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College of Engineering – King Khalid University

Bachelor of Science (BSc.) in Civil Engineering
Old Program Study Plan

(Revised as per trimester system-1444)

Distribution of Courses over Different Levels

September 2022

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First Year- Common Engineering Year

Level 1				
Course N° and Code	**Course Title**	**Credit Hours**	**Contact Hours**	**Pre- requisite**
011-ENG-6	Intensive English Program 1	6	12	
107-CHEM-6	General Chemistry	6	7	
111-GE-4	Engineering Drawing	4	8	
Total No. Of Credits/Contact Hrs		**14**	**27**	

Level 2				
Course N° and Code	**Course Title**	**Credit Hours**	**Contact Hours**	**Pre- requisite**
012-ENG-6	English Intensive Program 2	6	12	011-ENG-6
119-MATH-5	Differentiation and Integration -1	5	5	
111-ICI-2	The Entrance to the Islamic Culture	2	2	
Total No. Of Credits/Contact Hrs		**13**	**22**	

Level 3				
Course N° and Code	**Course Title**	**Credit Hours**	**Contact Hours**	**Pre- requisite**
129-PHYS-6	Physics -1	6	7	
129-MATH-5	Algebra and Geometry	5	5	119-MATH-5
101 CMS-5	Computer Science	5	6	
Total No. Of Credits/Contact Hrs		**16**	**18**	

Second Year: Civil Engineering Department

Level 4				
Course N° and Code	**Course Title**	**Credit Hours**	**Contact Hours**	**Pre- requisite**
112-ICI-2	Islamic Culture-2	2	2	
218-EE-4	Electric Engineering - 1	4	5	129-PHYS-6 119-MATH-5
219-MATH- 5	Differentiation and Integration-2	5	5	119-MATH-5
201-ARAB-3	Language Skills	3	3	
Total No. Of Credits/Contact Hrs		**14**	**15**	

Level 5				
Course N° and Code	**Course Title**	**Credit Hours**	**Contact Hours**	**Pre- requisite**
121-ME-4	Production Technology and Workshop	4	7	111-GE-4
211-CE-5	Statics	5	7	129-PHYS-6
225-CE-3	Introduction to Geotechnical Engineering	3	3	
229-MATH- 5	Differentiation and Integration-3	5	5	219-MATH-5
Total No. Of Credits/Contact Hrs		**17**	**22**	

Level 6				
Course N° and Code	**Course Title**	**Credit Hours**	**Contact Hours**	**Pre- requisite**
224-CE-5	Surveying	5	7	119-MATH-5
223-CE-5	Mechanics of Materials	5	6	211-CE-5
221-GE-3	Computer for Engineers	3	5	101 CMS-5
113-ICI-3	Islamic Culture-3	3	3	
Total No. Of Credits/Contact Hrs		**16**	**21**	

Third Year: Civil Engineering Department

Level 7				
Course N° and Code	**Course Title**	**Credit Hours**	**Contact Hours**	**Pre- requisite**
202-ARAB-2	Arabic Writing	2	2	
312-CE-5	Properties and Testing of Materials	5	6	223-CE-5
311-CE-5	Fluid Mechanics	5	7	211-CE-5
319-MATH- 5	Differential Equations	5	5	219-MATH-5
Total No. Of Credits/Contact Hrs		**17**	**20**	

Level 8				
Course N° and Code	**Course Title**	**Credit Hours**	**Contact Hours**	**Pre- requisite**
114-ICI-2	Islamic Culture-4	2	2	
321-CE-5	Structural Analysis - 1	5	6	223-CE-5
314-CE-3	Dynamics	3	3	211-CE-5
323-CE-3	Eng. Properties of and their Soils Measurements	3	3	312-CE-5
313-CE-3	Properties and Testing of Concrete	3	4	223-CE-5
Total No. Of Credits/Contact Hrs		**16**	**18**	

Level 9				
Course N° and Code	**Course Title**	**Credit Hours**	**Contact Hours**	**Pre- requisite**
301-ENG-3	Reports Technical Writing	3	3	012-ENG-9
322-CE-5	Hydraulics	5	6	311-CE-5
324-CE-6	Geographic Information Systems	6	7	
329-STAT-3	Principles of Statistics and Probability	3	3	
Total No. Of Credits/Contact Hrs		**17**	**19**	

Summer Internship

Course N° and Code	Course Title	Credit Hours	Contact Hours	Pre- requisite
400-CE-0	Summer Training	0	0	After completing 130 Cre.Hrs.

After the successfully completion of 9 level (9^{h} trimester), student has directed to attend a compulsory Professional Internship (Full time summer Training) in an industrial institution. Requirement for professional internship, as per the prerequisite for registration, the number of hours should be completed 130 hours. The student will train in an appropriate environment for not less than eight weeks (five days per week). A report will then be submitted to the department, and will be a graduation requirement. The evaluation will be undertaken at department level, alongside confidential feedback from the organisations concerned.

Fourth Year: Civil Engineering Department

Level 10				
Course N° and Code	**Course Title**	**Credit Hours**	**Contact Hours**	**Pre- requisite**
412-CE-5	Structural Analysis - 2	5	6	321-CE-5
414-CE-6	Soil Mechanics	6	8	223-CE-5
411-CE-6	Transportation Systems	6	7	224-CE-5
Total No. Of Credits/Contact Hrs		**17**	**21**	

Level 11				
Course N° and Code	**Course Title**	**Credit Hours**	**Contact Hours**	**Pre- requisite**
413-CE-5	Reinforced Concrete - 1	5	6	321-CE-5
421-CE-6	Environmental Engineering	6	8	322-CE-5
425-CE-6	Highway Engineering	6	7	311-CE-5
Total No. Of Credits/Contact Hrs		**17**	**21**	

Level 12				
Course N° and Code	**Course Title**	**Credit Hours**	**Contact Hours**	**Pre- requisite**
422-CE-3	Water Chemistry	3	3	322-CE-5
423-CE-5	Reinforced Concrete - 2	5	6	413-CE-5
419-MATH-5	Numerical Analysis	5	5	319-MATH-5
424-CE-5	Foundation Engineering - 1	5	6	414-CE-6 413-CE-5
Total No. Of Credits/Contact Hrs		**18**	**20**	

Fifth Year: Civil Engineering Department

Level 13				
Course N° and Code	**Course Title**	**Credit Hours**	**Contact Hours**	**Pre- requisite**
519-CE-0	Graduation Project*	4	4	Passing 188 credit hours
511-CE-3	Pavement design and Materials 1	3	3	411-CE-6 321-CE-5
	Elective 1	4	5	
	Elective 2	3	3	
Total No. Of Credits/Contact Hrs		**14**	**15**	

Level 14				
Course N° and Code	**Course Title**	**Credit Hours**	**Contact Hours**	**Pre- requisite**
523-CE-5	Design of Steel Structures	5	6	412-CE-5
	Elective 3	4	4	
512-CE-5	Hydrology	5	6	311-CE-5
Total No. Of Credits/Contact Hrs		**14**	**16**	

Level 15				
Course N° and Code	**Course Title**	**Credit Hours**	**Contact Hours**	**Pre- requisite**
521-CE-3	Industry and the Environment	3	3	
522-CE-3	Construction Engineering	3	3	
424-IE-3	Engineering Economy	3	3	
	Elective 4	4	4	
Total No. Of Credits/Contact Hrs		**13**	**13**	

Course Requirements

University Requirements

Sl.No.	Course Code & No.	Course Title	Credit /Contact hrs
1	111-IC1-2	The Entrance to the Islamic Culture	2/2
2	112-IC1-2	Islamic Culture - 2	2/2
3	113-IC1-3	Islamic Culture - 3	3/3
4	114-IC1-2	Islamic Culture - 4	2/2
5	201-ARAB-3	Language Skills	3/3
6	202-ARAB-2	Arabic Writing	2/2
Total			**14/14**

College Requirements

Sl.No.	Course Code & No.	Course Title	Credit /Contact hrs
1	011-ENG-6	Intensive English Program - 1	6/12
2	012-ENG-6	Intensive English Program - 2	6/12
3	301-ENG-3	Technical Report Writing	3/3
Total			**15/25**

Math & Basic Sciences

Sl. No.	Course Code & No.	Course Title	Credit /Contact hrs
1	107-CHEM-6	General Chemistry	6/7
2	119-MATH-5	Differentiation and Integration - 1	5/5
3	219-MATH-5	Differentiation and Integration - 2	5/5
4	129-PHYS-6	Physics - 1	6/7
5	229-MATH-5	Differentiation and Integration - 3	5/5
6	129-MATH-5	Algebra and Geometry	5/5
7	319-MATH-5	Differential Equations	5/5
8	329-STAT-3	Principals of Statistics & Probability	3/3
9	419-MATH-5	Numerical Analysis	5/5
10	101-CMS-5	Computer Science	5/6
11	221-GE-3	Computer for Engineers	3/5
Total			**53/56**

Total Non- Engineering Courses

Sl. No.	Course Requirement	Credit /Contact hrs
1	University Requirement	14/14
2	College Requirement	15/25
3	Math & Basic Sciences	53/56
Total		**82/95**

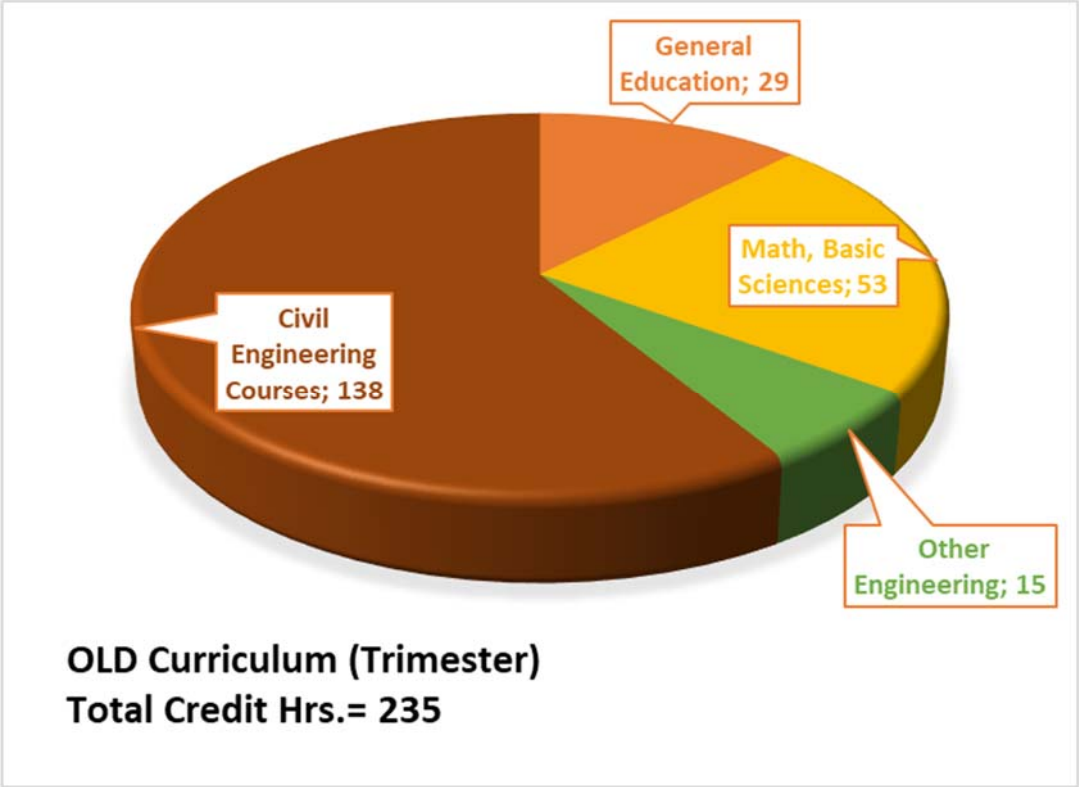
Common Engineering Courses

Sl.No.	Course Code & No.	Course Title	Credit /Contact hrs
1	111-GE-4	Engineering Drawing	4/8
2	221-ME-4	Production Technology and Workshop	4/7
3	218-EE-4	Electric Engineering - 1	4/5
4	311-IE-3	Engineering Economy	3/3
Total			**15/23**

