Jordan University of Science and Technology

Faculty of Engineering

Department of Civil Engineering

Curriculum for the Bachelor of Science Degree in Civil Engineering

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Introduction

Civil engineering department is one of eight departments in the faculty of engineering at Jordan University of science and technology, which was established in 1979, the Department began in the academic year 1980/1981, at Yarmouk University. The department continued in Yarmouk University until 31/8/1986, which was moved within the College of engineering to the Jordan University of science and technology in 1/9/1986. The Department offers bachelor's and master's degrees in civil engineering and began to accept students at the doctoral level at the beginning of the academic year 1998/1999, majoring in transportations.

Civil Engineering department includes (45) faculty members with several research interests to activate the key specialties in the field of civil engineering. Faculty members in the department contribute in leading research projects of major national and international research institutions. Members of the teaching staff in scientific and practical experience cover all areas of civil engineering, construction and transportation, geotechnical and materials of water and environment and construction management.

Vision:

Towards an outstanding graduates in Civil Engineering education, research, and community service.

Mission:

Our mission is to contribute to the Advancement of the Community through:

- Providing high quality civil engineering education that graduates competitive and creative engineers.
- Advancing research that generates new solutions to enhance the quality of life and stimulate economic development and sustainability.
- Being an effective source of engineering expertise providing know-how engineering services that match the market needs and development relevance through training and consultancy for industrial and governmental organizations and the general community.

Objectives:

1. Graduating qualified engineers equipped with essential skills and knowledge to comprehend and deal with modern Civil Engineering trends.
2. Keeping up with the state-of-practice in Civil Engineering disciplines through continuous review, evaluation and modification of the curriculum.
3. Promoting scientific research and studies, which address local, regional and international problems.
4. Establishing partnership with local, regional and international companies and agencies to enhance and nourish the education process and scientific research.

BSc Program Learning Outcomes

Upon completion of the degree program, students will have:

A. A strong background in engineering fundamentals, and civil engineering practice in the areas of design and analysis of structures and building, mechanical and electrical systems, and architecture/construction management.

B. The ability to design and conduct experiments, as well as analysis and interpretation of results.

C. To develop the understanding of the design and implementation of projects.

D. Ability to work on multiple teams, trends or scientific backgrounds.

E. The ability to identify, formulate and solve engineering problems.

F. To learn ethical and professional responsibilities.

G. Scientific and critical thinking skills that will help them to formulate ideas and evaluating decisions.

H. Ability to communicate effectively with other engineering disciplines.

I. Awareness of the need for continuous learning and the ability to engage in its fields.

J. Sufficient knowledge of contemporary issues and problems.

K. Appropriate background to enter graduate programs and professional degrees as well as professional life.

Curriculum for the Bachelor of Science Degree in Civil Engineering

Numbering and coding system of the curriculum courses.

Course Coding

The following codes are used to designate courses:

Department		Level/year	Course Topic	Academic Semester
A	B	x	y	z

The Faculty of Engineering Departments codes (A, B) are as follows:

Code	Department	Code	Department
AE	Aeronautical Engineering	EE	Electrical Engineering
BME	Biomedical Engineering	IE	Industrial Engineering
ChE	Chemical Engineering	ME	Mechanical Engineering
CE	Civil Engineering	NE	Nuclear Engineering

Course Numbering

- The courses are tabled and numbered in such a manner to recognize each course regarding its subject area, year or level, and semester offered.
- The symbol (CE xyz) denotes Civil Engineering and (xyz) is a 3-digits number.
  A. The first digit (x) denotes the year level of the course according to student's study plan as follows:

Code	Level/year
1	First year
2	Second year
3	Third year
4	Fourth year
5	Fifth year

B. The second digit (y) denotes the field of the course as follows:

Second number	Specialization
0	Introductory courses in Civil Engineering
1	Basic science in Civil Engineering
2	Engineering Materials
3	Structural Engineering
4	Transportation Engineering
5	Water and Environmental Engineering
6	Geotechnical Engineering
7	Construction Management, specifications, contracts &Quantity Surveying, and Engineering Economy
8	Special topics
9	Graduation Projects and Engineering Training

C. The third digit (z) denotes sequence of the semester

Example: **CE 532** (Pre-stressed Concrete) means

CE	5	3	2
Civil Engineering	Level (fifth year)	Field (Structural Engineering)	Sequence (2nd semester)

A Bachelor of Science (B.Sc.) degree in Civil Engineering at JUST is awarded in accordance with the statute stated by JUST regulations (adjusted) for B.Sc. awarding issued by the Deans' Council based on the 1987 law for awarding scientific degrees and certifications at JUST, and after the successful completion of 160 credit hours, distributed as indicated in the following table.

Table (1): Distribution of Civil Engineering program Credit hours

Classification	Credit hours		
	Compulsory	Elective	Total
University Requirements	16	9	25
Faculty Requirements	31	0	31
Department Requirements	92	12	104
Total	136	24	160

Table 2: Courses Classification

Source of Courses	Credit Hours		Percentage
	Lecture	Lab	
Humanities	24		15.0
		1	0.6
Basic Sciences	32		20.0
		2	1.3
General Eng. Sciences	13		8.1
		2	1.3
Civil Eng. Science	79		49.4
		7	4.4
Total	148	12	100

Degree Requirements

A Bachelor of Science (B.Sc.) degree in Civil Engineering at JUST is awarded in accordance with the statute stated by JUST regulations (adjusted) for B.Sc. awarding issued by the Deans' Council based on the 1987 law for awarding scientific degrees and certifications at JUST, and after the successful completion of 160 credit hours, distributed as follows.

A. University Requirements (25 Credit Hours)

1. Compulsory University Requirements: (16 Credit Hours)

Course No.	Course title	Credit hours	Theoretical	Practical
ARB 101	Arabic language	3	3	-
HSS 100	Culture and University Behavior	1	1	-
Eng 111(1)	English Language 1	3	3	-
Eng 112(2)	English Language 2	3	3	-
CIS 100 (3)	Computer Skills	3	3	-
MS 100 (4)	Military Sciences	3	3	-
Total		**16**	**16**	**-**

(1) Pre-requisite: Passing ENG 099 or passing English Language Placement Test with a grade > 50%.

