كليـــة الهندسة
Faculty of Engineering

2020 - 2026

جامعة تبوك
University of Tabuk

Civil Engineering Handbook

Faculty of Engineering, University of Tabuk, Tabuk, Saudi Arabia

Fourth Edition (2023)

بِسْمِ اللَّهِ الرَّحْمَٰنِ الرَّحِيمِ

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Chairman's Message

On behalf of the faculty and staff, I warmly welcome all students joining the Civil Engineering Department at our esteemed institution. As the department's Chairman, I am honored to guide and support you throughout your academic journey. Civil engineering is a field that holds immense importance in shaping the world we live in. Civil engineers play a vital role in creating a better future, from designing sustainable infrastructure to tackling complex environmental challenges. Our department is committed to providing a comprehensive education encompassing theoretical knowledge and practical skills necessary for success in this dynamic profession.

This handbook serves as a valuable resource to acquaint you with our department's policies, procedures, and guidelines. It is designed to provide key information that will aid your academic and personal success. I encourage you to read through the handbook thoroughly and refer to it whenever you have questions or need clarification. The handbook is a reference guide and a tool for empowerment. By familiarizing yourself with its contents, we hope you will feel confident and supported as you navigate your academic journey.

Again, I extend my warmest welcome to all the new and returning students of the Civil Engineering Department. Jointly, let us strive for excellence and positively impact society through the remarkable field of civil engineering.

Wael Al-Rashed, PhD

Chairman of Civil Engineering Department

Department of Civil Engineering (CE)

The department of civil engineering was founded in 1428H and the studying in the preparatory year started in the academic year 1429-1430 H. The department currently offers one program, Bachelor of Science in Civil Engineering. The study is of 5 years' duration including the preparatory year (10 semesters) in addition to a summer training of 8 weeks in companies and agencies under the supervision of the faculty members.

Vision

The department's vision is innovation and leadership in education, scientific research, and community services.

Mission

The mission of the department is to support the needs of Tabuk region and the Kingdom of Saudi Arabia society by providing high quality educational program and contributing to research related to civil engineering profession.

Program Goals

1. Graduating qualified civil engineers equipped with essential skills and knowledge to understand and deal with modern civil engineering trends.
2. Serve as a source of engineering expertise in the fields of civil engineering to solve engineering problems.
3. Performing scientific research and studies, which address, local, regional and international problems.
4. Establishing partnership with local, regional and international societies to enhance the education process and scientific research.
5. Keeping up with the state-of-practice in civil engineering disciplines through continuous review, evaluation and modification of the study plan.

Program Educational Objectives

Program educational objectives (PEOs) are broad statements that describe what graduates are expected to attain within five years of graduation. The PEOs support the mission of the institution and are based on the needs of the program's constituencies.

The PEOs for the Civil Engineering Program are that within five years of graduation:

PEO 1: Graduates will establish themselves in successful careers in civil engineering or related fields and will become key team member that can communicate and collaborate effectively in a multidisciplinary environment.

PEO 2: Graduates will take into account economic, environmental, societal and ethical considerations in solving the civil engineering problems.

PEO 3: Graduates will purse life-long learning, professional development, professional licensure and participation in professional societies or graduate studies.

University of Tabuk Admission Guidelines

https://www.ut.edu.sa/ar/Deanship/dar/Documents/1444.pdf

Program Admission Requirements

1. Pass all preparatory year courses.

2. After completing 78 credit hours (completing the Level 5-second year), the student can choose from the four engineering programs offered (Civil, Mechanical, Electrical, and Industrial).

3. Applications are submitted electronically through the student's academic portal.

4. Admissions are based on students' GPA , selections and the program's capacity, as approved by the Faculty of Engineering Council for that academic year.

5. Dean Approval.

Faculty of Engineering Admission Process Video

https://shorturl.at/hlHL6

Student Academic Guide

https://www.ut.edu.sa/ar/Deanship/dar/Documents/Student%20Guide%20443.pdf

Study and Tests Regulations

https://www.ut.edu.sa/ar/Deanship/dar/Documents/S.R.444.pdf

Organizational Structure

CE Department Organization Chart

CE Department Council

CE Department Chairman

CE Department Committees

Curriculum	**Accreditation**
Academic Advising	**Strategic Plan**
Labs and Equipment	**Alumni**
Senior Design Project	**Scientific Committee**
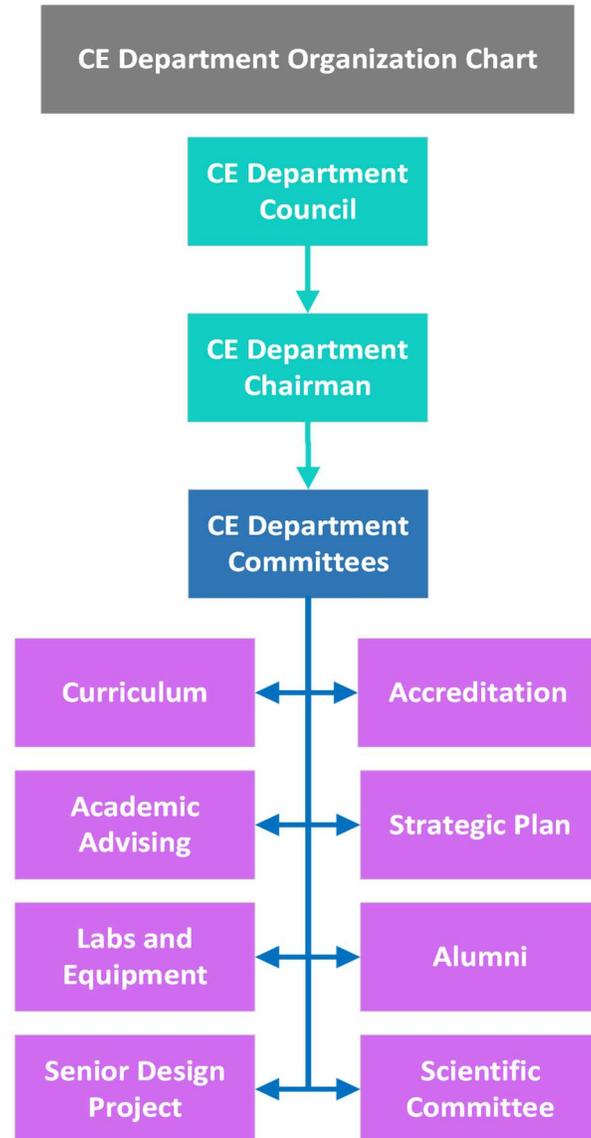
Degree Requirements

The Department of Civil Engineering awards the B.Sc. degree in Civil Engineering. The curriculum within the Department of Civil Engineering is structured in such a way as to provide its graduates with the technical and professional expertise necessary for serving and developing society and for conducting scientific research within the Islamic and Engineering Ethical framework.

To obtain the B.Sc. degree in civil engineering, the student must successfully complete 167 credit hours which are split over 10 levels of studying. In addition, the students are required to complete practical summer training sessions (8 - weeks) in the industrial field.

Towards the total of 167 credit hours, 20 credit hours represent the university requirements and 62 credit hours represent the faculty of Engineering requirements whereas 85 credit hours represent the department requirements. The table below shows an overall summary the of requirements to obtain the degree.

	Course Title	Course Code	Credit
1	University Requirements	Compulsory	20
2	Faculty of Engineering Requirements	Compulsory	62
3	Civil Engineering Department Requirements	Compulsory	73
		Elective	12
Total			167

The civil engineering program curriculum allows the student to choose four elective courses (12 credit hours) from the following tracks:

A. Structural and Geotechnical Engineering Track.
B. Construction Engineering and Management Track.
C. Transportation and Highway Engineering Track.
D. Water Resources and Environmental Engineering Track

University Requirements

The university requirements in the UT consist of 20 credits covering a wide spectrum of subject areas including communication skills, computer skills, learning and thinking skills, Arabic language, Islamic studies, English language, basic sciences, biology, and mathematics. The table below shows the set of courses in the university requirements.

