

# Construction Engineering



## GRADUATION REQUIREMENTS

In the Construction Engineering Department, Students are required to fulfill a minimum of 175 credits satisfactorily. These credits are distributed between common 14-credits required by the university, another common 34-credits required by the college of engineering, and the Department of Construction Engineering requires the remaining 127-credits.



## INTRODUCTION

In the last few decades major development took place in the field of construction engineering which dictates a consequent development in the design skills and knowledge of the modern construction engineers. The goal of construction engineering department in ERU University is to provide the country with experienced and well knowledge engineers, who are well prepared to follow their careers as construction engineers. The construction engineering department in ERU University is characterized by graduating engineers who have the ability to unite both structure and construction management disciplines in one specialized program which is recently required by the work market in the Arab Republic of Egypt.

## VISION

The construction engineering department is one of pioneer and distinct departments on both national and international levels. It provides an under-graduate program which meets the international standards and presents distinct research programs to serve the country.

## MISSION

The mission of construction engineering department stems from the mission of the faculty of engineering of ERU, to educate and prepare construction engineering graduates who are fully aware with the fundamental of basic sciences, as well as applied ones. Graduates have skills which can compete with the international engineering market standards required by most construction engineering projects. Those sciences vary to include basic theories to analyze structures which lead to safety design for concrete and steel structures, as well as the up-to-date methods of construction management. This mission helps to prepare future engineering staff that is able to represent any expert consultant house and benefit the surrounding community in the field of construction engineering.

## EDUCATIONAL OBJECTIVES

The main objectives of the undergraduate program are:

1. To reach well prepared graduates armed with basic knowledge whether they are engineering, scientific or humanity with the ability to engage in creativeness and analysis in the construction engineering field.
2. Preparing engineering graduates able to use and apply modern technical methods in construction projects.
3. Preparing engineering graduates capable of self-development as well as self-learning to match the continuous technical changes.
4. Enhancing engineering graduates skills through training courses and workshops.
5. Presenting engineering graduates for post graduate programs.
6. Carrying out different researches, small projects, and studies to learn practically how to solve problems commonly faced in construction projects.

# CONSTRUCTION ENGINEERING DEPARTMENT COURSES

## 1. COMPULSORY COURSES (122 CREDITS):

Course Code	Course Title	Credit Hours	Prerequisite
AR108	Building Construction 1	3	BS010
BS101	Mathematics 3	3	BS001
BS102	Mathematics 4 (CE)	3	BS101
BS105	Computer Applications in Engineering (CE).	2	-
CE101	Civil Engineering Drawings	2	BS010
CE103	Mechanics of Materials I	3	CE108
CE104	Plane Surveying	3	-
CE106	Properties of Materials	3	-
CE108	Structural Analysis I	3	BS007
CE201	Structural Analysis II	3	CE108
CE202	Structural Analysis III	3	CE201
CE313	Structural Analysis IV	3	CE202
CE203	Concrete Technology	3	-
CE204	Civil Engineering Systems	3	-
CE205	Mechanics of Materials II	3	CE103
CE206	Reinforced Concrete I	3	CE103,CE106 CE108
CE301	Reinforced Concrete II	3	CE206
CE208	Steel Design I	3	CE103,CE108
CE102	Engineering Geology	3	-
CE302	Reinforced Concrete III	3	CE301
CE314	Reinforced Concrete IV	3	CE302
CE303	Steel Design II	3	CE208
CE304	Pavement Materials and Design	2	-
CE210	Soil Mechanics	3	CE103,CE210
CE305	Foundations Engineering	3	CE210
CE307	Engineering Hydrology	3	ME102
CE308	Sanitary & Environmental Engineering	3	ME102
CE309	Transportation & Traffic Engineering	3	-
CE310	Construction Law	2	120 CR.HR
CE311	Highway Geometric Design	3	-
CE312	Construction Management	3	120 CR.HR
CE401	Computer- Aided Structural Design	3	CE202
CE402	Construction Productivity	3	120 CR.HR
CE403	Construction Administration	3	120 CR.HR
CE404	Construction Engineering Equipments	3	CE206
CE405	Construction Cost Estimating	3	HM202
CE490	Senior Seminar	2	130 CR.HR
CE499	Graduation Project	6	130 CR.HR
EE113	Fundamentals of Electrical & Mechanical Engineering	3	BS004
ME102	Fluid Mechanics	3	BS004

## 2. Elective Courses (9 Credits)

Prerequisite: senior standing

Students at the senior standing must complete 9 credits from the following electives:

Course Code	Course Title	Credit Hours
CE440	Independent Study in Civil Engineering	3
CE441	Structural Dynamics	3
CE442	Theory of Structures	3
CE443	Plastic Analysis and Design of Frames	3
CE444	Prestressed Concrete	3
CE445	Bridge Structures	3
CE446	Airport Engineering	3
CE447	Construction Project Engineering	3
CE448	Construction of Buildings	3
CE449	Quality Control of Construction Materials	3
CE450	Building Repair & Maintenance	3
CE451	Construction and Maintenance of Highways and Airports	3
CE452	Excavation and Tunneling	3
CE453	Geosynthetics	3
CE454	Rock Mechanics	3
CE455	Stability of Earth Masses	3
CE456	Flow in Open Channels	3
CE457	Sediment Transport Sediment Transport	3
CE458	Coastal Hydraulics	3
CE459	Hazardous Waste Processes	3
CE460	Solid Waste Management	3
CE461	Water Resources Policy	3
CE462	Hydraulic Structures	3
CE306	Earth Retaining Structures	3