(2) Pre-requisite: Eng 111 or passing the English Language Placement Test with a grade > 80%. Students who have a TOEFL score of > 500 are exempted from both ENG 099 and Eng. 111.

(3) A student who passes the Computer Skills Placement Test with a grade > 50% is exempted from CIS 100.

(4) This course is required from Jordanian students only; graded on Pass/Fail basis. Students graduating from Royal Military faculty and military candidate's school and equivalent institutes are exempted from taking this course. Non-Jordanian Arabic speaking students are required to take a substitute for this course from the elective courses and in this case the grade of this course is included in their grade point average (GPA).

Note: All non-Arabic speaking international students in the University are required to study one course in Arabic language as shown below:

Course No.	Course title	Credit hours	Theoretical	Practical
ARB 101A(1)	Fundamentals of Arabic Language (for non-Arabic speaking students as a substitute for the course ARB 101 Arabic Language)	3	3	-

(1) The director of the Admission and Registration Department is permitted to determine the students from non-Jordanian/non-Arabic speaking who are eligible to take ARB 101A.

2. Elective courses: (9) credit hours selected from the following courses:

Course No.	Course title	Credit hours	Theoretical	Lab
ADS 100	Oral and Dental Health (for non-Dentistry and non Dentistry Sciences students)	3	3	0
AP 200	Farm Animal Products And Production (For Non Agriculture And Veterinary Students)	3	3	0
ARB 200	Appreciation of Literary Texts	3	3	0
ChE 191	Introduction to the Nanotechnology	3	3	0
ES 103	Enivrement Protection (for non Environnent Sciences surdents)	3	3	0
HSS 105	Basic French Language	3	3	0
HSS 106	Basic German Language	3	3	0
HSS 115	Islam and Recent Problems	3	3	0

Course No.	Course title	Credit hours	Theoretical	Lab
HSS 116	Economic System in Islam	3	3	0
HSS 121	Principles of Sociology	3	3	0
HSS 126	Principles of Psychology	3	3	0
HSS 127	Educational Technology	3	3	0
HSS 128	National Education	3	3	0
HSS 131	Islamic Civilization	3	3	0
HSS 132	The History of the City of Jerusalem	3	3	0
HSS 133	Civilization and Recent Cultures	3	3	0
HSS 135	Islamic culture	3	3	0
HSS 137	Human rights	3	3	0
HSS 141	Introduction to Economics (for non CIS students)	3	3	0
HSS 142	Library and Information Research	3	3	0
HSS 151	Introduction to Management Sciences (for non CIS students)	3	3	0
HSS 161	Contemporary Problems	3	3	0
HSS 166	Man and Science	3	3	0
HSS 211	Sociology (in English)	3	3	0
HSS 212	Arab Society	3	3	0
HSS 213	Individual and Society	3	3	0
HSS 216	International Global Issues	3	3	0

Course No.	Course title	Credit hours	Theoretical	Lab
HSS 221	Introduction to Psychology (in English)	3	3	0
HSS 222	Creativity and Problems Solving	3	3	0
HSS 224	Leader ship and Communication Skills	3	3	0
HSS 231	History of Science in Islam	3	3	0
HSS 250	The History of Music (in English)	3	3	0
HSS 429	The Science of Children Behavior	3	3	0
ME 102	Introduction to renewable energy	3	3	0
ME 211	Fundamentals of Automobile Engineering (for non ME students)	3	3	0
NF 177	Food Preservation (in English)	3	3	0
NR 200	Natural Resources	3	3	0
NUR 100	Health Promotion (for non Medicine, non Nursing, and non Midwifery students)	3	3	0
PH 104	Community Health and Nutrition (for non Medicine, non Nursing, and non Midwifery students)	3	3	0
PH 200	First Aid (for non Medicine, non Nursing, and non Midwifery and paramedic students)	3	3	0
PHAR 104	Drugs and Medicinal Plants in Jordan	3	3	0
PP 200	Home Gardens (for non Agriculture students)	3	3	0
PP 201	Bee Keeping (for non Agriculture students)	3	3	0
PP 202	Natural plants of Jordan (For Non agriculture Students)	3	3	0
PT 100	Wellness and Life Styles (for non physical therapy students)	3	3	0

Course No.	Course title	Credit hours	Theoretical	Lab
VM 211	Animal Health (for non Veterinary Medicine and non Agriculture students)	3	3	0
VM 212	Pet Animal Care (for non VM and Agriculture students)	3	3	0
VM 213	Animal Behaviour and Welfare	3	3	0

B. Faculty Requirements: (31 credit hours) distributed as follows:

I. Courses from the Faculty of Engineering (2 C.H): students are required to take the following courses from the Department of Mechanical Engineering:

Course No.	Course title	Credit hours	Theoretical	Lab	Prerequisite
ME 100	Engineering Workshops	1	0	1	---
ME 200	Engineering Drawing A	1	0	1	CIS 100
Total		2	0	2	

II. Courses from the Faculty of Science and Arts (26 C.H)

a) Mathematics Courses (12 C.H):

Course No.	Course title	Credit hours	Theoretical	Lab	Prerequisite
MATH 101	Calculus 1	3	3	0	---
MATH 102	Calculus 2	3	3	0	MATH 101
MATH 201	Intermediate Analysis	3	3	0	MATH 102
MATH 203	Ordinary Differential Equations	3	3	0	MATH 102
Total		12	12	0	

b) Physics Courses (7 C.H):

Course No.	Course title	Credit hours	Theoretical	Lab	Prerequisite
PHYS 101	General Physics 1	3	3	0	---
PHYS 102	General Physics 2	3	3	0	PHYS 101
PHYS 107	General Physics Lab	1	0	1	PHYS 102 (or Co.)
Total		7	6	1	

c) Chemistry Courses (7 C.H):

Course No.	Course title	Credit hours	Theoretical	Lab	Prerequisite
CHEM 101	General Chemistry 1	3	3	0	---
CHEM102	General Chemistry 2	3	3	0	CHEM 101
CHEM107	General Chemistry Lab	1	0	1	CHEM 102 (or Co.)
Total		7	6	1	

