Civil Engineering Program

Introduction

Civil engineering is a profession that applies the basic principles of science in conjunction with mathematical and computational tools to solve problems associated with developing and sustaining civilized life on our planet. Civil engineering is a broad engineering discipline both in terms of the range of problems that fall within its purview and in the range of knowledge required to solve those problems.

The completion of a civil engineering project involves the solution of technical problems in which uncertainty of information and a myriad of non-technical factors often plays a significant role. Some of the most common examples of civil engineering works include bridges, buildings, dams, airports, highways, tunnels, and water and sewage distribution systems. Civil engineers are also concerned with flood control, landslides, air and water pollution, and the design of facilities to withstand earthquakes and other natural hazards.

The career paths available to the civil engineer are many and varied and can involve a wide range of activities, tools, situations, clients, and venues from conceptual design of facilities that do not yet exist to forensic study of facilities that have failed to perform as expected, from advanced simulation of complex systems to the management of people and projects, from private consulting to public service. In addition to the educational objectives that apply to all engineering programs, the civil engineer must be as well prepared for a career that traverses this considerable professional breadth as for a career focused on a single professional activity.

The civil engineering curriculum is designed specifically to meet this educational challenge by emphasizing fundamental knowledge, transferable skills, and lifelong learning. It is designed to develop engineers who have a strong background in Mathematics and Basic Science, engineers who are articulate, and understand the nature of their special role in society and the impact of their work on the progress of civilization. The curriculum is designed to guarantee a certain breadth of knowledge of the civil engineering disciplines through a set of core courses and ensure depth and focus in certain disciplines through core and elective area of specialization. The curriculum develops the basic engineering tools necessary to solve problems in the field of civil engineering.

The civil engineering program comprises of six main disciplines: (1) Structural Engineering, (2) Transportation Engineering, (3) Environmental Engineering, (4) Geotechnical Engineering, (5) Water Resources Engineering, and (6) Construction Engineering and Management. While each discipline has its own special body of knowledge and engineering tools, they all rely on the same fundamental core principles. Civil engineering projects often draw expertise from many of these disciplines.

Civil engineering includes planning and design of various facilities such as residential and service buildings, roads, bridges, tunnels, airports, water supply systems, water pumping stations, sewage networks, purification and water treatment plants, dams, and irrigation projects. Civil engineering also includes supervision on the construction of such facilities. In addition, it comprises the study and analysis of existing facilities for the purposes of development and maintenance and develops solutions for existing problems.

A graduate of civil engineering can work in the following fields:

1. Construction companies.
2. Local and international engineering consulting offices.
3. Engineering departments in the government as well as the private sector.
4. Maintenance and operation departments in the government and private sectors.
5. Specifications and standards authorities.
6. Asphalt and concrete factories.
7. Manufacturing of building materials.
8. Ministries directly related to certain specialization like; Ministry of Housing, Ministry of Transport, Ministry of Water and Electricity, and Ministry of Environment, Water and Agriculture.
9. Specialized research organizations and centers in the field of civil engineering.
10. Public transportation Agencies.
11. Construction materials and testing laboratories.
12. Civil engineering academic fields at universities and colleges.
13. Technical Training Institutes.

Vision

A civil engineering department renown for excellent learning experience, innovative research and community service while adhering to the Islamic values and principles.

Mission

The mission of civil engineering department is to produce competent civil engineers, advancement of scientific knowledge through research, and to provide valuable services to civil engineering profession and society.

Goals

1. Provide high quality education that prepares our graduates for civil engineering practice and graduate studies.
2. Develop necessary skills in our graduates that allows them to be professional leaders and vibrant contributors to the society.
3. Maintain a program of study that is consistent with the current and future needs of civil engineering profession.

Program Educational Objectives

Program educational objectives of the civil engineering program at Al Imam Mohammad Ibn Saud Islamic University are:

1. Successfully commence their career as practicing civil engineers and/or pursue graduate studies and research in related fields.
2. Analyze, design and implement sustainable engineering solutions to real world problems considering realistic constraints and societal needs.
3. Demonstrate commitment to lifelong learning and professional development to stay current in modern engineering practice and contemporary issues.
4. Advance to increasing levels of responsibility and leadership in their professional roles.

Student Outcomes

Student outcomes of the civil engineering program are:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Overview of the Curriculum

Course Codes

The General Engineering, Core and Technical Elective courses are numbered to recognize each course according to the area of specialization and the year level. Each course code contains two-letters symbol followed by three-digits.

Symbol	Description
GE	General Engineering Courses
CE	Civil Engineering Core Courses and Technical Electives

The first digit denotes the year level of the course according to the study plan:

First Digit	Level of Course
1	First Year (Freshman)
2	Second Year (Sophomore)
3	Third Year (Junior)
4	Fourth Year (Senior)

The second digit represents the field/specialization within the department:

Second Number	Specialization
0	General Engineering
1	Materials and Structural Engineering
2	Transportation Engineering
3	Environmental Engineering
4	Water Resources Engineering
5	Geotechnical Engineering
6	Construction Engineering and Management
9	Graduation Project

The third digit denotes the sequence number of the course in a certain field/specialization in a given year. The number 9 as a third digit is reserved for engineering training and special topics in civil engineering courses.

For example, CE 421 refers to:

Code	First Digit	Second Digit	Third Digit (0-9)
CE	4	2	1
Department (Civil Engineering)	Year (Fourth Year)	Field (Transportation Engineering)	The course Serial.no in Transportation Engineering for Fourth year*

* If the course serial number is "0" or not in sequence for specific year, this shows that course code has been modified due to some change (credit hours, course name etc.) for the continuous improvement of the curriculum

Undergraduate Curriculum

The curriculum leading to the degree of Bachelor's Degree of Civil Engineering is organized as follows:

University requirement	**14** Credit Hours
College of Engineering requirement	**53** Credit Hours
Department requirement	**70** Credit Hours
Total Credit Hours:	**137** Credit Hours

- University requirement (Quran, Tawheed. etc)
- College of Engineering requirements include:
  1- Mathematics and Basic Sciences. (33 credit hours)
  2- General Engineering. (17 credit hours)
  3- Technical Writing in English (3 credit hours)
- Department requirement includes core courses and Technical Electives. (70 credit hours).

1. General Engineering

The following courses are required as *General Engineering* courses in the undergraduate curriculum of civil engineering program.