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Communication Skills	COMM001	2	0	0	2	
2	Computer Skills	CSC001	4	0	0	3	
3	Learning, Thinking, &Research Skills	LTS001	4	0	0	3	
4	Language Skills	ARAB101	2	0	0	2	ARAB101
5	Writing Skills	ARA201	2	0	0	2	
6	Islamic Culture I	ISLS101	2	0	0	2	ISLS101
7	Islamic Culture II	ISLS201	2	0	0	2	ISLS201
8	Islamic Culture III	ISLS301	2	0	0	2	ISLS301
9	Islamic Culture IV	ISLS401	2	0	0	2	
	Total		**22**	**0**	**0**	**20**	

Faculty Requirements

The Faculty of Engineering requirements consist of 62 credits. The tables below show the set of courses in the faculty requirements.

A. Faculty requirements (Preparatory Year)

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	English Language I	ELS001	15	0	0	5	
2	English Language II	ELS002	15	0	0	5	ELS001
3	Mathematics I	MATH100	3	0	0	3	
4	Mathematics II	MATH101	3	0	0	3	MATH100
5	General Physics	PHYS101	3	0	0	3	
6	General Biology	BIO101	3	0	0	3	
7	General Chemistry	CHEM101	3	0	0	3	
	Total		**45**	**0**	**0**	**25**	

B. Faculty requirements (Additional Courses)

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
8	Mathematical Geometry	MATH284	3	0	1	3	MATH101
9	Statistics & Probability	MATH325	3	0	1	3	MATH284
10	Differential Equations	MATH383	3	0	1	3	MATH284
11	Linear Algebra	MATH241	3	0	1	3	MATH284
12	Physics	PHYS205	3	2	0	4	PHYS101
13	General Physics Lab	PHYS281	0	2	0	1	PHYS101
14	General Chemistry Lab	CHEM203	0	2	0	1	CHEM101
15	Engineering Drawing and Graphics	ENG201	1	4	0	3	
16	Production Tech. and Workshops	ENG202	1	4	0	3	ENG201
17	Engineering Mechanics I	ENG203	2	0	1	2	PHYS101
18	Engineering Mechanics II	ENG204	2	0	1	2	ENG203
19	Engineering Design I	ENG205	3	3	0	3	ELS002-MATH101
20	Engineering Design II	ENG213	2	2	0	2	ENG205
21	Engineering Economy	ENG214	2	0	0	2	ENG213
22	Engineering Management	ENG215	2	0	0	2	ENG214-MATH325
Total			75	19	6	37	

Departmental Course Requirements (Compulsory)

The table below shows the set of compulsory courses in the civil engineering department.

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Structural Analysis I	CE 302	3	0	1	3	ENG 203
2	Structural Analysis II	CE 303	3	0	1	3	CE 302
3	Steel Structures	CE 405	3	0	1	3	CE 303
4	Earthquake Engineering	CE 406	3	0	1	2	CE 303
5	Surveying	CE 311	3	2	1	3	MATH 383
6	Construction Materials	CE 323	3	2	1	4	ME 213
7	Geotechnical Engineering I	CE 331	3	2	1	4	ME 213
8	Geotechnical Engineering II	CE 432	2	2	1	3	CE 331
9	Foundation Engineering	CE 433	3	0	1	3	CE 432- CE 451
10	Transportation Engineering	CE 441	3	0	1	3	CE 311
11	Highway Design and Construction	CE 442	2	2	1	3	CE 441
12	Reinforced Concrete I	CE 451	3	0	1	3	CE 323- CE 303
13	Reinforced Concrete II	CE 452	3	0	1	3	CE 451
14	Environmental Engineering I	CE 461	3	0	1	3	CE 371; BIO 101
15	Water and Wastewater Engineering	CE 462	3	2	1	4	CE 472- CHEM 203
16	Fluid Mechanics	CE 371	2	2	1	3	PHYS 281- ENG 204
17	Hydraulics	CE 472	2	2	1	3	CE 371
18	Construction Management	CE 482	3	0	1	3	ENG 215
19	Civil Eng. Drawing	CE 391	1	4	0	3	ENG 201
20	Computer Application for CE	CE 494	2	2	1	3	MATH 241- CE 303
21	Field training	CE 499	0	4	0	2	Department approval

	Course Title	Course Code	Lecture	Lab	Tutorial	Credit	Prerequisites
21	Mechanics of Materials	ME 213	2	2	1	3	ENG 205
23	Electromechanical Engineering	CE 492	2	0	1	2	CE 323
24	Graduation Project I	CE 495	1	2	1	2	
25	Graduation Project II	CE 496	1	3	0	2	CE 495
Total						**73**	

Departmental Course Requirements (Elective Courses)

The students have to choose four courses (12 credit hrs.). The name of these courses depends on the specialty area as follows:

A. Structural and Geotechnical Engineering

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Advanced Structural Analysis	CE 407	3	0	1	3	CE 303
2	Improvement of soil properties	CE 435	3	0	1	3	CE 432
3	Advanced Steel Structures	CE 408	3	0	1	3	CE 405
4	Advanced Reinforced Concrete	CE 453	3	0	1	3	CE 452
5	Introduction to rock mechanics	CE 434	3	0	1	3	CE 432
6	Foundations on Problematic soils	CE 436	3	0	1	3	CE 432-CE 433
7	Special topics in Structural and Geotechnical Engineering	CE 437	3	0	1	3	CE 452-CE 433
Total						**12**	

B. Construction Engineering and Management

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Advanced Materials of Construction	CE 423	3	0	1	3	CE 322
2	Advanced Concrete Technology	CE 424	3	0	1	3	CE 322
3	Advanced Methods of Construction	CE 483	3	0	1	3	CE 451
4	Construction Contracts	CE 484	3	0	1	3	CE 482
5	Construction Planning	CE 485	3	0	1	3	CE 482
6	Estimating Construction Costs	CE 486	3	0	1	3	CE 323- CE 482
7	Special topics in Construction Engineering and Management	CE 487	3	0	1	3	CE 482
Total of 4 courses						**12**	

C. Transportation and Highways Engineering

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Advanced surveying	CE 412	3	0	1	3	CE 311
2	Traffic Engineering	CE 445	3	0	1	3	CE 441
3	Advanced Design of Pavements	CE 444	3	0	1	3	CE 442
4	Transportation Economics	CE 446	3	0	1	3	CE 441
5	Airports Planning and Design	CE 447	3	0	1	3	CE 442
6	Railway Engineering	CE 448	3	0	1	3	CE 441
7	Special topics in Transportation Engineering and Highways Engineering	CE 449	3	0	1	3	CE 442
Total of 4 courses						**12**	

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Advanced surveying	CE 412	3	0	1	3	CE 311
2	Hydrology and Groundwater	CE 474	3	0	1	3	CE 472
3	Hydraulic Structures	CE 473	3	0	1	3	CE 472- CE 452
4	Water resources	CE 463	3	0	1	3	CE 472
5	Environmental Engineering II	CE 464	3	0	1	3	CE 461- CE 462
6	Wastewater Reclamation and Reuse	CE 465	3	0	1	3	CE 462
7	Solid and Hazard Wastes	CE 466	3	0	1	3	CE 462
Total of 4 courses						**12**	

Civil Engineering Program Study Plan

Preparatory Year/First Year

The preparatory year aims at enhancing the skills of the students through intense English courses and courses that improve their communication and computer skills. It also provides foundation courses in IT, mathematics, and basic sciences. The tables below illustrate the modules studied during the preparatory year.

