College of Engineering – King Khalid University

Bachelor of Science (BSc.) in Civil Engineering
New 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	English Intensive Program 1	6	12	
107-CHEM-6	General Chemistry	6	7	
201-ARAB-2	Language Skills	2	2	
Total No. Of Credits/Contact Hrs		**14**	**21**	

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**	**19**	

Level 3				
Course N° and Code	**Course Title**	**Credit Hours**	**Contact Hours**	**Pre- requisite**
112-ICI-2	Islamic Culture -2	2	2	
219-MATH-5	Differentiation and Integration -2	5	5	119-MATH-5
129-PHYS-6	Physics -1	6	7	
104 CMS-3	Computer Science	3	5	
Total No. Of Credits/Contact Hrs		**16**	**19**	

Second Year: Civil Engineering Department

Level 4				
Course N° and Code	**Course Title**	**Credit Hours**	**Contact Hours**	**Pre- requisite**
111-GE-4	Engineering Drawing	4	8	
218-EE-4	Electric Engineering - 1	4	5	129-PHYS-6 219-MATH-5
229-MATH- 5	Differentiation and Integration-3	5	5	219-MATH-5
211-GE-3	Learning Skills	3	3	
Total No. Of Credits/Contact Hrs		**16**	**21**	

Level 5				
Course N° and Code	**Course Title**	**Credit Hours**	**Contact Hours**	**Pre- requisite**
221-ME-4	Production Technology and Workshop	4	7	111-GE-4
211-CE-5	Statics	5	7	129-PHYS-6
219-PHYS-6	Physics-2	6	7	129-PHYS-6
113-ICI-2	Islamic Culture-3	2	2	
Total No. Of Credits/Contact Hrs		**17**	**23**	

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	Creativity and Innovation	3	3	
319-MATH- 5	Differential Equations	5	5	219-MATH-5
Total No. Of Credits/Contact Hrs		**18**	**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	Construction Materials	5	6	223-CE-5
314-CE-3	Dynamics	3	3	211-CE-5
329-MATH- 4	Linear Algebra	4	4	
Total No. Of Credits/Contact Hrs		**14**	**15**	

Level 8				
Course N° and Code	**Course Title**	**Credit Hours**	**Contact Hours**	**Pre- requisite**
114-ICI-2	Culture-4 Islamic	2	2	
321-CE-5	Structural Analysis - 1	5	6	223-CE-5
311-CE-5	Fluid Mechanics	5	7	211-CE-5
	Elective 1 (Soft Skills)	3	3	
Total No. Of Credits/Contact Hrs		**15**	**18**	

Level 9				
Course N° and Code	**Course Title**	**Credit Hours**	**Contact Hours**	**Pre- requisite**
301-ENG-3	Technical Reports Writing	3	3	012-ENG-6
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
419-MATH-5	Numerical Methods	5	5	319-MATH- 5
Total No. Of Credits/Contact Hrs		**16**	**19**	

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
422-CE-4	Civil Engineering Drawing	4	6	111-GE-4
423-CE-5	Hydrology	5	6	311-CE-5
411-GE-3	Professional Ethics and Practice	3	3	
Total No. Of Credits/Contact Hrs		**17**	**21**	

Level 12				
Course N° and Code	**Course Title**	**Credit Hours**	**Contact Hours**	**Pre- requisite**
421-CE-6	Transportation Engineering	6	7	224-CE-5
425-CE-5	Design of Steel Structures	5	6	412-CE-5
424-CE-5	Foundation Engineering - 1	5	6	414-CE-6 413-CE-5
Total No. Of Credits/Contact Hrs		**16**	**19**	

Fifth Year: Civil Engineering Department

Level 13				
Course N° and Code	**Course Title**	**Credit Hours**	**Contact Hours**	**Pre- requisite**
598-CE-4	Senior Design Project	4	4	Passing 174 credit hours
501-CE-5	Reinforced Concrete - 2	5	6	413-CE-5
	Elective - 2	4	5	
Total No. Of Credits/Contact Hrs		**13**	**15**	

Level 14				
Course N° and Code	**Course Title**	**Credit Hours**	**Contact Hours**	**Pre- requisite**
591-CE-4	Special topics	4	4	
581-CE-3	Construction Management	3	3	
	Elective - 3	4	5	
	Elective - 4	4	5	
Total No. Of Credits/Contact Hrs		**15**	**17**	

Level 15				
Course N° and Code	**Course Title**	**Credit Hours**	**Contact Hours**	**Pre- requisite**
561-CE-3	Industry and the Environment	3	3	
582-CE-3	Construction Engineering	3	3	
	Elective - 5	4	5	
311-IE-3	Engineering Economy	3	3	
Total No. Of Credits/Contact Hrs		**13**	**14**	

Elective Courses

Elective 1

Course N° and Code	Course Title	Credit Hours	Contact Hours	Pre-requisite
311-GE-3	Knowledge Management	3	3	
321-GE-3	Design Thinking	3	3	
322-GE-3	System Dynamics	3	3	

Elective courses (2), (3), (4) and (5) are selected according to the following:

1- The student interested in the structural engineering track: selects only structural engineering courses from the list of elective courses
2- The student interested in the water and environmental engineering track: he chooses water and environmental engineering courses only from the list of elective courses
3- The student wishing to study the transportation engineering track: he chooses transportation engineering courses only from the list of elective courses
4- A student desiring a general track: he chooses the elective courses without being restricted to any track

Elective 2 - Elective 3 - Elective 4 - Elective 5

Course N° and Code	Course Title	Credit Hours	Contact Hours	Pre-requisite
521-CE-4	Foundation Engineering (II)	4	5	424-CE-5
562-CE-4	Environmental Engineering	4	5	322-CE-5
541-CE-4	Advanced GIS Engineering	4	5	324-CE-6
502-CE-4	Computer Aided Design	4	5	422-CE-5 413-CE-5 425-CE-5
563-CE-4	Groundwater Engineering	4	5	322-CE-5 423-CE-5
542-CE-4	Traffic Engineering	4	5	421-CE-6
503-CE-4	Advanced Reinforced Concrete Design	4	5	501-CE-5
564-CE-4	Open Channel Hydraulics	4	5	322-CE-5
543-CE-4	Highway design and construction	4	5	421-CE-6
504-CE-4	Bridge Engineering	4	5	501-CE-5 425-CE-5
565-CE-4	Remote sensing of the Environment	4	5	224-CE-5 324-CE-6
544-CE-4	Pavement design and Materials	4	5	312-CE-5 421-CE-6

