. The derivative: techniques of differentiation, derivatives of trigonometric functions, the chain rule, implicit differentiation, differentials, Roll's Theorem, the mean value theorem, the extended mean value theorem, L'Hopital's rule, increasing and decreasing functions, concavity, maximum and minimum values of a function, graphs of functions including rational functions (asymptotes) and functions with vertical tangents (cusps), antiderivatives, the indefinite integral, the definite integral, the fundamental theorem of calculus, the area under a curve, the area between two curves. Transcendental functions: inverse functions, logarithmic and exponential functions, derivatives and integrals, limits (the indeterminate forms), hyperbolic functions and their inverses, inverse trigonometric functions.

0301102 Calculus (2) (3 Cr. Hrs.)

Prerequisite: (0301101)

Techniques of integration: integration by substitution, integration by parts, integrating powers of trigonometric functions, trigonometric substitutions, integrating rational functions, partial fractions, rationalization, miscellaneous substitution. Improper integrals, application of definite integral: volumes, length of a plane curve, area of a surface of revolution polar coordinates and parametric equations: polar coordinates, graphs in polar coordinates, area in polar coordinates, infinite series: sequences, infinite series, convergence tests, absolute convergence, conditional convergence, alternating series, power series: Taylor and Maclurine series, differentiation and integration of power series.

0301201 Calculus (3) (3 Cr. Hrs.)

Prerequisite: (0301102)

Three dimensional space and vectors rectangular coordinates in 3D, spheres, cylindrical surfaces, quadric surfaces, vectors: dot product, projections, cross product, parametric equations of lines planes in 3-spaces, vector -valued functions: calculus of vector valued functions, change of parameters, arc length, unit tangent and normal vectors, curvature, functions of two or more variables: domain, limits, and continuity, partial derivatives, differentiability, total differentials, the chain rule, the gradient, directional derivatives, tangent planes, normal lines; maxima and minima of functions of two variables, Lagrange multipliers, multiple integrals: double integral, double integrals in polar coordinates, triple

integrals, triple integrals in cylindrical and spherical coordinates, change of variables in multiple integrals, Jacobian .

0302101 General Physics (1) (3 Cr. Hrs.)

Prerequisite: (-)

Motion in one dimension, vectors, motion in two dimensions, the laws of motion, circular motion, conservation of energy, linear momentum and collisions, rotation of a rigid object about a fixed axis, angular momentum, static equilibrium, universal gravitation, fluid mechanics, oscillatory motion.

0302102 General Physics (2) (3 Cr. Hrs.)

Prerequisite: (0302101)

Electric field, Gauss's law, electric potential, capacitance and dielectrics, current and resistance, direct current circuits, magnetic field, sources of the magnetic field, Faraday's law, inductance, alternating current circuits, the nature of light and the principles of ray optics, image formation.

0302111 General Physics Lab. (1) (1 Cr. Hr.)

Prerequisite or Concurrent: (0302101)

11 experiments each of 3 hrs/week duration: collection and analysis of data, measurements and uncertainties, vectors: force table, kinematics of rectilinear motion, force and motion, collision in two dimensions, rotational motion, simple harmonic motion: simple pendulum, gas's Laws, ballistic pendulum, specific heat capacity of metals.

0302112 General Physics Lab. (2) (1 Cr. Hr.)

Prerequisite or Concurrent: (0302102)

12 experiments each of 3 hrs /week duration: electric field mapping, specific charge of copper ions, power transfer, potentiometer, capacitors: RC time constant, Kirchhoff's laws, magnetic field of a current, lenses, Young's double slit experiment, electromagnetic induction, Ohm's law, Wheatstone bridge.

0966111 Workshops (1 Cr. Hr.)

Prerequisite: (-)

General safety, materials and their classifications, measuring devices and their accuracy, fits and tolerances, theoretical background for the practical exercises including fitting, forging, carpentry, casting, welding, mechanical saws, shearers, drills, lathes, milling machines, shapers and grinders.