1. 1st Level/ Preparatory Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	English Language Skills I	ELS001	15	0	0	5	
2	Mathematics I	MATH100	3	0	2	3	
3	Communication Skills	COMM001	2	0	0	2	
4	Computer Skills & Applications	CSC001	4	0	0	3	
5	General Physics	PHYS101	3	0	0	3	
Total			**27**	**0**	**2**	**16**	

2. 2nd Level/ Preparatory Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	English Language Skills (2)	ELS002	15	0	0	5	
2	Mathematics II	MATH101	3	0	2	3	
3	Learning & Thinking Skills	LTS001	3	0	0	3	
4	Chemistry	CHEM101	3	0	0	3	
5	General Biology	BIO101	3	0	0	3	
	Total		27	0	2	17	

Degree Curriculum

1. 3rd Level / Second Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Theoretical	Practical (Lab)	Tutorial		
1	Engineering Drawing and Graphics	ENG 201	1	4	0	3	-
2	Engineering Mechanics (1)	ENG 203	2	0	1	2	PHYS 101
3	Introduction to Engineering Design (1)	ENG 205	2	2	0	3	MATH 101 ELS 002
4	Islamic Culture I	ISLS 101	2	0	0	2	-
5	Mathematical Geometry (3)	MATH 284	3	0	1	3	MATH 101
6	Physics	PHYS 205	3	2	0	4	PHYS 101
7	General Physics Lab	PHYS 281	0	2	0	1	PHYS 101
	Total					18	

2. 4th Level / Second Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		

	Course Title	Course Code	Lecture	Lab	Tutorial	Credit	Prerequisites
1	General Chemistry Lab	CHEM 203	0	2	0	1	CHEM 101
2	Introduction to Engineering Design (2)	ENG 213	2	2	0	2	ENG 205
3	Linear Algebra	MATH 241	3	0	1	3	MATH 284
4	Language Skills	ARB 101	2	0	0	2	-
5	Production Technology and Workshops	ENG 202	1	4	0	3	ENG 201
6	Engineering Mechanics (2)	ENG 204	2	0	1	2	ENG 203
7	Islamic Culture (2)	ISLS 201	2	0	0	2	ISLS 101
8	Differential Equations	MATH 383	3	0	1	3	MATH 284
	Total					18	

3. 5th Level / Third Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Mechanics of Materials	ME 213	2	2	1	3	ENG 205
2	Structural Analysis (1)	CE 302	3	0	1	3	ENG 203
3	Fluid Mechanics	CE 371	2	2	1	3	PHYS 281- ENG 204
4	Civil Drawing	CE 391	1	4	0	3	ENG 201
5	Islamic Culture (3)	ISLS 301	2	0	0	2	ISLS 201
6	Statistics & Probabilities	MATH 325	3	0	1	3	MATH 284
	Total					17	

4. 6th Level / 3rd Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Construction Materials	CE 323	3	2	1	4	ME 213
2	Writing Skills	ARB 201	2	0	0	2	ARB 101
3	Structural Analysis (2)	CE 303	3	0	1	3	CE 302
4	Surveying	CE 311	2	2	1	3	MATH 383
5	Geotechnical Engineering (1)	CE 331	3	2	1	4	ME 213
6	Islamic Culture (4)	ISLS 401	2	0	0	2	ISLS 301

	Total					18	

5. 7th Level / 4th Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Geotechnical Engineering (2)	CE 432	2	2	1	3	CE 331
2	Transportation Engineering	CE 441	3	0	1	3	CE 311
3	Reinforced Concrete I	CE 451	3	0	1	3	CE 303 - CE 323
4	Environmental Engineering (1)	CE 461	3	0	1	3	CE 371- BIO 101
5	Hydraulics	CE 472	2	2	1	3	CE 371
6	Engineering Economy	ENG 214	2	0	0	2	ENG 213
	Total					17	

6. 8th Level / 4th Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Computer Applications for Civil Engineering	CE 494	2	2	1	3	MATH 241- CE 303
2	Highway Design and Construction	CE 442	2	2	1	3	CE 441
3	Reinforced Concrete II	CE 452	3	0	1	3	CE 451
4	Water and Wastewater Engineering	CE 462	3	2	1	4	CE 472- CHEM 203
5	Engineering Management	ENG 215	2	0	0	2	MATH 325 ENG 214
6	Elective Course	CE XXX	3	0	0	3	
	Total					18	

7. Field Training / Fourth Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		

15

	Course Title	Course Code	Lecture	Lab	Tutorial	Credit	Prerequisites
1	Field Training	CE 499	0	4	0	2	Department approval
	Total					**2**	

8. 9th Level / 5th Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Foundation Engineering	CE 433	3	0	1	3	CE 451-CE 432
2	Construction Management	CE 482	3	0	1	3	ENG 215
3	Graduation Project (1)	CE 495	1	2	0	2	CE 432 or CE 452 or CE 462 or CE 442
4	Elective Course	CE XXX	3	0	0	3	-
5	Elective Course	CE XXX	3	0	0	3	-
	Total					**14**	

9. 10th Level / 5th Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Electromechanical Engineering	CE 492	2	0	1	2	CE 323
2	Steel Structures	CE 405	3	0	1	3	CE 303
3	Earthquake Engineering	CE 406	2	0	0	2	CE 303
4	Graduation Project (2)	CE 496	1	2	0	2	CE 495
5	Elective Course	CE XXX	3	0	0	3	-
	Total					**12**	

Senior Design Project

The senior design project (SDP) is an emulation of real-life engineering projects where students develop their technical and professional skills and apply their knowledge to solve a complicated engineering problem. The project is designed to enable the students to practice

their research and problem-solving skills and enhance their communication, teamwork, time management and project planning skills. Furthermore, it emphasizes students' understanding of safety polices, ethical issues, conflict of interest as well as social and environmental impacts of engineering solutions.

Students undertaking senior design project work under the direct supervision of a faculty advisor. The students are expected to work on a team on an engineering problem, conduct sufficient literature survey, recognize the objectives of their work and identify any relevant constraints, perform experiments, build prototypes and/or produce simulations as appropriate to their problem, analyze the results and present their work in the form of a report and a presentation.

Steps to Assign Senior Project

Students registered for the course apply for available projects individually or as a team. Students interested in a specific problem may approach a faculty member whose specialty is compatible with the proposed project before the beginning of the term for approval.

The process for project proposals and registration are as follows:

1. Supervisors submit the senior project proposal (SDP Proposal Form).

2. Proposals are presented in a department meeting for approval.

3. Approved proposals are announced to the students for the selection process.

4. Students may apply for one or more of the approved projects (SDP Application Form).

5. If the number of students apply for a project exceeds five, the five students with highest GPAs will be selected.

6. Students are registered with the designated faculty member

Senior Design Project Perquisites and Duration

Students must complete at least 180 credit hours as well as certain courses depending on the field of study prior registering for Senior Design Project I, at least one of the following courses: **CE 0452, CE 0461, CE 0472, CE 0441, CE 0432**. Then, the student continues their project in Senior Design Project II. The completion of senior design project requires an academic year.

Senior Design Project Guide

https://www.ut.edu.sa/ar/Faculties/engineering/civil/Documents/Senior%20Design%20Project%20Guide.pdf

Students Enrollment and Graduation Statistics

Bachelor of Science in CE Enrolment Statistics

2018-2019	2019-2020	2020-2021	2021-2022	2022-2023
265	220	175	159	164

(Y-axis: Number of Students)

Bachelor of Science in CE Graduation Statistics

2018-2019	2019-2020	2020-2021	2021-2022	2022-2023
81	81	66	39	40

(Y-axis: Number of Students)