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-IC1-2	Islamic Culture - 3	2/2
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			**13/13**

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	219-PHYS-6	Physics - 2	6/7
7	319-MATH-5	Differential Equations	5/5
8	329-MATH-4	Linear Algebra	4/4
9	329-STAT-3	Principals of Statistics & Probability	3/3
10	419-MATH-5	Numerical Analysis	5/5
Total			**50/53**

Soft Skills

Sl. No.	Course Code & No.	Course Title	Credit /Contact hrs
1	211-GE-3	Learning Skills	3/3
2	221-GE-3	Creativity and Innovation	3/3
3		Elective 1 Soft skills	3/3
4	411-GE-3	Professional Ethics and Practices	3/3
Total			**12/12**

*Choose any Elective Soft skills from below mentioned
321-GE-3 Knowledge Management
322-GE-3 Design Thinking
323-GE-3 System Dynamics

Total Non- Engineering Courses

Sl. No.	Course Requirement	Credit /Contact hrs
1	University Requirement	13/13
2	College Requirement	15/25
3	Math & Basic Sciences	50/53
4	Soft Skills	12/12
Total		**90/103**

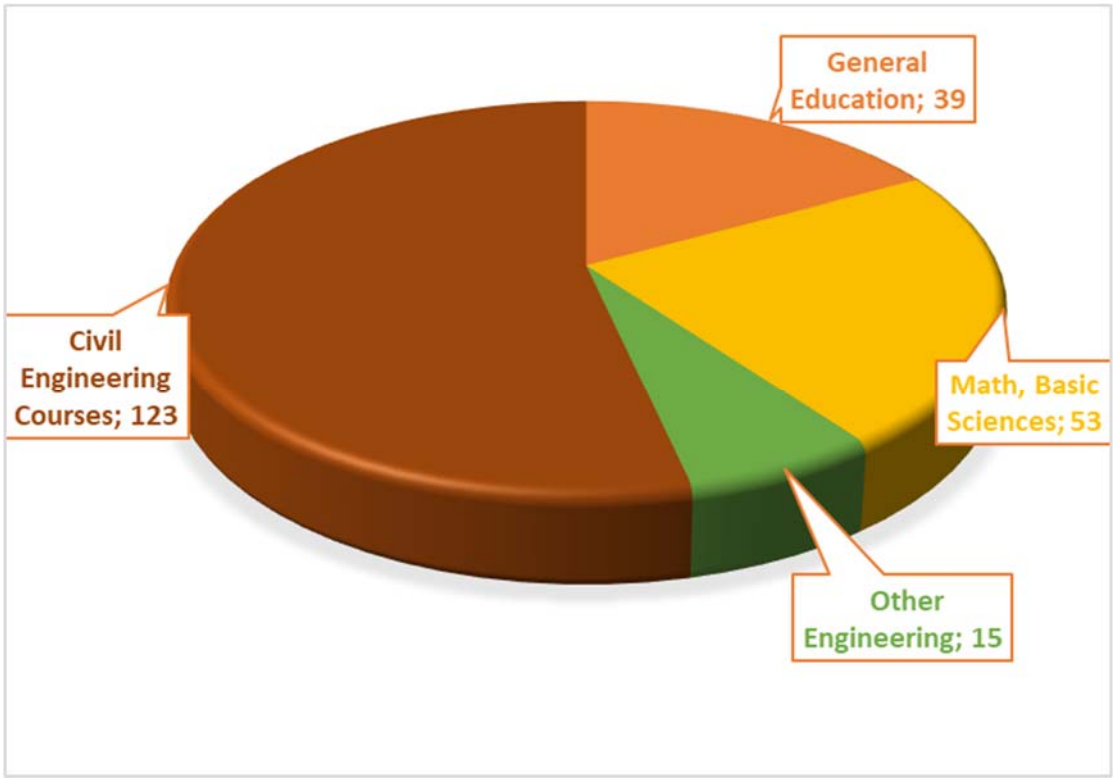
Common Engineering Courses

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	311-CE-5	Fluid Mechanics	5/7
5	312-CE-5	Construction Materials	5/7
6	314-CE-3	Dynamics	3/3
7	321-CE--3	Structural Analysis - 1	5/7
8	322-CE-5	Hydraulics	5/7
9	324-CE-6	Geographic Information Systems (GIS)	6/7
10	400-CE-0	Professional Internship (summer)	0/0
11	412-CE-5	Structural Analysis - 2	5/7
12	413-CE-5	Reinforced Concrete - 1	5/7
13	414-CE-6	Soil Mechanics	6/8
14	421-CE-6	Transportation Engineering	6/7
15	422-CE-5	Civil Engineering Drawing	5/7
16	423-CE-5	Hydrology	5/7
17	424-CE-5	Foundation Engineering - 1	5/7
18	425-CE-5	Design of Steel Structures	5/7
19	581-CE-3	Construction Management	3/3
20	501-CE-5	Reinforced Concrete - 2	5/7
21	598-CE-4	Senior Design Project -1	4/4
22	561-CE-3	Industry and the Environment	3/3
23	582-CE-3	Construction Engineering	3/3
24	591-CE-4	Special topics	4/4
25		Elective - 2	4/5
26		Elective - 3	4/5
27		Elective - 4	4/5
28		Elective - 5	4/5
Total			**123/149**

