Ministry of Higher Education & Scientific Reserch
University Of Anbar
College of Engineering
Civil Engineering Department

Curriculum

For

Civil Engineering Department

2021-2022

Course description

Courses are coded as follows:
1. Course code and number
2. Course title
3. Parenthesized numerals, e.g., (4-3-1-3), indicate, in order, the credit hours, the classroom hours (1 hour = 1 credit hour), tutorial hours (credit hour = 0), and the laboratory hours (2 hours = 1 credit hour).

Prerequisites, if any, are indicated at the course description. These have been established to assure an adequate and uniform background for students in advanced classes. Occasionally, students may feel they already have the appropriate background for an advanced course because of previous training, transfer credits, or credit by examination.

Course Numbering System

Course code = CE

The number consists from 4 digits as following:-
1000- First year
2000- Second year
3000- Third year
4000- Fourth year level
100- University Requirements
200- College Requirements
300- Department requirements
Numbers from 01, 02, 03, …….etc. describes the sequence of the course for each level in each requirements

Graduation Requirements

Requirements	Credit hours
University Requirements	**14**
College Requirements	**44**
Department Requirements inc. Elective Classes	**91**
total	**149**

University Requirements: 14 Credit Hours

Course NO.	Course Title	Credit hours	Weekly hours
CE1101	**English Language 1**	**2**	**2**
CE1102	**Arabic language**	**2**	**2**
CE1103	**Human Rights**	**1**	**1**
CE1104	**Democracy**	**1**	**1**
CE2101	**English Language 2**	**2**	**2**
CE3101	**English Language 3**	**2**	**2**
CE4101	**English Language 4**	**2**	**2**
CE4102	**Management and Leadership skills**	**2**	**2**
	Total	**14**	**14**

College Requirements: 44 Credit Hours

Course No.	Course Title	Credit hours	Weekly hours		
			Lec	Tut	Lab
CE1201	Calculus 1	3	3	1	-
CE1202	Calculus 2	3	3	1	-
CE1203	Physics	4	3	-	2
CE1204	Chemistry	4	3	-	2
CE1205	Fundamentals of Electrical Engineering	3	2	1	2
CE1206	Computer science	3	2	1	2
CE1207	Engineering Drawing	3	2	2	2
CE1208	Engineering Mechanics (Statics)	3	3	1	-
CE2201	Calculus 3	3	3	1	-
CE2202	Calculus 4	3	3	1	-
CE3201	Engineering statistics	3	3	-	-
CE3202	Engineering Numerical Methods	3	2	1	2
CE4201	Final Year Project 1	3	2	1	2
CE4202	Final Year Project 2	3	2	1	2
	Total	44	36	12	16

Department Requirements: 91 Credit Hours

Course NO.	Course Title	Credit Hours	Weekly hours		
			Lec.	Tut	Lab
CE1301	Applied Physics	3	3	-	-
CE1302	Construction Materials	3	2	1	2
CE2301	Concrete properties	4	3	1	2
CE2302	Building Contraction	3	2	1	2
CE2303	Engineering Geology	3	3	-	-
CE2304	Fluid Mechanics	3	2	1	2
CE2305	Dynamics	3	3	1	-
CE2306	Strength of Materials 1	3	3	1	-
CE2307	Strength of Materials 2	3	2	1	2
CE2308	Engineering Surveying 1	3	2	1	2
CE2309	Engineering Surveying 2	3	2	1	2
CE3301	Structure 1	3	3	1	-
CE3302	Structure 2	3	3	1	-
CE3303	Reinforced Concrete Design 1	3	3	1	-
CE3304	Reinforced Concrete Design 2	3	3	1	-
CE3305	Construction Management	3	3	-	-
CE3306	Engineering Economy	3	3	-	-
CE3307	Soil Mechanics 1	3	2	1	2
CE3308	Soil Mechanics 2	3	2	1	2
CE3309	Hydrology	3	3	1	-
CE3310	Traffic Engineering	3	3	1	-
CE4301	Hydraulic Structures	3	3	-	-
CE4302	Foundation Engineering 1	3	3	1	-
CE4303	Highway Engineering	3	2	2	2
CE4304	Sanitary and Environmental Engineering	4	3	1	2
CE4305	Method of construction and Estimation	3	3	1	-
CE4306	Steel Structure	3	3	1	-
CE4307	Computer Application in civil Engineering (CE Elective 1)	2	1	1	2
	CE Elective 2	2	2	2	-
	CE Elective 3	2	2	2	-
	CE Elective 4	2	2	2	-
	Total	91	79	30	24