18
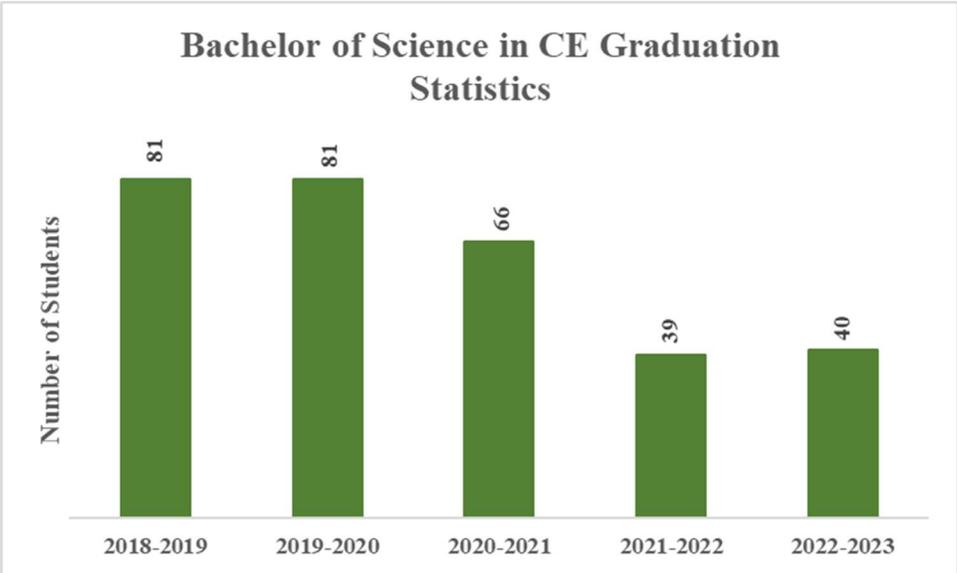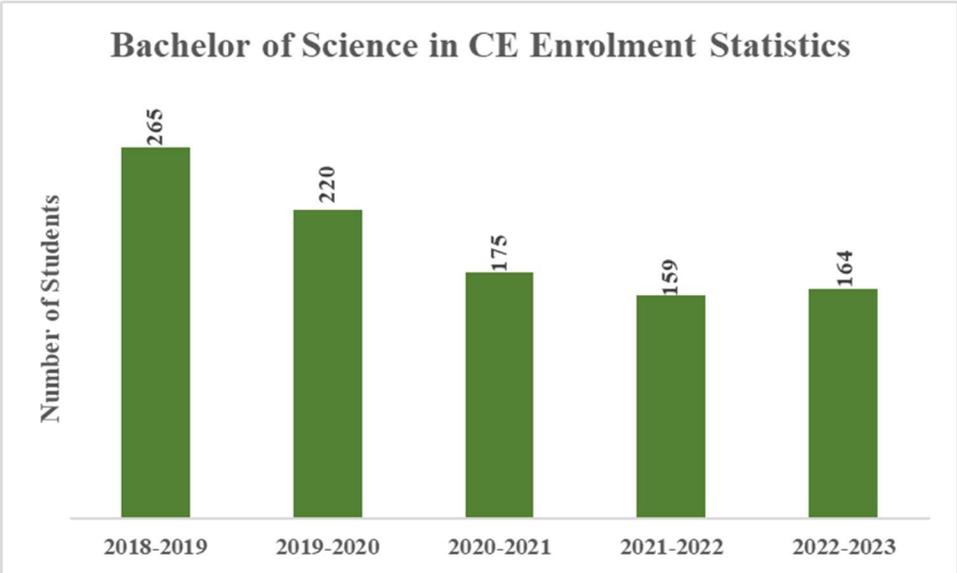
Faculty Members

Faculty Name	Rank	Area of Expertise	Email
Dr. Basuony Elgarhy	Professor	Geotechnical Engineering	belgarhy@ut.edu.sa
Dr. Eltayeb Onsa	Professor	Structural Engineering	e.onsa@ut.edu.sa
Dr. Mohammed Elsawy	Associate Professor	Geotechnical Engineering	melsawy@ut.edu.sa
Dr. Abderrahim Lakhouit	Associate Professor	Environmental Engineering	a.lakhouit@ut.edu.sa
Dr. Ahmed Boraey	Assistant Professor	Water Engineering	a.boraey@ut.edu.sa
Dr. Anis Ben Messaoud	Assistant Professor	Water & Environmental Engineering	amasud@ut.edu.sa
Dr. Wael Al-Rashid	Assistant Professor	Environmental Engineering	walrashed@ut.edu.sa
Dr. Abdulaziz Alghamdi	Assistant Professor	Construction Management	aalgamdy@ut.edu.sa
Dr. Turki Alahmari	Assistant Professor	Structural Engineering	talahmari@ut.edu.sa

Laboratories

The laboratories in use by the CE Department are housed in buildings 11 and 12 on the UT main campus. Each lab is used to serve the experimental component in one or more courses. A short description of these laboratories and equipment in each laboratory, courses served by each lab equipment are provided in detail in the next sections. The laboratories have adequate equipment for carrying out experimental work for courses, senior design projects and research. The laboratories are well maintained and regularly upgraded. The laboratories used by the CE program adequately support the curriculum delivery These laboratories include:

A. Soil Mechanics and Foundations laboratory.
B. Materials engineering laboratory.
C. Highways engineering laboratory.
D. Surveying laboratory.
E. Hydraulics and Fluid Mechanics laboratory.
F. Computer Laboratory

Laboratories safety Policies and Procedures

https://www.ut.edu.sa/ar/Faculties/engineering/Documents/Laboratory%20Safety%20Policies%20and%20Procedures.pdf

A. Soil Mechanics and Foundations laboratory

Located in room 1-11-0-4, the lab actively contributes to the experimental activities in the CE Department. Its enables faculty and students are to perform a wide variety of different test in geotechnical engineering and foundations. It serves educational purposes at different levels to students at the undergraduate level. Some of major equipment are shown in Fig.7.1. This Soil mechanics and Foundation laboratory covers the experimental work associated with the CE 331, CE 432 and Senior Design Project (SDP).
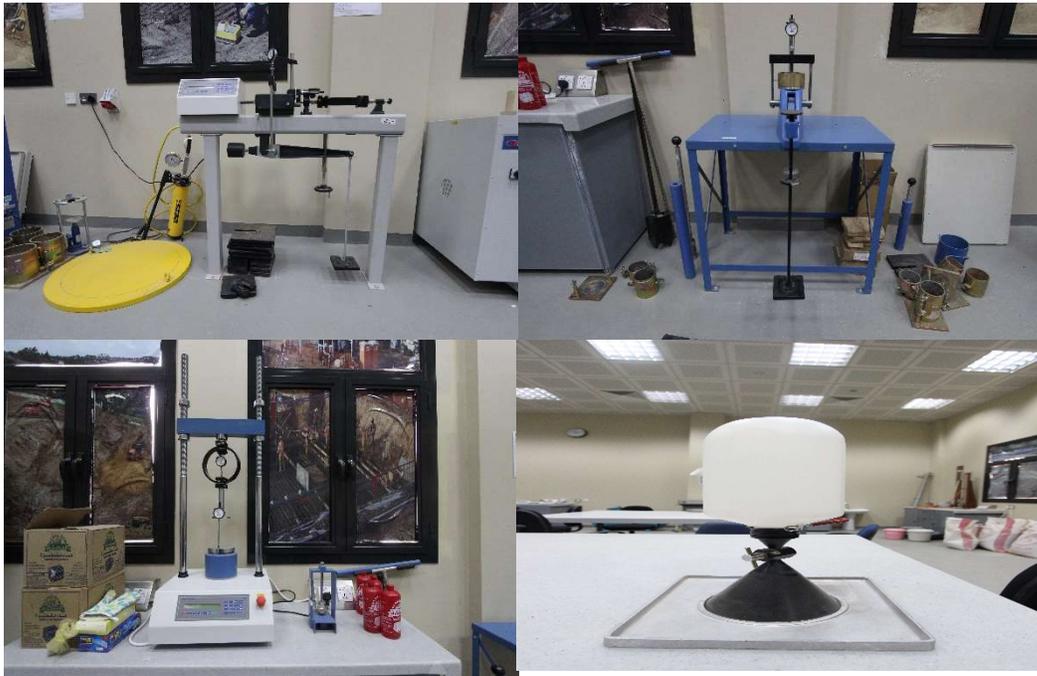
B. Materials engineering laboratory

The laboratory is located in room 1-11-0-3. This Laboratory is equipped with machines and apparatus for training the students in the field of concrete manufacturing. The construction material lab enables the students and Faculty to perform tests on the materials of reinforced concrete and on samples of concrete such as consistency and strength of cement paste, particle size distribution and abrasion of aggregate, consistency and workability of fresh concrete and compressive strength of hardened concrete. It provides educational facilities at different levels to students. The construction material laboratory covers the experimental work associated with CE 323, SDP courses.