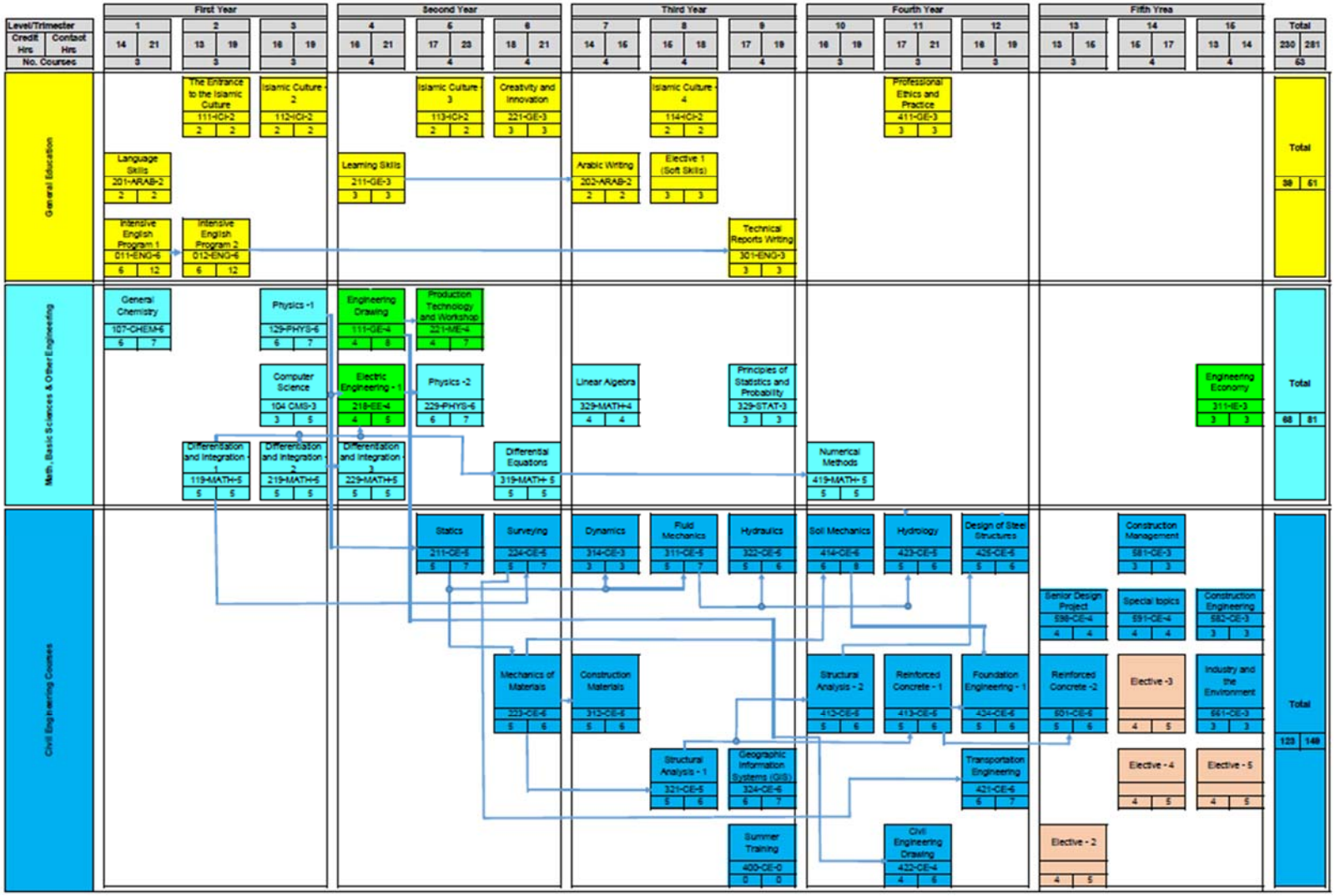
Course Credit hours



Total Credit Hrs.

230

Flowchart New Curriculum Trimester Plan



Descriptions of BSc. Civil Engineering Core Courses

Course Title	Statics	Coordinator			
Course Code	211-CE-5	Credit Hrs.	5	Contact Hrs.	7
Prerequisites	129-PHYS-6	Level/Year		5/2	

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:
CLO-1: To define the fundamentals of forces in plane or in space and equivalent force systems as well as the equations of equilibrium of particles and rigid bodies.
CLO-2: To design and analyze trusses and beams.
CLO-3: To solve friction problems under realistic constraints and interpret results.
CLO-4: To apply integration methods to determine the centroid and moments of Inertia.
CLO-5: To define the professional and ethical responsibility in the design of trusses and beams.

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			
Course Code	223-CE-5	**Credit Hrs.**	5	**Contact Hrs.**	6
Prerequisites	211-CE-5	**Level/Year**		6/2	

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:

CLO-1: To define 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

CLO-2: Tosolve problems related to torsional deformation of bars

CLO-3: To design beams for bending

CLO-4: To analyze structures experiencing combined loads

CLO-5: To apply Plane stresses Transformation to determine the principle planes and corresponding stresses as well as maximum shear stresses and corresponding planes

CLO-6: To define the concept of buckling and solve 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	• Centroid of an area • Moment of Inertia of an Area

Section Areas	• 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			
Course Code	224-CE-5	Credit Hrs.	5	Contact Hrs.	7
Prerequisites	119-MATH-5	Level/Year		6/2	

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:

CLO-1: To define fundamental principles of Engineering Surveying
CLO-2: To solve levelling problem under realistic constraints and interpret results.
CLO-3: To apply Simpson and trapezoidal rule to determine area
CLO-4: To demonstrate written communication effectively

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	Fluid Mechanics	Coordinator			
Course Code	311-CE-5	Credit Hrs.	5	Contact Hrs.	7
Prerequisites	211-CE-5	Level/Year		8/3	

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:
CLO-1: To define fluid mechanics, basic conversation laws: continuity, momentum and energy principles.
CLO-2: To analyze the problems on Hydrostatic Pressure, Fluid dynamics
CLO-3: To illustrate the basic principles of pipe flow
CLO-4: To demonstrate the tools and techniques for fluid mechanics applications

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 ed, 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	**Construction Materials**	**Coordinator**			
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 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 building materials, cement,Aggregate and green/hardened concrete

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

Expected Learning Outcome:
CLO-1To define the physical and mechanical properties of building material and its broader applications in civil engineering
CLO-2: To Solve problems based on mechanical properties of material under Realistic constraints and interpret results.
CLO-3: To apply statistical method to determine fineness modulus of aggregate.
CLO-4: To demonstrate good written communication effectively.

Course Contents:	
Unit I: 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 • Defects of wood • Seasoning and Preservation of wood • Apparatus and Testing for wood
Unit IV: 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 V : 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 (2002)**.** • Mindess, S. and Young, J.F.," Concrete", Prentice-Hall, Inc. New Jersey, 2nd Edition, 2002.	
Reference Book (s): • Derucher, K.N., Korfiatis ,G.P.Korfiatis., and A.S.,Ezeldin, "Materials for Civil and Highway Engineers", Prentice Hall Englewood Cliff, N.J., 4th Edition, 1998, • Michael S. Mamlouk, John P. Zaniewski, Materials For Civil And Construction Engineers, Prentice-Hall, Inc. New Jersey, Third Edition, 2011. • M.S. Shetty: Concrete Technology: Theory and Practice, S. Chand & company Ltd., Rev. edition., 2005	
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			
Course Code	314-CE-3	Credit Hrs.	3	Contact Hrs.	3
Prerequisites	211-CE-5	Level/Year		7/3	

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:
CLO-1: To define the basic kinematics concepts – displacement, velocity and acceleration for rectilinear and curvilinear motions (in-plane and in-space).
CLO-2: To apply newton's laws of motion and write equations of motion for particles and rigid bodies.
CLO-3: To formulate and solve the basic dynamics concepts – force, momentum, work, potential and kinetic energy.
CLO-4: To use Principle of Work & Energy and principle of Impulse-momentum to solve problems under realistic constraints and interpret results.