0904131 Engineering Drawing and Descriptive Geometry (3 Cr. Hrs.)

Prerequisite: (-)

Drawing equipment and use of instruments. Lettering, geometric construction, sketching and shape description. Basic descriptive geometry, developments and intersections. Axonometric, oblique and perspective drawings, Multiview projection, principal views, conventional practice, and sectional views. Auxiliary views. Dimensioning techniques. Parallel: introduction to computer drawing, drawing aids, geometrical construction, and the appropriate commands of text, editing, plotting, sections, layers, pictorial views, and dimensioning. Auxiliary views.

0921420 Engineering Economy (2 Cr. Hrs.)

Prerequisite: (Passing 90 Cr. Hr.s.)

Major elements of feasibility studies. Principles of engineering economy. Equivalence and compound interest formulas. Single payment model. Uniform payment model. Gradient payment model. Exponential payment model. Decision criteria for single and multiple alternatives: present worth, annual worth, future worth, internal rate of return, benefit cost ratio and payback methods. Income-tax effect on decision making.

1931102 Computer Skills for Scientific Faculties (3 Cr. Hrs.)

Prerequisite: (1901099)

Fundamental concepts of programming using C++, basic structures of programming tools: variable names, data types, control structures, arrays, functions, pointers, introduction to classes and objects, inheritance, applications using C++. Weekly practice in the lab.

0301202 Engineering Mathematics (I) (3 Cr. Hrs.)

Prerequisite: (0301201)

Ordinary differential equations, linear differential equations of second and higher order, systems of differential equations, phase plane, stability, series solutions of differential equations, orthogonal function, Laplace transforms, linear systems of equations, matrices and determinants.

0303101 General Chemistry (1) (3 Cr. Hrs.)

Prerequisite: (-)

Measurements and significant figures, chemical reactions, stoichiometry, the gaseous state, thermochemistry, electronic structure and periodicity, chemical bonding, molecular shapes, states of matter and intermolecular forces.

0303102 General Chemistry (2) (3 Cr. Hrs.)

Prerequisite: (0303101)

Physical properties of solutions, chemical kinetics, chemical equilibrium, chemical thermodynamics, acid-base equilibria in aqueous solutions, solubility and complex ion equilibria, electrochemistry.

0333109 General Chemistry Lab. For None Chemistry Students (1 Cr. Hr.)

Prerequisite or Concurrent: (0303101)

The course includes experiments dealing with the following topics: safety and laboratory rules, chemical observations, stoichiometry, volumetric analysis, oxidation and reduction, colligative properties, thermochemistry and equilibrium.

0914223 Dynamics for Civil Engineers (3 Cr. Hrs.)

Prerequisite: (0901241)

Kinematics of particles, Rectilinear and curvilinear motion in various coordinate systems. Kinetics of particles, Newton's second law, Equations of motion for single and for a system of particles. Work and energy, work of a force conservation of energy, power and efficiency. Impulse and momentum, principle of linear impulse and momentum for a single and for a system of particles, angular impulse and momentum principle, introduction to vibrations and linear systems, steady fluid streams.

0901230 Geology (3 Cr. Hrs.)

Prerequisite: (-)

Basics of engineering geology, minerals, rock types, engineering properties of rocks, topographic and geological maps, soil formation, soil structure, structural geology, geologic processes, natural hazards, ground water, plate tectonics, subsurface exploration and geophysical methods, introduction to geotechnical earthquake engineering, phase relationship, sieve analysis, hydrometer.

0941231 Geotechnical Engineering (3 Cr. Hrs.)

Prerequisite: (0941242, 0901361, 0901230)

Indexed properties of soil plasticity and structure of the soil, engineering classification of the soil, soil compaction, permeability and seepage, flow net, in situ stresses, stresses in a soil mass, soil compressibility and consolidation theory, time-settlement analysis, shear strength of soils.

0931232 Geotechnical Engineering Lab. (1 Cr. Hr.)

Prerequisite or Concurrent: (0941231)

Water content, specific gravity, consistency limits, grain-size distribution, hydrometer analysis, compaction, in-situ field density, permeability tests, consolidation test, direct shear test, triaxial test, unconfined compression test.