Code	Course Title	Credits	Prerequisite	Co-requisite
GE 103	Engineering Graphics and Design	3	None	
CS 108	Computer Programming	3	MATH 115	
GE 100	Introduction to Engineering	0		
GE 201	Statics	3	MATH 116 PH 117	
GE 202	Dynamics	3	GE 201	
GE 302	Professional Ethics for Engineers	2	GE 399	
GE 303	Engineering Economy	3	MATH 236	
GE 399	Engineering Training	0	Completion of 90 Credits	
Total Credit Hours:		**17**		

2. Core Courses and Technical Electives

Seventy credit hours of civil engineering courses (61 credits of core courses and 9 credits of technical electives) must be taken by the students in undergraduate civil engineering program. These courses are listed as follows:

A. Core Courses

Code	Course Title	Credits	Prerequisite	Co-requisite
CE 210	Civil Engineering Materials	2	STAT 215	
CE 211	Solid Mechanics	3	GE 103 GE 201 MATH 228 CE 210	
CE 213	Civil Engineering Materials Laboratory	1	ENGL 200	CE 210
CE 221	Engineering Surveying	3	CS 108 GE 103	

Code	Course Title	Credits	Prerequisite	Co-requisite
CE 232	Fundamentals of Environmental Engineering	2	CHEM 104 CHEM 105	CE 241
CE 241	Fluid Mechanics	3	MATH 228 GE 201	
CE 251	Geology for Engineers	2	CHEM 104	
CE 311	Structural Engineering	4	CE 211 GE 202 MATH 236	
CE313	Reinforced Concrete Design	3	MATH 346 CE 311	CE 316
CE 316	Concrete Properties	2	CE 213 CE 210	
CE 321	Transportation Engineering	3	CE 351 CE 221	
CE 322	Transportation Engineering Laboratory	1		CE 321
CE 331	Environmental Engineering Processes	3	CE 232 CE 241	
CE 332	Environmental Engineering Laboratory	1		CE 331
CE 343	Water Resources Engineering	3	CE 241 STAT 215	
CE 344	Water Resources Engineering Laboratory	1		CE 343
CE 351	Geotechnical Engineering	3	CE 211 CE 241 CE 251	
CE 352	Geotechnical Engineering Laboratory	1		CE 351
CE 411	Steel Structures	3	CE 311	
CE 420	Civil Engineering Systems	2	CE 461	
CE 421	Transportation Facility Design	3	CE 321 CE 322	
CE 451	Foundation Engineering	3	CE 313 CE 351 CE 352	
CE 461	Construction Engineering and Management	3	GE 303 CE 313 CE 321	

Code	Course Title	Credits	Prerequisite	Co-requisite
CE 462	Construction Contracts and Specifications	2	CE461	
CE 4**	Elective I	3	Refer to the elective course	
CE 4**	Elective II	3	Refer to the elective course	
CE 4**	Elective III	3	Refer to the elective course	
CE 493	Graduation Project I	2	Completion of 100 Credits CE 313 CE 321 CE 331 CE 343 CE 351	
CE 494	Graduation Project II	2	CE 493	
Total Credit Hours:		**70**		

B. Technical Electives

Students must take nine credits of elective courses to satisfy the requirements of Graduation Project and the selected area of specialization (Structural, Transportation, Environmental, Water Resources, Geotechnical, or Construction Engineering and Management). The technical electives in each area of specialization are as follows:

1. Structural Engineering

Code	Course Title	Credits	Prerequisite
CE 412	Indeterminate Structural Analysis	3	CE 313
CE 413	Advanced Reinforced Concrete Design	3	CE 313
CE 414	Bridge Engineering	3	CE 412
CE 415	Prestressed Concrete	3	CE 313
CE 416	Structural Dynamics	3	CE 412
CE 417	Advanced Concrete Materials	3	CE 316
CE 419	Special Topics in Structural Engineering	3	To be determined by the Instructor

2. Transportation Engineering

Code	Course Title	Credits	Prerequisite
CE 423	Traffic Engineering	3	Corequisite CE 421
CE 424	Pavement Engineering	3	CE 421
CE 425	Urban Transportation Planning	3	Corequisite CE 421
CE 426	Public Transportation Systems	3	Corequisite CE 421
CE 427	Traffic Safety	3	Corequisite CE 421
CE 429	Special Topics in Transportation Engineering	3	To be determined by the Instructor

3. Environmental Engineering

Code	Course Title	Credits	Prerequisite
CE 431	Design of Water and Wastewater Treatment Systems	3	CE 331
CE 432	Environmental Impact Assessment	3	CE 331
CE 433	Water Quality Engineering	3	CE 331
CE 434	Solid and Hazardous Waste Engineering and Management	3	CE 331
CE 435	Air Pollution Engineering	3	CE 331
CE 439	Special Topics in Environmental Engineering	3	To be determined by the Instructor

4. Water Resources Engineering

Code	Course Title	Credits	Prerequisite
CE 441	Surface Hydrology	3	CE 343
CE 442	Hydraulic Analysis and Design	3	CE 343
CE 443	Groundwater Engineering	3	CE 343
CE 444	Urban Hydrology and Hydraulics	3	CE 343
CE 445	Water Resources Management	3	CE 343
CE 449	Special Topics in Water Resources Engineering	3	To be determined by the Instructor

5. Geotechnical Engineering

Code	Course Title	Credits	Prerequisite
CE 452	Soil Mechanics and Behavior	3	CE 351 Corequisite CE 451
CE 453	Geosystems Engineering Design	3	CE 451
CE 454	Soil and Site Improvement	3	CE 351
CE 455	Geotechnical Investigations	3	CE 351
CE 456	Geotechnical Earthquake Engineering	3	CE 451
CE 459	Special Topics in Geotechnical Engineering	3	To be determined by the Instructor

6. Construction Engineering and Management

Code	Course Title	Credits	Prerequisite
CE 463	Construction Planning	3	Corequisite CE 461
CE 464	Decision and Risk Analysis	3	CE 461
CE 465	Construction Cost Analysis	3	CE 461
CE 466	Construction Productivity	3	CE 461
CE 467	Quality and Safety Management in Construction	3	CE 461
CE 469	Special Topics in Construction Engineering and Management	3	To be determined by the Instructor

Department of Civil Engineering
College of Engineering
Al Imam Mohammad Ibn Saud Islamic University
Riyadh, Kingdom of Saudi Arabia

Civil Engineering Undergraduate Program [Required Credit Hours = 137]