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-1	Coordinator			
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:
CLO-1: To define the fundamentals of structural analysis for solving determinate structures such as beam, frame, truss and arch structures.
CLO-2: To apply integration and differentiation methods to determinate the internal forces in beam, frame, truss and arch structures.
CLO-3: To analyze the determinate beam under moving loads to find the internal forces and draw the influence lines for all kinds of internal forces.
CLO-4: To solve actual problems for existing structures to calculate the deflection of different kinds of structures due to the applied loads.
CLO-5: To demonstrate the professional and ethical responsibility in the analysis and design of determinate structures.

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			
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:

CLO-1: Ability to acquaint with the basic principles of Hydraulics.
CLO-2: Ability to identify, formulate, and solve Hydraulics problems

CLO-3: Ability to understand the basic principles of Hydraulics.

CLO-4: Ability to acquire the skills to use some of the software used in the calculations of Hydraulics System Design.

CLO-5: To define the professional and ethical responsibility in the design of Hydraulics System.

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	Geographic Information System (GIS)	Coordinator			
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:
CLO-1: Explain characteristics, types and processing of geospatial data.
CLO-2: Describe how GIS is used as a tool in their discipline
CLO-3: Analyze vector and raster data using ArcMap
CLO-4: Produce maps at a professional standard
CLO-5: Critically analyze limitations of GIS applications in terms of accuracy and scale.
CLO-6: Use GIS to identify, explore, understand, and solve spatial problems
CLO-7: An ability to use the techniques, skills and geoinformation tools necessary for engineering practices.
CLO-8: Design and complete a GIS project from start to finish (data capture, data storage and management, analysis, and presentation);
CLO-9: Conduct simple spatial analysis using GIS software;
CLO-10: Demonstrate GIS modeling skills
CLO-11: Demonstrate critical thinking skills in solving geospatial problems.
CLO-12: Demonstrate competency with the ArcMap software to enhance and interpret data e.g. Use queries in GIS Analysis Formulate applications of GIS technology.

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 database	• Digitizing, Editing and Structuring Map Data • Creation of personnel Geodatabase • 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	Structural Analysis-2	Coordinator			
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:
CLO-1: To define the basics of structural analysis and different concept for solving indeterminate structures.
CLO-2: To apply the different methods and theory, the consistence deformation method, the three moment equation method, the slope deflection method, the moment distribution method and the stiffness matrix method for solving all kinds of indeterminate structures.
CLO-3: To calculate the internal forces in indeterminate structures needed to solve engineering problems
CLO-4: To illustrate the bending moments, shear forces, normal forces and influence lines diagrams of indeterminate structures.
CLO-5: To use the modern tools necessary for structural analysis.

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-1	Coordinator			
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:
CLO-1: To compute design loads according to code constraints of safety, serviceability and economy.
CLO-2: To analyze beams, solid slabs and columns.
CLO-3: To design beams, solid slabs and columns according to code provisions.
CLO-4: To evaluate the strength of reinforced concrete elements.
CLO-5: To demonstrate the importance of the building codes and ethical responsibility in the design process.

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			
Course Code	414-CE-6	Credit Hrs.	6	Contact Hrs.	8
Prerequisites	223-CE-5	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:

CLO-1: To define the fundamentals of soil mechanics such as phase diagram, index properties, standard methods to classify soils permeability, capillarity, permeability, total and effective stresses.

CLO-2: To design and analyze evolution of stresses, pore water pressure, permeability in profiles.

CLO-3: To solve shear strength problems for different types of soil. Differentiate applications upon the nature of external actions

CLO-4: To apply algebra, elementary calculus, and principles of elasticity theory in simple geotechnical systems.

CLO-5: To illustrate contemporary issues of earthworks.

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	Transportation Engineering	Coordinator			
Course Code	421-CE-6	Credit Hrs.	6	Contact Hrs.	7
Prerequisites	224-CE-5	Level/Year		12/4	

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:

CLO-1: Ability to acquaint with the basic principles of Transportation Engineering.

CLO-2: Ability to identify, formulate, and solve Transportation Engineering problems

CLO-3: Ability to understand the basic principles of Transportation Engineering.

CLO-4: Ability to acquire the skills to use some of the software used in the calculations of Transportation Engineering.

CLO-5: To define the professional and ethical responsibility in the design of Transportation Engineering System.

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 : Highway capacity	• Road Planning • Classification of Roads • Highway capacity and level of service • Cross sectional elements • Transportation planning process
Unit III: Geometric	• Introduction • Geometric Design of Highways • Width of Formation • Right of Way
Unit IV: Highway	• Width of Pavement

components	• 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	Civil Engineering Drawing	Coordinator			
Course Code	422-CE-4	Credit Hrs.	4	Contact Hrs.	6
Prerequisites	111-GE-4	Level/Year		11/4	

Course Objectives

The objective of this course is to teach civil engineering students the basic skills of civil engineering drawing and drafting by using a computer-aided design and drawing software. Autodesk product AutoCAD will be used throughout the course. The AutoCAD software is one of the most widely used design and drafting tools in the world. Students will be able to gain proficiency in AutoCAD software by creating/modifying plans, drawings, or design files used for a variety of civil and environmental engineering projects. Course topics may also include works of real field examples.

Teaching Method:

- Lectures, Training exercises, E Learning, Power point Presentation, (Tutorial + Labs, Reports for different subjects in this field)

Expected Learning Outcome:

At the end of the course the student should be able to:

- **CLO 1:** To define the basics of drawing, design and the fundamental concepts of AutoCAD as it relates to civil and construction engineering.
- **CLO 2:** To develop the skills to design components in form of drawings as per realistic constraint.
- **CLO 3:** To utilize techniques and skills for the reading of civil/construction plans, comprehending scale, engineering graphic standards.
- **CLO 4:** To create drawings of real-life examples to develop lifelong learning skills.
- **CLO 5:** To communicate effectively by creating/modifying plans, drawings or design files civil engineering practices
- **CLO 6:**To work in teams to accomplish a variety of tasks.