Civil Engineering Courses

Sl.	Course Code	Course Title	Credit
1	211-CE-5	Statics	5/7
2	223-CE-5	Mechanics of Materials	5/7
3	224-CE-5	Surveying	5/7
4	225-CE-3	Introduction to Geotechnical Engineering	3/3
5	311-CE-5	Fluid Mechanics	5/7
6	312-CE-5	Properties and Testing of Materials	5/6
7	313-CE-3	Properties and Testing of Concrete	3/3
8	314-CE-3	Dynamics	3/3
9	321-CE--3	Structural Analysis - 1	5/7
10	322-CE-5	Hydraulics	5/7
11	323-CE-5	Eng. Properties of Soils and their	5/6
12	324-CE-6	Geographic Information Systems (GIS)	6/7
13	400-CE-0	Professional Internship (summer)	0/0
14	412-CE-5	Structural Analysis - 2	5/7
15	413-CE-5	Reinforced Concrete - 1	5/7
16	414-CE-6	Soil Mechanics	6/8
17	421-CE-6	Environmental Engineering	6/8
18	422-CE-3	Water Chemistry	3/3
19	423-CE-5	Reinforced Concrete - 2	5/7
20	424-CE-5	Foundation Engineering - 1	5/7
21	425-CE-6	Highway Engineering	6/7
22	511-CE-3	Pavement design and Materials 1	3/3
23	512-CE-5	Hydrology	5/7
24	515-CE-4	Advanced Reinforced Concrete Design	4/5
25	516-CE-3	Construction Management	3/3
26	519-CE-4	Graduation Project	4/4
27	521-CE-3	Industry and the Environment	3/3
28	522-CE-3	Construction Engineering	3/3
29	523-CE-5	Design of Steel Structures	5/7
30	526-CE-4	Foundation Engineering-II	4/4
31	527-CE-4	Soil Stabilization	4/4
Total			**125/163**

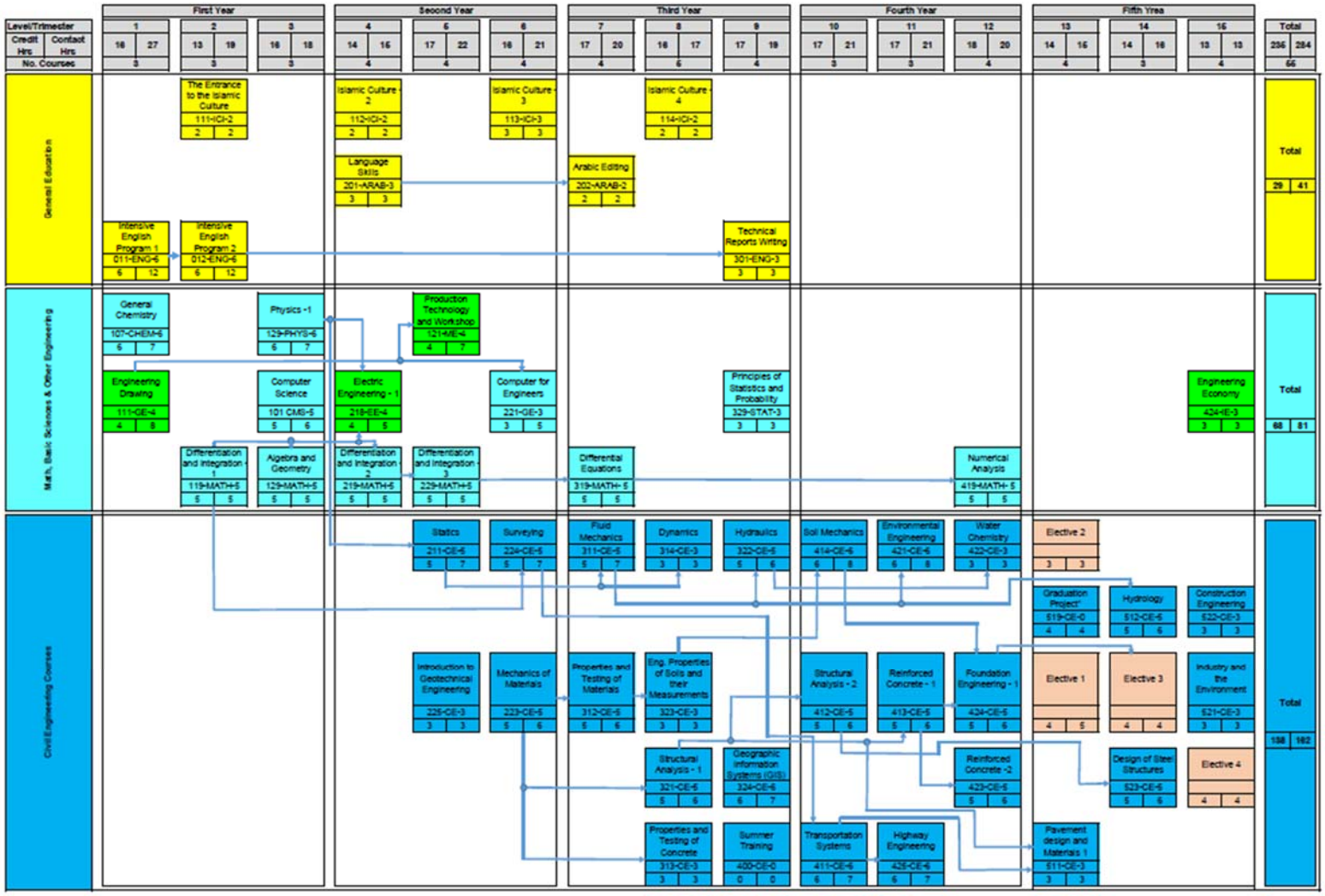
Course Credit hours



Total Credit Hrs.

235

Flowchart New Curriculum Trimester Plan



Descriptions of BSc. Civil Engineering Core Courses

Course Title	**Statics**	**Coordinator**		Dr. Mohamed Elouni	
Course Code	211-CE-3	**Credit Hrs.**	3	**Contact Hrs.**	4
Prerequisites	129-PHYS-4	**Level/Year**		3/2	

Course Objective:
To impart knowledge about the basic principles of engineering mechanics with emphasis on their analysis and application to practical engineering problems.

Teaching Method:
Lectures, and Training exercises

Expected Learning Outcomes:

- An ability to solve problems dealing with forces in a plane or in space and equivalent force systems, use of vector terminology and write the equations for equilibrium of particles and rigid bodies.
- An ability to solve truss, beam and frame problems and understand distributed force systems.
- An ability to solve friction problems
- An ability to determine centroid and moments of Inertia using integration methods.

Course Contents:	
Unit1: Introduction to solid mechanics	• What is mechanics? • History of mechanics • Fundamental Concepts • Fundamental Principles • Systems of Units
Unit II: Statics of Particles	• Resultant of Two Forces, Vectors, Addition of Vectors • Resultant of Several Concurrent Forces • Rectangular Components of a Force: Unit Vectors • Addition of Forces by Summing Components • Equilibrium of a Particle • Free-Body Diagrams • Rectangular Components in Space
Unit III: Rigid Bodies: Equivalent Systems of Forces and equilibrium	• External and Internal Forces • Principle of Transmissibility: Equivalent Forces • Vector Products of Two Vectors • Moment of a Force About a Point • Rectangular Components of the Moment of a Force • Scalar Product of Two Vectors • Moment of a Couple, Addition of Couples • Resolution of a Force Into a Force at O and a Couple • System of Forces: Reduction to a Force and a Couple • Reactions at Supports and Connections for a 2D Structure • Equilibrium of a Rigid Body in Two Dimensions • Statically Indeterminate Reactions • Equilibrium of a Two-Force Body • Equilibrium of a Three-Force Body

	• Equilibrium of a Rigid Body in Three Dimensions • Reactions at Supports and Connections for a Three-Dimensional Structure
Unit IV: Analysis of simple structures	• Definition of a Truss: plane truss, Space Trusses • Analysis of plane Trusses by the Method of Joints • Joints Under Special Loading Conditions • Analysis of Trusses by the Method of Sections • Trusses Made of Several Simple Trusses • Various Types of Beam Loading and Support • Shear and Bending Moment in a Beam • Relations Among Load, Shear, and Bending Moment
Unit V: Friction	• Laws of Dry Friction • Coefficients of Friction and Angles of Friction • Problems Involving Dry Friction • Wedges, Square-Threaded Screws
Unit VI: Moment of inertia, Centroids and Centers of gravity	• Moments of Inertia of an Area by Integration • Polar Moment of Inertia • Radius of Gyration of an Area • Parallel Axis Theorem • Moments of Inertia of Composite Areas • Product of Inertia • Moment of Inertia of: a Mass, Thin Plates, a 3D Body by Integration and Common Geometric Shapes • Center of Gravity of a 2D Body • Centroid of a Line, Centroids and First Moments of Areas • Determination of Centroids by Integration • Theorems of Pappus-Guldinus
Text Book (s): • R.C. Hibbler, Engineering Mechanics: Statics, 12th Edition, Pearson Prentice Hall, 2010. • R.C. Hibbler, Engineering Mechanics; Satatics and Dynamics, 11th Edition, Pearson, 2010	
Reference Book (s): • Meriam and Kraige, Engineering Mechanics: Statics Vol. 1, 7thed, Wiley, 2013. • Bedford, A, Engineering mechanics. Statics 5th ed. in SI units, 2008	
Mode of Evaluation: • Mid-Term Tests (Not less than two Exams) …… (40 %) • Assignments + E-Learning…… (10 %) • Final Exam. ……..…….. (50 %)	

Course Title	**Mechanics of Materials**	**Coordinator**		Dr. Nabil Ben Kahla	
Course Code	223-CE-3	**Credit Hrs.**	3	**Contact Hrs.**	4
Prerequisites	211-CE-3	**Level/Year**		4/2	

Course Objective:

The main objective of the course will be to show how to determine the stress, strain, and deflection suffered by structural elements when subjected to different loads (e.g. normal, shear, torsion, bending and combined loads). Once the state of stresses and strains has been established for a particular structure type, the student will be able to evaluate the allowable loads and associated allowable stresses before mechanical failure. Understanding the adequacy of mechanical and structural elements under different loads is essential for the design and safe evaluation of any kind of structure.

Teaching Method:

Lectures, and Training exercises.

Expected Learning Outcomes:

- Understand the fundamental concepts of stress and strain and the relationship between both through the strain-stress equations in order to solve problems for simple elastic solids
- An ability to solve problems relating to bending of beams
- An ability to solve problems relating to torsional deformation of bars
- Learn how to analyze structures experiencing *combined loads*
- Understand the concept of buckling and be able to solve the problems related to isolated bars

Course Contents:	
Unit I : Tension, Compression and Shear	• Introduction • Stress and strain • Tensile test • Hooke's law • Poisson's ratio • Deformations of members under axial loading • Ultimate strength of materials • Allowable load, allowable stress, factor of safety • Shearing stress and strain • Bearing stress in connections • The shear stress strain diagram • Modulus of rigidity • Transformation of Plane Stress • Principal Stresses • Maximum Shearing Stress • Mohr's Circle for Plane Stress
Unit II: Geometric Properties of Cross Section Areas	• Centroid of an area • Moment of Inertia of an Area • Polar Moment of Inertia

	• Radius of Gyration of an Area • Parallel Axis Theorem • Product of Inertia • Moments of Inertia for an Area about inclined Axes • Principal Moment of Inertia
Unit III: Analysis of Beams for Bending	• Introduction • Shear Force • Bending Moment • Procedure for Analysis • Diagrams • Relations Among Load, Shear, and Bending Moment • Strain Due to Bending • Stress Due to Bending • Beam Section Properties • Shear on the Horizontal Face of a Beam Element • Determination of the Shearing Stress in a Beam
Unit IV: Torsion	• Torsional Loads on Circular Shafts and Internal Stresses • Shaft Deformations • Shearing Strain • Stresses in Elastic Range • Normal Stresses • Angle of Twist in Elastic Range
Unit V: Stresses in Beams Under Combined Loadings	• Axial Force and Bending • Eccentric Axial Loading in a Plane of Symmetry • Unsymmetrical Bending • Axial force and Unsymmetrical Bending
Unit VI: Buckling of Columns	• Introduction • Critical Load • Ideal Column with Pin Supports • Columns having Various types of supports
Text Book (s): • R.C. Hibbeler, Mechanics of Materials, Prentice Hall, 9th Edition, 2014.	
Reference Book (s): • Beer, Johnston, Dewolf, Mechanics of Materials, 9th Edition, McGraw-Hill, USA, 2006. • Gere, James M, Mechanics of materials, 4th Edition, 2004, Brooks/Cole	
Mode of Evaluation: • Mid-Term Tests (Not less than two Exams) …… (40 %) • Assignments + E-Learning…… (10 %) • Final Exam. ……..…….. (50 %)	

Course Title	**Surveying**	**Coordinator**		Dr. Shams Al Deen	
Course Code	224-CE-4	**Credit Hrs.**	**4**	**Contact Hrs.**	**5**
Prerequisites	129-MATH-3	**Level/Year**		**4/2**	

Course Objective:

- Have the ability to apply knowledge of mathematics, science, and engineering to understand the measurement techniques and equipment used in land surveying.
- Have the ability to apply knowledge of mathematics, science, and engineering to understand the measurement techniques and equipment used in land surveying.
- Have the ability to apply knowledge of mathematics, science, and engineering to understand the measurement techniques and equipment used in land surveying.
- Ability to function as a member of a team.
- Understand the importance of professional licensure to protect the public in the practice of land surveying.