III. Courses from the Faculty of Computer and Information Technology (3 C.H)

Course No.	Course title	Credit hours	Theoretical	Lab	Prerequisite/Co-request
CS114	Programming For Engineers	3	2	1	CIS 100
Total		3	2	1	

C. Department requirements: (104 Credit Hours) distributed as follows:

1. Department Compulsory Courses (92 credit hours) distributed as follows:

Course No.	Course title	Credit hours	Theoretical	Lab	Prerequisite (Must Pass)	Co-requisite or Prerequisite
CE 201	Statics	3	3	0	PHYS 101	
CE 202	Strength of Materials	3	3	0	CE 201	
CE 211	Engineering geology	2	2	0		CHEM 102
MATH 235	Probability and Statistics for Engineering Students	3	3	0		MATH 102
CE 301	Dynamics for Civil Engineers	2	2	0		CE 201
CE 302	Civil Engineering Drawing	2	1	1	ME 200	
CE303	Engineering Economy	2	2	0	MATH 201	
CE 304	Numerical Methods	3	3	0	MATH 203	CS 114
CE 321	Materials Science and Engineering	2	2	0	CHEM 102	CE 202(OR CO)
CE 322	Concrete Technology	3	3	0		CE 321
CE 326	Materials Lab	1	0	1		CE 321, CE 322 (OR CO)
CE 332	Structural analysis (1)	3	3	0	CE 202	
CE 341	Surveying	3	3	0		MATH 235, MATH 201(OR CO)

CE 343	Surveying Lab	1	0	1		CE 341(OR CO)
CE 345	Transportation Engineering	3	3	0		CE 341
CE 351	Fluid Mechanics for Civil Engineering	3	3	0	CE 201	
CE 352	Hydraulics and Hydrology	3	3	0	CE 351	
CE 354	Fluid Mechanics and Hydraulics Lab	1	0	1		CE 351, CE 352 (OR CO)
CE 371	Building Construction	*3*	*3*	0	*CE201*	CE 302(OR CO)
CE 431	Structural analysis (2)	3	3	0	CE 332	CE304 (OR CO)
CE 432	Reinforced concrete (1)	3	3	0		CE 322, CE 371, CE 431
CE 434	Steel Design	3	3	0		CE 371, CE 431
CE 442	Pavement materials & Design	3	3	0		CE 345
CE 443	Highway Geometric Design	3	3	0	CE301	CE 341
CE 444	Highway Laboratory	1	0	1		CE 442 (OR CO)
CE 452	Environmental Engineering (1)	3	3	0		CE 352
CE 453	Environmental Engineering Lab	1	0	1		CE 452 (OR CO)
CE 462	Geotechnical Engineering	3	3	0	CE 202	CE 211
CE 463	Geotechnical Engineering Lab	1	0	1		CE 462 *(OR CO)*

CE 464	Foundation Engineering	3	3	0	CE 462	CE432(OR CO); CE 463
CE 472	Contracts, Specifications &Quantity Surveying	3	3	0		CE341, CE 432(OR CO)
[1]CE 490	Engineering Training	3	0	3	Completion of 117 Credit Hours	
CE 531	Reinforced Concrete (2)	3	3	0	CE 432	
CE 557	Environmental Engineering (2)	3	3	0	CE 452	
CE 570	Engineering Projects and Construction Management	3	3	0	CE 472, CE 303	CE 371
CE 591	Graduation Project (1)	1	1	0	Completion of 120 Cr. Hr.	
CE 592	Graduation Project (2)	3	3	0		CE 591
	Total	**92**	78	14		

[1] 8 weeks of practical training in a by-Faculty accredited institution pertaining to civil engineering

2. Department Technical Electives (12 credit hours):

The student is advised to select courses (12 Credit Hours) from the following tables:

Course No.	Course title	Credit hours	Theoretical	Lab	Prerequisite or Co-requisite
CE 503	Geographic Information System GIS	2	2	0	CE 341
CE 504	Dams Engineering	3	3	0	CE 352, CE432, CE464
CE 505	Geographic Information System GIS (Lab)	1	0	3	CE 503 (Compulsory OR CO)
CE521	Advanced Cementitious Materials	3	3	0	CE322
CE 532	Pre-stressed Concrete	3	3	0	CE 432
CE533	Earthquake Engineering	3	3	0	CE 301,CE531
CE534	Introduction to Finite Element	3	3	0	CE 431
CE 535	Computer-aided analysis and design of Civil Engineering Structures	2	2	0	CE 434, CE 531
CE 536	Bridge Engineering and Design	3	3	0	CE434, CE 531
CE 537	Computer-aided analysis and design of Civil Engineering Structures (Lab)	1	0	3	CE 535 (Compulsory CO)
CE 541	Traffic Engineering	3	3	0	CE 443
CE 542	Photogrammetry and Geodesy	3	3	0	CE304, CE341
CE 544	Transportation Planning	3	3	0	CE345, CE 443
CE 546	Highway Maintenance	3	3	0	CE 442
CE 547	Airport Engineering	3	3	0	CE 442
CE548	Railway Engineering	3	3	0	CE 442

CE 552	Water Resources	3	3	0	CE 352
CE 553	Ground Water Management	3	3	0	CE 352
CE 554	Engineering Hydrology	3	3	0	CE 352
CE 559	Solid and Hazardous Waste Management	3	3	0	CE557
CE 565	Applied Geotechnical Engineering	3	3	0	CE 464
CE 566	Soil Stabilization	3	3	0	CE 464
CE567	Geotechnical Aspects of Dam Engineering Problems	3	3	0	CE 464
CE 568	Subsurface exploration	3	3	0	CE464
CE 581	Special Topics in Structural Engineering	3	3	0	Department approval
CE 582	Special Topics in Transportation Engineering	3	3	0	
CE 583	Special Topics in W/E Engineering	3	3	0	
CE 584	Special Topics in Geotechnical Engineering	3	3	0	