CE Elective Classes: 12 Credit Hours

- Major electives courses are offered occasionally to meet specific demands of society and students.
- Subject to availability, four courses (8 credits) can be selected from the following list by the department:

Group	Course No.	Course Title	cr. Hrs.	Weekly hours		
				Lec.	Tut.	Lab
Group A (Structure Analysis& Design)	CE4307	Computer Application in Civil Engineering	2	1	1	2
	CE4308	Reinforced Concrete Design 3	2	2	2	-
	CE4309	Foundation Engineering 2	2	2	2	-
	CE4310	Design prestressed Structures	2	2	2	-
Group B (Geotechnical Eng.)	CE4307	Computer Application in Civil Engineering	2	1	1	2
	CE4309	Foundation Engineering 2	2	2	2	-
	CE4311	Earth Retaining Structures	2	2	2	-
	CE4312	Selected Topics in Geotechnical Engineering	2	2	2	-
Group C (Hydraulics &Environmental ENG)	CE4307	Computer Application in Civil Engineering	2	1	1	2
	CE4313	Environmental Impact Assessment	2	2	2	-
	CE4314	Hydraulic Application in Environmental Engineering	2	2	2	-
	CE4315	Water Quality Modeling and Control	2	2	2	-
Group D (Transportation Eng.)	CE4307	Computer Application in Civil Engineering	2	1	1	2
	CE4316	Pavement Design	2	2	2	-
	CE4317	Highway Materials	2	2	2	-
	CE4318	Transportation Planning	2	2	2	-
Group E (Construction Management)	CE4307	Computer Application in Civil Engineering	2	1	1	2
	CE4319	Project Management	2	2	2	-
	CE4320	Operation Research	2	2	2	-
	CE4321	Quality Management	2	2	2	-
		Total	40	35	35	10

Recommended Civil Engineering Department course plan by semester

First Year					
Semester I					
Category	**Subject**	**Hours**			**Units**
		Theoretical	**Tutorial**	**Practical**	
College requirement	Calculus 1	3	1	-	3
College requirement	Physics	3	-	2	4
College requirement	Chemistry	3	-	2	4
College requirement	Fundamentals of Electrical Engineering	2	1	2	3
College requirement	Computer Science	2	1	2	3
University requirement	English Language I	2	-	-	2
University requirement	Human Rights	1	-	-	1
Total Hours and Units		16	3	8	20

Semester II					
Category	**Subject**	**Hours**			**Units**
		Theoretical	**Tutorial**	**Practical**	
College requirement	Calculus 2	3	1	-	3
Department requirement	Applied Physics	3	-	-	3
College requirement	Engineering Mechanics (Static)	3	1	-	3
Department requirement	Construction Materials	2	1	2	3
College requirement	Engineering Drawing	2	2	2	3
University requirement	Arabic Language	2	-	-	2
University requirement	Democracy	1	-	-	1
Total Hours and Units		17	4	4	18

Second Year					
Semester I					
Category	**Subject**	**Hours**			**Units**
		Theoretical	**Tutorial**	**Practical**	
College requirement	Calculus III	3	1	-	3
Department requirement	Engineering Surveying 1	2	1	2	3
Department requirement	Strength of Materials 1	3	1	-	3
Department requirement	Concrete Properties	3	1	2	4
Department requirement	Dynamics	3	1	-	3
University requirement	English Language II	2	-	-	2
Total Hours and Units		16	5	4	18
Semester II					
Category	**Subject**	**Hours**			**Units**
		Theoretical	**Tutorial**	**Practical**	
College requirement	Calculus IV	3	1	-	3
Department requirement	Engineering Surveying 2	2	1	2	3
Department requirement	Strength of Materials 2	2	1	2	3
Department requirement	Building Construction	2	1	2	3
Department requirement	Engineering Geology	3	-	-	3
Department requirement	Fluid Mechanics	2	1	2	3
Total Hours and Units		14	5	8	18