# CONSTRUCTION ENGINEERING PROGRAM FRESHMAN

## • Semester 3

Course Code	Course Title	Credit Hours	LT	TU	LB	Contact Hours
BS101	Mathematics 3	3	2	2	-	4
BS105	Computer Applications in Engineering (CE).	2	1	-	2	3
CE101	Civil Engineering Drawings	2	1	3	-	4
CE108	Structural Analysis I	3	2	2	-	4
EE113	Fundamentals of Electrical & Mechanical Engineering	3	2	2	1	5
HM	Elective	2	2	-	-	2
HM101	Technical Writing	2	2	-	-	2
<b>Total</b>		<b>17</b>	<b>12</b>	<b>9</b>	<b>3</b>	<b>24</b>

## • Semester 4

Course Code	Course Title	Credit Hours	LT	TU	LB	Contact Hours
BS102	Mathematics 4 (CE)	3	2	2	-	4
CE204	Civil Engineering Systems	3	2	2	-	4
CE104	Plane Surveying	3	2	1	2	5
CE106	Properties of Materials	3	2	2	1	5
CE103	Mechanics of Materials I	3	2	2	-	4
HM102	Scientific Thinking	2	2	-	-	2
EN101	Technical Training I	-	-	-	-	-
<b>Total</b>		<b>17</b>	<b>12</b>	<b>8</b>	<b>3</b>	<b>23</b>

# CONSTRUCTION ENGINEERING PROGRAM

## SOPHOMORE

### • Semester 5

Course Code	Course Title	Credit Hours	LT	TU	LB	Contact Hours
CE208	Steel Design I	3	2	2	-	4
CE206	Reinforced Concrete I	3	2	2	-	4
CE201	Structural Analysis II	3	2	2	-	4
CE203	Concrete Technology	3	2	2	-	4
BS108	Probability & Statistics in Engineering	2	2	1	-	3
ME102	Fluid Mechanics	3	2	2	1	5
<b>Total</b>		<b>17</b>	<b>12</b>	<b>11</b>	<b>1</b>	<b>24</b>

### • Semester 6

Course Code	Course Title	Credit Hours	LT	TU	LB	Contact Hours
CE202	Structural Analysis III	3	2	2	-	4
CE309	Transportation & Traffic Engineering	3	2	2	-	4
CE301	Reinforced Concrete II	3	2	2	-	4
AR108	Building Construction I	3	2	2	-	4
CE102	Engineering Geology	3	2	2	1	5
HM202	Engineering Economics and Management	2	2	1	-	3
EN102	Technical Training II	-	-	-	-	-
<b>Total</b>		<b>17</b>	<b>12</b>	<b>11</b>	<b>1</b>	<b>24</b>

## CONSTRUCTION ENGINEERING PROGRAM JUNIOR

### • Semester 7

Course Code	Course Title	Credit Hours	LT	TU	LB	Contact Hours
CE302	Reinforced Concrete III	3	2	2	-	4
CE312	Construction Management	3	2	2	-	4
CE210	Soil Mechanics	3	2	2	-	4
CE307	Engineering Hydrology	3	2	2	1	5
CE313	Structural Analysis IV	3	2	2	-	4
CE311	Highway Geometric Design	3	2	2	-	4
<b>Total</b>		<b>18</b>	<b>12</b>	<b>12</b>	<b>1</b>	<b>25</b>

### • Semester 8

Course Code	Course Title	Credit Hours	LT	TU	LB	Contact Hours
CE314	Reinforced Concrete IV	3	2	2	-	4
CE205	Mechanics of Materials II	3	2	2	-	4
CE304	Pavement Materials and Design	2	2	1	-	3
CE305	Foundations Engineering	3	2	2	-	4
CE310	Construction Law	2	2	1	-	3
CE303	Steel Design II	3	2	2	-	4
HM	Elective	2	2	-	-	2
EN103	Technical Training III	-	-	-	-	-
<b>Total</b>		<b>18</b>	<b>14</b>	<b>10</b>	<b>-</b>	<b>24</b>

# CONSTRUCTION ENGINEERING PROGRAM SENIOR

## • Semester 9

Course Code	Course Title	Credit Hours	LT	TU	LB	Contact Hours
CE	Elective	3	2	2	-	4
CE401	Computer- Aided Structural Design	3	2	2	-	4
CE308	Sanitary & Environmental Engineering	3	2	2	-	4
CE403	Construction Administration	3	2	2	-	4
CE405	Construction Cost Estimate	3	2	2	-	4
CE499	Graduation Project	3	2	1	2	5
<b>Total</b>		<b>18</b>	<b>12</b>	<b>11</b>	<b>2</b>	<b>25</b>

## • Semester 10

Course Code	Course Title	Credit Hours	LT	TU	LB	Contact Hours
CE	Elective	3	2	2	-	4
CE	Elective	3	2	2	-	4
CE402	Construction Productivity	3	2	2	-	4
CE404	Construction Engineering Equipment	3	2	2	-	4
CE490	Senior Seminar	2	1	2	-	3
CE499	Graduation Project	3	2	1	2	5
<b>Total</b>		<b>17</b>	<b>11</b>	<b>11</b>	<b>2</b>	<b>24</b>