Study Plan

FIRST YEAR											
First semester						Second semester					
Course No.	Course name	Total credits	Weekly hours		Prerequisite	Course No.	Course name	Total credits	Weekly hours		Prerequisite
			Lecture	Lab					Lecture	Lab	
CIS 100	Computer Skills	3	3	-	---	ENG 112	English Language 2	3	3	-	ENG 111
ENG 111	English Language 1	3	3	-	Passing Eng 099	ARB 101	Arabic Language	3	3	-	----
MATH 101	Calculus 1	3	3	-	---	MATH 102	Calculus 2	3	3	-	MATH 101
PHYS 101	General physics 1	3	3	-	---	PHYS 102	General Physics 2	3	3	-	PHYS 101
CHEM 101	General Chemistry 1	3	3	-	---	CHEM 102	General Chemistry 2	3	3	-	CHEM 101
						CHEM 107	General Chemistry Lab.	1	-	3	CHEM 102 (OR CO)
						PHYS 107	General Physics Lab.	1	-	3	PHYS 102 (OR CO
						HSS 100	Culture and University Behavior	1	1	-	----
Total		**15**	**15**	**-**		**Total**		**18**	**16**	**6**	

SECOND YEAR											
First semester						Second semester					
Course No.	Course name	Total Credits	Weekly hours		Prerequisite	Course No.	Course name	Total Credits	Weekly hours		Prerequisite
			Lecture	Lab					Lecture	Lab	
ME 100	Engineering Workshops	1	-	3	---	MATH 203	Ordinary Differential Equations	3	3	-	MATH 102
CS 114	Programming for Engineers	3	2	-	CIS 100	ME 200	Engineering Drawing A	1	-	3	CIS 100
MATH 235	Probability and Statistics for Engineering	3	3	-	MATH 102	CE 202	Strength of Materials	3	3	-	CE 201 (pass)
MATH 201	Intermediate Analysis	3	3	-	MATH 102	MS 100	Military Sciences	3	3	-	---
CE 201	Statics	3	3	-	Phys 101 (pass)	CE 211	Engineering Geology	2	2	-	Chem 102
---	University Elective	3	3	-	----	CE 321	Materials Science & Engineering	2	2	-	Chem 102 (Pass); CE 202(OR CO)
						CE 301	Dynamics for civil engineers	2	2	-	CE201
Total		**16**	**14**	**3**		**Total**		**16**	**15**	**3**	

THIRD YEAR											
First semester						Second semester					
Course No.	Course name	Total credit	Weekly hours		Prerequisite	Course No.	Course name	Total credit	Weekly hours		Prerequisite
			Lecture	Lab					Lecture	Lab	
CE 302	Civil Engineering Drawing	2	1	3	ME 200 (Pass)	CE 322	Concrete Technology	3	3	-	CE 321
CE 303	Engineering Economy	2	2	-	Math 201 (Pass)	CE 326	Materials Lab	1	-	3	CE321, CE 322 (OR CO)
CE304	Numerical Methods	3	3	-	CS 114, Math 203 (Pass)	CE 345	Transportation Engineering	3	3	-	CE 341
CE 332	Structural Analysis 1	3	3	-	CE 202(Pass)	CE 352	Hydraulics and Hydrology	3	3	-	CE 351 (Pass)
CE 341	Surveying	3	3	-	Math 235; Math 201(OR CO)	CE 354	Fluids Mechanics & Hydraulics Lab	1	-	3	CE351, CE 352 (OR CO)
CE 343	Surveying Lab	1	-	3	CE 341 (OR CO)	CE 371	Building Construction	3	3	-	CE 201 (Pass), CE 302 (OR CO)
CE 351	Fluid Mechanics for Civil Engineering	3	3	-	CE 201 (Pass)	***	University Elective Course	3	3	-	
Total		**17**	**15**	**6**		**Total**		**17**	**15**	**6**	

FOURTH YEAR											
First semester						Second semester					
Course No.	Course name	Total credits	Weekly hours		Prerequisite	Course No.	Course name	Total credits	Weekly hours		Prerequisite
			Lecture	Lab					Lecture	Lab	
CE 431	Structural Analysis 2	3	3	-	CE 332 (pass), CE 304 (OR CO)	CE 432	Reinforced Concrete 1	3	3	-	CE322, CE 371 , CE 431
CE 443	Highway Geometric Design	3	3	-	CE 301 (Pass), CE 341	CE 434	Steel Design	3	3	-	CE 371, CE 431
CE 442	Pavements Materials and Design	3	3	-	CE 345	CE 444	Highway Lab	1	-	3	CE 442 (OR CO)
CE 452	Environmental Engineering 1	3	3	-	CE 352	CE 464	Foundation Engineering	3	3	-	CE 462 (Pass), CE 463, CE 432(OR CO)
CE 453	Environmental Engineering Lab	1	-	3	CE 452 (OR CO)	CE 472	Contracts, Specifications & Quantity Survey	3	3	-	CE 341, CE 432(OR CO)
CE 462	Geotechnical Engineering	3	3	-	CE 202 (Pass); CE211	***	University Elective Course	3	3	-	
CE 463	Geotechnical Engineering Lab	1	-	3	CE462 (OR CO)						
Total		**17**	**15**	**6**		**Total**		**16**	**15**	**3**	

Summer semester					
Course No.	Course name	Total credit	Weekly hours		Prerequisite
			Lecture	Lab	
CE 490	Engineering training	3	-	-	**Completion of 117 Credit hours**
Total		**3**		**-**	

FIFTH YEAR											
First semester						Second semester					
Course No.	Course name	Total credit	Weekly hours		Prerequisite	Course No.	Course name	Total credit	Weekly hours		Prerequisite
			Lecture	Lab					Lecture	Lab	
CE 531	Reinforced Concrete 2	3	3	0	CE 432 (Pass)	CE ***	Department Technical Elective	3	***	***	***
CE 557	Environmental Engineering 2	3	3	0	CE 452 (Pass)	CE ***	Department Technical Elective	3	***	***	***
CE 570	Engineering Projects and Construction Management	3	3	0	CE 371, CE472 (Pass), CE303 (Pass)	CE ***	Department Technical Elective	3	***	***	***
CE***	Department Technical Elective	3	3	0	***	CE 592	Graduation Project 2	3	3	0	CE 591
CE 591	Graduation Project 1	1	1	0	Completion of 120 Credit Hours						
Total		**13**	**13**	**0**		**Total**		**12**	***	***	

Course Catalogue

CE 201: Statics (3Cr. Hr.)