Teaching Method:

- Lectures, Training exercises (Tutorial + Labs, Reports for different subjects in this field , tanning in different surveying instruments)

Expected Learning Outcome:

- A brief summary of the knowledge or skill the course is intended to develop;
- A description of the teaching strategies to be used in the course to develop that knowledge or skill;
- The methods of student assessment to be used in the course to evaluate learning outcomes in the domain concerned

Course Contents:	
Unit 1:	• An Overview of Surveying Engineering • Capabilities of Surveying • Hardware and Software requirements of Surveying • Application of Surveying in Civil engineering • Classification of Surveying
Unit II :	• Units of measurements • International system of units (SI) • Significant Figures • Rounding off numbers
Unit III:	• Distance measurements • Linear measurements • Obstacle in linear measurements • Corrections of linear measurements
Unit IV:	• Levelling theory and methods • Introduction and Definitions • Equipment for differential levelling • Levelling field procedures and computations
Unit V :	• Traversing

	• Methods of measuring traverse angles • Measurements of traverse lengths • Traverse field notes • Traverse with Total Station Instruments • Traverse Computations
Text Book (s): • Duggal S K, " Surveying " (vol-1&2) 9th edition , Tata McGraw Hill, 2013 • Paul R. Wolf and Chales D. Ghilani " Elementary Surveying an introduction to Geomatics "12thedition , Pearson Prentice Hall, 2008	
Reference Book (s): • Barry Kavanagh, " Surveying Principles and Application" Pearson, 8th edition, 2009	
Mode of Evaluation: • Mid-Term Tests (Not less than two Exams.) ……..…… (20 %) • Practical Work ……..……..…….. (20 %) • Assignments + E-Learning…….……..…… (10 %) • Final Exam. ……..……..….(50 %)	

Course Title	**Introduction to Geotechnical Engineering**	**Coordinator**		Dr. Ahmad Babakar	
Course Code	**225-CE-2**	**Credit Hrs.**	2	**Contact Hrs.**	2
Prerequisites	None	**Level/Year**		**4-2**	

Couse Objective:

- To know the principles and applications of geotechnical engineering.
- To know the history of this science and most important contributors.
- To understand the geological cycle.
- To know the different type of rocks and examples for each type.

Teaching Method:

- Lectures, training exercises (Tutorial, report for different subjects in this field).

Expected Learning Outcome:

- Ability to understanding basic principles of geotechnical *engineering* for various other civil engineering applications.
- An ability to earn the knowledge about the geotechnical *engineering* and co-relationship with geological science, and knowledge of different type of rocks, geological cycle, weathering process and soil minerals.
- An ability to identify, and solves spatial problems.

-Course Contents:	
Unit 1: Introduction to Geotechnical Engineering	• Learn the common terminology used in the field of Geotechnical Engineering. To provide hands on experience with the measurement of geotechnical laboratory parameters.
Unit II : Origin of soil.	• Understand the fundamental differences between behaviors of sands and clays and other.
Unit III: Geological cycle of rocks and Types of minerals and rocks.	• Understand the three rock groups including igneous, sedimentary, and metamorphic rocks.
Unit IV: Weathering process and soil minerals.	Including physical, chemical, and biological.

Text Book (s):

- Das, B., "Principles of Geotechnical Engineering", 8th edition, Brooks/Cole, 2014.

Reference Book (s):

- Holtz, R. D., and Kovaes, W. D.," An Introduction to Geotechnical Engineering ", Prentice-Hall, USA. 2nd Edition, 2013.
- Cotudo, D.P., "Geotechnical Engineering-Principles and Practices, Prentice Hall, 2nd edition, 2011.

Mode of Evaluation:

- Mid-Term Tests (Not less than two Exams.) …… (20 %)
- Practical Work …….. (20 %)
- Assignments + E-Learning…… (10 %)
- Final Exam. ……. . (50 %)

Course Title	**Fluid Mechanics**	**Coordinator**		Dr. Mohd Abul H	
Course Code	311-CE-3	**Credit Hrs.**	3	**Contact Hrs.**	4
Prerequisites	211-CE-3	**Level/Year**		5/3	

Course Objective:
To impart knowledge about the basic properties of fluids and their behavior, flow conditions, principles of pipe flow and other various civil engineering applications using fluids mechanics principles.

Teaching Method:
Lectures, Training exercises (Tutorial + Labs, Reports etc.)

Expected Learning Outcome:
- Ability to acquaint with the fluid mechanics basic conservation laws: continuity, momentum, and energy principles.
- Ability to identify, formulate, and solve engineering problems
- Ability to understand the basic principles of pipe flow.
- Ability to use the applications, and modern engineering tools necessary for engineering practice.

Course Contents:	
Unit 1: Introduction	• Fluid definition and its various physical properties. • Pressure and Pressure head and Measurement of pressure • Pascal's law and its applications in Engineering field
Unit II : Static Fluid	• Total pressure and centre of pressure • Total pressure on different immersed bodies and their position of centre of pressure • Applications of total pressure and center of pressure.
Unit III: Fluid Dynamics	• Flow concepts and conservation of mass principle. • Bernoulli's equation, Momentum principle. • Energy principle. • Engineering Applications
Unit IV: Pipe Flow	• Pipe flow: Flow conditions. • Major Head losses (Darcy Weisbach, and Moody diagram). • Pipe connections: Series and parallel
Unit V: Dimensional Analysis	• Dimensional analysis and similitude. • Types of similitude and analysis.

Text Book (s):
- Munson & Okiishi," Fundamentals of Fluid Mechanics", John Wiley, 6th edition, 2010.

Reference Book (s):
- White, Frank M. Fluid Mechanics, McGraw Hill, 7th Edition 2011
- Roberson, J.A. and Crowe, C.T.," Engineering Fluid Mechanics", John Wiley, 7th Edition, 2001.

Mode of Evaluation:

- Mid-Term Tests (Not less than two Exams.) …… (30 %)
- Practical Work …….. (10 %)
- Assignments + E-Learning…… (10 %)
- Final Exam. ……. . (50 %)

Course Title	**Properties and Testing of Materials**	**Coordinator**		Dr. Mohd. Ahmed	
Course Code	312-CE-5	**Credit Hrs.**	5	**Contact Hrs.**	6
Prerequisites	223-CE-5	**Level/Year**		7/3	

Course Objective:

- To impart knowledge about the physical and mechanical properties of building materials especially the properties of steel, aggregate and wood
- To prepare the student to conduct the tests on building materials

Teaching Method:
Lectures, Training exercises (Tutorial + Labs, Reports for different topics in this field)

Expected Learning Outcome:

- Ability to understand and to describe the physical and mechanical properties of building materials
- Ability to know how to use measuring devices and to conduct the tensile testing of steel
- Ability to calculate the mechanical properties from the tension test
- Ability to classify the building materials type
- Ability to know the wood and aggregates, and their properties
- Ability to conduct the testing on wood and aggregates
- An ability to identify, formulates, and solves field problems related to use of building Material

Course Contents:	
Unit 1: Properties of Materials	• Physical Properties of Building Materials • Mechanical Properties of Building Materials • Tests Measuring Devices for Tension, Compression, Flexure, Hardness and Impact Machines • Tensile testing of Material (Steel or Aluminum Alloy) • Measurement of different Steel Properties from Tension Test (Elasticity, Plasticity and Yield etc.)
Unit II : Aggregates	• Properties of Aggregates • Classification of Aggregates • Apparatus and Testing for Aggregates (Grain Size, Fineness, Specific Gravity, Unit Weight, Absorption, Abrasion, Impact)
Unit III: Wood	• Properties of Wood • Classification of wood and Defects of wood • Seasoning and Preservation of wood • Apparatus and Testing for wood

Text Book (s):

- Kosmatka, S.H. and Panarese, W.C., "Design and Control of Concrete Mixture", Portland cement Association, Skokie, Illinois, 14th Edition (2002).

Reference Book (s):

- O'Flaherty, Coleman Anthony, Highways [electronic resource]: the location, design, construction and maintenance of road pavements, Butterworth-Heinemann, 2002.
- Saudi Building Code : Concrete Structures Commentary SBC 304 C, Saudi Building Code National Committee, 2007

Mode of Evaluation:

- Mid-Term Tests (Not less than two Exams.) ……(30 %)
- Practical Work …….. (10 %)
- Assignments + E-Learning…… (10 %)
- Final Exam. ……. .(50 %)

Course Title	**Properties and testing of Concrete**	**Coordinator**		Dr. Mohd. Ahmed	
Course Code	313-CE-3	**Credit Hrs.**	3	**Contact Hrs.**	3
Prerequisites	223-CE-5	**Level/Year**		8/3	

Course Objective:

- To impart knowledge about the cement and concrete manufacturing and properties and tests of cement and concrete
- To prepare the student to conduct the tests on cement and green/hardened concrete

Teaching Method:
Lectures, Training exercises (Tutorial + Labs, Reports for different topics in this field)

Expected Learning Outcome:

- Ability to understand the Manufacturing of cement and concrete
- Ability to earn the knowledge about the Ingredients of the cement and concrete
- Ability to describe the Properties of cement and concrete
- Ability to classify the cement and concrete type
- Ability to conduct the testing on cement and concrete
- Ability to employ quality control of cement and concrete in field
- Ability to identify, formulates, understand and recommend creative and innovative solutions using practical experience on Apparatus and Testing for cement and concrete

Course Contents:	
Unit 1: Cement	• Manufacturing of cement • Ingredients of cement • Properties of cement • Classification of cement • Apparatus and Testing for cement (Fineness, Surface Area, Normal Consistency, Initial and Final Setting Time, Compression, Flexural, and Tensile Tests) • Quality control of cement in Field
Unit II : Concrete	• Manufacturing of concrete • Ingredients of concrete • Properties of concrete • Classification of concrete • Apparatus and Testing for concrete (Slump, Flow, Compression test for cubes and cylinders, Concrete Test Hammer, and Pundit Plus) • Quality control of concrete in Field

Text Book (s):

- Kosmatka, S.H. and Panarese, W.C., "Design and Control of Concrete Mixture", Portland Cement Association, Skokie, Illinois, 14th Edition (rev.) (2002).

Reference Book (s):

- O'Flaherty, Coleman Anthony, Highways [electronic resource]: the location, design, construction and maintenance of road pavements, Butterworth-Heinemann, 2002.
- Saudi Building Code : Concrete Structures Commentary SBC 304 C, Saudi Building Code National Committee, 2007

Mode of Evaluation:

- Mid-Term Tests (Not less than two Exams.) …… (30 %)
- Practical Work …….. (10 %)
- Assignments + E-Learning…… (10 %)
- Final Exam. ……..…….. (50 %)

Course Title	**Dynamics**	**Coordinator**		Dr. Mohamed Elouni	
Course Code	314-CE-3	**Credit Hrs.**	3	**Contact Hrs.**	3
Prerequisites	211-CE-5	**Level/Year**		8/3	

Course Objective:
To know the principles of particle and rigid body kinematics and kinetics and application to practical engineering problems.