0901241 Statics (3 Cr. Hrs.)

Prerequisite: (0301102, 0904131, 0302101)

General principles. Force vectors, force systems (2D and 3D). Equilibrium of particles and rigid bodies (2D and 3D), free body diagrams, constraints and structural determinacy, structures (trusses, frames and machines), distributed forces (centroids and centers of mass), fluid pressure, beams (shear force and bending moment diagrams), friction, moments of inertia and virtual work.

0901242 Strength of Materials (3 Cr. Hrs.)

Prerequisite: (0901241)

Equilibrium of deformable bodies, average normal and shear stress, bearing stress, allowable stress, factor of safety, normal and shear strain. The tension test, Hooke's law, Poisson's ratio, elastic deformation of axially loaded members, statically indeterminate axially loaded members. Thermal stresses. The torsion formula, solid and hollow shafts, thin-walled tubes, power transmission. Shear and moment diagrams. The flexure formula, bending of composite beams, stress concentrations, eccentric axial loading, un-symmetric bending. The shear formula, shear stresses in beams, shear flow in built-up members. Plane stress transformation, general equations of plane stress transformation. Mohr's circle. The state of stress caused by combined loading.

0951281 Surveying (3 Cr. Hrs.)

Prerequisite: (030102)

Principles and basic definitions, units of measurements, plotting scale, linear measurements, levelling, bearings, the theodolite, total station and applications, contour lines, traversing and coordinate determination, locating points by intersection and resection, areas and volumes, curve ranging.

0931282 Surveying Lab. (1 Cr. Hr.)

Prerequisite or Concurrent: (0951281)

Distance measurement and adjustment, levelling exercises, theodolite exercises, contouring exercises, topographic surveys, determination of areas and volumes, traversing exercises.

0951301 Numerical Methods (3 Cr. Hrs.)

Prerequisite: (0301202)

Algorithms to solve linear and non-linear equations. Solution of simultaneous linear equations using various methods: Gaussian elimination, Gauss-Jordan and Iterative Gauss-Seidel method. Solution using optimization techniques: unconstrained and constrained optimization. Curve fitting: Least square regression, Newton divided difference interpolation, Lagrange interpolation, Spline interpolation and Fourier Approximation. Numerical differentiation and integration. Numerical solution of ordinary differential equations: Runge-Kutta methods. Introduction to partial differential equation methods: Finite element method and finite difference method.

0951331 Foundation Engineering (3 Cr. Hrs.)

Prerequisite: (0931232)

Soil mechanics review, foundations definitions and types, distribution of stresses in soils, bearing pressure, bearing capacity of soils, rectangular combined footing, mat foundations, settlement of shallow foundations, deep foundations capacity and settlement, lateral earth pressure and retaining walls, stability of slopes.

0941341 Structures (1) (3 Cr. Hrs.)

Prerequisite: (0941242)

Classification of structures, types of supports, stability and classification of statically determinate and indeterminate beams, trusses and frames. Loads and forces and their combinations, load paths. Internal loads in members and structures, shear, moment and axial force diagrams for determinate beams and frames. Plane truss analysis, method of joints, method of sections, complex and space trusses. Analysis of statically determinate cables and arches. Deflections, direct integration method, conjugate beams, moment-area theorems, and real and virtual work methods. Introduction to analysis of statically indeterminate structures, Maxwell's reciprocal theorem. Moving loads and influence lines for determinate structures including beams, girders and trusses.

0951342 Structures (2) (3 Cr. Hrs.)

Prerequisite: (0941341)

Introduction to indeterminate structures, degree of freedom, static and kinematic indeterminacy, principle of superposition. Deflections by force methods for single and multiple degree of indeterminacy, method of consistent deformations, theorem of three moment equations, least work and Castigliano's second theorem. Deflections by displacement methods for beams and frames, frames with/without sways, slope deflection method, moment distribution method, analysis methods for different structures subjected

to symmetric or anti-symmetric loadings. Deflection due to thermal effects, fabrication errors and supports settlement. Introduction to analysis by matrix method.