Introduction to mechanics of rigid bodies, Basic concepts, force and displacement vectors, force systems, equivalent force systems, static equilibrium, analysis of simple structures, friction, geometric properties: centroids and moments of inertia, Introduction to shear and bending moment diagrams. Pre: Phys 101(Pass).

CE 202:Strength of Materials (3Cr. Hr.)

Concepts of stress and strain. Stresses and displacements of axially loaded members. The state of stress and strain, Normal, bending, shear, and torsion stresses, Mechanical properties of materials, combined stresses, composite sections, Deflections: integration Method, Moment area method, Buckling of columns. Pre: CE 201(Pass).

CE 211: Engineering Geology (2Cr. Hr.)

Engineering Geology, Identification of Rock and minerals types, soil properties, weathering and soils Basic principles of physical and structural geology with emphasis related to civil engineering, active tectonics and earthquakes hazards, Ground water, slope stability and landslides. Pre: CH102.

CE 301: Dynamics for Civil Engineers (2Cr. Hr.)

Kinematics of Particles, Kinematics of Systems of Particles, Kinetics of Rigid Bodies (Planar), Principle of Work and Kinetic Energy for Rigid Bodies (Planar), Principle of Impulse and Momentum for Rigid Bodies (Planar), Dynamic loads in civil engineering, introduction to structural dynamics. Pre: CE 201.

CE 302: Civil Engineering Drawing (2Cr. 1Hr. 3Lab.)

Instruments of Drawing, Graphic geometry (Lines, Letters, Numbers, Tangency Construction), Intersections, Types of Projection, Dimensioning, Plane Sectioning. Steel Structure Drawing, Reinforced Concrete Beams Drawing, Highway Projection (Curves, Slopes, Earth Works and their projection), Bridge Drawing (Retaining Walls, Abutments, and Piers), Projection of Water Structure at Water-way Intersection. Pre: ME 200(Pass).

CE 303: Engineering Economics (2Cr. Hr.)

Cost concepts and classifications, Breakeven analysis, Time value of money, Cash-flow diagrams and interest calculations, Economic selection among investment alternatives. Depreciation and income taxes. Engineering project characteristics and phases. Pre: MATH 201(Pass).

CE 304: Numerical Methods (3Cr. Hr.)

Machine epsilon, round-off error, linear systems of equations, Gauss elimination and iterative methods, largest eigenvalue using power methods, spline interpolation, numerical integration, ordinary differential equations, nonlinear equations, zeros of polynomials, one dimensional optimization, least squares data fitting, singular value decomposition, uniform random number generator. Pre: MATH 203 (Pass),CS 114.

CE 321: Materials Science and Engineering (2Cr. Hr.)

Atomic structure, bonding, crystalline and non-crystalline structure, defects and dislocations, diffusion, structure-property and processing-property relations in metallic, ceramics, and polymers, mechanical behavior of materials, including: elastic and plastic deformation, fracture, creep, fatigue, impact, mechanical testing, metal strengthening, corrosion of metals and ceramics, polymer degradation, criteria for materials selection. Pre: Chem. 102 (Pass), CE 202.

CE 322: Concrete Technology (3Cr. Hr.)

Concrete as construction material, cementing materials, concrete aggregates fresh concrete properties, Mixing, transporting, placing and compacting of concrete, admixtures, curing of concrete and strength development, hot and cold weather- concreting, strength determination and non-destructive testing, durability of concrete and concrete mix design, fiber reinforced concrete (FRC). Pre: CE 321.

CE 326: Materials lab (1Cr. 3Hr.)

Specific Gravity of Cement, Normal Consistency & Setting Time of Cement Past, Fresh and Mechanical Properties of Mortar, Sieve Analysis of Aggregate, Specific Gravity of Aggregate, Unit Weight of Aggregate, Abrasion test of Aggregate, Workability tests on concrete, Hardened properties of concrete (stress-strain diagram in compression, and compressive, splitting, and flexural strengths), Nondestructive testing using impact hummer and ultrasonic pulse velocity, Mechanical properties (tension and compressive behavior) of ductile and brittle steel, Tests on wood (Mechanical and Visual), Hardness Test on Metals, mechanical and electrical strain measurements, Students present the report of one experiment using data show. Pre: CE 321, Pre, Cor:CE 322

CE 332:Structural Analysis 1 (3Cr. Hr.)

Analysis of statically determinate structures, stability and determinacy of structures, type of loads, Shear and moment diagrams, Analysis of arches and cables, Deflections, settlements of supports, temperature changes, Methods of virtual work, moment-area, and conjugate beam methods, Influence lines for beams and trusses. Pre: CE 202(Pass).

CE 341:Surveying (3Cr. Hr.)

Principles of surveying, linear measurements, Theory of errors and adjustment of observations, Leveling and its application in contouring, profiles and cross-sections, Areas, volumes, earthwork and mass-haul-diagram. Measurement of angles, coordinates geometry, traverse surveys, Tachometry and electronic distance measurements. Principles of triangulation, Construction survey. Pre: MATH 235, MATH 201 (OR CO).

CE 343: Surveying Laboratory (1Cr. 3Hr.)

Chain surveying, the use of the level and leveling staff, setting out levels, profile and cross-section leveling. The theodolite and its use traverse surveying, Tacheometry and electronic distance measurements, Measurement of areas with planometer, The usage of laser theodolite and level, Total stations, Computer applications in surveying. Students present the report of one experiment using data show. Pre/Cor: CE 341.

CE 345: Transportation Engineering (3Cr. Hr.)

The field of transportation engineering, role of transportation in society economics, social, political, and environmental, Operational and vehicular characteristics for all modes of transportation, Traffic control devices, pavement markings, object marking, delineators, studs, signs, and channelization, introduction to traffic signal timings. Rail transportation, Urban rail transit, railway cross section, Urban rail transit cross section, Air transport demand, selection of airport site and runway orientation, Airport passenger terminal area. Water transportation including marine structures, classes of harbors and planning and design of port facilities, Introduction to Intelligent Transportation Systems (ITS). Pre: CE 341.