Teaching Method:
Lectures, and Training exercises

Expected Learning Outcomes:

- An ability to solve problems dealing with basic kinematics concepts – displacement, velocity and acceleration for rectilinear and curvilinear motions (inplane and in space).
- An ability to apply Newton's laws of motion and write equations of motion for particles and rigid bodies
- An ability to understand basic dynamics concepts – force, momentum, work and energy
- An ability to understand principle of work & energy and principle of Impulse-momentum

Course Contents:	
Unit I : Kinematics of Particles	• Rectilinear Motion • Plane Curvilinear Motion • Rectangular Coordinates • Normal and Tangential Coordinates • Polar Coordinates • Space Curvilinear Motion • Relative Motion
Unit II: Kinetics of Particles: Newton's second law	• Newton's Second Law • Equation of Motion and Dynamic equilibrium • Rectilinear Motion and Curvilinear Motion • Linear Momentum of a Particle • Angular Momentum of a Particle • Conservation of momentum
Unit III: Kinetics of Particles: Energy and Momentum Methods	• Work of a Force • Principle of Work & Energy • Power and Efficiency • Potential Energy • Conservative Forces • Conservation of Energy • Motion Under a Conservative Central Force • Principle of Impulse and Momentum • Impulsive Motion • Impact: Direct Central Impact, Oblique Central Impact
Unit VI: Kinematics	• Translation

of Rigid Bodies	• Rotation About a Fixed Axis • Equations Defining the Rotation of a Rigid Body About a Fixed Axis • General Plane Motion • Absolute and Relative Velocity in Plane Motion • Instantaneous Center of Rotation in Plane Motion • Absolute and Relative Acceleration in Plane Motion • Analysis of Plane Motion in Terms of a Parameter • Rate of Change With Respect to a Rotating Frame • Motion About a Fixed Point • General Motion: Three Dimensional Motion. • Coriolis Acceleration • Frame of Reference in General Motion
Unit V: Plane Motion of Rigid Bodies: Forces and Accelerations	• Equations of Motion of a Rigid Body • Angular Momentum of a Rigid Body in Plane Motion • Plane Motion of a Rigid Body: d'Alembert's Principle • Axioms of the Mechanics of Rigid Bodies • Problems Involving the Motion of a Rigid Body • Constrained Plane Motion: Noncentroidal Rotation and Rolling Motion
Text Book (s): • R.C. Hibbler, Engineering Mechanics; Satatics and Dynamics, 11th Edition, Pearson, 2010 • R.C. Hibbler, Engineering mechanics: Dynamics, 5thEdition, Pearson Prentice Hall, 2003.	
Reference Book (s): • J. Meriam & L.G. Kraige, "Engineering Mechanics: Dynamics" John Wiley and sons inc, 5th edition,, 2003.	
Mode of Evaluation: • Mid-Term Tests (Not less than two Exams) …… (40 %) • Assignments + E-Learning…… (10 %) • Final Exam. ……..…….. (50 %)	

Course Title	Structural Analysis-I	Coordinator		Dr. Yasser Alashker	
Course Code	321-CE-5	Credit Hrs.	5	Contact Hrs.	6
Prerequisites	223-CE-5	Level/Year		8/3	

Course Objective:
To impart knowledge about the basic principles of structural analysis for understand the fundamentals and the basic methods that used in the structural analysis, influence lines and deflections of structures. Enable the students to use the computer applications to analyze the beam structure.

Teaching Method:
Lectures, Training exercises (Tutorial and Reports for different subjects in this field)

Expected Learning Outcome:
- An ability to apply knowledge of mathematics, science and engineering to analyse the structures.
- An ability to determinate and evaluate the internal forces for determinate structures.
- An ability to use the theory, skills to make a complete analysis of different types of determinate structures.
- An ability to identify, formulates, and solves spatial determinate structures problems.

Course Contents:	
Unit 1: Introduction to Structural Analysis	• Introduction to structural analysis. • Types of structures and supporting system. • Reaction forces.
Unit II : Internal forces for different types of determinate structures	• Internal forces of statically determinate beams. • Internal forces of statically determinate frames. • Internal forces of statically determinate trusses. • Internal forces of statically determinate arches.
Unit III: Structures classification	• Stability of structures. • Determinate or indeterminate classification of structures.
Unit IV: Influence lines of determinate structures	• Introduction to influence lines. • Influence lines of determinate beams.
Unit V: Deflections of structures	• Introduction to deflections. • Deflection of beams using virtual work method.
Unit VI: Computer applications	• Computer applications for structural analysis of beams

Text Book (s):
- R.C. Hibbler, "Structural Analysis", Prentice-Hall, 7th Edition. 2009

Reference Book (s):
- Hassoun, M. Nadim, Structural concrete : theory and design, 4th Edition, 2008
- Jack C. McCormac, “Structural Analysis: Using Classical and Matrix Methods”, Wiley; 4th Edition, 2007

Mode of Evaluation:

- Mid-Term Tests and E-Learning tests (Not less than two Exams) …….(40 %)
- Practical Work and Assignments …….. (10 %)
- Final Exam. ……. …… (50 %)

Course Title	**Hydraulics**	**Coordinator**		Dr. Mohd Abul H	
Course Code	322-CE-5	**Credit Hrs.**	5	**Contact Hrs.**	6
Prerequisites	311-CE-5	**Level/Year**		9/3	

Course Objective:
To impart knowledge about the basic principles of fluids and of fluid flow, pipe flow and open channel flow, measurements in pipes and open channels.

Teaching Method:
Lectures, Training exercises (Tutorial + Labs, Reports etc.)

Expected Learning Outcome:

- Ability to acquaint with the basic principles of fluid flow in pipes and open channes
- Ability to identify, formulate, and solve engineering problems
- Ability to understand the basic principles of open channel flow.
- Ability to design and analysis of different types of hydraulic systems.
- Ability to acquire the skills to use some of the software used in the calculations of water distribution networks.

Course Contents:	
Unit 1: Review: Pressurized Flow	• Pressurized pipe flow –. Energy, Laws • Open channel flow, difference between pipe flow and open channel flow • Friction losses and minor losses. • Series, parallel, and branching flow.
Unit II : Pumps and Pumps Selection	• Pumps and pump selection. • Water Distribution Systems.
Unit III: Open Channel Flow	• Open channel flow – Steady and uniform flow. • Laminar and turbulent flow • Open channel flow: Design and analysis
Unit IV: Hydraulic Structures	• Specific energy; Hydraulic Jump. • Water surface profiles, Measurements • Dams, Reservoirs and head works
Unit V: Dimensional analysis and Similitude	• Dimensional analysis and similitude. • Types of similitude and analysis.

Text Book (s):

- Featherstone, R. E.," Civil Engineering Hydraulics", Blackwell Science, 2009.

Reference Book (s):

- Sturm, Terry W, Open channel hydraulics, McGraw-Hill, 2nd Edition, 2010

Mode of Evaluation:

- Mid-Term Tests (Not less than two Exams.) …… (30 %)
- Practical Work …….. (10 %)
- Assignments + E-Learning…… (10 %)
- Final Exam. ……. . (50 %)

Course Title	**Engineering properties of soil and their measurements**	**Coordinator**		Dr. Ahmad Babakar	
Course Code	323-CE-3	**Credit Hrs.**	3	**Contact Hrs.**	3
Prerequisites	312-CE-5	**Level/Year**		8-3	

Couse Objective:

- Knowing physical properties of soil.
- How to use measuring devices for soil.
- Understanding and getting index properties of soil.
- How to classify soil by different methods.
- Understanding soil compaction and its parameters.

Teaching Method:

- Lectures, Training exercises (Tutorial + Labs, Reports for different subjects in this field)

Expected Learning Outcome:

- An ability to understanding basic principles of physical properties of soil and laboratory methods for measuring.
- An ability to earn the knowledge about the index properties of soil and their use in soil classification by different methods.
- An ability to study the soil compaction and its parameters are included.

Course Contents:	
Unit 1: Introduction to Engineering properties of soil and their measurements	• Learn the common terminology used in the field of Engineering properties of soil and their measurements. • To provide hands on experience with the measurement of soil laboratory parameters. • Origin of soils.
Unit II : Soil physical.	• Soil physical characteristics and classification A. Soil Particles Size and Clay Minerals B. Grain Size Distribution C. Weight-Volume Relationships (Phase Relationships) & Relative Density D. Plasticity and Structure of Soil. E. Soil Classification.
Unit III: **Index Properties** of **soil**.	• Understand the liquiud limit, plastic limit, and shrinkage limit.
Unit IV: Soil Compaction.	Soil Compaction including:- A. Standard Proctor Test. B. Modified Proctor Test.

Text Book (s):

- Cernica, J.N., "Soil Mechanics", John Wiley and Sons, 1995.
- Das, B., "Principles of Geotechnical Engineering", 8th edition, Brooks/Cole, 2014.

Reference Book (s): • Das, B, "Soil Mechanics Laboratory Manual", Engineering Press, Oxford University Press, USA; 7th Edition, 2009.
Mode of Evaluation: • Mid-Term Tests (Not less than two Exams.) …… (20 %) • Practical Work …….. (20 %) • Assignments + E-Learning…… (10 %) • Final Exam. ……. . (50 %)

Course Title	**Geographic Information System (GIS)**	**Coordinator**		Dr. Javed Mallick	
Course Code	324-CE-6	**Credit Hrs.**	6	**Contact Hrs.**	7
Prerequisites	None	**Level/Year**		9/3	

Course Objective:
To impart knowledge about the basic principles of Geoinformation techniques for mapping, analysis and various other civil engineering applications using GIS technology.

Teaching Method:
Lectures, Training exercises (Tutorial + Labs, Reports for different subjects in this field)

Expected Learning Outcome:

- An ability to enhance understanding basic principles of GIS for mapping and various other civil engineering applications.
- An ability to earn the knowledge about the geographic and projected coordinate system, vector-based and raster map layers, map navigation in a GIS, attribute and spatial query methods, map design principles, source of free map layers on the internet, data preparation and cleaning for use, extraction or compilation of map layers to build study regions.
- An ability to use the techniques, skills and geoinformation tools necessary for engineering practices.
- An ability to identify, formulates, and solves spatial problems.

Course Contents:	
Unit 1: Introduction to GIS	• Geographical Information System (GIS): An Overview • Capabilities of GIS • Hardware and Software requirements of GIS • Application of GIS in Civil engineering • Classification of map layers • Spatial data models (Vector based-raster based)
Unit II : Getting Information from a GIS	• Map formats, Metadata • Map Navigation System (GPS) • Map projection in GIS • Geographic coordinate system (GCS) Vs projection system • Map scale and resolution GIS queries, ArcGIS for Map queries • GIS data products
Unit III: Designing Maps	• Map design • Graphical Hierarchy • Point line and polygon symbols • Map Layouts • Numeric intervals • ArcGIS for Map Design
Unit IV: Building a GIS	• Digitizing, Editing and Structuring Map Data • Creation of personnel Geodatabase

database	• Data management (feature conversion, append etc.) • Recourses on the Internet: US. Census Bureau Data/ESRI Website • Satellite image free download • Open source GIS
Unit V: GIS Analysis	• Mapping data with identifiers • Geocoding, Updating and modification • Join and relate the spatial data • Spatial Analysis • Work in Mini GIS Project
Text Book (s): • Concepts and Techniques of Geographical Information System by Lo, C. P. and Young, A. K. W., Prentice Hall, 2007.	
Reference Book (s): • Clarke, Keith C. ,l Getting started with geographic information systems 5th ed. Pearson Education, 2011 • Longley, Paul, Geographic information systems & science, Wiley, 3rd Edition, 2011 • Ormsby Tim, Getting to Know Arc GIS desktop, ESRI, 2010.	
Mode of Evaluation: • Mid-Term Tests (Not less than two Exams.) …… (20 %) • Practical Work …….. (20 %) • Assignments + E-Learning…… (10 %) • Final Exam. ……. (50 %)	

Course Title	**Transportation Systems**	**Coordinator**		Dr. Shams Al Deen	
Course Code	411-CE-6	**Credit Hrs.**	**6**	**Contact Hrs.**	**7**
Prerequisites	224-CE-5	**Level/Year**		**10/4**	

Course Objectives:

- The course focuses on highway transportation rather than other several transportation mode
- The review and application of selected engineering, planning, economic and mathematical concepts and principles to address highway transportation problems.
- To promote a protocol that considers preservation before expansion.
- Consider amending STP-Urban project selection criteria that rewards preservation activity.