0941351 Properties of Concrete (3 Cr. Hrs.)

Prerequisite: (0941242)

Concrete constituents and their principal roles in concrete performance. Cement: manufacture and types, contents, properties. Cement hydration reactions, concrete microstructure formation, hydration products and their influence to final concrete qualities. Setting, hardening and heat of hydration relationships and their significance. Fresh concrete: workability, segregation and mixing tests of fresh concrete. Other cementations materials and their effects on hydration process and ultimate concrete behaviour. Aggregate selection: physical and chemical properties affecting the performance of fresh and hardened concrete. Admixtures: chemical and physical effects on concrete behaviour both in fresh and hardened state. Additives: chemical and physical effects on concrete behaviour. Strength of concrete: compressive, tensile and flexural. Elasticity, shrinkage and creep. Testing of hardened concrete. Mix design. Durability problems in concrete.

0941352 Properties of Concrete Lab. (1 Cr. Hr.)

Prerequisite or Concurrent: (0941351)

Mineral aggregates, properties and testing. Portland Cement: composition, hydration, properties and testing. Proportioning concrete mixes. Testing of fresh concrete. Mechanical properties and testing of hardened concrete. Non-destructive evaluation methods.

0901361 Fluid Mechanics (3 Cr. Hrs.)

Prerequisite: (0914223, 0301202)

Fluid properties. Fluid in static and flowing conditions. Pressure variations. Control volume approach. Conservation of mass, conservation of momentum, conservation of Energy. Dimensional analysis and simulated flow in closed conduits.

0931362 Engineering Hydraulics (3 Cr. Hrs.)

Prerequisite: (0901361)

Hydraulics of pipe network. Introduction of hydro-machinery: pumps and turbines. Pumps selection. Pumps in-parallel and in-series. Uniform flow in open channels. Varied flow in open channels. Fluid measurements.

0941363 Engineering Hydraulics Lab. (1Cr. Hr.)

Prerequisite or Concurrent: (0931362)

Center of pressure, force on gates, triangular and rectangular notches, Venturi and orifice meters, impact of a jet, head loss in pipes, specific energy, critical depth, turbulent pipe flow, centrifugal pumps, axial flow pumps, hydraulic jump.

0931371 Drinking Water Engineering (3 Cr. Hrs.)

Prerequisite: (0931362)

Sources of drinking water, water demand, design period, population forecasting. Water distribution network design. Physical, chemical, biological and radiological properties of water. Drinking water treatment and disinfection. Introduction to advanced water treatment.

0931401 Statistics and Probability (3 Cr. Hrs.)

Prerequisite: (0301102)

Descriptive statistics, discrete and continuous random variables and probability distributions, joint probability distributions, point and interval estimation, tests of hypothesis, correlation and regression, analysis of variance, time series. Computer applications.

0941421 Contracts, Specifications and Quantity Surveying (3 Cr. Hrs.)

Prerequisite: (0931451)

Contractual procedures, contract types and contract documents. The legal aspects of contracts and tenders, types of construction documents including contracts and bonds, focus on the general of the construction contract (FIDIC), formulation of the building specifications and technical interpretation, their application to the selection and installation of materials and equipment in the construction projects, the quantity take-off and BOQ, term project consisting of preparing a tender documents for a building project.

0931451 Reinforced Concrete (1) (3 Cr. Hrs.)

Prerequisite: (0941352, 0941341)

Introduction to design philosophy and bases, design codes and specifications, loads, load combinations and load paths. Properties and tests of concrete and steel materials. Design methods, strength design method, flexural analysis and design of beams, cracked and un-cracked sections, concepts of ductile and brittle behavior, tension- and compression-controlled members and strength reduction factors. Design for flexural bending, singly and doubly reinforced rectangular beams, T-sections and other shapes, design of one-way solid slabs. Design of beams for shear and diagonal tension. Requirements for bond, anchorage

and development lengths. Serviceability requirements, deflection and cracking control, shrinkage and creep deflections. Analysis and design of short (non-slender) columns, pure axially loaded short columns, interaction diagrams, eccentrically loaded short columns, short columns subjected to compression plus uniaxial bending.