## CONSTRUCTION ENGINEERING PROGRAM

Code	Course Title	CR	LT	TU	LB	CT	Code	Course Title	CR	LT	TU	LB	CT
<b>Preparatory</b>		<b>Semester 1</b>					<b>Semester 2</b>						
BS001	Mathematics 1	3	2	2	-	4	BS002	Mathematics 2	3	2	2	-	4
BS003	Physics 1	3	2	1	1	4	BS004	Physics 2	3	2	1	1	4
BS005	Chemistry	3	2	1	1	4	BS008	Engineering Mechanics 2	3	2	2	-	4
BS007	Engineering Mechanics 1	3	2	2	-	4	BS010	Engineering Drawing 2	2	1	2	-	3
BS009	Engineering Drawing 1	2	1	2	-	3	HM002	Russian Language 2	2	1	2	-	3
HM001	Russian Language 1	1	-	2	-	2	HM004	English Language 2	2	1	2	-	3
HM003	English Language 1	1	-	2	-	2	BS006	Computer Aided Drawing	1	-	-	2	2
HM005	Introduction to Engineering	2	2	-	-	2	ME002	Production Technology	2	1	1	1	3
<b>Total</b>		<b>18</b>	<b>11</b>	<b>12</b>	<b>2</b>	<b>25</b>	<b>Total</b>		<b>18</b>	<b>10</b>	<b>12</b>	<b>4</b>	<b>26</b>
<b>Freshman</b>		<b>Semester 3</b>					<b>Semester 4</b>						
BS101	Mathematics 3	3	2	2	-	4	BS102	Mathematics 4 (CE)	3	2	2	-	4
BS105	Computer Applications in Engineering (CE).	2	1	-	2	3	CE204	Civil Engineering Systems	3	2	2	-	4
CE101	Civil Engineering Drawings	2	1	3	-	5	CE104	Plane Surveying	3	2	1	2	5
CE108	Structural Analysis I	3	2	2	-	4	CE106	Properties of Materials	3	2	2	1	5
EE113	Fundamentals of Electrical & Mechanical Engineering	3	2	2	1	5	CE103	Mechanics of Materials I	3	2	2	-	4
HM	Elective	2	2	-	-	2	HM102	Scientific Thinking	2	2	-	-	2
HM101	Technical Writing	2	2	-	-	2	EN101	Technical Training I	-	-	-	-	-
<b>Total</b>		<b>17</b>	<b>12</b>	<b>9</b>	<b>3</b>	<b>24</b>	<b>Total</b>		<b>17</b>	<b>12</b>	<b>8</b>	<b>3</b>	<b>23</b>
<b>Sophomore</b>		<b>Semester 5</b>					<b>Semester 6</b>						
CE208	Steel Design I	3	2	2	-	4	CE202	Structural Analysis III	3	2	2	-	4
CE206	Reinforced Concrete I	3	2	2	-	4	CE309	Transportation & Traffic Engineering	3	2	2	-	4
CE201	Structural Analysis II	3	2	2	-	4	CE301	Reinforced Concrete II	3	2	2	-	4
CE203	Concrete Technology	3	2	2	-	4	AR108	Building Construction I	3	2	2	-	4
BS108	Probability & Statistics in Engineering	2	2	1	-	3	CE102	Engineering Geology	3	2	2	1	5
ME102	Fluid Mechanics	3	2	2	1	5	HM202	Engineering Economics and Management	2	2	1	-	3
							EN102	Technical Training II	-	-	-	-	-
<b>Total</b>		<b>17</b>	<b>12</b>	<b>11</b>	<b>1</b>	<b>24</b>	<b>Total</b>		<b>17</b>	<b>12</b>	<b>11</b>	<b>1</b>	<b>24</b>
<b>Junior</b>		<b>Semester 7</b>					<b>Semester 8</b>						
CE302	Reinforced Concrete III	3	2	2	-	4	CE314	Reinforced Concrete IV	3	2	2	-	4
CE312	Construction Management	3	2	2	-	4	CE205	Mechanics of Materials II	3	2	2	-	4
CE210	Soil Mechanics	3	2	2	-	4	CE304	Pavement Materials and Design	2	2	1	-	3
CE307	Engineering Hydrology	3	2	2	1	5	CE305	Foundation Engineering	3	2	2	-	4
CE313	Structural Analysis IV	3	2	2	-	4	CE310	Construction Law	2	2	1	-	3
CE311	Highway Geometric Design	3	2	2	-	4	CE303	Steel Design II	3	2	2	-	4
							HM	Elective	2	2	-	-	2
							EN103	Technical Training III	-	-	-	-	-
<b>Total</b>		<b>18</b>	<b>12</b>	<b>12</b>	<b>1</b>	<b>25</b>	<b>Total</b>		<b>18</b>	<b>14</b>	<b>10</b>	<b>-</b>	<b>24</b>
<b>Senior</b>		<b>Semester 9</b>					<b>Semester 10</b>						
CE	Elective	3	2	2	-	4	CE	Elective	3	2	2	-	4
CE401	Computer- Aided Structural Design	3	2	2	-	4	CE	Elective	3	2	2	-	4
CE308	Sanitary & Environmental Engineering	3	2	2	-	4	CE402	Construction Productivity	3	2	2	-	4
CE403	Construction Administration	3	2	2	-	4	CE404	Construction Engineering Equipment	3	2	2	-	4
CE405	Construction Cost Estimate	3	2	2	-	4	CE490	Senior Seminar	2	1	2	-	3
CE499	Graduation Project	3	2	1	2	5	CE499	Graduation Project	3	2	1	2	5
<b>Total</b>		<b>18</b>	<b>12</b>	<b>11</b>	<b>2</b>	<b>25</b>	<b>Total</b>		<b>17</b>	<b>11</b>	<b>11</b>	<b>2</b>	<b>24</b>

# CONSTRUCTION ENGINEERING

## COURSE DESCRIPTION

### 1. BUILDING CONSTRUCTION I

Code	Credit Hours	LT	TU	LB	Prerequisites
AR108	3	2	2	-	BS010

Architectural Building: Basics and Fundamentals of Architectural Building ,Architectural and Constructive Symbols and Codes of Materials ,Fundamentals of Building Works (Stone ,Timber, Masonry, Concrete ,Steel ) and Types of Building ( Skeleton ,Bearing Walls), Arches ,Lintel ,Staircases, Means of Isolation ( moisture ,heat ,acoustic ) , Studying Types of Openings (Doors , Windows ,Etc.) Technology of Finishing Materials and Articles, Technology of Ceramic Materials.