CE 351: Fluid Mechanics for Civil Engineering (3Cr. Hr.)

Properties of fluids, Statics of fluids, Dynamics of fluids, system and control volume, equations of continuity, Euler, Bernoulli, energy, linear momentum, and angular momentum with applications, Dimensional analysis and dynamic similitude, Viscous flow: laminar flow through tubes, energy grade lines, turbulent flow in pressure conduits and in open channels, steady incompressible flow through simple pipes and open channels. Pre: CE 201(Pass).

CE 352: Hydraulics and Hydrology (3Cr. Hr.)

Pipe branching and pipe networks, hydraulic machinery, open channel flow, elements of hydrology: hydrologic cycle evaporation, transpiration, precipitation, run off, hydrographs, design discharge, rainfall statistics, magnitude of floods, watershed characteristics, channel routing, frequency analysis, the unit hydrograph, SCS Curve Number Method, Aquifers, Darcy's law, and well hydraulics, Storm sewer design. *Pre: CE 351* (Pass).

CE 354: Fluid Mechanics and Hydraulics Laboratory (1Cr. 3Hr.)

Experiments on, properties of fluids, flow measurements, statics of fluids, principles of continuity, Bernoulli, energy, and momentum, viscous effects, free surface flow, and pumps. Students present the report of one experiment using data show. Pre CE 351, Pre/Cor: CE352.

CE 371: Building Construction (3Cr. Hr.)

Introduction to the development of building philosophy, Types of buildings and structural systems, Structural elements and transfer of load among the building components, Types of foundation, Geometric design of stairs, and Geometric design of Elevators walls Form work. Flooring, and damp proofing, Provision of joints in structures, Timber and steel structures, design and construction details, Civil engineering drawing, Sections and details of different components and works. Pre: CE 201(Pass), Pre/Cor: CE 302.

CE 431: Structural Analysis II (3Cr. Hr.)

Indeterminate structures, Force Method, slope deflection method, and moment distribution method, Influence line for first-degree indeterminate beams, Stiffness method for trusses, beams, and frames, Analysis of none-prismatic members. Approximate method of analysis. Pre: CE 332 (Pass) , Pre/Cor: CE 304.

CE 432: Reinforced Concrete I (3Cr. Hr.)

Introduction, design Codes, safety provisions, axial load analysis, materials, flexural analysis, beam behavior, strength design, design and detailing of singly reinforced rectangular beams, doubly reinforced rectangular beams, and T-beams. Shear and diagonal tension in beams, bond, anchorage and development length, design and detailing of one-way solid and ribbed slabs, design of short columns, serviceability, ACI Code provisions for control of cracks and deflections. Pre; CE 322 ; CE 371, CE 431.

CE 434: Steel Design (3Cr. Hr.)

Introduction to steel as a structural material, Design methods, Introduction to Load and Resistance Factor Design (LRFD) method, Design strength of tension members, Design strength of compression members, Effective length of compression members using elastic and inelastic stiffness methods, Design of beams bent about major axis, Beams subject to double moment, Beams subject to shear and deflection, Members subject to combined axial force and bending moments, Bolted and welded connections. Pre: CE 371; CE 431.

CE 442: Pavement Materials and Design (3Cr. Hr.)

Pavement types and definitions, soil classification for highway purposes, bituminous material types and tests, uses of asphalt in highways, design of bituminous mixtures by Marshall Procedure. Analysis of rigid and flexible highway pavement stresses (one layer system), Pavement layers, calculations of equivalent single axle load, design of rigid and flexible highway pavement by AASHTO procedure. Pre: CE 345.

CE 443: Highways Geometric Design (3Cr. Hr.)

Route selection process, Highway design elements. Horizontal alignment (simple circular, reverse, compound and spiral curves, Super-elevation and transition curves, Vertical alignment (design and setting of vertical curves), Sight distances, Widening of horizontal curves, Coordination of vertical and horizontal alignment, Design of intersections, Types of interchanges. Highway drainage. Pre: CE301 (Pass); CE 341.

CE 444: Highway Laboratory (1Cr. 3Hr.)

Tests on mineral aggregates, sieve analysis, specific gravity, CBR and absorption, Tests on asphalt viscosity, penetration, flash point, ductility, specific gravity, softening point. Tests on asphalt paving mixtures using Marshal test, Skid Resistance, and Extraction Test, Students present the report of one experiment using data show, Students present the report of one experiment using data show. Pre/Cor: CE 442

CE 452 Environmental Engineering I (3Cr. Hr.)

Introduction to environmental and ecological systems, Environmental chemistry and microbiology, Water quality parameters and standards, Population estimation, Material balance and reactor Engineering, Water treatment units and design (Physiochemical and advanced technology), Air pollution, Noise pollution, Introduction to Environmental Impact Assessment. Pre. CE 352.

CE 453: Environnemental Engineering Lab. (1Cr. 3Hr.)

Water and Wastewater Analysis including, solids determination, spectrophotometry and Beers' law, pH, turbidity, alkalinity, acidity, hardness, acid-base titration, biological and chemical oxygen demands, bacterial counts in water, coliform tests, Heavy metals determination and trace contaminants. Pre/Cor: CE452.

CE 462 Geotechnical Engineering (3Cr. Hr.)

Composition and structure of soils, Phase relations and index properties, soil classification, soil compaction, principle of effective stress, stresses due to self-weight, stresses due to applied loads, soil permeability, seepage: one and two dimensional, flow net, consolidation theory and consolidation settlement analysis, secondary compression, shear strength of soils (introductory). Pre: CE 202 (Pass); CE211.

CE 463 Geotechnical Engineering Lab (1Cr. 3Hr.)

Specific gravity test, Dry screening using sieve analysis, wet analysis (Hydrometer test), water content, Atterberg Limits: Liquid limit, Plastic limit, and Shrinkage limit, standard and Modified Proctor compaction tests, in situ field test, Permeability test (constant and falling head tests), Triaxial shear test, unconfined compression test, direct shear test. Students present the report of one experiment using data show. Pre/Cor. 462.