Total number of Courses = 58

Uni. Requirement (14)	Math (18)+ Phys. (8) + Chem. (4) +Stat (3)	General Engineering (17) + General Education (3)	Core (61) + Tech. Elect. (9)
14 Credit Hours	33 Credit Hours	20 Credit Hours	70 Credit Hours

FIRST YEAR (Freshman)

FALL (1)

- **CUL 101 [2]** Islamic Culture
- **MATH 115 [3]** Calculus I
- **CHEM 104 [3]** General Chemistry
- **CHEM 105 [1]** G. Chemistry Lab — CO: CHEM 104
- **PHYS 117 [3]** Physics I
- **PHYS 119 [1]** Physics I Lab — CO: PHYS117
- **ENGL 200 [3]** Technical Writing in English

SPRING (2)

- **IDE 133 [2]** Tawheed
- **MATH 116 [3]** Calculus II — PRE: MATH115
- **PHYS 118 [3]** Physics II — PRE: PHYS117, PHYS119
- **PHYS 120 [1]** Physics II Lab — PRE: PHYS117, PHYS119 — CO: PHYS118
- **STAT 215 [3]** Probability and Statistics for Engineers — PRE: MATH115
- **GE 100 [0]** Introduction to Engineering
- **GE 103 [3]** Engineering Graphics and Design
- **CS 108 [3]** Computer Programming — PRE: MATH115

SECOND YEAR (Sophomore)

FALL (3)

- **QUR 100 [2]** Quran Kareem
- **MATH 207 [3]** Calculus III — PRE: MATH116
- **MATH 228 [3]** Linear Algebra & ODE — PRE: MATH116
- **GE 201 [3]** Statics — PRE: MATH116, PHYS117
- **CE 210 [2]** Civil Engineering Materials — PRE: STAT215
- **CE 213 [1]** Civil Engineering Materials Lab — PRE:ENGL200, CO:CE210
- **CE 221 [3]** Engineering Surveying — PRE: GE103, CS108
- **CE 251 [2]** Geology for Engineers — PRE: CHEM104

SPRING (4)

- **QUR 150 [2]** Quran Kareem
- **MATH 236 [3]** Mathematical Methods for Engineers — PRE: MATH207, Math228
- **GE 202 [3]** Dynamics — PRE: GE201
- **CE 211 [3]** Solid Mechanics — PRE: MATH228, GE103, GE201, CE210
- **CE 232 [2]** Fundamentals of Environmental Eng — PRE: CHEM104, CHEM105 , CO:CE241
- **CE 241 [3]** Fluid Mechanics — PRE: GE201, MATH228

THIRD YEAR (Junior)

FALL (5)

- **FIQ 150 [2]** Fiqh
- **MATH 346 [3]** Numerical Analysis — PRE: MATH 236, CS 108
- **CE 311 [4]** Structural Engineering — PRE: MATH236, GE202, CE211
- **CE 343 [3]** Water Resources Engineering — PRE: STAT215, CE241
- **CE 344 [1]** Water Resources Engineering Lab — CO: CE343
- **CE 351 [3]** Geotechnical Engineering — PRE: CE211, CE241, CE251
- **CE 352 [1]** Geotechnical Engineering Lab — CO: CE351

SPRING (6)

- **NAHU 105 [2]** Nahu
- **GE 303 [3]** Engineering Economy — PRE: MATH236
- **CE 313 [3]** Reinforced Concrete Design — PRE: MATH346, CE311 — CO: CE316
- **CE 316 [2]** Concrete Properties — PRE: CE210, CE213
- **CE 321 [3]** Transportation Eng — PRE: CE351, CE221
- **CE 322 [1]** Transportation Engineering Lab — CO: CE321
- **CE 331 [3]** Environmental Engineering Processes — PRE: CE232, CE241
- **CE 332 [1]** Environmental Engineering Lab — CO: CE331

SUMMER SEMESTER

GE 399 Engineering Training [0] (Pre-requisite: 90 Credit Hours)

FOURTH YEAR (Senior)

FALL (7)

- **CE 411 [3]** Steel Structures — PRE: CE311
- **CE 421 [3]** Transportation Facility Design — PRE: CE321, CE322
- **CE 451 [3]** Foundation Eng. — PRE:CE313,CE351,CE352
- **CE 461 [3]** Construction Eng. & Management — PRE: GE303, CE313, CE321
- **CE 493 [2]** Graduation Project I — PRE: CE313, CE321, CE331, CE343, CE351,Completion of 100 Credit Hours
- **CE 4** [3]** Technical Elective I

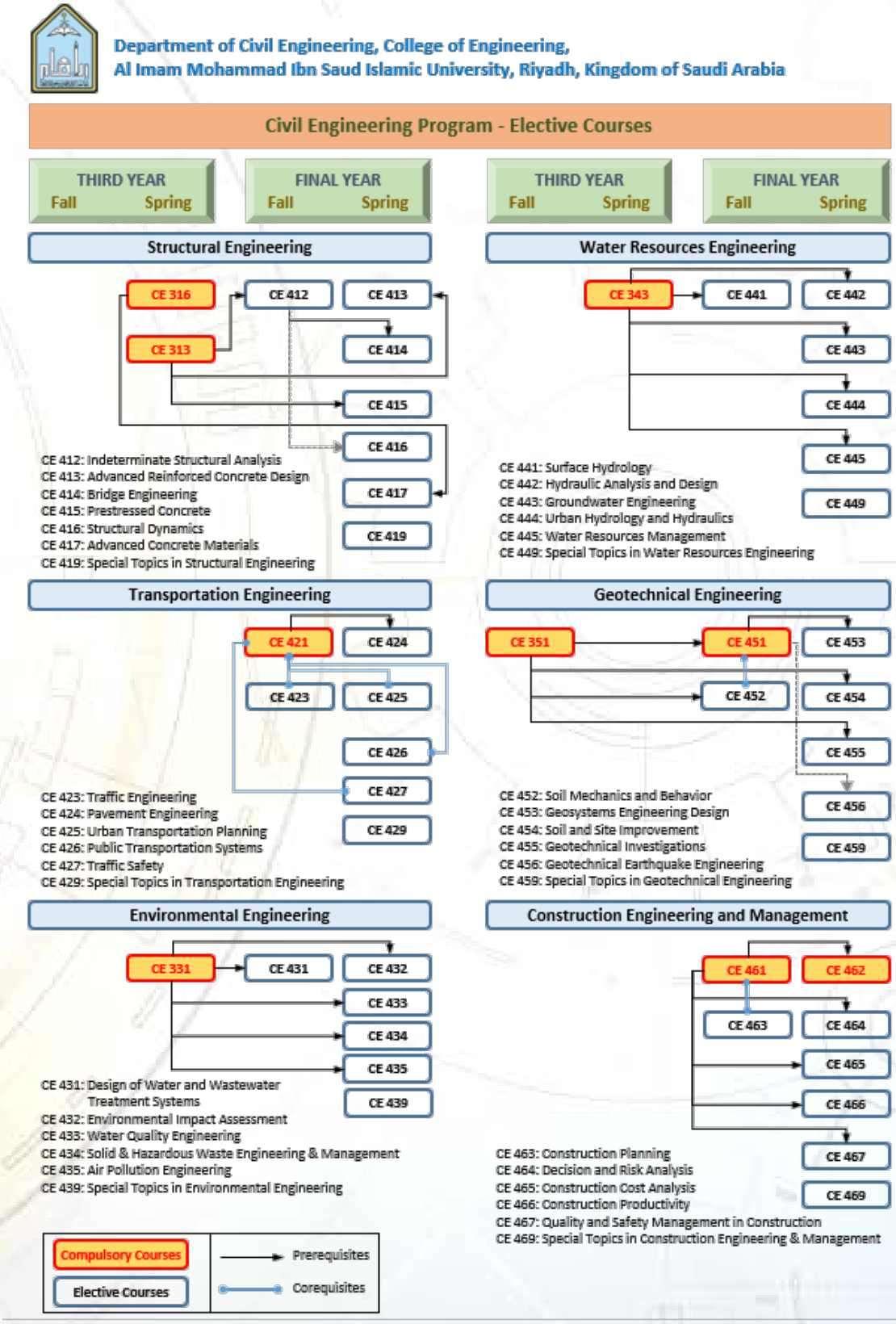
SPRING (8)