### 2. MATHEMATICS 3

Code	Credit Hours	LT	TU	LB	Prerequisites
BS101	3	2	2	-	BS001

Basic definitions of differential equations - First order differential equations - Engineering applications - Second order differential equations - Higher order differential equations - Laplace transformation - Solving differential equations using Laplace transformation - Systems of differential equations - Fourier Series - Partial differentiation - Maxima & minima of functions of two variables - Applications of partial derivatives - Directional derivative - Taylor theorem for functions of two variables - Double integrals - Triple integrals - Line integrals - Surface integrals.

### 3. MATHEMATICS 4 (CE)

Code	Credit Hours	LT	TU	LB	Prerequisites
BS102	3	2	2	-	BS101

Error estimates - Solution of nonlinear algebraic and transcendental equations - Numerical solutions of systems of linear equations - Interpolation - Numerical differentiation and integration - Curve fitting - Numerical solution of ordinary differential equations - Numerical solution of partial differential equations.

### 4. COMPUTER APPLICATIONS IN ENGINEERING (CE)

Code	Credit Hours	LT	TU	LB	Prerequisites
BS105	2	1	-	2	-

Introduction to AutoCAD drafting. Computer application to practical engineering drawings (Architecture – Structure). Basics of steel drawings.

## 5. CIVIL ENGINEERING DRAWING

Code	Credit Hours	LT	TU	LB	Prerequisites
CE101	3	2	3	-	BS010

Introduction to construction engineering as related to municipal and regional projects, a brief review of the construction industry, details of different connections of steel structures, basic details of concrete structure elements, drawings to demonstrate the concepts of various types of civil engineering construction projects which include: (Residential, Industrial buildings, Water-Resources projects, Urban transportation systems, Coastal development projects and Environmental protection on projects Design, construction ( as-built drawings), Field trips and analysis of local construction projects).

## 6. MECHANICS OF MATERIALS I

Code	Credit Hours	LT	TU	LB	Prerequisites
CE103	3	2	2	-	CE108

Properties of Plain sections - Concept of Stress, Strain, and Constitutive Relations – Normal Stress on sections due to Normal force, Bending Moments, or/and any combinations – Shearing Stresses in Beams due to shearing force or torsion and Combined Stresses – Stresses Transformation and Principal stresses.

## 7. PLANE SURVEYING

Code	Credit Hours	LT	TU	LB	Prerequisites
CE104	3	2	1	2	-

Introduction - Unites of Surveying Measurements - Chain & Detail Surveying - Cadastral map construction - Details of Maps - Scales -Areas Measurements and Calculation - Map Shrinkage - Compass Surveying - Magnetic north - Surveying and Prismatic Compasses - Compass Traverses- Plain Table Surveying - Theodolite Surveying -Introduction to theodolites - Temporary Adjustment of the Theodolite and angles measurement - Leveling - Methods of leveling Works - Applications of leveling - Longitudinal and cross sectional leveling - Earth work calculations – Contour lines.

## 8. PROPERTIES OF MATERIALS

Code	Credit Hours	LT	TU	LB	Prerequisites
CE106	3	2	2	1	-

Classification of Building Materials - Specifications, Material Testing and Quality Control - Conventional and Composite Construction Materials – Non-Metallic Construction Materials - Metallic Building Materials - Behavior of Metals under Static Loads: Tension, Compression, Flexure, Shear, Torsion and Surface Hardness. - Behavior of Metals under Dynamic Loads (Impact) and Repeated Loads (Fatigue) - Creep.

## 9. STRUCTURAL ANALYSIS I

Code	Credit Hours	LT	TU	LB	Prerequisites
CE108	3	2	2	-	BS107

Principles of Plane Statics Loads and Reactions- Analysis of Beams: Normal Forces, Shear Force and Bending Moments – Analysis of Statically Determinate Frames, Trusses and Arches.

## 10. STRUCTURE ANALYSIS II

Code	Credit Hours	LT	TU	LB	Prerequisites
CE201	3	2	2	-	CE108

Determine Deformations of Statically Determinate Structures using Different Methods (Conjugate beam - Virtual work) - Introduction to Indeterminate structures –Consistent Deformation –Analysis of Statically Indeterminate Structures using three Moment Equations.

## 11. STRUCTURAL ANALYSIS III

Code	Credit Hours	LT	TU	LB	Prerequisites
CE202	3	2	2	-	CE201

Analysis of Structures using Displacement Method –Slope Deflection, and Moment Distribution – Introduction to Stiffness Method.

## 12. STRUCTURAL ANALYSIS IV

Code	Credit Hours	LT	TU	LB	Prerequisites
CE313	3	2	2	-	CE202

Matrix Analysis of Structures and Computer Applications - Stiffness Method – Transformation from Local to Global Axes - Applications to 2D and 3D structures – Introduction to Modeling of Structures.