Third Year					
Semester I					
Category	**Subject**	**Hours**			**Units**
		Theoretical	**Tutorial**	**Practical**	
Department requirement	Structure 1	3	1	-	3
Department requirement	Reinforced concrete 1	3	1	-	3
Department requirement	Construction Management	3	-	-	3
Department requirement	Soil Mechanics 1	2	1	2	3
Department requirement	Hydrology	3	1	-	3
College requirement	Engineering Statistics	3	-	-	3
University requirement	English Language III	2	-	-	2
Total Hours and Units		19	4	2	20
Semester II					
Category	**Subject**	**Hours**			**Units**
		Theoretical	**Tutorial**	**Practical**	
Department requirement	Structure 2	3	1	-	3
Department requirement	Reinforced concrete 2	3	1	-	3
Department requirement	Engineering economy	3	-	-	3
Department requirement	Soil Mechanics 2	2	1	2	3
College requirement	Engineering Numerical methods	2	1	2	3
Department requirement	Traffic Engineering	3	1	-	3
Total Hours and Units		16	5	4	18

Fourth Year					
Semester I					
Category	**Subject**	**Hours**			**Units**
		Theoretical	**Tutorial**	**Practical**	
Department requirement	**Hydraulic Structures**	**3**	**-**	**-**	**3**
Department requirement	**Foundation Engineering 1**	**3**	**1**	**-**	**3**
Department requirement	**Highway Engineering**	**2**	**2**	**2**	**3**
Department requirement	**Computer Applications in Civil Engineering (Course Elective 1)**	**1**	**-**	**2**	**2**
Department requirement	**Course Elective 2**	**2**	**1**	**-**	**2**
College requirement	**Final Year Project I**	**2**	**1**	**2**	**3**
University requirement	**English Language IV**	**2**	**-**	**-**	**2**
Total Hours and Units		**15**	**5**	**6**	**18**
Semester II					
Category	**Subject**	**Hours**			**Units**
		Theoretical	**Tutorial**	**Practical**	
Department requirement	**Sanitary and Environmental Engineering**	**3**	**1**	**2**	**4**
Department requirement	**Methods of Construction and Estimation**	**3**	**1**	**-**	**3**
Department requirement	**Steel Structures**	**3**	**1**	**-**	**3**
Department requirement	**Course Elective 3**	**2**	**2**	**-**	**2**
Department requirement	**Course Elective 4**	**2**	**2**	**-**	**2**
College requirement	**Final Year Project II**	**2**	**1**	**2**	**3**
University requirement	**Ethics and Leadership Skills**	**2**	**-**	**-**	**2**
Total Hours and Units		**17**	**8**	**4**	**19**

English Language 1 (2-2-0-0)

Designation as a 'required' or 'elective' course:

This is a required course for the Civil Engineering Program.

Course Description:

This course is designed to enable academic writing course which provides an opportunity for the students to learn and practice the skills needed for handling topics related to the field of study. The course emphasizes the development of academic writing skills as well as the ability to read and think critically. Students will learn to use the library and appropriate online resources to find and evaluate sources to inform, develop and support their ideas in term paper writing. They will also learn skills for reading analysis, such as comprehension and inference.

Recommended Textbook(s):

John & Liz Soars, "New Headway Plus- Beginner Student's Book", 10th ed 2014

Prerequisites:

None

1.	• Am/ are/ is, my/ your • How are you? • What's this in English? • Plurals	• This is ……. • Good morning! • Numbers 1-10
2.	• Countries • Where's he from? • Numbers 11-30	• He/ she/ they, his/ her • Fantastic/ awful/ beautiful
3.	• Jobs • Negatives and questions • Social expressions-1	• Am/are/is • Personal information
4.	• Our/ their • The family • The alphabet	• Possessive's • Has/ have
5.	• Sports/ food/ drinks • a/ an • Numbers and prices	• Present simple- I/ you/ we/ they • languages and nationalities
6.	• The time • Always/ sometimes/ never • Days of the week	• Present simple- he/ she • Words that go together
7.	• Question words • This/ that • Can I ….?	• Me/ him/ us/ them • adjectives
8.	• Rooms and furniture • Prepositions	• There is/ are • Directions
9.	• Saying years • Past simple- irregular	• As/ were born • Have/ do/ go

	verbs • When's your birthday?	
10.	• Past simple- regular and irregular	• Questions and negatives
	• Sport and leisure	• Going sightseeing
11.	• Can/ can't	• Adverbs
	• Adjective+ noun	• Everyday problems
12.	• I'd like- some/ any	• In a restaurant
	• Signs all around	

Program and Course Outcomes :
By the end of successful completion of this course, the student will be able to:

1. Develop academic writing proficiency and critical thinking skills
2. Students are able to conduct effective searches of printed and electronic resources
3. Students can use external sources to support ideas in an academic writing in electrical
4. engineering
5. Students can identify and explain the academic integrity (how to avoid plagiarism)
6. Students are familiar with the citation methods like the APA style
7. Students can participate in a classroom community that involves constructive exchange of ideas

CE1102 Arabic Language (2-2-0-0)

Designation as a 'required' or 'elective' course:

This is a required course for the Civil Engineering Program.