- **HST 101 [2]** Asseerah Annabawia
- **GE 302 [2]** Professional Ethics for Engineers — PRE: GE399
- **CE 420 [2]** Civil Engineering Systems — PRE: CE461
- **CE 462 [2]** Construction Contracts & Specs. — PRE: CE461
- **CE 494 [2]** Graduation Project II — PRE: CE493
- **CE 4** [3]** Technical Elective II
- **CE 4** [3]** Technical Elective III

No. of Courses / Credits each Semester:

FALL (1)	SPRING (2)	FALL (3)	SPRING (4)	FALL (5)	SPRING (6)	SUMMER	FALL (7)	SPRING (8)
[7/ 16]	[8 / 18]	[8/ 19]	[6 / 16]	[7 / 17]	[8 / 18]	[1/0]	[6 / 17]	[7 / 16]

Technical Electives – Flow Chart



First Year (Freshman)

First Semester

No.	Code	Course Title	Hours			
			Credits	Theory	Lab	Tutorial
1	CUL 101	Islamic Culture	2	2		
2	MATH 115	Calculus I	3	3		2
3	PHYS 117	Physics I	3	3		1
4	PHYS 119	Physics I Lab	1		2	
5	ENGL 200	Technical Writing in English	3	3		1
6	CHEM 104	General Chemistry	3	3		1
7	CHEM 105	General Chemistry Lab	1		2	
Total Semester Hours			**16**	**14**	**4**	**5**

Second Semester

No.	Code	Course Title	Hours			
			Credits	Theory	Lab	Tutorial
1	IDE 133	Tawheed	2	2		
2	MATH 116	Calculus II	3	3		2
3	PHYS 118	Physics II	3	3		1
4	PHYS 120	Physics II Lab	1		2	
5	CS 108	Computer Programming	3	2	2	
6	GE 103	Engineering Graphics and Design	3	2	2	
7	STAT 215	Probability and Statistics for Engineers	3	3		1
8	GE 100	Introduction to Engineering	0			2
Total Semester Hours			**18**	**15**	**6**	**6**
Cumulative Credit Hours			**34**	**29**	**10**	**11**

Second Year (Sophomore)

Third Semester

No.	Code	Course Title	Hours			
			Credits	Theory	Lab	Tutorial
1	QUR100	Quran Kareem	2	2		
2	MATH 207	Calculus III	3	3		2
3	MATH 228	Linear Algebra and ODE	3	3		2
4	GE 201	Statics	3	3		1
5	CE 210	Civil Engineering Materials	2	2		1
6	CE 213	Civil Engineering Materials Lab	1		2	
7	CE 221	Engineering Surveying	3	2	2	1
8	CE 251	Geology for Engineers	2	2		1
Total Semester Hours			**19**	**17**	**4**	**8**
Cumulative Hours			**53**	**46**	**14**	**19**

Fourth Semester

No.	Code	Course Title	Hours			
			Credits	Theory	Lab	Tutorial
1	QUR 150	Quran Kareem	2	2		
2	MATH 236	Mathematical Methods for Engineers	3	3		2
3	GE 202	Dynamics	3	3		1
4	CE 211	Solid Mechanics	3	3		1
5	CE 232	Fundamentals of Environment Eng.	2	2		2
6	CE 241	Fluid Mechanics	3	3		1
Total Semester Hours			**16**	**16**		**7**
Cumulative Hours			**69**	**62**	**14**	**26**

Third Year (Junior)

Fifth Semester

No.	Code	Course Title	Hours			
			Credits	Theory	Lab	Tut
1	FIQ 150	Fiqh	2	2		
2	MATH 346	Numerical Analysis	3	3		2
3	CE 311	Structural Engineering	4	4		1
4	CE 343	Water Resources Engineering	3	3		2
5	CE 344	Water Resources Engineering Lab	1		2	
6	CE 351	Geotechnical Engineering	3	3		1
7	CE 352	Geotechnical Engineering Lab	1		2	
Total Semester Hours			**17**	**15**	**4**	**6**
Cumulative Hours			**86**	**77**	**18**	**32**

Sixth Semester

No.	Code	Course Title	Hours			
			Credits	Theory	Lab	Tut
1	NAHU105	Nahu	2	2		
2	GE 303	Engineering Economy	3	3		1
3	CE 313	Reinforced Concrete Design	3	3		1
4	CE 316	Concrete Properties	2	1	2	1
5	CE 331	Environmental Engineering Processes	3	3		1
6	CE 332	Environmental Engineering Lab	1		2	
7	CE 321	Transportation Engineering	3	3		1
8	CE 322	Transportation Engineering Lab	1		2	
Total Semester Hours			**18**	**15**	**6**	**5**
Cumulative Hours			**104**	**92**	**24**	**37**