## 13. CONCRETE TECHNOLOGY

Code	Credit Hours	LT	TU	LB	Prerequisites
CE203	3	2	2	-	-

Concrete materials: Cement, Aggregate, Mixing water and Admixtures - Concrete Manufacturing - Properties and Testing of Fresh Concrete - Properties and Testing of Hardened Concrete - Concrete Mix Design - Non Destructive Tests of Concrete Structures - Statistical Analysis of Concrete Quality - Special Types of Concrete.

## 14. CIVIL ENGINEERING SYSTEMS

Code	Credit Hours	LT	TU	LB	Prerequisites
CE204	3	2	2	-	-

Fundamentals of system design for Building Engineering - Role of Civil, Mechanical, Electrical and Architectural engineering in building design and Construction - Design philosophy, design fundamentals and construction Requirements for multistory and industrial buildings - Building components and Materials, Design - construction drawings & detailing - Building Engineering of Structural systems( system phase and process, skeleton, stairs, roofs) - Introduction to ancillary services( insulation, walls, plaster, mechanical, Electrical & plumbing ...etc) - Building codes.

## 15. MECHANICS OF MATERIALS II

Code	Credit Hours	LT	TU	LB	Prerequisites
CE205	3	2	2	-	CE103

Buckling and Elastic Stability –Introduction of Elastic Theory of Thin Plates –Thermal Stresses – Introduction of Elastic Theory of Thin Shells – Membrane theory – Surface of Revolutions – Cylindrical shells –Influence Line for Statically Determinate Structure: Beams, Frames, Trusses.

## 16. REINFORCED CONCRETE I

Code	Credit Hours	LT	TU	LB	Prerequisites
CE206	3	2	2	-	CE103,CE106,CE108

Introduction to the Mechanical Properties of Concrete and Steel – Design of Section under Bending – Design of Sections under Shear – Load Distribution on Beams – Design and Details of Beams – Design of Sections under Eccentric Loading (Single and Double Bending) – Design of Short and Long Columns and their Details – Design of Sections Subjected to Torsion.

## 17. REINFORCED CONCRETE II

Code	Credit Hours	LT	TU	LB	Prerequisites
CE301	3	2	2	-	CE206

Design of Solid Slabs and Details of Reinforcement – Design of Paneled Beams – Design of Hollow Block Slabs – Design of Flat Slab – Design of Stairs.

## 18. REINFORCED CONCRETE III

Code	Credit Hours	LT	TU	LB	Prerequisites
CE302	3	2	2	-	CE301

Design and Details of Reinforcement of Large Span Halls (Frames, Arches & Trusses) – Design of North Lighting Structures (Saw-Tooth Structures) – Design of Some Special Structures – Application through mini project.

## 19. REINFORCED CONCRETE IV

Code	Credit Hours	LT	TU	LB	Prerequisites
CE314	3	2	2	-	CE302

Design of Reinforced Concrete Sections Considering Crack Control – Design and Details of Reinforcement for the Rectangular and Circular Tanks | - Surface of Revolution – Design of Deep Beams – Design of Short Cantilever – Lateral Loads (Earthquake, Wind) on the Buildings – Design of Shear Walls – Introduction to prestressed Concrete. Mini projects.

## 20. STEEL DESIGN I

Code	Credit Hours	LT	TU	LB	Prerequisites
CE208	3	2	2	-	CE108

Introduction to steel properties and sections – Design of Tension Members – Design of Compression Members – Design of Columns – Design of Beams – Bolted and Riveted Connections – Welded Connections – Splices – Design of Built up Sections – Systems of Factory Halls and Steel Roofs – Workshop Drawings.

## 21. ENGINEERING GEOLOGY

Code	Credit Hours	LT	TU	LB	Prerequisites
CE102	3	2	2	1	CE104

Origin and formation of soil and soil structure – Phase diagram – Index properties of soil – Classification of soil – Weight volume relationships - Moisture-density relationships - Permeability, deformation, and strength of soils and seepage through isotropic soil media - Principle of total and effective stresses - Stress distribution due to external loads – Settlement in elastic media – Consolidation of soil – Soil compaction – Introduction to mineral and rocks and geological setting – Basic engineering properties for rock – Structural geology and earthquake hazards.

## 22. STEEL DESIGN II

Code	Credit Hours	LT	TU	LB	Prerequisites
CE303	3	2	2	-	CE208

Types of Bridges: Railway Bridges – Highway Bridges – Foot Bridges – Deck and through Bridges: Classification and Design of Bridge Elements – Design of Wind Resistant Elements – Earthquake Loads on Bridges – Design of Supports and Expansion Joints – Composite Sections. Sample project.

## 23. PAVEMENT MATERIALS AND DESIGN

Code	Credit Hours	LT	TU	LB	Prerequisites
CE304	3	2	2	-	-

Design principles of flexible and rigid pavements. Included is a study of soils and paving materials, their interaction, their behavior under various loading conditions and their ability to perform under all ambient loading conditions. Topics include surface, base, sub-base and base courses: bituminous materials, quality control, and flexible and rigid pavement design methods.

## 24. SOIL MECHANICS

Code	Credit Hours	LT	TU	LB	Prerequisites
CE210	3	2	2	-	CE210

Shear strength of soil – Compaction of soil – Stability of slopes – Lateral earth pressure – Bearing capacity of soil – Bearing capacity of rocks – Soil investigation.

## 25. FOUNDATION ENGINEERING

Code	Credit Hours	LT	TU	LB	Prerequisites
CE305	3	2	2	-	CE210

Shallow foundations (Isolated footing, combined footing, strap footing and raft) – Piles (types, installation, carrying capacity, testing, group effect) – Pile cap – Retaining walls – Sheet pile wall – Side support systems – Groundwater control systems.