0931452 Reinforced Concrete (2) (3 Cr. Hrs.)

Prerequisite: (0931451), Concurrent or Prerequisite: (0951342)

Review of design methods and bases, limit states, strain limits. Load distribution and transfer, one-way and two-way slabs, Design of two-way solid slabs using ACI Direct Design Method, design of two-way solid slabs using approximate coefficient methods, design of one-way and two way ribbed slabs. Design for torsion. Design of slender columns, moment magnification and second-order effects. Design of columns in braced and non-braced frames. Design of non-load bearing walls, load bearing walls, and retaining walls. Design of concentric and eccentric foundations, wall footings, isolated footings, combined and continuous footings, and strap beam foundations.

0951453 Steel Structures (3 Cr. Hrs.)

Prerequisite: (0951342)

Material properties of structural steel, design philosophies: Load resistant factor design (LRFD) /allowable strength design (ASD). Types of loads and load combinations. Tension members: behaviour and strength of tension members, influence of hole placement, design of tension members. Compression members: Euler column buckling, effective length of columns and slenderness, effect of residual stresses and initial imperfections, column strength by AISC provisions, local buckling, built-up members. Beams: lateral torsional buckling, local buckling, and beam strength by AISC provisions, shear strength, biaxial bending, deflection, shear center. Beam-column: second-order effects, moment magnification method, design of beam-columns by AISC provisions. Bolted connections: types and failure modes, design of simple bolted connections. Welded connections: types and failure modes, design of simple welded connections.

0951464 Engineering Hydrology (3 Cr. Hrs.)

Prerequisite: (0931362, 0931401)

The hydrologic cycle and its components: precipitation, evaporation and transpiration, infiltration, and steam flow. Rainfall-runoff analysis and its application. Peak flow calculations. Design floods: hydrologic forecast and design criteria. Introduction to groundwater hydrology and well hydraulics. Computer applications on hydrologic modelling.

0941471 Wastewater Engineering (3 Cr. Hrs.)

Prerequisite: (0931371, 0303102)

Quantities and characteristics of wastewater. Design of municipal sewer systems. Municipal wastewater treatment: pretreatment and flow equalization, primary treatment, secondary treatment, activated sludge and trickling filters. Introduction to sludge treatment and disposal.

0901472 Environmental Engineering Lab. (1 Cr. Hr.)

Prerequisite: (0333109) , Concurrent or Prerequisite: (0941471)

Physical and biological characterization of water and wastewater, laboratory application of various physical, chemical, and biological processes, employed in environmental engineering practice such as: coagulation-flocculation, sedimentation, filtration and biological processes.

0941482 Pavement Design (3 Cr. Hrs.)

Prerequisite: (0901484, 0941231, 0931451)

Pavement types, stress, strain and deflection analysis for flexible and rigid pavemets, vehicle and traffic consideration, structural design of flexible and rigid pavements, pavement materials: bituminous materials and their uses, asphalt concrete mix design, pavement distress and maintenance, preparation and construction of pavements. Planning of maintenance works.

0931483 Pavement Lab. (1 Cr. Hr.)

Prerequisite or Concurrent: (0941482)

Includes the following tests: penetration, softening point, flash point, ductility, CBR, viscosity, stripping, loss on heat, Marshall, extraction, aggregate air content, specific gravity, skid resistance, profilograph, and surface texture.

0901484 Highway Engineering (3 Cr. Hrs.)

Prerequisite: (0931282)

The concept of highway planning, basic principles, techniques and controls of highway design, route location, geometric design, sight distance, horizontal and vertical alignment, cross-section elements, drainage and drainage structures, intersection design, grade separation and interchanges, earthwork requirements and operations, construction contracts and supervision.

0951521 Construction Management (2 Cr. Hrs.)

Prerequisite: (0941421)

Planning, construction management concepts, network analysis using precedence technique, overlapping networks, project monitoring, project control, time-cost trade off, recourse levelling, network-analysis using arrow techniques PERT.

0901572 Environmental Engineering (3 Cr. Hrs.)

Prerequisite: (0941471)

Air pollution analysis and control. Solid and hazardous waste management. Noise pollution analysis and control. Environmental laws and regulations in Jordan. Risk assessment.