C. Highways engineering laboratory

Highways engineering Laboratory is located in room 1-11-09. This Laboratory has advanced equipment for training the students in the field of rigid and flexible asphalt manufacturing. Students and faculties can apply tests in the highway lab on the materials of asphalt, aggregate, soil on samples of different asphalt layers such as bearing ability of base, subbase and subgrade, consistency of bituminous samples, characteristics asphalt binders such as ductility, and softening point and design asphalt mixtures using Marshall Method. It provides educational facilities at different levels to undergraduate students. The Highway Engineering laboratory covers the experimental work associated with CE 442, and SDP courses

D. Surveying laboratory

The laboratory occupies rooms 1-11-0-11 and 1-11-0-12. This laboratory has different instruments and apparatus for training the students in the field of surveying. The survey lab supports the students and Faculty to determine the dimensions, levels and angles in the site. The survey lab enables the students to measure the topography of the sites, which helps calculate the quantities of cut and fill under any civil engineering structures. The survey laboratory learns the students to make different measurement in the field to draw maps for a site with different scales. It provides educational facilities at different levels to undergraduate students. The Survey Engineering laboratory covers the experimental work associated with CE 311, CE 412, SDP courses.

E. Hydraulics and Fluid mechanics laboratory

The Hydraulics and Fluid Mechanics laboratory provides a "hands on" environment that is crucial for developing students understanding of theoretical concepts. The laboratory contains equipment for the measurement of various fluid properties and flow characteristics. Facilities are available for investigating the fundamentals of characteristics of pipe and open channel flows. The lab is equipped with test instruments to aid students to demonstrate the Bernoulli's equation, Buoyancy law and Pascal's law. The students in the lab are able to demonstrate the flow over notches and weirs. The Fluid Mechanics and Hydraulic laboratory covers the experimental work associated with CE 371, CE 472.

F. Computer Laboratory

The students of the CE department have access to a computer lab. The systems are supplied with all necessary software for the students to carry out their tasks as: MS-Office (complete), AUTOCAD and other software. Total Number of PCs is 30 with total capacity of the laboratory maximum of 30 students. It is used for teaching different courses like Engineering Drawing, CAD, Numerical methods, etc.

Useful Links:

1. UT Deanship of Students Affairs

   https://www.ut.edu.sa/en/Deanship/student-affairs/Pages/default.aspx

2. Saudi Council of Engineers
   https://www.saudieng.sa/English/Pages/default.aspx

3. U.S. Environmental Protection Agency
   https://www.epa.gov

4. ASTM International-Standards Worldwide
   https://www.astm.org/

5. American Society of Civil Engineers
   https://www.asce.org/

6. Autodesk
   https://www.autodesk.com/

7. American Concrete Institute
   https://www.concrete.org/middleeast.aspx

8. Project Management Institute
   https://www.pmi.org/

Appendix A

Course Description

General Courses

PHYS0205 Physics

Geometrical Optics: Nature and propagation of light; Refraction of light, Prisms, Reflection of light, Lenses, Lens aberration, image formation-paraxial approximation; optical instruments; superposition of waves; standing waves beats; Wave motion and sound; two-beam and multiple-beam interference; polarization; Fraunhofer and Fresnel diffraction; holography; lasers; Selected Topics in Modern Physics; nuclear physics; Experiments.

Prerequisite: PHYS0101

PHYS0281 General Physics Lab

Determination of thermal conductivity of a bad conductor; Determination of the coefficient of surface tension of a liquid; Determination of Young›s modulus; Determination of the coefficient of viscosity of a viscous liquid; Determination of shear modulus; Comparison and determination of an EMF and R using potentiometer and meter – bridge; Determination of the resistivity of a material (metal wire).

Prerequisite: PHYS0101

CHEM0101 General Chemistry

Physical chemistry: Matter, atomic structure and the periodic table, chemical bonding, stoichiometry of pure substances, reaction in aqueous solutions, states of matter, gases, liquid state; Chemical equilibria; Chemical kinetics; Nuclear chemistry; Thermo- chemistry; Electrochemistry: corrosion of metals; Water treatment; Chemistry of cements; Chemistry of polymers; Fuels combustion; Pollution and its control; Experiments.

Prerequisite: None

MATH0284 Mathematical Geometry

Definite and indefinite integrals of functions of single variable; Applications of the definite integral; Fundamental theorem of calculus; Techniques of integration; Mean value theorems and Hospital›s rule; Integration and its applications in parametric and polar coordinates; Hyperbolic functions; Improper integrals; Sequences and series; Alternating series; Absolute and conditional convergence; Power series; Laplace transform.

Prerequisite: MATH0101

MATH0383 Differential Equations

Differential equations of the first order including basic concepts; Solving methods of differential equations; Differential equations of higher orders and their solutions; Euler›s equations and systems of linear equations; Solution by matrices: some applications; Fourier series; Partial differential equations including Alembert›s equations and separation of variables methods for solving heat; Wave and Laplace equations.

Prerequisite: MATH0284

MATH0325 Probability and Statistics

Descriptive statistics; Axiomatic probability; Random variables and their moments; Special discrete and continuous distributions; Sampling distributions; Estimation; Hypothesis testing; Linear regression; Analysis of variance; Analysis of categorical data.

Prerequisite: MATH0284

MATH0241 Linear Algebra

Systems of linear equations: matrices, determinants, inverse of a matrix, Cramer's rule. Vector spaces and subspaces; linear transformations; Determinants; Vectors in two and three dimensions: scalar and vector products; Equations of lines and planes in space, surfaces, cylindrical and spherical coordinates. Vector valued functions; Functions in two and three variables; Chain rule; Tangent planes and normal lines to surfaces; Extreme of functions of several variables, Lagrange multipliers.

Prerequisite: MATH0284

ENG0201 Engineering Drawing and Graphics

Engineering drawing techniques and skills; Orthographic projection of engineering bodies: points, lines, surfaces and bodies; Derivation of views from isometric drawings and vice versa; Derivation of views and sections from given views; Intersection of bodies and surfaces; Assembly drawings for some mechanical components; Introduction to Computer Aided Drawing (CAD); Fundamentals of engineering graphics in 2D and 3D drawings.

Prerequisite: None

ENG0202 Production Technology and Workshops

Introduction; Function and planning of workshops; Properties of engineering materials and their applications; Workshop metrology; Basic bench work operations; Machining operations; Tools; Equipment and machinery used in basic workshop processes: turning, milling, grinding, forging, sheet metal-work; Measurements: standardization, international measuring systems; Cost analysis and estimation of maintenance; Welding processes; Casting processes; Industrial safety; Workshops.

Prerequisite: ENG0201

ENG0203 Engineering Mechanics I

Basic concepts and principles of engineering mechanics; Vector analysis of forces; Moment and reduction of forces: moment and couples, reduction of a system force, equivalent system forces, equivalent couples; Equilibrium of particles in two and three dimensions; Equilibrium of rigid bodies; Friction and its applications; Analysis of trusses; Center of gravity and moment of inertia.

Prerequisite: PHYS0101

ENG0204 Engineering Mechanics II

Kinematics of a particle: rectilinear and curvilinear motion, and relative motion of a particles,

plane motion of a rigid body; Dynamics of systems of particles: Newton›s laws of motion, equations of motion for rectilinear and curvilinear motion; Kinetics of particles: work and energy, impulse and momentum, and impact; Kinetics of a rigid body in plane motion: translation, fixed axis rotation, work and energy, impulse and momentum.

Prerequisite: ENG0203

ENG0205 Engineering Design I

Introduction to active learning: working in teams, team dynamic, team norms and communication, conducting effective meetings and quality assessment; Problem solving: problem definition, generation of solutions, selection methodology, solution implementation, assessment of implementation; Levels of learning and degrees of internalization; Ethical decision; Organization of the work and design notebook; Engineering history; Technology and environment; Engineering Professions.