Course Description:

This course aims at building students' familiarity with and competence in Arabic literature in its various genres so as to increase their ability to appreciate literature and to develop their awareness of its concepts through the study of poetry, novel and the short story.

Recommended Textbook(s):

By Topic

Prerequisites:

None

Course Topics:

Study the text of the Quran and analysis, In the language and spelling and rules, the rules of writing the hamza, Written verbatim by Arab and Za - Rules of number and numerical adjective, punctuation, the method of detection for words in Arabic Dictionaries, In the applications of grammar and language- the actor and his deputy, Debutante and the news Acts missing, Equated with the letters already Byproducts, The case and exception, Ancient literary studies, Definition of literature and its importance, Ages historical Arabic literature – Modern Literary Studies, Study the texts of poetic eras (pre-Islamic, Islamic, Umayyad, Abbasid, Andalusia), Study of ancient prose texts (speeches, messages), examine the texts of modern poetry and contemporary, examine the
texts of modern prose (drama, novel, article)

Program and Course Outcomes:

1. Develop academic essay writing proficiency
2. Promote reading skills
3. Expand academic vocabulary through reading
4. Promote critical thinking skills

CE1103 Human Rights (1-1-0-0)

Designation as a 'required' or 'elective' course:

This is a required course for the Civil Engineering Program.

Course Description:

This course is designed to give the student the definition of freedom and the right language and idiomatically and legitimacy of the user, Origin of the right in the eyes of Islamic law, Elements of the right and types of, Personal freedom, Intellectual freedom, Rights and economic freedoms, Islam and Slavery, Human rights objectives, The use of freedom and the right general project, The right of a Muslim to his Muslim brother, Parental rights, Right neighbor, The right of women, Human rights in the heavenly religions, Religious tolerance in Islam.

Recommended Textbook(s):

By Topics

Prerequisites:

None

Course Topics:

1. The definition of freedom and the right
2. Origin of the right in the eyes of Islamic law
3. Elements and Types of the Human right
4. Rights and economic freedoms
5. Islam and Slavery
6. Human rights objectives
7. The use of freedom and the right general project
8. The right of a Muslim

Program and Course Outcomes:

1. Evaluate Human rights
2. Preservation of human rights in Islam
3. Evaluation of relationship between human rights and democracy

CE1104 Democracy (1-1-0-0)

Designation as a 'required' or 'elective' course:

This is a required course for the Civil Engineering Program.

Course Description:

This course is designed to give the student the definition of freedom democracy, the concept of democracy, history of democracy, the properties of democracy, traditional Greek democracy, its principles, modern democracy, and pressure groups.

Recommended Textbook(s):

By Topics

Prerequisites:

CE1103 Human Rights

Course Topics:

1. The concept of democracy
2. History of democracy
3. The properties and principle of democracy
4. Traditional Greek democracy and modern democracy
5. The relationship between human rights and democracy
6. Pressure groups

Program and Course Outcomes:

1. Learn what democracy?
2. Democratic approach in Islam and its applications
3. Accepts differing views
4. Evaluation of pressure groups

CE2101 English Language 2 (2-2-0-0)

Designation as a 'required' or 'elective' course:

This is a required course for the Civil Engineering Program.

Course Description:

This course is designed to enable the students to achieve academic oral and written communication to the standard required at university level. The course integrates all the language skills with emphasis on writing, and it stimulates students' imagination, and promotes personal expression. Students, in this course, are trained to apply critical thinking skills to a wide range of challenging subjects from diverse scientific topics. Course activities include writing various types of academic essays, acquiring advanced academic vocabulary, and getting involved in group discussions and debates. In addition, the course also includes other skills to consolidate the main skills, such as
further readings in civil engineering.