Engineering Training

No.	Code	Course Title	Hours			
			Credit	Theory	Lab	Tutorial
1	GE 399	Engineering Training	0	0	0	0

Fourth Year (Senior)

Seventh Semester

No.	Code	Course Title	Hours			
			Credits	Theory	Lab	Tutorial
1	CE 411	Steel Structures	3	3		1
2	CE 421	Transportation Facility Design	3	3		1
3	CE 451	Foundation Engineering	3	3		1
4	CE 461	Construction Engineering and Management	3	3		1
5	CE 493	Graduation Project I	2		4	
6	CE 4**	Technical Elective I	3	3		1
Total Semester Hours			**17**	**15**	**4**	**5**
Cumulative Hours			**121**	**107**	**28**	**42**

Eighth Semester

No.	Code	Course Title	Hours			
			Credits	Theory	Lab	Tutorial
1	HST 101	Asseerah Annabawia	2	2		
2	GE 302	Professional Ethics for Engineers	2	2		
3	CE 420	Civil Engineering Systems	2	2		2
4	CE 462	Construction Contracts and Specifications	2	2		1
5	CE 494	Graduation Project II	2		4	
6	CE 4**	Technical Elective II	3	3		1
7	CE 4**	Technical Elective III	3	3		1
Total Semester Hours			**16**	**14**	**4**	**5**
Cumulative Hours			**137**	**121**	**32**	**47**

Courses Description

1. GENERAL ENGINEERING

GE 100	**Introduction to Engineering**	**0 Credit Hours**

Introduction to the engineering profession, roles and responsibilities of engineers, professional and ethical aspects of the profession, major engineering disciplines, academic background and requirements of each discipline, sub-specialties within each discipline, jobs availability and financial benefits, role of professional engineering bodies and societies, teamwork.

GE 103	**Engineering Graphics and Design**	**3 Credit Hours**

Use of computer drafting software (AutoCAD) to model parts and assemblies. Use of parametric and non-parametric solids, surface and wire frame models. Part editing, two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multi-view, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerance techniques. Team or individual design project.

CS 108	**Computer Programming**	**3 Credit Hours**

The course introduces students to structured programming techniques. Topics include different control statements (sequence, selection, and repetition), functions, fundamental data types, and data structures (arrays and pointers). Upon successful completion of the course, students will solve computer problems by using structured programming techniques and adequate tools (text editor, compiler, and debugger).

GE 201	**Statics**	**3 Credit Hours**

Vector analysis, forces, moments, and couples, resultants of force systems, equilibrium analysis and free-body diagrams, analysis of forces acting on members of trusses and frames. Shear-force and bending-moment distributions, centroids, center of mass, hydrostatic pressure, moment of inertia, parallel axis theorem, polar moment of inertia, and product of inertia.

GE 202	**Dynamics**	**3 Credit Hours**

Kinematics and kinetics of particles including Newton's second law, energy-work principles, and impulse-momentum methods. Planar kinematics and planar kinetics of rigid bodies: translation, rotation about a fixed axis, and general plane motion. Introduction to three-dimensional dynamics of rigid bodies.

GE 302	**Professional Ethics for Engineers**	**2 Credit Hours**

Introduction to engineering ethics; definition of a profession, personal and professional ethics, explore many of the ethical issues, discussion of ethical theories, code of ethics, problem solving techniques. Introduce engineer's rights and responsibilities. Asses Safety, risk and accidents. Explain the rights and responsibilities of engineers.

GE 303	Engineering Economy	3 Credit Hours

This course investigates methods of economic analysis for decision making among alternative courses of action in engineering, business and government applications. Topics include: Time value of money, money management, and equivalence calculations under inflation, present worth analysis, annual equivalence analysis, rate of return analysis, benefit-cost ratio & profitability index analyses.

GE 399	Engineering Training	0 Credit Hours

Eight weeks training in a relevant industry under the supervision of an external supervisor from industry. Each student must submit a technical report about his learning experience during training in addition to fulfilling any other requirements as determined by the department.

2. CIVIL ENGINEERING CORE COURSES

CE 210	Civil Engineering Materials	2 Credit Hours

Introduction to materials engineering concepts and nature of materials, Structure and properties of civil engineering materials such as: steel, aluminium, aggregates, cement, masonry, wood, and composites. The properties range from elastic, plastic, fracture, porosity, thermal and environmental responses.

CE 211	Solid Mechanics	3 Credit Hours

Relationship between internal stresses and deformations produced by external forces acting on deformable bodies; design principles based on mechanics of solids; stresses and deformations produced by tensile, compressive, thermal, torsional, and flexural loading; stress concentration; stress transformation and Mohr's circle, failure criteria for plane stress; pressure vessels; buckling of columns.

CE 213	Civil Engineering Materials Laboratory	1 Credit Hour

This course introduces the concepts, procedures, tools and equipment used to evaluate the physical and mechanical properties of fundamental materials used in civil engineering construction including, reinforcing steel, aluminium, aggregates, cement, wood. The course will incorporate the use of a variety of equipment, including universal testing machine, Charpy fracture toughness device, Rockwell Hardness device, compression and flexure test devices, sieves, Vicat apparatus, Blaine air permeability apparatus, Mortar mixing equipment, Los Angeles abrasion test apparatus, electronic strain devices and other similar equipment.

CE 221	Engineering Surveying	3 Credit Hours

Introduction to surveying and photogrammetry. Horizontal and vertical distance measurement, angles and direction, traverses, errors, control and construction surveys, coordinate systems, land records and coordinate geometry. Introduction to horizontal and vertical curves. Lab and field practice.

CE 232	Fundamental of Environmental Engineering	2 Credit Hours

Considers the sources, characteristics, transport and effects of air and water contaminants; biological, chemical, and physical processes in water; atmospheric structure and composition; unit operations for air and water quality control; solid waste management; and environmental quality standards.

CE 241	Fluid Mechanics	3 Credit Hours

Introduction to fluid mechanics; unit conversion and dimensions, introduction to fluid properties, basics of hydrostatics, hydrostatic pressure forces on plain and curved surfaces. Buoyancy forces and stability. Introduction to fluid kinematics and conservation of mass. Fluid dynamics and energy equation, venture effect and stagnation point. Empting tank. Types of head losses in pipes, application of flow in pipes. Introduction to momentum principle.