CE 464: Foundation Engineering (3Cr. Hr.)

Review of basic soil mechanics, types of shallow foundations, bearing capacity of foundations: equations and correlations, settlement, geometric design of isolated footings, special types of footings, rectangular combined and strap footings and mat foundations, lateral earth pressure and retaining walls, introduction to deep foundations. Pre: CE 462 (Pass); CE 463 (Pass); CE 432.

CE 472: Contracts, Specifications and Quantity Surveying (3Cr. Hr.)

Legal aspects of engineering public works, general and special conditions, Settlement of disputes, Professional ethics, Specifications of construction materials according to different standards, Technical writing, Quantity surveying for civil engineering works, Professional Ethics. Pre: CE 341; CE 432.

CE 490: Engineering Training (3Cr. 8 Weeks)

Practical training in a Civil Engineering Project or any other places approved by the department, and according to the regulations drafted by the college of Engineering Training Committee. After Completing 117C(Pass).

CE 503: Geographic Information Systems (GIS) (2Cr. Hr.)

Fundamentals of GIS. GIS data acquisition, entry, structure and processing, Database management and analysis, Maps, projections and transformations, Project management and planning, Remote Sensing, Emphasis on product generation. Pre/ CE 341.

CE 504: Dam Engineering (3Cr. Hr.)

Different types of dams, choice dam according to sight location, type of forces acting on dams, design and construction of different types of dams: gravity dams, arch dams, buttress dams, hollow dams, earth and rock-fill dams, cofferdams, weirs, spillways dam tunnels and gates, quality of water retained by dams, environmental impact of dams construction.

Pre: CE 352, CE432, CE 464.

CE 505: Geographic Information Systems Lab (GIS) (1Cr. 3Hr.)

Applications on GIS software relevant to the theory presented in CE503. Cor (compulsory): CE 503.

CE 521: Advance Cementitious Materials (3Cr. Hr.)

Physical, mechanical, and chemical properties and durability of different types of cementitious composites, high strength concrete (HSC), lightweight concrete (LWC), self-compacting concrete (SCC), roller-compacted concrete (RCC), fiber reinforced concrete, ferrocement, high performance grouts and Nano-concrete. Pre: CE 322.

CE 531: Reinforced Concrete 2 (3Cr. Hr.)

Review of design basis of ultimate strength design method, modes of failure, design and detailing of statically indeterminate continuous beams, design of slender columns, design and detailing of rigid frames, design and detailing of two way solid and ribbed slabs, design for torsion, design and detailing of reinforced concrete wall footings, single column footings, and combined footings, design of reinforced concrete stairs, working stress method. Pre: CE 432(Pass).

CE 532: Prestressed Concrete (3Cr. Hr.)

Basic principles, short- and long-term properties of constituent materials, partial prestressing. Flexural behavior, analysis and design of prestressed concrete beams, classes, cracking, pretensioning, post-tensioning, service load design, load balancing, strength design, strain limits, flexural efficiency, Bond, transfer and development lengths, anchorage zone design, Shear and diagonal tension, Evaluation of immediate and long-term losses, Composite construction and design, shear-friction theory, Deflection calculation using approximate single time step approach. Pre: CE 432.

CE 533: Earthquake Engineering (3Cr. Hr.)

Nature and causes of earthquakes, earthquake magnitude and intensity, seismic waves, earthquake damage, Seismic response analysis of simple structures: structural dynamics of simple systems subject to harmonic, impulse and/or arbitrary loading. Elastic response spectra, design spectrum. Equivalent static force procedure, response spectrum analysis procedure, earthquake design criteria, Basic principles of conceptual design for earthquake-resistant RC Buildings, configurations and structural systems. Introduction to seismic codes: International and local, Application of capacity design principles to frame structures. Pre: CE301,CE 531.

CE 534: Introduction to Finite Element (3Cr. Hr.)

Review of matrix terminology and operations, Introduction to the Stiffness (Displacement Method) for spring element, plane and space- truss equations (2D and 3D), and beam and frame elements, Development of grid equations and applications to grid structures, Formulation of displacement functions, rigid body motion and boundary conditions, Potential energy approach, Computer applications considering practical projects of space-truss and frame structures. Pre: CE431.

CE 535: Computer-aided analysis and design of CE Structures (2Cr. Hr.)

Analysis and design of civil engineering structural systems through the use of computers, Emphasis will be placed on available computer software used in industry. Pre:CE 434, CE531.

CE 536: Bridge Engineering and Design (3Cr. Hr.)

Types of bridges, loads on bridges, analysis and design of reinforced concrete slab and girder type bridges, precast pre-stressed concrete bridge, metallic bridges, Substructure design, Construction details. Pre: CE 531,CE434.

CE 537: Computer-aided analysis and design of CE Structures Lab (1Cr. Hr.)

Applications on different software covering topics in structures, transportation, water and environmental, and geotechnical engineering. Compulsory Cor :CE535

CE 541: Traffic Engineering (3Cr. Hr.)

Traffic flow theory, Volume, speed, delay, parking and safety studies, Traffic control devices, Capacity analysis of signalized and unsignalized intersections, Capacity analysis of two-lane highways, multi-lane highways, and freeways. Pre/Cor: CE 443.

CE 542: Photogrammetry and Geodesy (3Cr. Hr.)

Introduction to photogrammetry, optics, photographs, cameras, imaging systems and adjustment of observations, Photographic measurements, Stereocopy, parallax, 3-D information and orientation, Terrestrial and close-range Photogrammetry, Analogue, analytical and digital Photogrammetry, Introduction to remote sensing, computer vision, geodesy principles, point positioning and GPS. Pre: CE 341, CE 304.

CE 544: Transportation Planning (3Cr. Hr.)

Introduction to transportation planning, fundamentals of traffic planning, trip generation, trip distribution, mode choice, and traffic assignment techniques. Intelligent transportation systems, transportation demand forecasts, traffic impact studies, transportation system evaluation, Transportation planning issues (energy, environment, & social factors), highway planning, mass transit planning, Traffic congestion and new technologies in transportation. Pre: CE 345, CE 443.

CE 546: Highway Maintenance (3Cr. Hr.)