Teaching Method:

- Lectures, Training exercises (Tutorial + Labs, Reports for different subjects in this field)

Expected Learning Outcome:

- A brief summary of the knowledge or skill the course is intended to develop;
- A description of the teaching strategies to be used in the course to develop that knowledge or skill;
- The methods of student assessment to be used in the course to evaluate learning outcomes in the domain concerned

Course Contents:	
Unit 1: Introduction	• An Overview of Transportation • Introduction to Transportation • Development of Transportation Systems • Roads as a Means of Communication • History of Road Construction
Unit II : Road	• Road Planning • Classification of Roads • Planning of Roads • Fact Finding Survey and Other Surveys
Unit III: Geometric	• Introduction • Geometric Design Of Highways • Width of Formation • Right of Way
Unit IV: Highway components	• Width of Pavement • Camber • Gradient • Speed • Sight Distance

Text Book (s):

- Banks, Tam, 'Introduction to Transportation Engineering, 2nd Edition, 2002.
- Paul H. Wright and Norman J. Ashford " Transportation Engineering" , John Wiley and Sons Publishing Co, 4th edition, 1998

Reference Book (s):

- Kavanagh, Barry F , Surveying : principles and applications, Pearson/Prentice Hall, 8th Edition, 2009
- Kutz, Myer, "Handbook of transportation Engineering ", McGraw Hill, 2004

Mode of Evaluation:

- Mid-Term Tests (Not less than two Exams.) …… (25 %)
- Practical Work …….. (15 %)
- Assignments + E-Learning…… (10 %)
- Final Exam. ……(50 %)

Course Title	**Structural Analysis-II**	**Coordinator**		Dr. Yasser Alashker	
Course Code	412-CE-5	**Credit Hrs.**	5	**Contact Hrs.**	6
Prerequisites	321-CE-5	**Level/Year**		10/4	

Course Objective:
To introduce the students to the indeterminate structural analysis, studying the internal forces and the deformations of the structures. Understand the fundamentals and the basic methods that used to solve the indeterminate structures, force methods and displacement methods such as, consistent deformation method, three moments equation, slope deflection method, moment distribution method, stiffness matrix method and approximate analysis of multi-story structures. Expose students to use the computer applications to analyze the indeterminate structure.

Teaching Method:
Lectures, Training exercises (Tutorial and Reports for different subjects in this field)

Expected Learning Outcome:
- An ability to apply knowledge of mathematics, science and engineering to analyse the structures.
- An ability to understand and activate the theory and the indeterminate methods for different kinds of structures.
- An ability to determinate and evaluate the internal forces for indeterminate structures.
- An ability to use the theory, skills to make a complete analysis of different types of indeterminate structures.
- An ability to identify, formulates, and solves spatial indeterminate structures problems.

Course Contents:	
Unit 1: Introduction to Indeterminate Structural Analysis	• Introduction to the indeterminate structures. • Concept of solving indeterminate structures • Degree of static and kinematic indeterminate structures.
Unit II : Force control methods	• Consistent deformation method. • Method of equation of three moments.
Unit III: Displacement control methods	• Slope deflection method • Moment distribution method. • Stiffness matrix method.
Unit IV: Influence lines of indeterminate structures	• Introduction to influence lines. • Influence lines of indeterminate structures.
Unit V: Approximate methods for solving indeterminate structures	• Portal frame method. • Cantilever method.
Unit VI: Computer applications	• Introduction to structural analysis software program. • Computer applications for structural analysis of indeterminate structures

Text Book (s): • R.C. Hibbler, "Structural Analysis", Prentice-Hall, 7th Edition. 2009
Reference Book (s): • Hassoun, M. Nadim, Structural concrete : theory and design, 4th Edition, 2008 • Jack C. McCormac, "Structural Analysis: Using Classical and Matrix Methods", Wiley; 4th Edition, 2007
Mode of Evaluation: • Mid-Term Tests and E-Learning tests (Not less than two Exams) …….(40 %) • Practical Work and Assignments …….. (10 %) • Final Exam. ……. …… (50 %)

Course Title	**Reinforced Concrete I**	**Coordinator**		Dr. Khalid Al Hadi	
Course Code	413-CE-5	**Credit Hrs.**	5	**Contact Hrs.**	6
Prerequisites	321-CE-5	**Level/Year**		11/4	

Course Objective:
To impart knowledge about the basic principles of design of reinforced concrete structures

Teaching Method:
Lectures, Training exercises (Tutorial, Quizzes and Assignment questions)

Expected Learning Outcome:
- An ability to understand basic principles of design of reinforced concrete structures
- An ability to earn the knowledge about the design of slabs, beams short columns
- An ability to work on real life problems.

Course Contents:	
Unit 1: Introduction to properties of concrete and reinforcing steel	• Mechanical properties of concrete • Mechanical properties of Reinforced steel • Compatibility between concrete and steel
Unit II : Types of loads and their factors	• Dead loads • Live loads • Lateral loads • ACI- 318
Unit III: Ultimate strength design method (USD)	• Design of singly reinforced sections • Design of doubly reinforced sections • screens • Design of rectangular sections • Design of T and L-shapes sections
Unit IV: Design of structural elements	• Design of beams against flexure • Design of beams against shear • Design of one -way slab • Design of short columns • Calculations of development length of steel

Text Book (s):
- Mashhour Ghoneim,Mohmoud EL-Mihlmy, "Design of Reinforced Concrete Structures",1st Edition, 2014

Reference Book (s):
- "ACI committee 318 Building Code Requirements for Reinforced concrete" ACI 318-05), 2005.
- Arthur H. Nilson" Design of Concrete Structures" 13th Edition, McGraw Hill, 2002

Mode of Evaluation:

- Mid-Term Tests (Not less than two Exams.) …… (30 %)
- Practical Work and Assignments …… (10 %)
- Quizzes and E-learning …… (10 %)
- Final Exam. …… . (50 %)

Course Title	**Soil Mechanics**	**Coordinator**		Engr. Saiful Islam	
Course Code	414-CE-6	**Credit Hrs.**	6	**Contact Hrs.**	8
Prerequisites	323-CE-3	**Level/Year**		10/4	

Course Objective:

- Understanding mechanics properties of soil
- Knowing hydraulics properties of soil.
- Getting skills in using principles of geotechnical engineering in engineering applications.

Teaching Method:
Lectures, Training exercises (Tutorial + Labs, Reports for different subjects in this field)

Expected Learning Outcome:

- An ability to enhance understanding basic principles of Soil and various other civil engineering applications.
- An ability to earn the knowledge about the mechanics and hydraulic property of soil
- An ability to use the techniques, skills and Soil mechanics tools necessary for engineering practices.
- An ability to identify, formulates, and solves spatial problems.

Course Contents:	
Unit 1: Introduction to Soil Mechanics	• Soil Mechanics: An Overview • Overview of Principle properties of soil
Unit II : Seepage	• Seepage in Soil • FLownets
Unit III: Stresses in Soil	• Stress below Soil • Newmark chart,Influence coefficient
Unit IV: Shear strength of Soil	• Different method for Determining shear strength Parameters • Direct shear test • Triaxial Test • Vane shear test • mohr Circle
Unit V: Consolidation and settlement	• Study of settlement of Soil with time
Unit VI: Earth Pressure	• Active and Passive Pressure • Study of soil at rest
Unit VII: Stability of slope	• Rankine theory

Text Book (s):

- Das, B., "Principles of Geotechnical Engineering", 8th edition, Brooks/Cole, 2014.
- Radwan, Amr, Fundamentals of Soil mechanics, 9th Edition, 2009, Dar Elmaarefa

Reference Book (s):

- Das, B, "Soil Mechanics Laboratory Manual", Engineering Press, Oxford University Press, USA; 7th Edition, 2009.
- Holtz, R. D., and Kovaes, W. D and Sheahan.," An Introduction to Geotechnical Engineering", pearson-Hall, USA. 2nd Edition, 2011
- Terzaghi, Karl, Soil mechanics in engineering practice, Wiley, 3rd Edition, 1996

Mode of Evaluation:

- Mid-Term Tests (Not less than two Exams.) …… (30 %)
- Practical Work …….. (10 %)
- Assignments + E-Learning…… (10 %)
- Final Exam. ……. . (50 %)

Course Title	**Environmental Engineering**	**Coordinator**		Dr. Ram Karan	
Course Code	421-CE-6	**Credit Hrs.**	6	**Contact Hrs.**	8
Prerequisites	322-CE-5	**Level/Year**		11/4	

Couse Objective:
To impart knowledge about the basic principles of Environmental Engineering and train them with the design concept of water and sewerage network system design.

Teaching Method:
Lectures, Training exercises (Tutorial, Labs, Quizzes and Assignment questions)

Expected Learning Outcome:
- An ability to enhance understanding basic principles of Environmental Engineering and making them aware the emerging issues of Environmental Engineering.
- An ability to earn the knowledge about the design of water supply system, water treatment system, sewerage treatment system, use of software to design these systems.
- An ability to work on real life problems to analyze and design these systems.

Course Contents:	
Unit 1: Introduction to Environmental Engineering	• Environmental Engineering: An Overview • Practical aspects of Environmental Engineering • Thrust problems in Environmental Engineering • Water and waste water concepts • Use of chemicals and water quality standards • Water and waste water treatment techniques
Unit II : Introduction to Water Supply System	• Water supply systems: An Overview • Types of water supply systems • Allocation of source of water • Allocation of water needs • Use of software in water distribution system network analysis
Unit III: Design of water treatment system	• Design of screens • Design of sedimentation tank • Design of flocculation • Design of filters • Design for disinfection
Unit IV: Design of sewerage treatment system	• Flow diagram of sewage treatment systems • Dissolve oxygen model and its use • DO,BOD and COD • Design of sewage treatment processes
Unit V: Reuse techniques and computer application in Environmental Engineering	• Concepts of reuse • End products of treatment and their use • Use of sludge • Software used in Environmental system analysis and design

Text Book (s):

- Peavy, Rowe and Tchobanoglous, "Environmental Engineering", McGraw-
- Hill, Last Edition, 1985 (Reprint 2015)
- Warren Viessman, Jr., and Mark. J. Hammer, "Water Supply and Pollution Control", 7th Edition, Prentice Hall, 2004.

Reference Book (s):

- Mackenzie L. Davis and Davis A. Cornwell.," Introduction to Environmental Engineering", McGraw-Hill, 5th Edition, 2013.
- Metcalf & Eddy, "Wastewater Engineering: Treatment and Reuse", McGraw-Hill, New York., USA, 4th Edition, 2003.

Mode of Evaluation:

- Mid-Term Tests (Not less than two Exams.) …… (30 %)
- Practical Work and Assignments …… (20 %)
- Quizzes and E-learning …… (10 %)
- Final Exam. …… . (50 %)

Course Title	**Water Chemistry**	**Coordinator**		Dr. Ahmad Babakar	
Course Code	422-CE-3	**Credit Hrs.**	3	**Contact Hrs.**	3
Prerequisites	322-CE-5	**Level/Year**		12/4	

Couse Objective:
To impart knowledge about the basic of chemicals that dealing with water treatment. Study the chemicals for water treatment, sedimentation, decaying, oxidation, precipitation and adsorption of organics.

Teaching Method:
Lectures, Training exercises (Tutorial, Quizzes and Assignment questions)

Expected Learning Outcome:
- An ability to enhance understanding and know the fundamentals of chemical analysis of water.
- An ability to earn the knowledge about the chemical fundamentals for water treatments and pollution control.

Course Contents:	
Unit 1: Introduction to Water Chemistry	• Water Chemistry: An Overview • Physical property of water • Turbidity of water • Color and odor of water • PH and specific conductivity of water • Role of physical water quality parameters in water and waste water
Unit II : Chemical Water Quality parameters	• Chemical water property : An Overview • Hardness of water • Acidity and alkalinity of water • Chemical compounds used in removing the hardness of water
Unit III: Water softening process	• Lime-soda process • Zeolite process • De-mineralization process • Dose of chemicals used Jar-test • Dose analysis
Unit IV: Water Quality standards	• WHO standard of water for domestic use • FAO standard for agricultural water use • Industrial water quality standards
Unit V: Latest development in water quality standards	• Mineralised water • Trace metals and chemicals in water • Advanced water treatment needs • Recent technologies of water treatment

Text Book (s):
- Baird, C.,W. H. Freeman," Environmental Chemistry", New York. 4thedition, 2008.

Reference Book (s):

- Mackenzie L. Davis and Davis A. Cornwell.," Introduction to Environmental Engineering", McGraw-Hill, 3rd Edition, 2013.
- Sawyer, C. N., P. L. McCarthy, and G. F. Parkin, "Chemistry for Environmental Engineering and Science", McGraw- Hill, New York. 5th edition 2007.

Mode of Evaluation:

- Mid-Term Tests (Not less than two Exams.) …… (40 %)
- Quizzes and E-learning …… (10 %)
- Final Exam. …… . (50 %)

Course Title	**Reinforced Concrete II**	**Coordinator**		Dr. Khalid Al Hadi	
Course Code	423-CE-5	**Credit Hrs.**	5	**Contact Hrs.**	6
Prerequisites	413-CE-5	**Level/Year**		8/4	

Course Objective:
To impart knowledge about the design of reinforced concrete structures

Teaching Method:
Lectures, Training exercises (Tutorial, Quizzes and Assignment questions)

Expected Learning Outcome:
- An ability to understand basic principles of design of reinforced concrete structures.
- An ability to earn the knowledge about the design of different types of slabs and frames.
- An ability to work on real life problems.