Course Contents:	
Unit 1: Introduction	• Software User Interface • Coordinates, Units and Limits • Scale, Board and Title and Plotting • Layer and Line setting • Hatching, Dimensioning, Blocks
Unit II: Residential Building Drawings	• Plan View • Elevation View • Cross Sectional View • Plan and cross sectional view of Doors, Windows, Staircase
Unit III: Structural Drawings	• Structural plan • Reinforcement details of structural elements (beams, columns, slab, etc) • Foundation plan and details
Unit IV: 3D modelling	• Introduction to 3D modelling of Civil Engineering Projects/design
Text Book (s):	

- Leach. AutoCAD 2008 Companion: Essentials of AutoCAD Plus Solid Modeling. (McGraw Hill, 2008). ISBN 978-0-07-340246-8
- Ellis, Rick. A Practical Guide to AutoCAD Civil 3D, Cadapult Press, 2017.

Reference Book (s):

- Harnessing Autodesk Civil 3D 2007 by Phillip Zimmerman. Thomson Delmar Learning
- Students are also encouraged to check the Autodesk AutoCAD website (http://knowledge.autodesk.com/support/autocad/) for more learning information.

Mode of Evaluation:

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

Course Title	Hydrology	Coordinator			
Course Code	423-CE-5	Credit Hrs.	5	Contact Hrs.	6
Prerequisites	311-CE-5	Level/Year		11/4	

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:

CLO-1: Understand and describe the global distribution of water on the earth's surface and how it moves through the hydrologic cycle

CLO-2: Describe the basic principles of hydrology and methods of managing water resources

CLO-3: Understand and apply probabilistic methods for quantitative analysis of rainfall variability and frequency analysis

CLO-4: Analyze and interpret stream hydrographs and hydrograph components, and implement techniques for calculating runoff from a catchment

CLO-5: Estimate the water resources availability and reduction of hydrological risks

CLO-6: An ability to use the techniques, skills and tools necessary for engineering practices

CLO-7: An ability to identify, formulates, and solves hydrological problems.

CLO-8: Demonstrate Hydrological modeling skills

CLO-9: Demonstrate critical thinking skills in solving hydrological problems.

CLO-10: Produce a written technical report based on proficient application of techniques for quantitative hydrologic analysis.

CLO-11: Undertake a detailed literature review to locate, identify and critically assess knowledge development in the discipline of hydrology

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, 4^{th}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	Foundations Engineering-1	Coordinator			
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:

CLO-1: To recognize the basic principles of foundations engineering for civil engineer.
CLO-2: To design different shallow foundations like isolated footing, strip footing, combined footing, strap footing and the raft foundations under realistic constraints
CLO-3: To develop foundation models using the techniques, skills and modern engineering tools.
CLO-4: To solve spatial problems concerning engineering foundations
CLO-5: To demonstrate contemporary issues of foundations

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	Design of Steel Structures	Coordinator			
Course Code	425-CE-5	Credit Hrs.	5	Contact Hrs.	6
Prerequisites	412-CE-5	Level/Year		12/4	

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:
CLO-1 define and calculate the design loads on a typical steel building.
CLO-2 Recognize and define the different failure modes of steel tension and compression members and beams, and compute their design strengths.
CLO-3 Choose the most suitable section shape and size for tension and compression members and beams, columns and Beam-columns
CLO-4 Analyze and Design bolted and welded connections for tension and comp. members and beams.

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	Construction Management	Coordinator			
Course Code	581-CE-3	Credit Hrs.	3	Contact Hrs.	3
Prerequisites		Level/Year		14/5	

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:
CLO 1: To define the fundamentals of Construction management including the description of project life cycle.
CLO 2: To describe the bid package with their implication in handling the project.
CLO 3: To justify the construction contracts according to their measurements an payments
CLO 4: To evaluate the changes and extra work for the requirements of the projects and enable the process of termination to the students
CLO 5: To calculate the different types of estimation process as per the design aspects of the project.

CLO 6: To summarize the project scheduling based on various contracts and need of the project.
CLO 7: To illustrate project scheduling according to the work break down structure so that it could be implemented in the project properly
CLO 8: To analyze the critical path method as per the flow or various construction stages for any ongoing project.

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	**Reinforced Concrete 2**	**Coordinator**			
Course Code	501-CE-5	**Credit Hrs.**	5	**Contact Hrs.**	6
Prerequisites	413-CE-5	**Level/Year**		13/5	
Elective Track		**Structural Engineering**			

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:
CLO-1: To compute design loads according to code constraints of safety, serviceability and economy.
CLO-2: To analyze different types of slabs and frame under loads
CLO-3: To design different types of slabs and frame according to code provisions.
CLO-4: To evaluate the strength of reinforced concrete elements.
CLO-5: To demonstrate the importance of the building codes and ethical responsibility in the design process.

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	Senior Design Project-1	Coordinator			
Course Code	598-CE-4	Credit Hrs.	4	Contact Hrs.	4
Prerequisites	Department approval (Completion of 174 Credit Hours).	Level/Year		13-14/5	

Couse Objective:

Students must be prepared for engineering practice through the curriculum culminating in a major design experience based on the knowledge and skills required in earlier course work and incorporating engineering standards and realistic constraints that take into account considerations such as: economic; environmental; safety; manufacturability; ethical; and social aspects. The objectives of this course where student can:

- Select and plan an engineering project involving analysis and design tasks
- Perform a literature survey
- Formulate, as a team, civil engineering design
- Perform the relevant calculations, analysis, and implement his design.
- Understand economic, environmental issues related to technology.
- Evaluate the impact of engineering on societal issues.
- Communicate technical information in writing.
- Communicate in oral and critically evaluate technical information

Teaching Method: Independent study/research, group discussion, meetings are scheduled with the supervisor for the particular project. Each students' group will meet together weekly, keeping detailed minutes of the meetings.