## 26. ENGINEERING HYDROLOGY

Code	Credit Hours	LT	TU	LB	Prerequisites
CE307	3	2	2	1	ME102

Hydrological cycle and the atmosphere – Effect of temperature, moisture, wind, solar radiation and earth rotation on the hydrological cycle – Rain Studies: Types, intensity, repetition, measurement methods and equipment. Soil infiltration studies: measurement methods, Evaporation and Evapotranspiration - measurement and calculation methods – Hydrographic measurements: properties and analysis of hydrographs – types of storms – relationship between rain and storms – water balance equation – storage.

## 27. SANITARY & ENVIRONMENTAL ENGINEERING

Code	Credit Hours	LT	TU	LB	Prerequisites
CE308	3	2	2	-	ME102

Impact of human and construction projects upon the environment - Point and Non-point sources of pollution in air, water and ground, Water quality requirements - Engineering systems for water purification, Wastewater treatment and disposal - Air quality standards - Classification of Pollutants and meteorological conditions - Engineering systems for air pollution Control - Industrial and solid waste management-Purification Works of Potable Water- Design of Purification Works- Treatment of Sewage Works- Design of Sewage treatment Works- Laboratory Tests for Water and Sewage Works.

## 28. TRANSPORTATION AND TRAFFIC ENGINEERING

Code	Credit Hours	LT	TU	LB	Prerequisites
CE309	3	2	2	-	BS106

Introduction- Transportation Planning- Transportation Systems- Transportation Planning Procedures- Trip Generation- Trip Distribution- Planning with Different Transportation Systems- Traffic Specialization- Traffic Engineering- Duties of Traffic Engineers- Behavior of Road Users- Traffic Volume- Speed and Delay Time Calculation- Types of Speed and Calculation of Delay Time- Types of Speed and Properties- Methods of Speed Measurement, Traffic Volume and Calculation of the Design Traffic Volume- Characteristics of Traffic Flow- Design of Traffic Intersections- Railways Engineering.

## 29. CONSTRUCTION LAW

Code	Credit Hours	LT	TU	LB	Prerequisites
CE310	3	2	2	-	120 CR.HR

Contract Principles and Construction Project (Contract Formation, Breach of Contract, Damages for Breach of Contracts, and Contractual Relationships on the Construction Projects) - The Contract Documents (The Agreement, The General Conditions, Defining the Scope of Work, Interpreting the contract, Contractor's Performance Obligations, and



Standard Agreements) - Contract Types (Fixed price Contracts, Unit-Price Contracts, Cost-Plus Contracts, Design-Build Contracts, and Construction management Contracts) - Competitive Bidding (Concept of Competitive Bidding, Bid Evaluation, Bid Security, Mistakes in Bids, Subcontractor Problems, and Bid Protests) - Architects, Engineering and Construction Process (Three Phases of the A/E's Work, A/E's Obligation to the owner, A/E's Liability to Third Parties, The A/E's Inspection Responsibilities, and The A/E's Roles in the Claims Process) - Owner's Assurance of Performance (Performance Bonds, Owner Right to Terminate the Contract, Owner's Release of Payment, and Warranties and Guaranties) - Changes in the Work (Why Changes Occur, Directed Changes, Constructive Changes, and Pricing Changed Work) - Sub-Contracts and Suppliers (Nature of the Relationship, Contract Formation, Rights of the Prime Contractor, Prime Contractor's Coordination Responsibilities, and Payment Obligations to sub-Contractors and Suppliers) - Disputes Resolution (Administrative remedies, Litigation, Arbitration, and Mediation) - Project Closeout (Substantial Completion, Final Acceptance of the Project, Waivers and Releases, and Contractor's Continuing Obligations).

### 30. HIGHWAY GEOMETRIC DESIGN

Code	Credit Hours	LT	TU	LB	Prerequisites
CE311	3	2	2	-	-

Analysis of factors in developing a highway transportation facility - traffic estimates and assignment - problems of highway geometrics and design standards - planning and location principles - intersection design factors - street systems and terminal facilities - programming improvements - drainage design - structural design of surface - concepts of highway management and finance - and highway maintenance planning.

### 31. CONSTRUCTION MANAGEMENT

Code	Credit Hours	LT	TU	LB	Prerequisites
CE312	3	2	2	1	120 CR.HR

Organization, management and planning in construction: fundamentals of construction management and construction manufacture; technological-organizational models of construction manufacture; technological-organizational designing; material support organization of construction manufacture; construction manufacture planning; organizational manufacturing forms and management structures in construction; quality control of manufacturing products; management of maintenance acceptance of completed project.

### 32. COMPUTER AIDED STRUCTURAL ANALYSIS

Code	Credit Hours	LT	TU	LB	Prerequisites
CE401	3	2	2	-	CE202

Drafting and editing commands three dimension and multi layer drawing- drawing sorting and editing- evaluation of design alternators using conventional and computer- conceptual building design- performance – evaluation using modeling analysis.

### 33. CONSTRUCTION PRODUCTIVITY

Code	Credit Hours	LT	TU	LB	Prerequisites
CE402	3	2	2	-	120 CR.HR

Introduction of the application of scientific principles to the measurement and forecasting of productivity in construction engineering, e.g., interviews, surveys, work sampling, recording



and viewing work-face activities. Conceptual and mathematical formulation of labor, equipment and material factors affecting productivity. Implementing crew balance charts, process charts and flow diagrams techniques to improve productivity.