Prerequisite: ECE0002-MATH0101

ENG0213 Engineering Design II

Engineering design process; Computer modeling of processes and products; Presentation, organization, and assessment of technical or Engineering work and the preparation of brief reports; quality principles; and self- regulation or the behaviors associated with taking personal responsibility for time management, learning new material, setting goals; Basic elements of technical report; Types of technical reports.

Prerequisite: ENG0205

ENG0214 Engineering Economy

Principles of engineering economy, Design and manufacturing processes, Cost terminology and estimation, Accounting, Balance sheet, Profit loss statement, Money time relationships, Simple and compound interest rates, Single amounts and uniform series, Increasing and decreasing gradient, Application of money, Time relationships, Present value, Internal and External rate of return, Payback period, Evaluation of alternatives for different useful life and study period, Depreciation methods, Replacement analysis, Determination of the economic life of challenger and defender, Engineering economy techniques for evaluation of public projects; Requires final project and presentation.

Prerequisite: ENG0213

ENG0215 Engineering Management

Introduction to engineering management, Types and characteristics of production systems, Forecasting methods and techniques, Product design, Capacity planning, Aggregate planning, Inventory planning and materials management, Short term scheduling, Quality management and quality control, Job design and work methods, Project planning and scheduling.

Prerequisite: ENG0214- MATH0325

Civil Engineering Courses

CE0391 Civil Engineering Drawing

Drawing steel connections: column base, riveted joints, connections between girders and beams, columns and beams; Drawing steel bridges: truss connections, main girders (upper and lower chords, verticals and diagonals), cross girders and stringers; drawing reinforced concrete structures and its detailing: footings, retaining walls, column slabs and beams.

Prerequisite: ENG0201

CE0302 Structural Analysis I

Types of loads; Types of supports; Reactions; Stability of statically determinate structures; Internal forces in statically determinate structures: beams, frames and arches; analyses of statically determinate trusses; Deflection calculations; Influence lines for determinate structures; Distribution of normal stresses on homogeneous sections; Core of cross sections.

Prerequisite: ENG0203

CE0371 Fluid Mechanics

Review of fluid properties and hydrostatics: Manometry Forces on plane and curved surfaces, Buoyancy, Fluid masses subject to acceleration (forced vortex). Kinematics of fluid motion: Fluid flow, Classification of flow, Continuity equation. Flow of Incompressible fluid: One-dimensional flow, Euler›s Equation in three dimensions, Bernoulli›s, Energy equation, and its applications. Pipe flow: Laminar and turbulent flow, Reynolds number, Shear stress distribution, Velocity distribution, Main losses,

Secondary losses, Single pipe, Pipe connections (parallel and series. The Impulse- Momentum principle: Development of the principle, Pipe bends, Enlargements and contractions, Hydraulic structures in open channels.

Prerequisite: PHYS0281, ENG0204

CE0303 Structural Analysais II

Analysis of statically indeterminate structures (normal force, shearing force, bending moments): trusses, beams, plane frames and arches; Method of consistent deformation; Slope deflection method; Method of moment distribution; Euler theory for buckling of compressive members; Introduction to computer applications.

Prerequisite: CE0302

CE0323 Construction Materials

Properties and testing of steel, Concrete materials: Cement, Aggregate, Concrete manufacturing. Properties of fresh concrete. Properties of hardened concrete. Concrete mix design. Non-destructive testing. Quality control of concrete mixes. Special concrete. Floor types, joints construction, Surface finishing and preparation. Properties and testing of bricks.

Prerequisite: ME0213

CE0331 Geotechnical Engineering I

Introduction to geological engineering; Types of rocks: igneous rock, sedimentary rock, metamorphic rock; Weathering processes; Soil formation; Soil structures; Soil minerals; Basic soil properties: weight-volume relationships, definitions, laboratory tests; Soil classifications; Types of water in soil; Total and effective stresses; Hydraulic

soil properties: laboratory and field soil permeability; Stresses in soil mass: stresses under point, line and distributed loads; Soil compaction: relative density, laboratory compaction tests, field compaction, compaction equipment, site control of compaction; Experimental tests.

Prerequisite: ME0213

CE0311 Surveying

Introduction to Surveying and Geomatics Engineering. Units of measurements and map scales. Mapping operations; reconnaissance and field sketches. Linear measurements, theory of errors and coordinate transformations. Compass, magnetic and geographic north directions and bearings. Theodolite instruments, horizontal and vertical angle observations and horizontal angle setting out. Traverse; types, observations, corrections and coordinate computations. Leveling; theory, equipment, field procedures, computations and Contour maps. Area calculations and land divisions. Earth works and volume computations.

Prerequisite: MATH0284

CE0494 Computer Application for CE

Importance, components and operation of microcomputers; Elementary programming

using FORTRAN language: data types, variables, operators, control Structures, simple input/output statements, relational and logical expressions, GO TO statement; IF-ELSE control statement, looping statements, arrays matrix methods, vectors; Applications for civil engineering problems; Simple design project using computer.

Prerequisite: CE0303, MATH0241

CE0451 Reinforced Concrete I

Properties of concrete and reinforcing steel; Limit-state design of reinforced concrete structures; ACI Code requirements; Loads and load combinations acting on reinforced concrete structures; Analysis and design of beams: rectangular beams, T-beams, doubly-reinforced beams, continuous beams; Bond and development length of reinforcement; Deflections and cracks.

Prerequisite: CE0323 – CE0303

CE0432 Geotechnical Engineering II

Compressibility and theory of consolidation: compressibility, e-logp relationship, consolidation test, types of soil settlements; Shear strength of soil: shear failures in soil, More-Coulomb theory, shear strength parameters, direct shear test, Triaxial test, unconfined compression test, vane shear test, pocket penetrometer test; Lateral earth pressure: conditions of lateral earth pressure, Rankine theory, Coulomb theory; Stability of slopes: infinite slope in cohesive and cohesionless soils,

finite slope in cohesive and cohesionless soils, mass methods, method of slices, friction circle method, design charts; Experimental tests.

Prerequisite: CE0331

CE0441 Transportation Engineering

Transportation planning; Mass transit plans design and operation: bus and rail; Traffic flow parameters: speed-flow-density, spacing and time headway, highway capacity and level of service for urban arterial highways; Analysis and design of signalized intersections; Traffic signal coordination.

Prerequisite: CE0311

CE0472 Hydraulics

Pipe flow, energy losses and pipe networks: Analysis, Design and Model. Open channel flow: Introduction, Types, States and Properties of open channels flow, Velocity distribution, Equations for uniform steady flow, Energy equation, Gradually and Rapidly varied flow, Roughness coefficient, Design of open channels cross sections, Applications. Water hammer in pipes: Unsteady flow equations, Water hammer theories, effects and control. Hydraulic machines: Types of turbines, Types of pumps, Pump characteristics and performance, Operation of pumps, Cavitation phenomena.

Prerequisite: CE0371

CE0461 Environmental Engineering

Elements of the environment, Population growth, Natural resources, Survey of environmental problems, Municipal and industrial water and wastewater systems, Water pollution in Coastal areas and groundwater aquifers. Basic biological treatment of water and wastewater. Air pollution sources and quality measurements, Global atmospheric changes, Environmental protection, Environmental impact assessment of engineering projects.

Prerequisite: CE0371, BIO0101

CE0462 Water and Wastewater Engineering

Introduction to water supply works, Sources of water and water quality. Biology of water and wastewater. Rate of water consumption, Analysis of water distribution and wastewater collection systems, computer modeling of network systems; water treatment including coagulation, flocculation, softening, sedimentation, filtration, desalination and disinfection; water and wastewater treatment, principles of biological treatment systems including activated sludge, extended aeration, aerated lagoons, and stabilization ponds.