Course Learning Outcome:

- Ability to perform a literature survey
- Ability to formulate design an engineering project, by setting objectives that are appropriate for the project purpose and scope and that take into account the following aspects: economic; environmental; manufacturability; ethical; safety; social; and political.
- Ability to plan an engineering project involving multiple tasks and contributors.
- Ability to identify, formulate and solve an engineering problem.
- Ability to work effectively on a team to complete the project.
- Ability to implement, evaluate, and document a project design.
- Ability to communicate technical information in writing.
- Ability to communicate technical information in oral presentations.
- Recognize the need for a lifelong learning.
- Ability to use modern tools in engineering solving problems

Topic Covered	1. Literature survey 2. Engineering design 3. Proposals 4. Project planning, budgeting, and management 5. Professionalism, ethics 6. Technical reports 7. Oral presentations

Text Book (s):

• Varies with the particular project.	
Reference Materials:	
• Varies with the particular project.	
Mode of Evaluation:	
Student progress and project product:(Assessed by the supervisor(s)):	**25**
Log book (Assessed by the supervisor (s))	**5**
Professional Conduct includes (Assessed by the supervisor(s)): • Cooperation with the project group • Alignment with the code of ethics • Attendance in discussion sessions with supervisor	**20**
Project Report	**20**
Presentation and defense (assessed by at least two panel members and the supervisor(s))	**30**
Total	**100**
Course Ground Rules	
The following department rules will be applied: • The deadline for submitting a hard copy of the project report is one week before the presentation. • If student does not submit the report on time, a 25% of the report grade will be deducted for every day delay. • If no report is submitted 24 hours before the presentation, a grade F will be given to the whole project. • Other additional rules by the supervisor	

<table>
<tr><td>Course Title</td><td>Industry and the Environment</td><td>Coordinator</td><td colspan="3"></td></tr>
<tr><td>Course Code</td><td>561-CE-3</td><td>Credit Hrs.</td><td>3</td><td>Contact Hrs.</td><td>3</td></tr>
<tr><td>Prerequisites</td><td>None</td><td>Level/Year</td><td colspan="3">15/5</td></tr>
<tr><td colspan="6">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.</td></tr>
<tr><td colspan="6">Teaching Method:Lectures; Training exercises (Tutorial, Quizzes and Assignment questions)</td></tr>
<tr><td colspan="6">Expected Learning Outcome:
CLO-1: Ability to acquaint with the basic principles of Industry and Environment.
CLO-2: Ability to identify, formulate, and solve Industry and Environment problems
CLO-3: Ability to understand the basic principles of Industry and Environment.
CLO-4: Ability to acquire the skills to use some of the software used in the calculations of Industry and Environment problems
CLO-5: To define the professional and ethical responsibility in the design of Industry and Environment systems</td></tr>
<tr><td colspan="2">Course Contents:</td><td colspan="4"></td></tr>
<tr><td colspan="2">Unit 1: Introduction</td><td colspan="4">• Introduction to Environmental
• Environmental Balance
• Environment Affects by Industry activities</td></tr>
<tr><td colspan="2">Unit II : Pollution type, Sources and Effects</td><td colspan="4">• 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</td></tr>
<tr><td colspan="2">Unit III: Pollution Control Techniques</td><td colspan="4">• Water Pollution Control Techniques
• Air Pollution Control Techniques
• Soil/Land Pollution Control Techniques
• Environmental Monitoring Technology</td></tr>
<tr><td colspan="2">Unit IV: Pollution Problem</td><td colspan="4">• Pollution Problems from Industry and Engineering fields</td></tr>
<tr><td colspan="6">Text Book (s):</td></tr>
<tr><td colspan="6">• J.Glynn Henry, Gary W. Heinke, ‘Environmental Science and Engineering’, 2nd edition. Prentice Hall, 1996, (Reprint 2014)</td></tr>
<tr><td colspan="6">Mode of Evaluation:
• Mid-Term Tests (Not less than two Exams.) ……….…… (30 %)
• A Tutorial, assignments and Quizzes.……..…………… (20 %)
• Final Exam. ………………………………………..……. (50 %)</td></tr>
</table>

Course Title	Construction Engineering	Coordinator			
Course Code	582-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:

CLO-1 To describe the construction methods for projects
CLO-2 To record the knowledge of societal, health, safety, legal, management, sustainability and cultural issues, and the consequent responsibility related to construction engineering
CLO-3 To analyze the construction contract components
CLO-4 To design reinforced concrete, frameworks, forms and shores, for different type of construction projects
CLO-5 To demonstrate good oral communication skills in construction site

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	Computer Aided Design	Coordinator			
Course Code	502-CE-4	Credit Hrs.	4	Contact Hrs.	5
Prerequisites	422-CE-4, 425-CE-3, 413-CE-5	Level/Year		14/5	
Elective Track		Structural Engineering			

Course Objectives:
Computer Aided Design (CAD) will introduce students to the basics of CAD utilizing software to produce civil engineering designs. The course will also provide an overview of the Civil Engineering projects including Steel and Reinforced Concrete (RC) structures. The CAD will give opportunity to develop structural models, analysis, interpret, design and present final plans of civil constructions.

Teaching Method:
Lectures, Software based labs, group discussion, small projects

Expected Learning Outcome:
After the completion of this course, it is expected that the student be able to:

CLO-1: To enhance knowledge about design steps of Civil Engineering structures

CLO-2: To model and design steel structures using softwares based on realistic constraints

CLO-3: To design and solve Reinforced Concrete structures problems using softwares

CLO-4: To analyze and interpret results of the software

CLO-5: To produce professionally and ethically calculation notes and final plans of construction using softwares

Course Contents:	
Unit 1: Introduction to CAD	History and overview of CAD– advantages of CAD over manual drafting and design – hardware requirements – computers and workstation, an overview of CAD software
Unit II: CAD of Steel buildings	Review of design steps of a steel building Different types of steels buildings Modeling Model a Steel structure using CAD software Structural analysis of steel building Interpretation of results Design using CAD software Application on a real project of steel building
Unit III: CAD of Reinforced Concrete buildings	Design steps of a Reinforced Concrete (RC) building Different types of RC buildings Modeling of an RC structure using CAD software Structural analysis of steel building Interpretation of results Design using CAD software Application on a real project of steel building
Unit IV: Presentation of calculation reports and final plans of construction	Calculation notes Interaction between drafting and design software Presentation of final plans of construction Presentation of details Professional ethics about final construction documents