CE 251	Geology for Engineers	2 Credit Hours

Introduction to geology science. Structure of earth. Geologic cycle. Minerals and rocks. Rocks classification: Igneous, sedimentary and metamorphic rocks. Structural geology. Weathering, erosion and soil formation. Proprieties of rocks and soils as geo-materials. Geophysical explorations. Introduction to Saudi Arabian geology.

CE 311	Structural Engineering	4 Credit Hours

Introduction to structural systems and their design; structural design process; computation of loads on structures; analysis of statically determinate trusses, beams, frames, cables and arches under static loads; shear and moment diagrams for beams and frames; deflections of beams and trusses; influence lines for moving loads; virtual work and energy principles; analysis of statically indeterminate structures by deformation compatibility and moment distribution methods; introduction to computer applications in structural analysis and design.

CE 313	Reinforced Concrete Design	3 Credit Hours

Study of the strength, behaviour, and design of reinforced concrete members (beams, short columns, one-way slab, footings etc.) and structural systems subjected to moments, shear, and axial forces; knowledge of code provisions for ultimate strength design, detailing and serviceability requirements; introduction to the use of design aids and computer design packages.

CE 316	Concrete Properties	2 Credit Hours

This course emphasizes a theoretical understanding of chemical bonding and microstructural properties of concrete, the main constituent of construction industry. Concrete fundamental materials, concrete mix design, concrete production, transportation and placing operations, fresh and hardened concrete properties and testing, hot weather concreting, durability, admixtures and special types of concrete. The laboratory is an essential part where fresh and hardened concrete testing will be conducted including the non-destructive testing methods to evaluate mechanical properties of concrete.

CE 321	Transportation Engineering	3 Credit Hours

An overview of the profession of transportation, transportation systems and organizations. Introduction to vehicle, pedestrians, driver and road characteristics, fundamental principles of traffic flow, intersection design and control, capacity and level of service for highway and signalized intersections, and transportation planning.

CE322	Transportation Engineering Laboratory	1 Credit Hour

An experimental investigation for the following: penetration grade of bitumen, softening point of bitumen, flash and fire point of bitumen, ductility of bitumen, extraction of bitumen – aging method, gradation of asphalt aggregate extracted, maximum theoretical specific gravity of asphalt, Marshal stability and flow, and superpave design method. Analysis of experimental data and preparation of testing reports.

CE 331	Environmental Engineering Processes	3 Credit Hours

Physical, chemical and biological water and wastewater quality parameters, unit operation and unit process in water treatment design: screening, grit removal, sedimentation, coagulation, flocculation, softening, filtration and disinfection. Order of reaction (batch, plug, continuous) and substrate kinetics. Design of sewerage system. Brief description of wastewater treatment system.

CE 332	Environmental Engineering Laboratory	1 Credit Hour

Water and wastewater analysis including: pH and alkalinity, turbidity and conductivity, hardness and chlorides. Solids content analysis in terms of suspended and dissolved solids and organic and inorganic solids. Optimization of water treatment chemicals, and BOD, COD, TOC, and heavy Metals.

CE 343	Water Resources Engineering	3 Credit Hours

Introduction to water resources and water scarcity in the globe and in Saudi Arabia. Hydraulic design of transmission lines: gravity and pumping systems, pipeline economics, pipe networks. Introduction to open channel hydraulics: uniform flow, critical flow, specific energy, gradually varied flow, rapidly varied flow, flow measurements in open channels. Introduction to hydrology: rainfall data analysis, Time of concentration, runoff analysis and rational method. Hydraulic analysis of gravity sewer flow.

CE 344	Water Resources Engineering Laboratory	1 Credit Hour

Experiments on: properties of fluids; flow measurements; statics of fluids; principles of continuity, Bernoulli, energy, and momentum; viscous effects; free surface flow; and pumps.

CE 351	Geotechnical Engineering	3 Credit Hours

Introduction to geotechnical engineering, basics of engineering geology, soil formation, soil composition, soil classification, excavation, grading and compacted fills, groundwater and permeability, stress distribution in soils, effective stress concept, compressibility and settlement analysis, oedometer test, soil strength.

CE 352	Geotechnical Engineering Laboratory	1 Credit Hour

Soil description and identification, specific gravity test, moisture content test, sieve analysis and hydrometer test, Atterberg limits tests, standard and modified compaction tests, California bearing ratio test, constant and falling head permeability tests, consolidation test, direct shear test.

CE 411	Steel Structures	3 Credit Hours

Introduction to the design of steel structures; analysis and design of members and various types of bolted and welded connections; strength, serviceability and stability requirements in the current design codes; gravity and lateral load resisting systems; plastic analysis and design; introduction to computer-based design of steel structures; overview of structural steel drawings and fabrication and erection practices for steel structures.

CE 420	Civil Engineering Systems	2 Credit Hours

Introduction to the formulation and solution of civil engineering problems. Major topics are: mathematical modelling and optimization. Techniques including classical optimization, linear and nonlinear programming, network theory, simulation, decision theory, and dynamic programming are applied to a variety of civil engineering problems. Course includes using spreadsheet in optimization, modelling and dynamic simulation.

CE 421	Transportation Facility Design	3 Credit Hours

Study of transportation facilities, with emphasis on highway engineering covering pavement material properties, asphalt mix design, geometric analysis and design, flexible and rigid pavements structural design. Pavement maintenance, rehabilitation and management. Railway elements and design requirements of horizontal and vertical alignments.

CE 451	Foundation Engineering	3 Credit Hours

Introduction to foundation engineering; general requirements of foundations and selection of foundation types; site exploration and characterization; bearing capacity theories; foundation settlement; geotechnical design of spread footings; lateral earth pressure theories and geotechnical design of retaining walls; stability of earth slopes.

CE 461	Construction Engineering and Management	3 Credit Hours

Introduction to construction industry, project participants, legal structure of organizations, and managing construction resources including money, materials, labor force, and construction equipment. The emphasis is on construction processes: planning and scheduling, estimating and cost control, quality control, construction safety, sustainable construction practices, and construction econometrics.

CE 462	Construction Contracts and Specifications	2 Credit Hours

Application of the construction contracts, drawings, and specifications to the construction process. Ethical issues in project administration. The methodology, procedures and organizational techniques involved in preparing and evaluating bids and contracts. Types of construction contracts, general and special conditions of contract, standard specifications and contract. Procedures for systematic handling of variations, claims and disputes and their clarification with their legal implications.