Course Contents:	
Unit 1: Introduction to properties of concrete and reinforcing steel	• Mechanical properties of concrete • Mechanical properties of Reinforced steel • Compatibility between concrete and steel
Unit II : Types of sabs	• Design of hollow blocks slabs • Design of flat slabs • Design of paneled beams slabs
Unit III: continuous beams	• Design of continuous beams against flexure • Design of continuous beams against shear • Details of reinforcement
Unit IV: Design of Frames	• Types of frames • Loads acting on frames • Design of long columns • Design of sections with eccentricity • Details of reinforcement • Using computer software in design of reinforced concrete structures

Text Book (s):
- Mashhour Ghoneim,Mohmoud El-Mihlmy,"Design of Reinforced Concrete Structures",,1st Edition,2014 (Vol. 2 and 3)

Reference Book (s):
- "ACI committee 318 Building Code Requirements for Reinforced concrete" ACI 318-05), 2005
- Arthur H. Nilson" Design of Concrete Structures" 13th Edition, McGraw Hill ,2002

Mode of Evaluation:

- Mid-Term Tests (Not less than two Exams.) …… (30 %)
- Practical Work and Assignments …… (10 %)
- Quizzes and E-learning …… (10 %)
- Final Exam. …… . (50 %)

Course Title	**Foundations Engineering (I)**	**Coordinator**		Dr. Mahmood H	
Course Code	424-CE-5	**Credit Hrs.**	5	**Contact Hrs.**	6
Prerequisites	413-CE-5 & 414-CE-6	**Level/Year**		12/4	

Course Objective:

• This course spots on the bearing capacity of soil and different types of foundations and the principles of analysis and design of foundations, foundation settlements, deep foundations, earth pressure and retaining walls.

Teaching Method:

Lectures, Training exercises (Tutorial + Labs, Reports etc.)

Expected Learning Outcome:

- Understanding the relation between the soil and the foundations.
- Knowing the different types of foundations.
- Getting skills to design different types of foundations and retaining walls.

Course Contents:	
Unit 1: Introduction	Type of foundations
Unit II : Bearing capacity of soil	• Bearing capacity of soil • Egyptian code method • Terzaghi Method • Field method
Unit III: Shallow foundation	• Design of isolating footing. • Design of combined footing. • Design of strip footing. • Design of strap footing. • Design of raft foundations.
Unit IV: Retaining structure	• Deep foundations. • Earth pressure. • Design of retaining wall.

Text Book (s):

- Das, B.M., "Principles of Foundation Engineering", Thomson-Brooks/Cole 6th Edition, 2007.

Reference Book (s):

- Bowles, J. E.," Foundation Analysis and Design", McGraw-Hill Bool Co., U.S.A, 5th Edition, 1996.

Mode of Evaluation:

- Mid-Term Tests (Not less than two Exams.) …… (30 %)
- Practical Work …….. (10 %)
- Assignments + E-Learning…… (10 %)
- Final Exam. ……. . (50 %)

Course Title	**Highways Engineering**	**Coordinator**		Engr. Isamel Yousif	
Course Code	425-CE-6	**Credit Hrs.**	6	**Contact Hrs.**	7
Prerequisites	411-CE-6	**Level/Year**		11/4	

Couse Objective:

- To understand the basics of highway planning and design.
- To understand the properties of road aggregate and bitumen.
- To have the skills of road design and its execution.

Teaching Method:

- Lectures.
- Training exercises (Assignments + Labs).
- Experimental Tests.

Expected Learning Outcome:

- Student gains highways engineering knowledge and concepts.
- Student can perform highway geometric design and flexible highway pavement design.
- Student gains both theoretical and experimental knowledge about the properties of highway materials.
- Maintenance and drainage problems are introduced.

Course Contents:	
Unit 1: Engineering design	• Planning and capacity of road. • Standard engineering design. • Geometric section elements.
Unit II : Curves design	• Sight distances, planning of horizontal and vertical highway curves.
Unit III: Structural design	• Cross sections, properties of highway materials. • Introduction to flexible highway pavement design.
Unit IV: Mix design	• Introduction to bitumen mix design.
Unit VI Maintenance	• Drainage requirements. • Retrofitting and maintenances highway pavement

Text Book (s):

- Wright Paul, "Highway Engineering", 7th edition, John Wiley and Sons, Inc, USA 2004.

Reference Book (s):

- "A policy on Geometric Design of Highways and Streets", Amer. Association of State Highway; 5th edition, 2004.
- AASHTO, "Guide for Design of Pavement Structures", Amer. Association of State Highway and Transport Officials, Washington, D.C., 16th ed., 1993.

Mode of Evaluation:

- Mid-Term Tests (Not less than two Exams.) …….. (30 %)
- Experimental Works……. (10 %)
- Homework ……. ……..…… (10 %)
- Final Exam. …… (50 %)

Course Title	**Pavement Design and Material-I**	**Coordinator**		Dr. A. Sivakumar	
Course Code	511-CE-3	**Credit Hrs.**	3	**Contact Hrs.**	3
Prerequisites	312-CE-5, 411-CE-6	**Level/Year**		13/5	

Couse Objective:
To impart knowledge about the technology of asphalt in its several forms, the application using asphalt, understanding of asphalt properties, characteristics, testing procedures, and specifications, stress analysis, asphalt layers and axial load analysis in asphalt pavements.

Teaching Method:
Lectures, Training exercises (Tutorial, Labs, Quizzes and Assignment questions)

Expected Learning Outcome:

- To understand the asphalt types.
- To know the soil classifications.
- Know the different types of asphalt mix.
- Gain skills for asphalt mix design.
- Understand the design for both the rigid and flexible pavements.

Course Contents:	
Unit 1: Introduction to Pavement Design and Materials	• Pavement Definition • Types of pavement • Structural aspects
Unit II : Soil Classification	• Soil an Introduction • Soil classification types • Use in the pavement Design
Unit III: Use of Asphalt	• Types of bitumen materials and its tests • Asphalt functions in road pavements • Design of asphalt mix using Marshal Method
Unit IV: Pavement Design	• Stress evaluation in asphalt pavements using "One layer theory" • Pavements layers • Equivalent axial load evaluations • AASHTO design for both rigid and flexible pavements

Text Book (s):

- Yoder, E.J. and Witczack, M.W., "Principles of Pavement Design", John Wiley & Sons, Inc., 2nd Edition. 1975, (reprint 2015)
- Lavin, Patrick G., Asphalt pavements : a practical guide to design, production and maintenance for engineers and architects, Taylor & Francis, 2003

Reference Book (s):

- O'Flaherty, Coleman Anthony, Highways [electronic resource]: the location, design, construction and maintenance of road pavements, Butterworth-Heinemann, 2002.

- AASHTO, "Guide for Design of Pavement Structures", Amer. Association of State Highway and Transport Officials, Washington, D.C., 16th ed., 1993.

Mode of Evaluation:

- Mid-Term Tests (Not less than two Exams.) …… (30 %)
- Practical Work and Assignments …… (20 %)
- Quizzes and E-learning …… (10 %)
- Final Exam. …… . (50 %)

Course Title	**Hydrology**	**Coordinator**		Dr. Javed Mallick	
Course Code	512-CE-5	**Credit Hrs.**	5	**Contact Hrs.**	6
Prerequisites	311-CE-5	**Level/Year**		14/5	

Couse Objective:

- To know the basics of hydrology with a focus on engineering aspects.
- To acquire the skills to use different methods in the management of water sources.
- To Understanding the hydrological cycle.
- To acquire the skills of Hydrology using GIS software.

Teaching Method: Lectures; Training exercises (Tutorial + Labs); Experimental Lab.

Expected Learning Outcome:

- An ability to enhance understanding basic principles of hydrology and methods of managing water resources
- An ability to estimate the water resources availability and reduction of hydrological risks
- An ability to use the techniques, skills and tools necessary for engineering practices.
- An ability to identify, formulates, and solves hydrological problems.

Course Contents:	
Unit 1: Principles and objectives of hydrology and water resources engineering	• Principles of hydrology and water resources engineering • Objectives of water resources development
Unit II : Hydrological cycle and hydrological processes	• Water demand • Hydrological cycle • Hydrological water budget • Measurement and analysis of precipitation • Measurement and analysis of Evaporation • Measurement and analysis of Infiltration
Unit III: Groundwater	• Ground water: water resources and geological agents • Conjunctive use of surface and ground waters
Unit IV: GIS Hydrology	• Applications of GIS in Water Resources Engineering • GIS Analysis Functions and Operations using ArcHydro tool
Unit V: Water resources	• Planning for water resources development • Economic analysis of water resources projects

Text Book (s):

- K Subramanya, "Engineering Hydrology", The McGraw-Hill, 4th Edition, 2013.

Reference Book (s):

- Raghunath, H. M. , Hydrology : principles, analysis, and design, New Age International, 2nd edition, 2006
- Leonard F. Debano, Greqarson, H. M., and Peter F. Folliott," Hydrology and the management of the Watershed", Iowa State Press; 3rd Edition, 2003.

Mode of Evaluation:

- *Mid-Term Tests (Not less than two Exams.) …….* *(30 %)*
- *Practical Work and Assignments……* *(20 %)*
- *Final Exam. ……* *(50 %)*

Course Title	**Construction Management**	**Coordinator**		Engr. Mishal	
Course Code	516-CE-3	**Credit Hrs.**	3	**Contact Hrs.**	3
Prerequisites	----	**Level/Year**		13/5	

Couse Objective:
To impart knowledge about the fundamentals and rules to plan and manage the engineering projects, know and understand the planning and organizing techniques. Know and apply of line of balance, bar-chart and network techniques. The student should get kills for material and labor resources and organization.

Teaching Method:
Lectures, Training exercises (Tutorial, Quizzes and Assignment questions)

Expected Learning Outcome:

- Understand and know the fundamentals of construction management
- Gain the skills to manage and plan the engineering projects
- Study the plans techniques used in engineering projects
- Achieve and evaluate the project time
- Get skills in organizing labor and material resources
- Using computer software for project management

Course Contents:	
Unit 1: Introduction to Project Management	• Introduction to project management • The manager responsibilities and duties • Engineering project management
Unit II : Network Planning	• Network planning. • Bar charts planning. • Using of network and bar chart planning in project management.
Unit III: Project Management Control	• Project management control. • Material recourses and cost control. • Equipment recourses and cost analysis and control. • Equipment and production cost estimation and productivity control.

Text Book (s):

- Robert Peurifoy and Clifford J. Schexnayder and Aviad Shapira and Robert Schmitt, "Construction planning, equipment & Methods", McGraw Hill, 8th Edition, 2010

Reference Book (s):

- S.W. Nunnaly," Construction Methods and Management", Prentice-Hall, Inc., 7th Edition, 2006.
- Richard Clough, "Construction Contracting: A Practical Guide to Company Management", Wiley; 7th Edition, 2005.

Mode of Evaluation:

- Mid-Term Tests (Not less than two Exams.) …… (30 %)
- Practical Work and Assignments …… (20 %)
- Quizzes and E-learning …… (10 %)
- Final Exam. …… . (50 %)

Course Title	**Industry and the Environment**	**Coordinator**		Dr. Mohd. Ahmed	
Course Code	521-CE-3	**Credit Hrs.**	3	**Contact Hrs.**	3
Prerequisites	None	**Level/Year**		15/5	

Couse Objective:

- To know the basics of Environment and environmental balances.
- To acquire knowledge of the pollution sources and types.
- To acquire the understanding of the Environmental Monitoring Technology and methods used to control the industry pollutions.

Teaching Method: Lectures; Training exercises (Tutorial, Quizzes and Assignment questions)

Expected Learning Outcome:

- Understand the relation between the industry outputs and the environmental.
- Ability to know the pollution sources and types.
- Ability to earn the knowledge of the pollution limits.
- Understand the techniques and methods used to control the industry pollutions.