Text Book (s): • Krishna Raju, "Structural Design & Drawing (Concrete & Steel)", CBS Publishers 2004.	
Reference Book (s): • Punmia, B.C., Ashok Kumar Jain, Arun Kumar Jain, "Design of steel structures", Lakshmi publications Pvt. Ltd 2003. • Manual of Robot Structural Analysis Professional. Autodesk 2017 • Manual of Sab 2000. Computers and Structures Inc Edition (2017)	
Mode of Evaluation: • Mid-Term Tests (Not less than two Exams)…..……...…..(20 %) • Quizes and Assignments ……..…….. …….(10 %) • Labs, quizzes and Assignments ……..…….. (20 %) • Final Exam. …….……. …….. (50 %)	

Course Title	Advanced Reinforced Concrete Design	Coordinator			
Course Code	503-CE-4	Credit Hrs.	4	Contact Hrs.	5
Prerequisites	501-CE-5	Level/Year		14/5	
Elective Track		Structural Engineering			

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:

CLO-1: To define the in-depth fundamental knowledge on the reinforced concrete design of complex civil engineering structures.

CLO-2: To calculate the various design factors responsible for economical design of pre-stressed concrete structures.

CLO-3: To analyze the unknown bending moments and shear forces fort the reinforced concrete frame structures in static method of analysis.

CLO-4: To demonstrate the applications of advanced design methods in life long applications of reinforced concrete design.

CLO-5 : To calculate the design of various structural elements using software applications and numerical methods

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	**Bridge Engineering**	**Coordinator**			
Course Code	504-CE -4	**Credit Hrs.**	**4**	**Contact Hrs.**	**5**
Prerequisites	501-CE -5, 425-CE-5	**Level/Year**		**15/5**	
Elective Track		**Structural Engineering**			

Course Objective:

1. To gain a comprehensive understanding of bridge loading
2. To develop a critical appreciation and comprehensive understanding of methods of idealization and analysis of bridge structures.
3. To develop a critical awareness of bridge inspection and assessment.

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

Expected Learning Outcome:
CLO-1: To recognize the thorough knowledge in the design of concrete bridges and apply conceptual design
CLO-2: To develop theoretical knowledge and practical skills to create novel and innovative solutions to bridge engineering problems.
CLO-3: To evaluate and asses the significant solutions to bridge design and provide analysis of complex design issues
CLO-4: To evaluate the bridge design parameters autonomously and perform multidisciplinary tasks with leadership capabilities.
CLO-5: To calculate the design of various structural elements using software applications and numerical methods

Course Contents:	
Unit 1: Introduction	• Load Distribution Theory - loading standards – Bridge slabs – Effective width method – Pigeaud's method – Bridge girders – Courbon's method – Assumptions and analysis of a typical bridge floor – Hendry-Jaeger method – Morice – Little version of Guyon and Massonet method (principles only)
Unit II : Types of bridges	• Slab Bridges - Straight and skew slab bridges – T beam bridges – Balanced cantilever bridges – Design of articulation – Continuous girder bridges
Unit III: Design of girders	• Arch Bridges - Single span closed and open spandrel symmetrical type (structural arrangements and functions only) – Design of bow string girder bridges.
Unit IV: Composite bridges	• Other Bridges - Box culvert (Single vent only) – Single span rigid frame bridges (Barrel of solid slab type only) – Pre-stressed composite T beam bridges (structural arrangements only)
Unit V: Design principles	• Substructures - Design principles of Piers and abutments –

	Bridge bearings - Hinges and expansion joints.

Text Book (s):

- Johnson Victor, D, (1999), Essentials of Bridge Engineering, Oxford Publishing Company.

Reference Book (s):

1. Jain and Jaikrishna (2000), Plain and reinforced concrete, Vol.2., Nem Chand Brothers.
2. Standard specifications and code of practice for road bridges, (2005) – IRC section I, II, III and IV. 3. The Concrete Association of India, (2000), Concrete Bridges.

Mode of Evaluation:

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

Course Title	Foundations Engineering-2	Coordinator			
Course Code	521-CE-4	Credit Hrs.	4	Contact Hrs.	5
Prerequisites	424-CE-5	Level/Year		13/5	
Elective Track		Structural Engineering			

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:

CLO1: To recognize the basic principles of foundations engineering for civil engineer.
CLO-2: To design of different Deep foundations like Piles, piers, retaining structure and caissons.
CLO3: To develop deep foundations models using the techniques, skills and modern engineering tools.
CLO-4: To solve spatial problems concerning engineering foundations.
CLO-5: To demonstrate contemporary issues of deep foundations.

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	Environmental Engineering	Coordinator			
Course Code	562-CE-4	Credit Hrs.	4	Contact Hrs.	5
Prerequisites	322-CE-5	Level/Year		13/5	
Elective Track		Water & Environmental Engineering			

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:
CLO-1: Ability to acquaint with the basic principles of Environment Engineering system.
CLO-2: Ability to identify, formulate, and solve Environment Engineering problems.
CLO-3: Ability to understand the basic principles of Environment Engineering.
CLO-4: Ability to acquire the skills to use some of the software used in the calculations of Environment Engineering.
CLO-5: To define the professional and ethical responsibility in the design of Environment Engineering problems.

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:	• Concepts of reuse

Reuse techniques and computer application in Environmental Engineering	• End products of treatment and their use • Use of sludge • Software used in Environmental system analysis and design
Standard Code and Ethics use	• ACI-1008

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	Groundwater Engineering	Coordinator			
Course Code	563-CE-4	Credit Hrs.	4	Contact Hrs.	5
Prerequisites	322-CE-5, 423-CE-5	Level/Year		14/5	
Elective Track		Water & Environmental Engineering			

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:
1. To Describe the nature of groundwater and its role in the water cycle.
2. To explain Darcy's law and the groundwater flow equation.
3. To analyze the technology of water wells and groundwater monitoring.
4. To demonstrate the tools and techniques for groundwater modeling
5. To assess the nature of groundwater contaminant transport including the phenomena of diffusion, dispersion, and advection.
6. To calculate direct and inverse well problems in confined, leaky, and unconfined aquifers.

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	Open Channel Hydraulics	Coordinator			
Course Code	564-CE-4	Credit Hrs.	4	Contact Hrs.	5
Prerequisites	322-CE-5	Level/Year		14/5	
Elective Track		Water & Environmental Engineering			

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:

CLO-1: Ability to acquaint with the basic principles of fluid flow in pipes and open channels.