CE 493	Graduation Project I	2 Credit Hour

The type of graduation project has to be a capstone design. A capstone design project is to provide a unified effort in developing: teamwork skills, multidisciplinary interaction, communication skills, fundamentals of engineering design processes, and application of engineering design principles to a real engineering project. This course covers the preliminary phase of the project. In this phase, the students choose a topic and a faculty advisor; define objectives and scope of the work, which may include theoretical design, experimentation, computer simulation and modelling, review relevant literature, initiate the project and submit a draft report. The second phase will be completed in CE 494.

CE 494	Graduation Project II	2 Credit Hours

This course is the continuation of CE 493 and main objective is to enable students to experience real life engineering problem solving, design, teamwork, project execution and management. Engineering design includes development of creativity, use of open-ended problems, research skills, use of modern design theory and methodology, analysis, formulation of design problem statements and specifications, consideration of alternative solutions and communication of results with written report, poster and presentation.

3. CIVIL ENGINEERING TECHNICAL ELECTIVES

CE 412	Indeterminate Structural Analysis	3 Credit Hours

Analysis of indeterminate structures by the force and displacement methods, Maxwell's method for indeterminate trusses; analysis of members with non-prismatic members; approximate analysis of indeterminate structures; stiffness method of structural analysis; fundamentals and algorithms; numerical analysis of plane trusses, grids and frames using matrix method; introduction to the finite element method for plane stress and plane strain; application of gravity and lateral loads on structures according to SBC/IBC.

CE 413	Advanced Reinforced Concrete Design	3 Credit Hours

Study of the strength, behaviour, and design of two-way slab systems using direct design and equivalent frame methods, design of continuous beams and slender columns, design for torsion; behaviour and design of lateral load resisting systems (moment frames and shear walls); design of combined footings, drawing typical plans and sections of R/C structures.

CE 414	Bridge Engineering	3 Credit Hours

Historical overview of bridge building and bridge types; bridge aesthetics and materials; bridge geometry; review of applicable design codes; loads (truck and lane, impact, braking, thermal, wind, seismic, hydraulic etc.) on bridges and force distribution; influence lines; grillage analysis for super-structure elements; design of concrete and steel girder bridges; design of sub-structure components (foundations, pier, abutment, wing walls, approach slab); bridge bearings and expansion joints; bridge maintenance and rehabilitation.

CE 415	Prestressed Concrete	3 Credit Hours

Theoretical basis for the analysis and design of pre-stressed concrete members; estimation of losses in pre-stressed reinforced concrete members and structures; design of posttensioned beams and slabs; introduction to pretensioned, precast construction systems and techniques; use of prestressing in containment structures and structural strengthening and rehabilitation.

CE 416	Structural Dynamics	3 Credit Hours

Analysis of the dynamic response of structures and structural components to transient loads and foundation excitation; single-degree-of-freedom and multi-degree of freedom systems; time and frequency domain analysis; response spectrum concepts; simple inelastic structural systems; and introduction to systems with distributed mass and flexibility; application of computer methods. Introduction to code-based seismic design procedures.

CE 417	Advanced Concrete Materials	3 Credit Hours

Rheology models for concrete, microstructure and strength relationships, failure modes, fracture mechanics, creep, shrinkage and thermal deformations, design for durability and performance, quality control and quality assurance for concrete materials, fiber-reinforced concrete.

CE 419	Special Topics in Structural Engineering	3 Credit Hours

This course covers special advanced topics in structural engineering. The contents vary depending on the topic.

CE 423	Traffic Engineering	3 Credit Hours

Elements of the road traffic system; traffic flow theory and road capacity analysis; theory and design for signalized intersections; principles and procedures in traffic impact analysis and traffic survey methods.

CE 424	Pavement Engineering	3 Credit Hours

Design approaches, new pavement and rehabilitation design, failure mechanisms, effects of materials and construction on pavement performance. Emphasis on understanding of fundamental issues of pavement engineering, approaches to evaluation and design for new pavements and maintenance and rehabilitation design, practical lab experience with asphalt concrete materials and tools used for evaluation of pavements, understanding of construction issues.

CE 425	Urban Transportation Planning	3 Credit Hours

Principles of planning, evaluation, selection, adoption, financing, and implementation of alternative urban transportation systems; formulation of community goals and objectives, inventory of existing conditions; transportation modelling: trip generation, trip distribution, modal choice, assignment; transport related land-use models.

CE 426	Public Transportation Systems	3 Credit Hours

Analysis of mass transit systems, their operation, and management. Technology of transit vehicles and structure. Public policy and financing.

CE 427	Traffic Safety	3 Credit Hours

Principles of engineering, behavioural science, and vision science to preventing traffic collisions and subsequent injury. A systematic approach to traffic safety, human behaviour, vehicle design, and roadway design as interacting approaches to prevent traffic crashes, vehicle and roadway designs approaches to prevent injury after collision.

CE 429	Special Topics in Transportation Engineering	3 Credit Hours

This course covers special advanced topics in transportation engineering. The contents vary depending on the topic.

CE 431	Design of Water and Wastewater Treatment Systems	3 Credit Hours

Characterization of water and wastewater. Design of advanced water treatment systems (adsorbers and membrane processes). Wastewater Treatment design: screening, grit removal, primary and secondary clarification, biological process (suspended and attached growth system), disinfection of the effluent, processing of sludge, and water reuse.

CE 432	Environmental Impact Assessment	3 Credit Hours

Study of environmental impacts of engineering projects on the environmental components of water, air, and soil. Social, economic and cultural impacts. Identification and prediction of various impacts and mitigation measures.

CE 433	Water Quality Engineering	3 Credit Hours

Fundamental theories underlying the unit processes utilized in water and wastewaters networks system and treatment processes. Ground water quality control processes.

CE 434	Solid & Hazardous Waste Engineering & Management	3 Credit Hours

Investigation of the regulatory and technical issues affecting solid and hazardous waste management, with an emphasis on the principles governing the transport, fate, and remediation of solid and hazardous waste in the subsurface, including advection, dispersion, sorption, inter-phase mass transfer, and transformation reactions.

CE 435	Air Pollution Engineering	3 Credit Hours

Description and application of chemical and physical principles related to air pollutants, aerosol mechanics, attenuation of light in the atmosphere, air quality regulation, generation of air pollutants, methods to remove gaseous and particulate pollutants from gas streams, and atmospheric dispersion. Overview of practical and advanced approaches to air pollution modelling, including aspects of pollutant transport, transformation, and loss. Models considered include: Gaussian plume, chemical mass balance, chemical reaction, grid and trajectory. Evaluation of models and the development of efficient control strategies.