Course Contents:	
Unit 1: Introduction	• Introduction to Environmental • Environmental Balance • Environment Affects by Industry activities
Unit II : Pollution type, Sources and Effects	• Pollution Types (Water Pollution; Air Pollution; Soil and Land Pollution) • Water Pollution: Types, Sources and Effects • Air Pollution: Types, Sources and Effects • Soil/Land Pollution: Types, Sources and Effects
Unit III: Pollution Control Techniques	• Water Pollution Control Techniques • Air Pollution Control Techniques • Soil/Land Pollution Control Techniques • Environmental Monitoring Technology
Unit IV: Pollution Problem	• Pollution Problems from Industry and Engineering fields

Text Book (s):

- J.Glynn Henry, Gary W. Heinke, 'Environmental Science and Engineering', 2nd edition. Prentice Hall, 1996, (Reprint 2014)

Mode of Evaluation:

- *Mid-Term Tests (Not less than two Exams.) …….* *(30 %)*
- *A Tutorial, assignments and Quizzes……* *(20 %)*
- *Final Exam. ……* *(50 %)*

Elective Courses

Course Title	**Traffic Engineering**	**Coordinator**			
Course Code	513-CE-4	**Credit Hrs.**	4	**Contact Hrs.**	5
Prerequisites	411-CE-6	**Level/Year**		14/5	

Couse Objective:

- To impart knowledge about the components of traffic system and specifications of traffic flow
- To prepare the student to conduct the traffic field survey to manage the traffic flow

Teaching Method:
Lectures, Training exercises (Tutorial + Reports for different topics in this field)

Expected Learning Outcome:

- Ability to understand and to describe the traffic engineering system
- Ability to know traffic engineering safety
- Ability to know the highway capacities and alignments
- Ability to conduct the field survey related to road and traffic flow
- An ability to identify, formulates, and solves field problems related to traffic engineering

Course Contents:	
Unit 1: Traffic Engineering	• Introduction to traffic engineering system • Traffic flow specifications • Traffic engineering studies • Cars parking • Pedestals
Unit II : Traffic Safety and Traffic Management	• Traffic engineering safety • Road alignments • Street capacities and intersections • Rush hours traffic flow managements

Text Book (s):

- Roger P. Roess, William R. McShane & Elena S. Prassas," Traffic Engineering", Prentice-Hall, Inc., New Jersey, 3rd Edition, 2004.

Reference Book (s):

- Wright Paul, "Highway Engineering", 7th edition, John Wiley and Sons, Inc, USA 2004.

Mode of Evaluation:

- Mid-Term Tests (Not less than two Exams.) …….(30 %)
- Practical Work …….. (10 %)
- Assignments + E-Learning…… (10 %)
- Final Exam. ……. .(50 %)

Course Title	Remote Sensing	Coordinator			
Course Code	514-CE-4	Credit Hrs.	4	Contact Hrs.	5
Prerequisites	224-CE-6	Level/Year		14/5	

Couse Objective:
To impart knowledge about the basics of remote sensing systems and how to interpret aerial photographs, digital images, using the computer.

Teaching Method:
Lectures, Training exercises (Tutorial, Labs, Quizzes and Assignment questions)

Expected Learning Outcome:
- Understanding of remote sensing and applications of various engineering.
- Skills Visual Interpretation and Digital Interpretation
- To identify the satellites used in remote sensing and digital image processing

Course Contents:	
Unit 1: Introduction to Fundamentals of remote sensing systems	• Fundamentals of remote sensing • Electromagnetic Radiation, Terms and Definitions, Laws of Radiation, EM Spectrum, Sources of EMR.
Unit II : Imaging multi-spectrum and thermal infrared	• Earth Observation Satellites (LANDSAT, SPOT, IRS, IKONOS) and their characteristics • Remote Sensing Systems - Active and Passive Systems, Imaging and Non Imaging Systems, • Principles of Thermal Remote Sensing including its uses
Unit III: Digital images of the Landsat satellites of America and the satellite SPOT-French	• Concept of Resolutions in RS - Spatial, Spectral, Radiometric and Temporal of Landsat and SPOT
Unit IV: Digital image processing applications with computer	• Satellite data interpretation – Visual Interpretation and Digital Interpretation • Ground truth data collection • Spectral Reflectance, Physical basis of spectral signatures of the objects and Spectral Signature for Vegetation, Soil, Water and Snow • Application of Remote Sensing

Text Book (s):
- T.M. Lillesand and R.W. Kiefer, "Remote Sensing and Image Interpretation", John Wiley and Sons,6th Edition, 2008.

Reference Book (s):
- Campbell, James , Introduction to remote sensing, Guildford Press, 4th Edition, 2008
- Floed F. Sabins, "Remote Sensing: Principles and Interpretation", Prentice Hall, 7th Edition, 2005.

Mode of Evaluation:

- Mid-Term Tests (Not less than two Exams.) …… (30 %)
- Practical Work and Assignments …… (20 %)
- Quizzes and E-learning …… (10 %)
- Final Exam. …… . (50 %)

Course Title	**Advanced Reinforced Concrete Design**	**Coordinator**		Dr. A. Sivakumar	
Course Code	515-CE-4	**Credit Hrs.**	4	**Contact Hrs.**	5
Prerequisites	423-CE-5	**Level/Year**		14/5	

Couse Objective:
To impart knowledge about the design of reinforced concrete structures

Teaching Method:
Lectures, Training exercises (Tutorial, Quizzes and Assignment questions)

Expected Learning Outcome:
- An ability to understand basic principles of design of prestressed concrete structures.
- An ability to earn the knowledge about the design of structures against seismic loads
- An ability to earn the knowledge about the design of water tanks.
- An ability to work on real life problems.

Course Contents:	
Unit 1: Introduction to behavior of prestressed concrete	• Production of PSC • Post- tensioning PSC • Pre-tensioning PSC
Unit II : General design principles	• Properties of concrete and steel • Losses in prestressed concrete • Calculation of prestressing forces
Unit III: prestressing elements	• Design of continuous prestressed beams against flexure • Design of continuous prestressed beams against shear • Details of reinforcement
Unit IV: seismic loads	• Calculation seismic loads • Analysis of structures against seismic loads • Design of shear walls • Details of reinforcement • Using computer software in design
Unit V: Design of water tanks	• Types of water tanks • Calculation lateral loads • Design of ground tanks • Design of elevated tanks • Details of reinforcement

Text Book (s):
- Mashhour Ghoneim,Mohmoud EL-Mihlmy,"Design of Reinforced Concrete Structures", 1th Edition, 2014, Vol. 2 and 3.

Reference Book (s):
- "ACI committee 318,'Building Code Requirements for Reinforced concrete" ACI 318-05),2005
- Arthur H. Nilson" Design of Concrete Structures" 13th Edition, McGraw Hill ,2002

Mode of Evaluation:

- Mid-Term Tests (Not less than two Exams.) …… (30 %)
- Practical Work and Assignments …… (10 %)
- Quizzes and E-learning …… (10 %)
- Final Exam. …… . (50 %)

Course Title	Irrigation and Drainage	Coordinator			
Course Code	517-CE-4	Credit Hrs.	4	Contact Hrs.	5
Prerequisites	322-CE-6	Level/Year		14/5	

Course Objective:
To impart knowledge about the sheds light on account of the needs of the plant water, the design of irrigation and drainage networks, different re-use of water.

Teaching Method: Lectures, Training exercises (Tutorial etc.)

Expected Learning Outcome:

- Ability to acquaint with the needs of various aquatic plants and with different circumstances and determine appropriate periods of irrigation.
- Ability to identify, formulate, and solve engineering problems
- Ability to understand the latest irrigation systems and drainage
- Ability to design irrigation and drainage networks of various kinds.

Course Contents:	
Unit 1: Introduction to Irrigation Engineering	• The foundations of Irrigation Engineering. • The relationships between crops and water consumption of crops for water. • Scheduling irrigation.
Unit II : Types of Irrigation	• Sprinkler irrigation. • Drip irrigation. • Surface irrigation. • Irrigation under the surface.
Unit III: Design concepts and Head works	• Theories of design of the transfer of irrigation water • The work of measurement of irrigation water. • Cross drainage works
Unit IV: Design of Head works	• Charges of open and expenses brick. • The depth of exchange and the distance between the Expenses • Re-use of wastewater.

Text Book (s):

- Laycock, A., "Irrigation System: Design, Planning and Construction", Oxford University Press, USA, 2007.

Reference Book (s):

- AdrainLaycock, Irrigation system: Design, planning and construction, 2007

Mode of Evaluation:

- Mid-Term Tests (Not less than two Exams.) …… (30 %)
- Tutorial Work …….. (10 %)
- Assignments + E-Learning…… (10 %)
- Final Exam. ……. . (50 %)

Course Title	Groundwater Engineering	Coordinator			
Course Code	518-CE-4	Credit Hrs.	4	Contact Hrs.	5
Prerequisites	322-CE-6	Level/Year		14/5	

Couse Objective:
To impart knowledge about the basics of hydrology and ways to manage and account movement, rules and fundamental equations, wells, pumping, mathematical models in hydrology, the use of computers.

Teaching Method:
Lectures, Training exercises (Tutorial, Labs, Quizzes and Assignment questions)

Expected Learning Outcome:

- An ability to enhance basic of movement and types of groundwater aquifers.
- Skills analysis of the movement of water toward the wells.
- Learn the foundations of groundwater management.
- To acquire the skills to use software of GIS in a case study of groundwater, over-pumping, water enters the sea.

Course Contents:	
Unit 1: Introduction to Groundwater Engineering	• Introduction to Groundwater Engineering: An Overview • Reservoirs (geological)-bearing water, groundwater • Groundwater movement
Unit II : Groundwater Analysis	• The rules and fundamental equations • Wells Hydraulics • Test the reservoir underground and Network analysis of groundwater flow • Pumping test and assess the hydraulic characteristics.
Unit III: Groundwater Quality	• Groundwater quality parameters • Water quality standards (WHO,FAO) • Management of water quality
Unit IV: The Use of Software in Groundwater Engineering	• Use of RS and GIS in Groundwater Engineering • Use of Modflow in Groundwater Engineering • Case studies and real life application • Solute transports in Groundwater Engineering

Text Book (s):

- David K. Todd, and Larry W. Mays, "Groundwater Hydrology", Wiley; 3rd Edition, 2005.

Reference Book (s):

- McWhorter and Sunada, "Groundwater Hydrology", Bertran Books Ltd, 2005

Mode of Evaluation:

- Mid-Term Tests (Not less than two Exams.) …… (30 %)
- Practical Work and Assignments …… (20 %)
- Quizzes and E-learning …… (10 %)
- Final Exam. …… . (50 %)

Course Title	Construction Engineering	Coordinator		Engr. Isamel Yousif	
Course Code	522-CE-3	Credit Hrs.	3	Contact Hrs.	3
Prerequisites	None	Level/Year		15/5	

Couse Objective:

- Understand and know the construction methods of engineering projects.
- Evaluate the digging works, quantities, handling and productivity.
- Productivity of engineering projects.
- Study and apply the construction contract and economics.
- Gain skills in design of reinforced concrete forms and shores for different types of construction projects.

Teaching Method:

- Lectures.
- Training exercises

Expected Learning Outcome:

- Students can understand the construction methods for projects.
- Students study and apply the construction contract and economics.
- Students can design reinforced concrete, forms and shores, for different types of construction projects.

Course Contents:	
Unit 1:	• Introduction to construction engineering. • Construction economics.
Unit II :	• Construction projects contracts.
Unit III:	• Digging quantity evaluation. • Filling and flatting works.
Unit IV:	• Equipment recourses. • Handling and productivity evaluations.
Unit ---	• Design of R.C. forms.

Text Book (s):

- Robert Peurifoy and Clifford J. Schexnayder and Aviad Shapira and Robert Schmitt, "Construction planning, equipment & Methods", McGraw Hill, 8th Edition, 2010

Reference Book (s):

- S.W. Nunnaly," Construction Methods and Management", Prentice-Hall, Inc., 7th Edition, 2006.
- Richard Clough, "Construction Contracting: A Practical Guide to Company Management", Wiley; 7th Edition, 2005.

Mode of Evaluation:

- Mid-Term Tests (Not less than two Exams.) …….. (40 %)
- Practical Work ……..…… (10 %)
- Final Exam. ……..… (50 %)

Course Title	**Design of Steel Structures**	**Coordinator**		Dr. Mohammad Ismail	
Course Code	523-CE-4	**Credit Hrs.**	4	**Contact Hrs.**	5
Prerequisites	412-CE-4	**Level/Year**		14/5	

Couse Objective:
The purpose of the course is to introduce the students to the introduction to the properties of the steel materials and design the steel structures as well, design of the tension and compression members and get the skills for analysis and design of the steel structures. Enable the students to use the computer applications and software programs to design and produce detailed drawings for steel structures.

Teaching Method:
Lectures, Training exercises and project work (Tutorial and Reports for different subjects in this field)

Expected Learning Outcome:
- An ability to gain skills for design and details of steel structures.
- An ability to identify, formulates, and solves spatial indeterminate structures problems.
- An ability to use high techniques and modern engineering tools to design and generate engineering details for practical use.