Prerequisite: CE0472, CHEM0203

CE0405 Steel Structures

Analysis and design of roof trusses. Design of tension and compression members, columns under eccentric loadings, column bases and footings. Design of beams. Welded and bolted connections. Design of building frames. Introduction to plastic analysis. Industrial building project. All

according to AISC specifications.

Prerequisite: CE0303

CE0452 Reinforced Concrete II

Analysis and design of slabs: one-way slab, two-way slab, ribbed slab, flat slab, stairs; Analysis and design of statically determinate frames; Floor systems for covering large halls; Analysis and design of columns subject to axial load and bending; Analysis and design of water tanks; Design of reinforced concrete elements using the working stress design method.

Prerequisite: CE0451

CE0442 Highway Design and Construction

Classification of roads; Design control and criteria; Highway cross section; Horizontal alignment including design of curves and super-elevation; Vertical alignment design including grades and vertical curves; Highway drainage; Intersection design of both at-grade and interchanges; Structural design including loading analysis: design of asphalt layers; Highway construction; Operation and road safety.

Prerequisite: CE0441

CE499 Field Training

Industrial training course, all students must participate in an approved training program in the mining industry, developing a multidisciplinary and teamwork experience. At the completion of 8 week of supervised training each student must submit a formal report and oral presentation.

Prerequisite: None

CE0492 Electromechanical Engineering

Fundamentals of electric circuit theory, Ohm's law, Kirchhoff's laws, A circuits, Polyphase systems. Electric motors: Dc motors, Induction motors, Fractional horsepower motors. Fluid mechanics: Fluid properties, similitude, fluid statics, Bernoulli's equation, applications of the mass, momentum and energy equations, viscous flow in pipes, flow over immersed bodies, introduction to hydraulic machines. Thermodynamics: The first law of thermodynamics, Reversible processes, Irreversible processes. The second law of thermodynamics, Thermal cycles, Steam cycles, Entropy, fuel and combustion. Heat transfer : Heat transfer by conduction, Forced convection, Heat transfer by radiation, Heat exchangers.

Prerequisite: PHYS0281, CE0499

CE0433 Foundation Engineering

Site investigation: importance, objectives, planning, boreholes, open and test pits, soil sampling, rock coring, visual inspection, SPT, CPT, vane shear test, plate load test, soil report; Bearing capacity of the soil; Foundation settlements; Shallow foundations: isolated footings, combined footings, strip footings, strap footing, and raft foundations; Stability of retaining walls and sheet pile walls; Deep foundations.

Prerequisite: CE0432 - CE0451

CE0495 Graduated Project I

In coordination with the department, the student or group of students choose theoretical or practical project topic that is related to one of civil engineering majors; literature review pertaining to the topic; preparing for/or preliminary conducting the experiments; collecting the field data and developing the mathematical/computer model if applicable; writing the first two chapters along with any preliminary findings.

Prerequisite: depending on Area Prerequisite.

CE0482 Construction Management

Understanding topics necessary for effective construction management. Using a generic construction project life cycle, essential aspects of construction projects including client brief preparation, the tendering process, preparing tenders, tender evaluation, project planning, resource allocation, teamwork, site safety, and contract types are covered. Case studies are used to reinforce the application of theoretical ideas to the successful running of construction. Practice teamwork by performing case studies about the requirements of Saudi Tender Regulations, scheduling and cash flow.

Prerequisite: ENG0215

CE0496 Graduated Project II

The students are assigned to complete the integrated design project I involving various disciplines of civil engineering. The module define design objectives, constraints, compare alternatives, and select one alternative based on evaluation criteria and feasibility analysis. Plan an effective design strategy and a project work plan, using standard project planning techniques, to ensure project completion on time and within budget. Implement a planned strategy for an Experimental Project, if applicable. Implement a planned strategy for a Product-Based Project, if applicable. Demonstrate ability to achieve project objectives while acting as an effective member of a multidisciplinary team.

Prerequisite: CE0495

CE0406 Earthquake Engineering

Causes of earthquakes; Characteristics of earthquake ground motions; Earthquake magnitude and intensity measurements; Seismic response analysis of simple structures; Derivation of elastic response spectra and earthquake design spectra; Earthquake design criteria; Free and forced vibration analysis of frame structures; Soil liquefaction phenomena; Seismic performance of slopes, earth structures and soil- structure interaction; Design codes; Computer applications for frames.

Prerequisite: CE0303

CE0407 Advanced Structural analysis

Matrix analysis of plane frames: force method and displacement method; Formulation of stiffness

and flexibility matrices; Influence of temperature change and settlement   of supports on the internal forces; Influence lines of displacements and internal forces for statically determinate structures; Introduction to plastic analysis: applications on beams and frames; Finite element method; Introduction to plates and shells.

Prerequisite: CE0303

CE0435 Improvement of Soil Properties

Soil and rocks cycle; Analysis of Stress and Strain: Mohr›s circle, shear stress, strain tensor; Deformation and failure of rocks: stress-strain curve, axial stress; Engineering properties of rocks: compressive strength, tensile strength, shear strength, permeability; Methods of rock classification; Rocks as a construction material; Bearing capacity of rocks.

Prerequisite: CE0432

CE0408 Advanced steel Structures

Advanced knowledge on the design methodology for steel and composite structures.   It also provides a learning experience on the key concepts and engineering concerns of steel-concrete composite frames and tubular structures. The topics covered innovative design by exploring various steel structural schemes include steel frame structures, steel-concrete composite systems, tubular structures and joints and long-span structures. The students are expected to demonstrate their proficiency in structural steel design through term paper projects.

Prerequisite: CE0405

CE0453 Advanced Reinforced Concrete

Basic concepts of pre-stressing: pre- and post-tension techniques, wires, bars, stands, cables, tendons and pre-stressing end anchors; Fiber stresses in a pre-stressed beam; Load balancing; permissible stress in concrete and pre-stressing steel; Pre-stress partial losses; Pre-stressed concrete hollow core slabs; Elastic design of pre-stressed concrete members: selection of concrete section, tendon eccentricity and profile; Flexure design of pre-stressed concrete elements; Shear and torsion strength design; Rehabilitation of reinforced concrete structures: flexure strengthening of beams and slabs, shear strengthening of beams, rehabilitation of columns.

Prerequisite: CE0452

CE0434 Introduction to Rock Mechanics

Soil and rocks cycle; Analysis of Stress and Strain: Mohr›s circle, shear stress, strain tensor; Deformation and failure of rocks: stress-strain curve, axial stress; Engineering properties of rocks: compressive strength, tensile strength, shear strength, permeability; Methods of rock classification; Rocks as a construction material; Bearing capacity of rocks.

Prerequisite: CE0432

CE0437 Special Topics in Structural and Geotechnical Engineering

This course covers emerging and advanced topics in the field of structural and geotechnical engineering. The course contents and prerequisite will vary depending on the topics.

Prerequisite: CE0452- CE0433

CE0423 Advanced Construction Materials

Advanced technology of finishing and insulating materials, Adapted technology of alternative building materials for low-cost construction, New developments and innovative uses of construction materials, Miscellaneous non-conventional construction materials and products : ceramics, refractories, polymers and plastics, injection materials and joint sealants, composite, optical fibers, carbon fibers, pipes for water and sewage networks, Material-related failures of structures, maintenance and repair techniques structures, Welding technology, Modern technique for non- destructive testing..

Prerequisite: CE0323

CE0424 Advanced Concrete Technology

The course provides students with an in-depth knowledge on the advanced role of constituents of concrete mix including admixtures and their interactions that affect the properties of fresh and hardened concrete including durability. It also discusses the latest development and progress in concrete technology for selection of correct ingredients to achieve a suitable mix and to obtain a technical execution of concrete works in hot weather. The course provides full examples in understanding the basic considerations and design philosophy required for concrete mixes with respect to the most widespread methods of mix design.