CE 439	Special Topics in Environmental Engineering	3 Credit Hours

This course covers special advanced topics in environmental engineering. The contents vary depending on the topic.

CE 441	Surface Hydrology	3 Credit Hours

Hydrological analysis of surface water systems, main elements of the hydrological cycle. Water and mass balance. Precipitation and rainfall data frequency analysis, generation of IDF curves, evaporation and evapotranspiration, infiltration. Introduction to GIS for hydrological applications, hydrological properties of catchments, DEM and catchment delineation. Rainfall-runoff modelling, river and reservoir routing using hydrological methods. Hydrological modelling using software packages. Introduction to urban hydrology. Design of culverts and Irish crossings.

CE 442	Hydraulic Analysis and Design	3 Credit Hours

Hydraulic analysis and design of engineering systems using spreadsheet and professional software. Applications include: closed conduits; pipe networks; hydraulic structures; water bridges, spillways, stilling basins, and gates, embankment seepage; selection and installation of pumps and turbines.

CE 443	Groundwater Engineering	3 Credit Hours

Introduction to sub-surface water hydrology and types of aquifers. Hydraulics of porous media, Introduction to darcy law, flow net and mass balance equations. The concept of safe yield, storage. Estimation of groundwater recharge. Well hydraulics and design of aquifer pumping tests. Introduction to numerical modelling of groundwater flow: estimation of flow net and seepage analysis using spreadsheet and/or other programs. Introduction to groundwater contamination and saltwater intrusion.

CE 444	Urban Hydrology and Hydraulics	3 Credit Hours

Hydraulic analysis and design of urban, highway, airport, and small rural watershed drainage problems; discussion of overland and drainage channel flows; hydraulics of storm drainage systems and culverts; determination of design flow; runoff for highways, airports, and urban areas; design of drainage gutters, channels, sewer networks, and culverts.

CE 445	Water Resources Management	3 Credit Hours

Water laws. Reservoirs, dams, and reservoir basins. Hydro- power generation. Flood estimation, routing and control. Engineering economy in water resources planning. Introduction to system engineering in water resources. Topics in arid and semi-arid region water resources. Desertification and water conservation techniques, reuse of water, remote sensing and arid water resources. Linear programming and its applications in water resources.

CE 449	Special Topics in Water Resources Engineering	3 Credit Hours

This course covers special advanced topics in water resources engineering. The contents vary depending on the topic.

CE 452	Soil Mechanics and Behaviour	3 Credit Hours

Physical and chemical properties of soils, clay minerals, soil structure, shear strength and deformation, pore pressure parameters, effective stress analysis, consolidation and settlement analysis, Introduction to unsaturated soil mechanics.

CE 453	Geosystems Engineering Design	3 Credit Hours

Stability of shallow foundations, analysis and design of piles and deep foundations, rafts and combined footings, foundations under lateral loads, dewatering of foundations, embankments, introduction to earth retention systems.

CE 454	Soil and Site Improvement	3 Credit Hours

Problematic soils, need of soil improvement, methods and principles for improving engineering properties of soils, mechanical, chemical, electrical and thermal stabilization, use of geo-synthetics in geotechnical and geo-environmental applications.

CE 455	Geotechnical Investigations	3 Credit Hours

Structure of ground investigation, sources of information, planning, management and control, Site exploration techniques, geophysical testing methods, geotechnical instrumentation, geotechnical report writing.

CE 456	Geotechnical Earthquake Engineering	3 Credit Hours

Introduction to earthquake engineering, basic earth features and earthquake principles, common earthquake effects/damages, Site investigation for geotechnical earthquake engineering, liquefaction, bearing capacity of foundations, retaining wall and slope stability analysis, seismic micro-zonation, site improvement methods to mitigate earthquake effects.

CE 459	Special Topics in Geotechnical Engineering	3 Credit Hours

This course covers special advanced topics with focus on modern trends and recent developments in geotechnical engineering. The contents vary depending on the topic.

CE 463	Construction Planning	3 Credit Hours

Introduction: Planning and scheduling, project control, why schedule projects, scheduling and project management. Bar/Gantt charts and basic networks: Introduction, advantages and disadvantages of bar charts, arrow and node Networks, networks versus bar charts, time-scaled logic diagrams resource allocation, categories of resources, resource levelling, materials management. schedule compression and time cost trade-Off: Setting priorities, accelerating a project, direct and indirect Costs, recovery schedules, potential issues with uncoordinated acceleration, optimum project scheduling.

CE 464	Decision and Risk Analysis	3 Credit Hours

Basic notions of set theory and probability: Sample space and events; conditional probability; statistical independence, total probability; Bayes theorem. Random variables: univariate and multivariate distributions, expectation, moments. Probabilistic models for engineering analysis: Bernoulli sequence, binomial distribution, poisson and related distributions, normal and related distributions, extreme-value distributions, other distributions used in statistics. Introduction to decision theory: Basic notions of utility theory, decision tree, terminal analysis, pre-posterior analysis, decision problems in estimation.

CE 465	Construction Cost Analysis	3 Credit Hours

Introduction to the application of scientific principles to costs and estimates of costs in construction engineering; concepts and statistical measurements of the factors involved in direct costs, general overhead costs, cost mark-ups and profits; and the fundamentals of cost recording for construction cost accounts and cost control.

CE 466	Construction Productivity	3 Credit Hours

Introduction to the application of scientific principles to the measurement and forecasting of productivity in construction engineering. Conceptual and mathematical formulation of labour, equipment, and material factors affecting productivity, motivation and construction productivity, productivity improvement programs. Learning curves, fatigue, overtime, the physical environment, quality circles, safety considerations. A system view of construction productivity, techniques for measuring productivity: cost methods.

CE 467	Quality and Safety Management in Construction	3 Credit Hours

Introduction to quality management, quality standards, development and implementation of quality management systems, quality indicators, quality audits, importance of construction safety, safety culture, health and safety hazards, personal protective equipment, OSHA Standards, new trends in safety and safety. Accidents causation theories, ethics in safety and OSHA compliance. Construction equipment and safety, accident investigation, reporting and record keeping, emergency response plan, total safety management. Preventing violence in workplace, stress and behaviour-based safety, promoting safety.

CE 469	Special Topics in Construction Engineering and Management	3 Credit Hours

This course covers special advanced topics in construction engineering and management. The contents vary depending on the topic.