### 34. CONSTRUCTION ADMINISTRATION

Code	Credit Hours	LT	TU	LB	Prerequisites
CE403	3	2	2	-	120 Cr. Hr.

Definition, interpretation, and utilization for drawings, specifications, agreements, bidding forms, contracting methods, bonds, subcontracts, cash flow, shop drawings, and related documents.

### 35. CONSTRUCTION ENGINEERING EQUIPMENTS

Code	Credit Hours	LT	TU	LB	Prerequisites
CE404	3	2	2	-	CE205

Selection and acquisition for the construction equipment, Application of the engineering fundamentals and economics to the performance characteristics and production of equipment, Heavy construction methods and economic applications.

### 36. CONSTRUCTION COST ESTIMATE

Code	Credit Hours	LT	TU	LB	Prerequisites
CE405	3	2	2	-	HM202

Estimation of construction costs. Topics will include project life cycle, financial considerations, order-of-magnitude estimates, the project acquisition decision, material/labor and equipment costs, and overhead and profit consideration, building systems estimates, uncertainty, the bidding process, value engineering, and cost control.

### 37. INDEPENDENT STUDY IN CIVIL ENGINEERING

Code	Credit Hours	LT	TU	LB	Prerequisites
CE440	3	2	2	-	-

Covers areas of study in which one or more students may be interested but which is not of sufficiently broad interest to warrant a regular course offering.

### 38. STRUCTURAL DYNAMICS

Code	Credit Hours	LT	TU	LB	Prerequisites
CE441	3	2	2	-	-

Single Degree of Freedom (SDOF) – Undamped Free Vibration Mode – SDOF Damped Free Vibration Mode – SDOF Under Harmonic Loading – Dynamic Behavior due to General Loading – Multi Degree of Freedom (MDOF) Systems – Damped Motion of Shear Buildings – Analysis of Structures Subjected to Earthquake – Computer Applications.

### 39. THEORY OF STRUCTURES

Code	Credit Hours	LT	TU	LB	Prerequisites
CE442	3	2	2	-	-

Analysis of Space Frames – Analysis of Space Trusses – Determine of Stresses in Circular Plates – Determine of Stresses in Rectangular Plates – Determine of Stresses in Shells and

#### 40. PLASTIC ANALYSIS AND DESIGN OF FRAMES

Code	Credit Hours	LT	TU	LB	Prerequisites
CE443	3	2	2	-	-

Plastic analysis and design of frames. Fundamental theorems of plastic analysis; general methods of plastic analysis, design requirements, minimum weight design theorems and applications, shakedown theorems.

#### 41. PRE-STRESSED CONCRETE

Code	Credit Hours	LT	TU	LB	Prerequisites
CE444	3	2	2	-	-

Analysis and design of pre-tensioned and post-tensioned pre-stressed concrete elements for both determinate and indeterminate structures will be studied. Examples of pre-stressed elements used in buildings and bridges will be discussed, as well as the source and magnitude of pre-stress losses.

#### 42. BRIDGE STRUCTURES

Code	Credit Hours	LT	TU	LB	Prerequisites
CE445	3	2	2	-	-

Bridge design in structural steel and reinforced concrete. Application of AASHTO Bridge Design Specifications. Analysis techniques for complex structures. Preliminary designs include investigating alternative structural systems and materials. Final designs include preparation of design calculations and sketches.

#### 43. AIRPORT ENGINEERING

Code	Credit Hours	LT	TU	LB	Prerequisites
CE446	3	2	2	-	-

Planning of individual airports and statewide airport systems. Functional decision of air and landside facilities. Orientation, number and length of runways. Concepts of airport capacity. Passenger and freight terminal facility requirements. Airport access systems. FAA operating requirements. Financial, safety and security issues.

#### 44. CONSTRUCTION PROJECT ENGINEERING

Code	Credit Hours	LT	TU	LB	Prerequisites
CE447	3	2	2	-	-

Managerial aspects of contracting. Study of an individual firm in relation to the entire construction industry. Topics include contractor organization and management, legal aspects of construction, and financial planning.

## 45. CONSTRUCTION OF BUILDINGS

Code	Credit Hours	LT	TU	LB	Prerequisites
CE448	3	2	2	-	-

Conceptual estimating. Bid preparation for buildings, highways, heavy, mechanical trades. Estimating costs for material, labor, equipment, overhead, and profit. Quantity surveys, unit costs, production rates, and pricing methods. Subcontract bid analysis and bid procedure. Cost analysis and cost control.

## 46. QUALITY CONTROL OF CONSTRUCTION MATERIALS

Code	Credit Hours	LT	TU	LB	Prerequisites
CE449	3	2	2	-	-

Integration of previous construction coursework into the planning, scheduling, and management of time, costs, and other resources. Emphasis on preparation and analysis of network schedules. Comprehensive planning and scheduling project. Computer applications.

## 47. BUILDING REPAIR AND MAINTENANCE

Code	Credit Hours	LT	TU	LB	Prerequisites
CE450	3	2	2	-	-

Introduction and expressions – types of maintenance – information systems – management of maintenance operations – method of building evaluations – evaluation of maintenance requirements – destructive and non-destructive testing – faults and common problems – methods of repair.

## 48. CONSTRUCTION AND MAINTENANCE OF HIGHWAYS AND AIRPORTS

Code	Credit Hours	LT	TU	LB	Prerequisites
CE451	3	2	2	-	-

Design problems for airports, terminals, and highway intersections and interchanges are undertaken.