CLO-2: Ability to identify, formulate, and solve engineering problems

CLO-3: Ability to understand the basic principles of open channel flow.

CLO-4: Ability to acquire the skills to use some of the software used in the calculations of water distribution networks.

CLO-5: To define the professional and ethical responsibility in the design of open 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	Remote Sensing of the Environment	Coordinator			
Course Code	565-CE-4	Credit Hrs.	4	Contact Hrs.	5
Prerequisites	224-CE-5, 324-CE-6	Level/Year		15/5	
Elective Track		Water & Environmental Engineering			

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:
CLO-1: Define and explain the key concepts and terminology used in remote sensing.

CLO-2: Conversant with the b

asic principles of remote sensing and its various fields of application

CLO-3: Conduct basic to intermediate remote sensing analyses (atmospheric and geographic corrections, spectral transformations and enhancements, classification, modeling and change detection)

CLO-4: Apply the underlying principles of interpreting image data

CLO-5: Carry out the most commonly used Digital Image manipulation, Image Filtering and image enhancement approaches, and explain their uses and applications

CLO-5: Explain examples of the use of remote sensing data to detect and quantify environmental change

CLO-6: Explain image clustering approaches, and to be able to apply them to semi-automatically classify spectral data in order to generate your own thematic maps

CLO-7: Able to use image processing software to process remote sensing data

CLO-8: Critically examine the tradeoffs between spatial, spectral, radiometric and temporal resolution of remotely sensed data;

CLO-9: Evaluate applications of remotely sensed data for monitoring and managing water and terrestrial resources.

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): • John R. Jensen, "Remote Sensing of the environment", Pearson, 2nd Edition, 2011.	
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 Geographic Information System: (Advanced GIS)	Coordinator			
Course Code	541-CE-4	Credit Hrs.	4	Contact Hrs.	5
Prerequisites	324-CE-6	Level/Year		13/5	
Elective Track		Transportation Engineering			

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:

CLO-1: Understand the importance of the geographical characteristics of data.

CLO-2: Describe the theory, acquisition, analysis and interpretation of geographical data across a range of applications.

CLO-3: Perform sophisticated raster and vector GIS analysis in a GIS environment

CLO-4: The application of geographic information science for the understanding of social and economic problems and environmental management

CLO-5: Understand the ways in which geographical data of various types can be combined, interpreted and modelled.

CLO-6: Analyze and critically interpret secondary geographical data.

CLO-7: Use appropriate techniques, including computer software, to produce clear diagrams and maps.

CLO-8: Develop a broad appreciation of spatial and network analysis techniques and application areas

CLO-9: Explore and solve spatial problems using GIS techniques and technology

CLO-10: Demonstrate understanding of the structure, advantages and limitations of raster datasets

CLO-11: Produce fluent and comprehensive written reports on complex topics.

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	**Traffic Engineering**	**Coordinator**			
Course Code	542-CE-4	**Credit Hrs.**	4	**Contact Hrs.**	5
Prerequisites	421-CE-6	**Level/Year**		14/5	
Elective Track		**Transportation Engineering**			

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:
CLO-1 To define the fundamental of traffic component system.
CLO-2 :To design intersection of road
CLO-3:To solve rush hour problem under realistic constrains and interpret results
CLO-4 To define the professional and ethical responsibility in the design of Intersection
CLO-5 To demonstrate written communication skill effectively

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 %)

<table>
<tr><td>Course Title</td><td colspan="2">Highway Design and Construction</td><td colspan="2">Coordinator</td><td colspan="2"></td></tr>
<tr><td>Course Code</td><td colspan="2">543-CE-4</td><td>Credit Hrs.</td><td>4</td><td>Contact Hrs.</td><td>5</td></tr>
<tr><td>Prerequisites</td><td colspan="2">421-CE-6</td><td colspan="2">Level/Year</td><td colspan="2">14/5</td></tr>
<tr><td colspan="3">Elective Track</td><td colspan="4">Transportation Engineering</td></tr>
<tr><td colspan="7">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.</td></tr>
<tr><td colspan="7">Teaching Method: Lectures, Power point presentations / Video Lectures and Labs &Training exercises.</td></tr>
<tr><td colspan="7">Expected Learning Outcome:
CLO-1 To outline highways engineering principles and concepts and define the properties of highway materials.
CLO-2 To recognize safety, sustainability and consequent responsibility related to highway engineering.
CLO-3 To estimate experimentally the properties of highway materials and interpret results.
CLO-4 To solve highway engineering problems including drainage and maintenance
CLO-5 To design the geometric properties of the roads, the thickness of pavement layers and the percentage of bituminous materials.</td></tr>
<tr><td>Course Contents:</td><td colspan="6"></td></tr>
<tr><td>Unit 1: Highway geometric design</td><td colspan="6">• Introduction to standard engineering design.
• Geometric section elements.
• Sight distances, planning of horizontal and vertical highway curves.
• Intersection design</td></tr>
<tr><td>Unit II: pavement materials testing</td><td colspan="6">• Introduction to pavement types and layers
• properties of materials
• Characteristics of subgrade soil</td></tr>
<tr><td>Unit III: Structural design</td><td colspan="6">• Introduction to flexible pavement structural design using AASHTO method</td></tr>
<tr><td>Unit IV: Mix design</td><td colspan="6">• Introduction to Marshal Stability bitumen mix design.</td></tr>
<tr><td>Unit V: Maintenance</td><td colspan="6">• Drainage requirements.
• Retrofitting and maintenances highway pavement</td></tr>
<tr><td colspan="7">Text Book (s): Wright Paul, "Highway Engineering", 7th edition, John Wiley and Sons, Inc, USA 2004.</td></tr>
<tr><td colspan="7">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</td></tr>
</table>

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	Coordinator			
Course Code	544-CE-4	Credit Hrs.	4	Contact Hrs.	5
Prerequisites	312-CE-5, 421-CE-6	Level/Year		15/5	
Elective Track		Transportation Engineering			

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:
CLO-1: To define the fundamentals of pavement construction and materials required for the flexible pavement design
CLO-2: To apply the theoretical concepts for effective pavement design to determine the thickness.
CLO-3: To solve and use the techniques, skills and appropriate methodology necessary for pavement construction engineering practices.
CLO-4 : To solve the different types of pavement problems required for different traffic conditions
CLO-5: To define the professional and ethical responsibility in the design of rigid pavement for different types of subgrade conditions.

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 %)