0951581 Traffic Engineering (3 Cr. Hrs.)

Prerequisite: (0901484, 0931401)

Traffic system elements, driver, pedestrian, and vehicle characteristics, traffic flow characteristics. Traffic studies, traffic volume, speed, travel time and delay, origin-destination, accidents and traffic impact analysis, capacity and level of service, traffic signals and traffic control devices, traffic management.

0901598 Capstone Project (1) (1 Cr. Hr.)

Prerequisite: (Passing 120 Cr. Hr.s.)

Integrated systematic team approach to civil planning, analysis, evaluation, and design for complete large scale projects in civil engineering areas with interactions with other scientific and engineering disciplines. Establishment of performance criteria, economic analysis, identification of potential problems regarding ethical conduct and professional engineering practice are emphasized.

0901599 Capstone Project (2) (2 Cr. Hrs.)

Prerequisite: (0901598)

Project 2 is complementary to Project 1, which focuses on the final stages of the graduation project, including statistical analysis and environmental impact assessment of the project. Writing the project's remote report also represents the final component to show the main work components of the entire project, so it must be given the importance it deserves. To achieve this, the student must acquire, during this period, high-quality professional technical writing skills in line with some academic and technical standards (how to accurately define the project objectives, format according to the report requirements, professional writing, formatting tables and figures, final output of the report, sources and references). Preparing the presentation before the discussion committee of judges from the core of the specialization, with the aim of qualifying and preparing students for the labor

market or continuing the academic path, as well as working within a homogeneous work team.

0941303 Computer Applications in Structural Engineering (3 Cr. Hr.)

Prerequisite: (0931452)

Analysis of different types of structures using available computer packages like SAP2000 and ETABS. Analysis of prismatic and non-prismatic continuous beams under general loading. Pattern loading according to ACI-318. Analysis of 2D and 3D Trusses. Analysis of prismatic and non-prismatic plane frames. Analysis of arches. Analysis of footings as beams on elastic foundation. Analysis of one-way ribbed floor systems. Finite element analysis of two-way floor systems. Center of mass and center of rigidity. Lateral distribution of earthquake forces. Temperature loading. Modeling and analysis of water tanks. Analysis of highway bridges.

0901322 Introduction to Remote Sensing (RS) and Geographic Information System (GIS) (3 Cr. Hrs.)

Prerequisite: (0931282)

Introduction to remote sensing, energy sources and physical principles, radiation emission, Planck's equation, energy interaction with earth surface features, introduction to remote sensing satellites. The nature of GIS, the real world and its representations, geographic information and geospatial data types, spatial referencing and positioning, methods of data capture and sources of data. Upon completion, students should be able to know the principles of remote sensing and to identify GIS hardware components, typical operations, products/applications, and differences between database models and between raster and vector systems.

0901337 Building Construction (3 Cr. Hrs.)

Prerequisite: (0931451)

Historical review of building systems development. Introduction to the structural elements in buildings function and analysis of determinate members. Structural loads, building materials with emphasis on local materials. Timber and formwork. Provision of joints in structures. Finishing-tile, plastering.

0931431 Earth Retaining Structures (3 Cr. Hrs.)

Prerequisite: (0941331)

Review of fundamentals and lateral earth pressure. Design of gravity retaining wall, cast-In-Place retaining walls, mechanically stabilized earth walls, sheet pile walls, anchored sheet pile walls, braced excavation systems, soldier pile wall with lagging, slurry wall, gabions, soil nail wall, case studies. Computer applications.

0901503 Integrated Solid Waste Management (3 Cr. Hrs.)

Prerequisite: (0941471)

Laws and regulations for solid waste management. Waste sources, characteristics, generation, collection, transfer and transport. Waste recycling, reuse, recovery, treatment and disposal. Hazardous waste management issues and productivity. Hazardous treatment and disposal. Integrated waste management strategies, disposal and diversion methods.

0901506 Air Pollution Control (3 Cr. Hrs.)

Prerequisite: (0941471)

Laws and regulations for protecting the air quality. Design principles and economics of particulate and gaseous pollutants emission controls. Emissions from mobile sources and vehicles emission control.