## 49. EXCAVATION AND TUNNELING

Code	Credit Hours	LT	TU	LB	Prerequisites
CE452	3	2	2	-	-

Selection of methods of attack for excavation of tunnels and deep vertical-sided openings. Tunneling procedures based on behavioral characteristics of soil and rock. Study of tunnel boring machines, shielded and drill-and-blast operations, linings. Soil liner interaction. Deep excavation procedures related to support of excavation systems, methods of installation and dewatering.

## 50. GEOSYNTHETICS

Code	Credit Hours	LT	TU	LB	Prerequisites
CE453	3	2	2	-	-

Includes engineering properties of geosynthetics and their application in civil engineering, such as filtration, seepage, and erosion control; subgrade and slope stabilization. Soil improvement topics include preloading, electrokinetic stabilization, soil modification, admixtures and grouting.

## 51. ROCK MECHANICS

Code	Credit Hours	LT	TU	LB	Prerequisites
CE454	3	2	2	-	-

Rock mechanics including geological aspects, mechanical properties, testing, and in-situ measurements of rock properties, and a brief introduction to design of structures in rock.

## 52. STABILITY OF EARTH MASSES

Code	Credit Hours	LT	TU	LB	Prerequisites
CE455	3	2	2	-	-

Practical design solutions for resisting the damaging effects of earthquake ground motions and other severe dynamic excitations. Factors which control dynamic response in elastic and inelastic ranges, and the nature of severe dynamic excitations. Theories of structural analysis and dynamics, and modern design methodologies on the behavior of structures.

## 53. FLOW IN OPEN CHANNELS

Code	Credit Hours	LT	TU	LB	Prerequisites
CE456	3	2	2	-	-

The principles developed in fluid mechanics are applied to flow in open channels. Steady and unsteady flow, channel controls, and transitions are considered. Application is made to natural rivers and estuaries.

## 54. SEDIMENT TRANSPORT

Code	Credit Hours	LT	TU	LB	Prerequisites
CE457	3	2	2	-	-

Unified treatment of sediment transport over a wide range of conditions; basic theory and application to engineering problems. Sediment transport problems associated with the analysis and design aspects of hydraulic and environmental structures, including channel stability, scouring, dredging, reservoir sedimentation, and wastewater solids are presented.

## 55. COASTAL HYDRAULICS

Code	Credit Hours	LT	TU	LB	Prerequisites
CE458	3	2	2	-	-

An introductory course covering basic wave theory, sediment transport and ocean circulation. The application of these principles to various coastal engineering problems will be discussed, including beach erosion, pollution transport in coastal waters, and the design of shore protection structures.

## 56. HAZARDOUS WASTE PROCESSES

Code	Credit Hours	LT	TU	LB	Prerequisites
CE459	3	2	2	-	-

The study of thermal, chemical and other systems and processes used in the detoxification of hazardous wastes, other than radioactive wastes, emphasizing the protection of the public health and environment.

## 57. SOLID WASTE MANAGEMENT

Code	Credit Hours	LT	TU	LB	Prerequisites
CE460	3	2	2	-	-

The study of methods for managing the solid wastes generated by urban communities, evaluating alternatives and design of disposal facilities. Methods for minimizing adverse effects on the human health and environment are included.

## 58. WATER RESOURCES POLICY

Code	Credit Hours	LT	TU	LB	Prerequisites
CE461	3	2	2	-	-

Training in methods of developing water supplies and the means to treat supplies for consumptive use. Covers hydrologic techniques such as surface and ground water yield, hydrograph and routing analyses, and probabilistic methods related to hydrologic studies.

## 59. HYDRAULIC STRUCTURES

Code	Credit Hours	LT	TU	LB	Prerequisites
CE462	3	2	2	-	-

Review design of hydraulic structures, pertinent fluid mechanics and hydraulic theory and applications. Examples of the failures and successes of hydraulic structures. Class project and field trip required.

## 60. SENIOR SEMINAR

Code	Credit Hours	LT	TU	LB	Prerequisites
CE490	2	1	3	-	135 CR.HR.

Selected topics of interest to the faculty will be used to introduce students to engineering science.

## 61. GRADUATION PROJECT

Code	Credit Hours	LT	TU	LB	Prerequisites
CE499	6	4	2	4	135 CR.HR

The student introduces a complete study and constructs a project determined through his department applying the basics of sciences that he studied – The student presents a report containing the rules and calculations that he made in his project.

## 62. FUNDAMENTALS OF ELECTRICAL AND MECHANICAL ENGINEERING

Code	Credit Hours	LT	TU	LB	Prerequisites
EE113	3	2	2	1	BS004

Electric field – Magnetic field – Electric circuits – Elements of electric circuits – Source of electric voltage – Electric current sources – Element of resistances – Capacitors and Induction coils – Methods of analysis for continuous current circuits – Types of distribution, installations, wiring, and wire size – Sine concept – Applications on theory of alternating current.

Fundamentals of conduction, convection and radiation. Energy transfer with engineering applications in building. Thermal comfort cooling and heating loads. Industrial ventilation in

buildings. Air conditioning types. Suitability of conditioning systems in architectural conditions.

### 63. FLUID MECHANICS

Code	Credit Hours	LT	TU	LB	Prerequisites
ME102	3	2	2	1	BS004

Introduction – Fluid properties – Fluid statics – Fundamentals of fluid motion – Fluid kinematics – Bernoulli’s equation – Principal equations for mass continuity, energy conservation and momentum – Applications – Dimensional analysis and similarity – Laminar and turbulent flows – Reynolds number – Laminar flow cases – Steady flow in pipelines – Friction coefficient and losses – Minor losses – Methods of nets connection.