Maintenance management concepts and components, Structural and functional failures, flexible and rigid pavement distresses, pavement surface condition survey and rating procedures, maintenance and repair alternatives, assessments of maintenance needs, selection of proper maintenance alternatives, repair of different pavement distresses. Computer applications in maintenance management systems. Pre: CE 442.

CE 547 Airport Engineering (3Cr. Hr.)

Air transport demand, selection of airport site and runway orientation, design and drawing of wind rose, airport passenger terminal area, airport capacity analysis, Geometric design of runways and taxiways, design of flexible and rigid pavements. Pre: CE442.

CE 548 Railway Engineering (3Cr. Hr.)

Train dynamics, determination of maximum speed, ruling gradient, braking and stopping distance, railway track design, track alignment design, track junctions design, passenger stations and freight stations. Pre: CE442.

CE 557 Environmental Engineering II (3Cr. Hr.)

Wastewater quality, standards and regulations, Wastewater treatment operations and units, Wastewater microbiology and Bio-kinetics, Wastewater collection system design, Design of wastewater treatment units (physical, chemical and biological: Activated Sludge, Trickling filters, Stabilization ponds), Wastewater reuse, Solid waste management, Hazardous waste management, Sludge management, Environmental Systems Auditing. Pre: CE 452(Pass).

CE 552: Water Ressources (3Cr. Hr.)

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, Water conservation techniques, Linear programming and its applications in water resources. Pre: CE 352.

CE 553 Groundwater Management (3Cr. Hr.)

Definition and occurrence, groundwater and the hydrologic cycle, Darcy's law, groundwater flow equations, analytic solutions, type curves, superposition, aquifer evaluation: pump test, slug test, salt water intrusion, delayed yield, basics of numerical modeling, groundwater contamination, transport processes, one dimensional transport equation and available solutions, and groundwater remediation. Pre: CE 352.

CE 554 Engineering Hydrology (3Cr. Hr.)

Introduction to Hydrology, Watershed Characteristics, Precipitation, Infiltration, Evapotranpiration, Hydrograph Analysis and Synthesis, Peak Discharge Estimation, Hydrologic Design Methods, Reservoir Routing, Channel Routing, Statistical Methods in Hydrology. Pre: CE 352.

CE 559 Solid and Hazardous Waste Management (3Cr. Hr.)

Function elements of solid waste management processes, Traditional versus integrated options for solid waste management, Physical and chemical characteristics of solid waste, Hazardous waste regulatory aspects, Characterization of hazardous waste, Treatment and disposal options of hazardous waste. Risk assessment and risk management. Pre: CE 557

CE 565 Applied Geotechnical Engineering (3Cr. Hr.)

Application of soil mechanics to earth pressures and retaining structures, pressures and bases for design of bracing of open cuts, anchored bulkheads, cofferdams, tunnels, and culverts, strength of intact rock, strength of rock joints, foundation in rock, Stability of slopes in soil and rock, Stability of earth and rockfill dams,Computer programs. Pre: CE 464.

CE 566 Soil Stabilization (3Cr. Hr.)

General Review of basic soil mechanics,Physical and chemical properties of soil, Types of major problematic soils and properties, Expansive soils, collapsible soils and dispersive soils, General constriction problems in soils with emphasis on bearing capacity,

Settlement and expansion, Methods of soil stabilization: compaction, Preloading densification using vibratory equipment, Soils cement soil lime, Soil bitumen, chemical and thermal stabilization, Grouting and soil injection, Use geo-textile to improve soil in reinforced earth walls, embankment & steep slopes. Pre: CE 464.

CE 567 Geotechnical Aspects of Dam Engineering Problems (3Cr. Hr.)

Regional geosciences investigations, Siesmotectonic investigation. Related subsurface exploration programs: Standard penetration test, vane shear test, dutch cone test. Pressure meter test, geophysical exploration and interpretation of results. observation of ground water. determination of permeability in the field, Fundamentals of problems of slope stability, Seepage in composite sections and anisotropic materials. Methods of stability analysis, Mechanisms of failure of natural and artificial slopes, Compaction, design of dam foundations, Foundation treatment, Grouting in the ground, Earthquake response analysis of earth and rock-fill dams, Liquefaction problems, Special consideration: sinkholes, foundation defects, and land subsidence, Inspection and field observations, Operation and maintenance, Monitoring (Instrumentation), remedial measures, Case studies, Lectures supplemented by interactive computer aided design projects. Pre: CE 464.

CE 568 Subsurface exploration (3Cr. Hr.)

Geophysical and geological exploration, seismic, gravimetric, magnetic & electrical surveys. elementary wave propagation, theories, application of borehole data to exploration problems, identification of geological environments from well logs, In situ elastic coefficients, Prerequisite. Pre: CE 464.

CE 570: Engineering Project and Construction Management (3Cr. Hr.)

Duties and responsibilities of project managers, Organization and management of engineering projects, Network presentation and calculations, Role of networks and bar-charts in project planning, monitoring and control, Resource leveling and allocation. Selection of equipment and formalization with standard construction method, Cost of owning and operating equipment. Productivity and production cost calculations. Pre: CE 303 (Pass); CE 371; CE 472 (Pass).

CE 581: Special Topics in Structural Engineering (3Cr. Hr.)

CE 582: Special Topics in Transportation Engineering (3Cr. Hr.)

CE 583: Special Topics in W/E Engineering (3Cr. Hr.)

CE 584: Special Topics in Geotechnical Engineering (3Cr. Hr.)

These courses cover special advanced topics in one of the areas of Civil Engineering. The contents vary depending on the topic.

Pre: 5th Year Standing and Department Approval (Depends on the topic)

CE 591: Graduation Project I (1Cr.)

Directed readings in the literature of civil engineering, Introduction to research methods, seminar discussions dealing with special engineering topics of current interest. It is the first phase of the entire project. The mechanism of offering the course is decided by the Civil Engineering Department Council after Students *Complete 120 Credit Hours.*

CE 592:Graduation Project II (3Cr.)

Planning, design, construction and management of a civil engineering project. As defined and outlined in the first phase, writing a technical report, Preparation of technical engineering drawings. Pre: CE 591(Pass).