0931522 Construction Methods (3 Cr. Hrs.)

Prerequisite: (0901420)

Basics of earthmoving, understanding and selection of a construction equipment l, earthmoving equipment: bulldozers, loaders, scrapers, trucks and wagons, compaction equipment, excavators, and shovels, lifting mechanisms such as buckets and cranes, fleet productivity, factors influencing fleet productivity, asphalt machines, equipment for concrete works, economic analysis of the equipment cost. Design of formworks.

0931523 Project Management (3 Cr. Hrs.)

Prerequisite: (Passing 90 Cr. Hrs.)

Project management concepts, construction strategic planning, legal aspects of the construction process, management structure, project finance and funding, budgeting, construction inventory management, personnel management, manpower planning, total quality management.

0901534 Introduction to Soil Improvement (3 Cr. Hrs.)

Prerequisite: (0951331)

Basics of design methodologies related to densification including dynamic compaction and vibro-compaction, hydraulic modification including prefabricated vertical and horizontal drains, physical and chemical modification including admixtures, chemical and cement grouting, soil mixing, and jet grouting, use of inclusions including stone columns, dynamic replacement, soil nailing and geosynthetic reinforcement.

0941541 Structures (3) (3 Cr. Hrs.)

Prerequisite: (0951342)

Qualitative influence lines, influence lines of continuous beams, indeterminate trusses, frames and arches of prismatic and non-prismatic sections. Structural analysis using classical and matrix methods, including flexibility and stiffness methods. Analysis using matrix method for rods, plane trusses, space trusses, two and three dimensional beams, and frames. Analysis of curved beams. Principles governing analysis of special structures such as plates, doms, and shells. Introduction to finite element method. Software packages for structural modeling and analysis.

0941551 Reinforced Concrete (3) (3 Cr. Hrs.)

Prerequisite: (0931452)

Design of slabs using the Equivalent Frame Method, design for openings in slabs. Approximate methods for analysis and design of concrete elements and frames. Design of shear walls and basement walls. Design of stairs. Strut-and-tie models. Design of water tanks. Design of mat and pile foundations. Basic principles on design of prestressed concrete elements. Special topics.

0961552 Prestressed Concrete (3 Cr. Hrs.)

Prerequisite: (0931452)

Introduction to prestressed concrete, types and concepts of prestressed concrete, prestressing methods, types of concrete and prestressing steel, flexural analysis using elastic stresses, flexural strength analysis, partial prestressing. Flexural design of beams, beams design with load balancing. Design based on strength requirements, flexural crack control, loss of prestress force, composite beams.

0931553 Introduction to Earthquake Engineering (3 Cr. Hrs.)

Prerequisite: (0931452)

Introduction to earth and earthquake nature and characteristics, earth plate tectonics, faults, seismic waves, earthquake records, measurement, magnitude, intensity, and seismic effects on structures. Introduction to structural dynamics, period, frequency, damping, stiffness and rigidity. Single- and multi-degree of freedom systems. Seismic response of linear elastic single- and multi-degree of freedom (SDOF and MDOF) systems. Seismic design elastic response spectrum. Estimation of earthquake load by dynamic modal analysis. Analysis using generalized coordinates and Raleigh's methods. Design codes such as UBC, IBC/ASCE 7, and Jordanian Codes. Analysis of multi-storey frame and shear wall buildings using equivalent static, response spectra, and response history procedures. Vertical and horizontal distribution of lateral seismic loads. Calculations of lateral

displacements and floor drifts. Basic principles and requirements for earthquake resistant design and detailing of reinforced concrete buildings using design codes such as ACI 318.

0901555 Bridge Engineering (3 Cr. Hrs.)

Prerequisite: (0951453, 0931452)

Introduction to highway bridges: types, trends, economics, aesthetic, planning and alternative designs. Principles of probabilistic design and the LRFD AASHTO Code. Highway design loads and load combinations. Bridge deck slabs: types analysis and design. Use of structural analysis software for live load analysis. Distribution of live loads to bridge girders. Analysis and design of bridge girders according to AASHTO specifications. Piers: types, analysis and design. Abutments: types, analysis and design. Bearing pads.