Prerequisite: CE0323

CE0483 Advanced Methods of Construction

Introduction to the advanced methods of construction - Earth work - Foundation technology – False-work – Pre-stressed concrete – Precast concrete – Fabrication and erection of steel constructions – Formwork: types, materials, loads, design, economics– Scaffolds: materials, couplers and fittings, fundamentals of erection and design, economics, safety - basis of the quality control process and testing in the advanced construction method - Equipment: types, economy, method of selection.

Prerequisite: CE0451

CE0484 Construction Contracts

The course gives an overview of the liabilities and rights according to the valid laws and regulations governing the engineering works in all its specializations. It reviews and explains theoretically and practically, such laws and makes references known.   It concentrates on the relationship between the parties of local and international contracts in civil and administrative laws, the claims and/or disputes resulting thereof during execution of the works, The engineer›s decision in this respect and   the settlement of such disputes in local and international contracts amicably or by institutional arbitration.

Prerequisite: CE0452

CE0485 Construction Planning

The course gives an overview of the study of the planning process and fundamental management procedures for construction projects. Special attention given to: planning of methods and resources; use of schedules; monitoring time; managing cash flow and costs; and overall project administration and record keeping. Types, selection, utilization, and unit cost of construction equipment regarding different types of projects; Formwork design types and unit cost for horizontal and vertical structural elements; Planning process for building construction.

Prerequisite: CE0391

CE0486 Estimating Construction Costs

This course introduces construction engineering cost planning. Key subjects include estimating and prediction throughout the project lifecycle; principles and applications of cost planning, control and design economics. Construction cost data sources and applications, standard forms of cost analysis, estimating and tendering; effects of procurement methods and contract conditions on pricing; preliminaries costing and contractor›s cash flow and bidding strategy.

Prerequisite: CE0452

CE0487 Special topics in Construction Engineering and Management

This course covers emerging and advanced topics in the field of Construction Engineering and Management and prerequisite will depend on the topics.

Prerequisite: CE0482

CE0412 Advanced Surveying

Role of Surveying in Civil Engineering projects. EDM and total station instruments with applications. Coordinate determination by intersection and resection. Setting out of highways, Roads, Airports, Runways and their correlated horizontal and vertical curves. Tunnel Surveying. Setting out of water Sewerage, infrastructure networks and buildings. Deformation mentoring. Geometric geodesy and map projection. GPS principles and observing techniques. Photogrammetry and Remote Sensing; aerial photography and space imaging satellite systems. GIS/LIS, Digital Mapping and Digital Elevation Models.

Prerequisite: CE0311

CE0443 Traffic Engineering

Introduction to traffic engineering; Traffic studies: volume, speed, density, and travel time, delay; Traffic flow characteristics; Traffic control devices: definition, types, purpose of devices; Intersection control: conflict points at intersections, types of intersection control, traffic signals design, green weaves; Parking survey; Design principles of parking spaces; Accidents and road safety.

Prerequisite: CE0441

CE0444 Advanced Design of Pavements

Review of engineering soil properties; Soil classification for highway construction; Soil field compaction and construction equipment; Types and behavior of pavements; Bituminous materials: uses, properties, and tests of asphalted materials; Advanced design procedures for hot and cold mixes of flexible pavements; Components of pavements; Design parameters of pavements; Advanced structural design methods of pavements.

Prerequisite: CE0442

CE0446 Transportation Economics

Introduction; Modes of transportation: road, railway, air and water transport, comparison between the modes, criteria of choice between them; Buses: types, comparison between their specifications and prices; Factors affecting economy of transport: rolling resistance, air resistance, etc. and the methods used to improve the economy of road transport; Economic evaluation of transportation plans: cost and benefit to traffic; Elements of cost: breakeven point concept, vehicle operating cost, factors affecting vehicle operating cost, fuel consumption and spare parts consumption, replacement policy of transportation fleet.

Prerequisite: CE0441

CE0447 Airports Planning and Design

Importance and classification of airports; Airports and shipping technology; Site selection; Air traffic control; Economical analysis; Optimum capacity; Aircraft characteristics related to airport design; Airport planning; Airport layout; Geometric design of the landing area; Planning and design of the terminal area; Lighting; Marking and signing; Computer applications.

Prerequisite: CE0442

CE0448 Railway Engineering

Importance of railways engineering; Train resistance and attractive forces; Train trip- time estimation by graphical method; Elements of geometric alignment of railway lines; Design of different elements of railway track; Renewal and maintenance of railway lines; Geometric design of different types of turnouts & crossings; Design of railway stations and yards; Safety and types of railway signals.

Prerequisite: CE0441

CE0449 Special Topics in Transportation and Highway Engineering

This course covers emerging and advanced topics in the field of transportation engineering. The course contents and prerequisite will vary depending on the topics.

Prerequisite: CE0442

CE0474 Hydrology and Groundwater

Review of fundamentals of hydrology and advanced elements of the hydrologic cycle; hydrologic flood routing; probability concepts in hydrology, flood frequency analysis; hydrologic principles in engineering design; computer applications in hydrology and introduction to minor structure design. Introduction and definitions of ground water storage

and supply, Darcy's Law and its limitation, steady and unsteady flows in confined and unconfined aquifers, radial flow towards wells, storage coefficient and safe yield in a water-table aquifer, design of wells, methods of drilling and construction, development of maintenance of wells.

Prerequisite: CE0472

CE0473 Hydraulic Structures

Rainwater Harvesting Structures and Dam design concepts. Design of flood-way, overflow and outlet structures; frontal overflow, side channel, morning glory over fall, siphon, free fall, chute, cascade spillway. Design of dissipation structures; hydraulic jump and stilling basin, drop structures and plunge pools, trajectory basins. Design of bottom outlets; gate types, hydraulics of high head gates, air entrainment, cavation. Design of intake structures; hydraulic losses, vortex formation, hydraulic loadings, control gates and valves, penstock.

Prerequisite: CE0472- CE0452

CE0463 Water ressources

Principles water resources engineering. Objectives of water resources planning, management and development. Water demand. Hydrologic cycle. Measurement and analysis of precipitation, evaporation, infiltration and stream flows. Water balance. Reservoirs, Dams and Spillways. Conjunctive use of surface and groundwater. Planning for water resources development. Economical and formulation analysis of water resources projects. Planning for multipurpose projects. Systems analysis and design. Mathematical modeling and optimization. Risk analysis.

Prerequisite: CE0472

CE0464 Environmental Engineering (2)

Examines natural environmental processes and their relevance to engineering. Soil and water chemistry, equilibrium and organic chemistry, microbiology, biochemistry and biological processes will be examined, focusing on the application of these in engineering design, practice and management. Industrial waste sources, impacts, characteristics and management measures; environmental impact assessment; design of sampling and methods of risk assessment; cost-benefit analysis.

Prerequisite: CE0461- CE0462

CE0465 Wastewater Reclamation and Reuse

Wastewater reuse as an essential part of water resources management. Biology of wastewater. Characteristics of municipal secondary effluents and quality standards for reuse. Reclaimed wastewater uses in agricultural, landscaping, recreational and industrial developments. Industrial wastes: characteristics, reclamation and recycling. Combining of treatment units to achieve the required water quality standards. Design of advanced wastewater treatment systems for reuse. Land treatment systems and groundwater recharge. Design of non-potable water distribution networks. Potential reuse alternatives. Water reuse economics.

Prerequisite: CE0462

CE0466 Solid and Hazard Wastes

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. Evolution of solid waste sources, composition and properties. Biology of solid waste composition. Engineering principles. Separation, transformation and recycling of waste, materials. Disposal methods and regulations. Site selection, site investigations and design for landfills. Construction problems in waste disposal sites. Hazard wastes disposal, Environmental assessments.

Prerequisite: CE0461

CE0413 Selected Topice in Civil Engineering (1)

This course covers emerging and advanced topics in Civil Engineering. The course contents and prerequisite will vary depending on the topics.

CE0414 Selected Topice in Civil Engineering (2)

This course covers emerging and advanced topics in Civil Engineering. The course contents and prerequisite will vary depending on the topics.