Course Contents:	
Unit 1: Introduction to design of steel structures	• Introduction to design of steel structures. • Design loads
Unit II : Design of steel members subjected to axial load	• Design of tension members. • Design of compression members.
Unit III: Design of steel sections	• Design of beam sections. • Design of beam-column sections. • Design of columns subjected eccentric loads.
Unit IV: Steel connections	• Design of bolted connections. • Design of welded connections. • Design of base plate connection
Unit VI: Computer applications	• Introduction to steel design software program. • Computer applications for design of steel structures.

Text Book (s):
- Jack c. McCormac, "Structural Steel Design", Prentice Hall; 5th Edition, 2012.
- William T. Segui, “Steel Design”, Thomson, 4th edition, 2007.

Reference Book (s):
- Charles G. Soliman and John E. Johron, "Steel Structures Design and Behavior", Prentice Hall, 5th Edition, 2009.
- B.C. Punmia and A.K. Jain, ‘ Design of steel structures, 1998, LP, Reprint 2013

Mode of Evaluation:

- Mid-Term Tests and E-Learning tests (Not less than two Exams) …… (30 %)
- Practical Work and Assignments …….. (10 %)
- Project work …….. (10 %)
- Final Exam. ……. …… (50 %)

Course Title	Pavement Design and Materials II	Coordinator			
Course Code	524-CE-4	Credit Hrs.	4	Contact Hrs.	5
Prerequisites	511-CE-3	Level/Year		15/5	

Couse Objective:

- To impart knowledge about asphalt material classifications and about construction methods for roads and airports pavements.
- To prepare the student to do analysis and design flexible and rigid pavement

Teaching Method:

Lectures, Training exercises (Tutorial + Reports for different topics in this field)

Expected Learning Outcome:

- Ability to understand and to describe the asphalt material classifications
- Ability to know how to use asphalt material for mix design and construction in roads and airports pavements construction
- Ability to analyze flexible and rigid pavement
- Ability to design flexible and rigid pavement
- An ability to identify, formulates, and solves field problems related to use of asphalt material in roads and airports

Course Contents:	
Unit 1: Asphalt Materials and Asphalt Mix Design	• Asphalt materials classification • Super pave design method
Unit II : Design and Construction of Pavements	• Sub base layer design • Stress analysis in rigid and flexible pavements • Methods of design for rigid and flexible pavements • Construction methods for road pavements

Text Book (s):

- Yoder, E.J. and Witczack, M.W., "Principles of Pavement Design", John Wiley & Sons, Inc., 2nd Edition. 1975, (reprint 2015)
- Lavin, Patrick G., Asphalt pavements : a practical guide to design, production and maintenance for engineers and architects, Taylor & Francis, 2003

Reference Book (s):

- O'Flaherty, Coleman Anthony, Highways [electronic resource]: the location, design, construction and maintenance of road pavements, Butterworth-Heinemann, 2002.
- AASHTO, "Guide for Design of Pavement Structures", Amer. Association of State Highway and Transport Officials, Washington, D.C., 16th ed., 1993.

Mode of Evaluation:

- Mid-Term Tests (Not less than two Exams.) ……(40 %)
- Assignments + E-Learning…… (10 %)
- Final Exam. …….…… .(50 %)

Course Title	**Advanced Geographic Information System: (Advanced GIS)**	**Coordinator**			
Course Code	525-CE-4	**Credit Hrs.**	4	**Contact Hrs.**	5
Prerequisites	324-CE-6	**Level/Year**		15/5	

Couse Objective:
To impart knowledge about the main Geo-database, Geo-processing, Analyzing network, Geo-coding, modeling, and how to use Arc GIS

Teaching Method:
Lectures, Training exercises (Tutorial, Labs, Quizzes and Assignment questions)

Expected Learning Outcome:

- Dealing with various types of data, analysis and management using the software like Arc GIS
- Skills-building and the use of geographic databases Geo-database
- Identify the linkages between spatial phenomena during data entry and analysis, using more than one way, such as the use (Geo-processing)
- Skills analysis linear network for water and sewer lines networks using (Analyzing network)
- Use the system for coding the futures like Roads and Buildings (Geo-coding)

Course Contents:	
Unit 1: Geo-database	• Data Models • Conceptual Model of Spatial Information • Concept of databases • Geodatabase Creation
Unit II : Geo-processing	• Highlight the spatial relationships between the datasets, including clip, buffer, dissolve and spatial join
Unit III: Analyzing network	• Creating a network dataset • Creating a multimodal network dataset • Finding the best route using a network • dataset
Unit IV: Data entry and Preparation	• Spatial data input • Data Preparation • Data transformation • Advance operations on continuous field raster
Unit V: Spatial data analysis	• Classification of analytical GIS capabilities • Retrieval, Classification and Measurement • Overlay functions: Vector overlays and Raster overlays operators

Text Book (s):

- C.P. Lo, Albert Yeung, ‘ Concepts and Techniques of Geographic Information Systems, 2nd edition, 2014.

Reference Book (s):

- Paul A. Longley, Geographic Information Systems & Science, , 3rd edn, Wiley, New York, 2011
- Maguire, D. J., GIS, spatial analysis, and modeling, ESRI Press, 1st Edition, 2005

Mode of Evaluation:

- Mid-Term Tests (Not less than two Exams.) …… (30 %)
- Practical Work and Assignments …… (20 %)
- Quizzes and E-learning …… (10 %)
- Final Exam. …… . (50 %)

Course Title	**Foundations Engineering (II)**	**Coordinator**		Dr. Mahmood H	
Course Code	526-CE-4	**Credit Hrs.**	4	**Contact Hrs.**	4
Prerequisites	424-CE-5	**Level/Year**		14/5	

Course Objective:
• This course spots on the advanced principles of foundations engineering and analysis of it. Using elastic and plastic methods in foundations analysis. Deep foundations and skin friction and types of piles.

Teaching Method:
Lectures, Training exercises (Tutorial + Labs, Reports etc.)

Expected Learning Outcome:
- Understanding settlement of structures
- Knowing the types of different foundations
- Understanding advanced analysis of foundations engineering
- Design of sheet piles wall

Course Contents:	
Unit 1: Introduction	• Allowable settlement in the structures. • Rigid and flexible foundations.
Unit II : Shallow foundations	• Combined and raft foundations
Unit III: Deep foundations	• Piles foundations • Positive and negative skin friction • Group actions of piles foundations • Piles cap
Unit IV: Retaining structure	• Sheet piles wall. • Design of retaining wall.

Text Book (s):
- Das, B.M., "Principles of Foundation Engineering", Thomson-Brooks/Cole 6th Edition, 2007.

Reference Book (s):
- Bowles, J. E.," Foundation Analysis and Design", McGraw-Hill Bool Co., U.S.A, 5th Edition, 1996.

Mode of Evaluation:
- Mid-Term Tests (Not less than two Exams.) …… (30 %)
- Practical Work …….. (10 %)
- Assignments + E-Learning…… (10 %)
- Final Exam. ……. . (50 %)

Course Title	**Soil stabilization**	**Coordinator**		Dr. Mahmood H	
Course Code	527-CE-4	**Credit Hrs.**	4	**Contact Hrs.**	4
Prerequisites	414-CE-6	**Level/Year**		15/5	

Course Objective:
• This course includes revision of soil mechanics and properties of soil , settlement and swelling, soil stabilization , grouting of soil and soil reinforcement.

Teaching Method:
Lectures, Training exercises (Tutorial + Labs, Reports etc.)

Expected Learning Outcome:
- Understanding of physical and mechanical properties of soil
- Knowing bearing capacity of soil
- Knowing advanced methods in soil stabilization

Course Contents:	
Unit 1: Introduction	• Revision of principles of soil mechanics • Physical and mechanical properties of soil • Bearing capacity of soil
Unit II : Soil stabilization	• Stabilization of difficult soil • Preloading methods • Soil grouting • Vibration methods
Unit III: Soil reinforcement	• Soil reinforcement using geotextile and geomembrane
Unit IV: Retaining structure	• Sheet pile wall

Text Book (s):
- Radwan, Amr, Fundamentals of Soil mechanics, 9th Edition, 2009, Dar Elmaarefa
- Cernica, J.N., "Soil Mechanics", John Wiley and Sons, 1995.

Reference Book (s):
- Das, B., "Principles of Geotechnical Engineering", 8th edition, Brooks/Cole, 2014.
- Soil stabilization for pavements : U. S. Army, U. S. Navy, and U. S. Air Force, United States. Dept. of the Army. 2005 ("Reprinted from the 1994 edition")

Mode of Evaluation:
- Mid-Term Tests (Not less than two Exams.) …… (30 %)
- Practical Work …….. (10 %)
- Assignments + E-Learning…… (10 %)
- Final Exam. ……. . (50 %)

Course Title	**Open Channel Hydraulics**	**Coordinator**			
Course Code	528-CE-4	**Credit Hrs.**	4	**Contact Hrs.**	4
Prerequisites	322-CE-5	**Level/Year**		15/5	

Couse Objective:
To impart knowledge about the advanced key concepts of fluid flow in open channels under different conditions with the study and control devices in the channel and the changes resulting from the stations where the transition.

Teaching Method:
Lectures, Training exercises (Tutorial, Labs, Quizzes and Assignment questions)

Expected Learning Outcome:

- An ability to enhance understanding basic concepts of flow in open channels with the knowledge of the governing equations of flow in these cases are different.
- Understanding the flow of various forms of regular and irregular and their relationship to power and resistance
- Know and control means in the channels and their impact on the flow
- Know the flow under the influence of various changes in the channels

Course Contents:	
Unit 1: Flow in the Open Channels	• Flow in open channels: An Overview • The concept of energy • The main equations of motions in channel
Unit II : Change of Flow condition in Open Channel	• Problem of change in transition in Channel • Critical, subcritical and supercritical flow • Formation of hydraulic jumps • Analysis of hydraulic jumps • Energy dissipations
Unit III: Resistance to flow in open channel	• Roughness coefficient of channel beds • Types of surface flow
Unit IV: Control devices in open channel flow	• Types of control devices • Design of the control devices • Operation and maintenance of control devices and open channel.
Unit V: Software used in the open channel design	• HEC-RAS software • MIKE series of software

Text Book (s):

- Featherstone, R. E.," Civil Engineering Hydraulics", Blackwell Science, 2009.

Reference Book (s):

- Sturm, Terry W, Open channel hydraulics, McGraw-Hill, 2nd Edition, 2010

Mode of Evaluation:

- Mid-Term Tests (Not less than two Exams.) …… (30 %)
- Practical Work and Assignments …… (20 %)
- Quizzes and E-learning …… (10 %)
- Final Exam. …… . (50 %)

Course Title	**Design of treatment systems, drinking water and wastewater**	**Coordinator**			
Course Code	529-CE-4	**Credit Hrs.**	4	**Contact Hrs.**	4
Prerequisites	421-CE-5	**Level/Year**		14/5	

Course Objective:
This course covers the principles and methods of treating water and wastewater, network design, ventilation, deposition shallow, stay basins, waste treatment plants.

Teaching Method:
Lectures, Training exercises (Tutorial + Labs,)

Expected Learning Outcome:

- Ability to acquaint with the skills to predict future needs for water and wastewater
- Ability to identify, formulate, and solve engineering problems
- Ability to understand the basic principles of design of water distribution networks a nd sewage.
- Ability to design and analysis of different types of water and wastewater treatment system

Course Contents:	
Unit 1: Introduction: Water & Waste Water Treatment	• Population prediction, the amount of water and wastewater. • Design of water & waste water treatment units • Water distribution systems
Unit II : Networks and Drainage System	• Water distribution networks and its hydraulics • Design drainage systems. • Ventilation. • Shallow deposition. • Basin stay. • Facilities surplus nomination.
Unit III: Design of Water and Waste Water Treatment Plants	• The design of supply stations and water purification. • Waste treatment plant design.
Unit IV: Other Treatments	• Absorption and ion exchange. • Membranes and analysis of salt water/ treatment • Sterilization. • Sedimentation ponds
Unit V: Sludge Disposal and Treatment	• Sludge Disposal, Types, methods • Sludge treatment

Text Book (s):

- Mark J. Hammer, "Water and Wastewater Technology ", Prentice Hall; 5th edition, 2008.

Reference Book (s):

- Metcalf & Eddy, "Wastewater Engineering: Treatment and Reuse", McGraw-Hill, New York., USA, 4th Edition, 2003.

Mode of Evaluation:

- Mid-Term Tests (Not less than two Exams.) …… (30 %)
- Practical Work …….. (10 %)
- Assignments + E-Learning…… (10 %)
- Final Exam. ……. . (50 %)