0951561 Hydraulic Structures (3 Cr. Hrs.)

Prerequisite: (0951464)

Design of dams and spillways. Seepage and uplift pressure. Stable channel design. Design of sluice gates, flumes, settling basin. Protection works: diversion works, weirs, sediment control, falls and transitions. Cross drainage works: siphon, aqueduct, culverts and outlet works.

0941562 Water Resources Engineering (3 Cr. Hrs.)

Prerequisite: (0951464)

Systems analysis of conventional and none conventional water resources: surface water, groundwater, water harvesting and water desalination Analysis and design of storage and water distribution systems. Climate change impact and mitigation in water resources. Integrated water resources management (IWRM) concept and applications. Social, environmental, economic, legal and institutional aspects in IWRM. Water challenges and strategies in Jordan and the Arab region. Application and term project.

0941563 Stormwater Drainage (3 Cr. Hrs.)

Prerequisite: (0951464)

Introduction to stormwater drainage, rainfall-runoff analysis, design criteria of property, drainage systems. Urban drainage and flood protection works, stormwater management. Case studies and computer application.

0901573 Environmental Impact Assessment (EIA) (3 Cr. Hrs.)

Prerequisite or Concurrent: (0901572)

Introduction to the environmental impact assessment (EIA), Jordanian regulation for EIA, introduction to the concepts, methodologies, valued environmental components and

various stages of the EIA process which include: screening, scoping, baseline conditions, evaluation and impact assessment, impact management, environmental management plan (EMP) and environmental monitoring program, EIA and EMP reporting, public consultation, reviewing, environmental auditing (EA), appeal rights and decision making.

0901574 Water Reuse Engineering (3 Cr. Hrs.)

Prerequisite: (0941471)

Water reuses definitions and historical background. Environmental and health issues of water reuse. Risk assessment and risk management. Non potable and potable uses of reclaimed water: Agricultural irrigation, industrial uses, groundwater recharge, and indirect potable reuse. Case studies.

0931582 Transportation Engineering (3 Cr. Hrs.)

Prerequisite: (0901484, 0951581)

Transportation planning: introduction to transportation in an urban area setting, issues and challenges, modes of transportation, demand analysis, air transportation: Airport planning, aircraft characteristics, airport configuration, runway and taxiway design, apron and terminal area, rail transportation: characteristics of railways, geometric elements and design, the track system, railway interoperability. Water transportation: port classification and components, ships and their characteristics, port site selection, design of quay walls. Transportation system management. Transport project evaluation and financing.

0901585 Railway Engineering (3 Cr. Hrs.)

Prerequisite: (0901484)

Characteristics of rail transport, track system, high speed trains, planning the railway activity, management of railways, forecast of rail demand, railway costs, capacity analysis, railway interoperability and standardization, problems, legal and institutional framework, technical solutions. Rail safety management, economic and financial aspects. Project management for railways, value engineering.

0901595 Special Topics in Civil Engineering (3 Cr. Hrs.)

Prerequisite: (Passing 120 Cr. Hr.s.)

Selected topics on recent developments in civil engineering directed to near-graduation students. Topics for each semester are announced at the time of course enrolment and varied from term to term. It covers issues related to specific branch in Civil Engineering (structures, material, geotechnical, water and environment, highway and traffic & project management).

0951500 Employability Readiness and Field Training (5 Cr. Hrs.)

Prerequisite: (Passing 120 Cr. Hr.s.)

The course offers a comprehensive blend of theoretical and practical instruction, spanning university classrooms and external settings such as companies, factories, and government institutions. Intensive coursework, totaling 105-120 contact hours over four weeks, covers essential topics like: Technical Skills Development, Teamwork, Written and Oral Communications, Career Services, Networking and Professional Associations, Work Ethics, Professionalism, Industry Projects and Case Studies, Certification and Continuing Education. Emphasis is placed on practical application through assignments, assessments, and field training, both domestically and internationally. The program aligns with University of Jordan regulations and aims to equip students with the skills necessary for successful careers.