Recommended Textbook(s):

John & Liz Soars, "New Headway Plus- Beginner Student's Book", 10th ed 2014

Prerequisites:

CE1101 English Language 1

Course Topics:

1	- Tenses	- Question forms
	- Vocabulary (Jobs)	- Writing (informal letter)
2	- Present simple	- Have/have to
	- Present continuous	- Writing (Linking words +Describing a person)
3	- Past simple	- Have + noun
	- Past continuous	- Writing (a story 1)
4	- Count and uncount nouns	- Articles
	- Expression of quantity	- Vocabulary (clothes)
		- Writing (filling in forms)
5	- Verb patterns	- Will and going to
	- Would like and like	- Writing (postcard)
6	- What … like?	- Vocabulary (adjective formation)
	- Comparative and superlatives	- Writing (relative closes)
8	- Present perfect	- Vocabulary (men and women)
	- Tense revision	- Writing (a biography)
9	- have to & got to	- Vocabulary (job description)
	- have to & should & must	- Writing (formal letter)
10	- Present simple or will	- Time clauses
	- Conditional clauses	- Writing (discussing ideas)
11	- Verb patterns	- Infinitives
	- Used to	- Writing (formal letters)
12	- The passive form	- Vocabulary (words with more than one meaning)
	- Active and passive	- Writing (email)
13	- Second conditional	- Vocabulary (phrasal verbs)

- Might - Writing (a story 2)

Program and Course Outcomes:

1. Develop academic essay writing proficiency
2. Promote reading skills
3. Expand academic vocabulary through reading
4. Promote speaking ability through group discussions and debates
5. Promote critical thinking skills

CE3101 English Language 3 (2-2-0-0)

Designation as a 'required' or 'elective' course:

This is a required course for the Civil Engineering Program.

Course Description:

This course introduces students to writing as a conscious and developmental activity. Students learn to read, think, and write in response to a variety of texts, to integrate their ideas with those of others, and to treat writing as recursive process. Through this work with texts, students are exposed to a range of reading and writing techniques they can employ in other courses and are introduced to fundamental skills of information literacy. Students work individually and collaboratively, participate in peer review, and learn to take more responsibility for their writing development. Grammar, reading, vocabulary and writing sections are always combined with speaking and listening activities to encourage genuine communication using target language .

Recommended Textbook(s):

John & Liz Soars, "New Headway Plus- Beginner Student's Book", 10th ed 2014

Prerequisites:

CE1101 English Language 2

Course Topics:

1.
   - Auxiliary verbs
   - Grammar revision
   - Vocabulary
   - Pronunciation
   - Prepositions
   - **Writing** (Correcting mistakes 1)
   - **Reading** (Wonders of the modern world)
   - **Listening and speaking** (My wonders)
2.
   - Present simple
   - Pronunciation revision
   - Present states and actions
   - Vocabulary
   - Phrasal verbs
   - **Reading and speaking** (I'm a clown doctor!)
   - **Writing** (Letters and emails)
3.
   - Past simple and past continuous
   - Grammar revision
   - Past perfect
   - Past passive
   - Vocabulary
   - Prepositions revision
   - **Listening and writing** (Books and films)

- **Writing** (Narrative 1)
- **Everyday English** (Giving opinions)

4.
- Have to /don't have to
- Can and be allowed to
- Should
- Must and have to
- Vocabulary
- Pronunciation
- **Listening and speaking** (Come round to my place!)
- **Writing** (For and against)

5.
- Future form 1
- Future form 2
- Grammar revision
- Vocabulary
- Pronunciation
- Prepositions revision
- **Reading and speaking** (Hotels with a difference)
- **Writing** (Making a reservation)

6.
- Like
- Grammar review
- Verb patterns
- Vocabulary
- Pronunciation
- Phrasal verbs
- **Listening and speaking** (New York and London)
- **Everyday English** (Signs and sounds)
- **Writing** (A description 1)

7.
- Present perfect
- Tense review
- Present perfect passive
- Vocabulary
- Pronunciation
- Prepositions
- **Reading and speaking** (Dream jobs)
- **Listening and speaking** (The busy life of a retired man)
- **Writing** (A letter of application)

8.
- Conditionals 1 and time clauses
- Conditionals 2
- Vocabulary
- Pronunciation
- Phrasal verbs
- **Reading and speaking** (Who wants to be a millionaire)
- **Everyday English** (Making suggestions)
- **Writing** (Narrative 2)

9.
- Modal verbs of probability in the present
- Modal verbs of probability in the past
- Vocabulary
- Pronunciation
- Prepositions
- **Listening and speaking** (Brothers and sisters)
- **Writing** (A description 2)

10
- Present perfect continuous
- Simple and continuous revision
- Time expressions
- Vocabulary
- Pronunciation
- Prepositions
- **Reading and speaking** (A big name in Hollywood)
- **Listening and speaking** (Collectors)
- **Writing** (Writing a biography)

11
- Indirect questions
- Grammar revision
- Question tags
- Vocabulary and pronunciation
- Phrasal verbs
- **Listening and speaking** (The forgetful generation)
- **Writing** (Words that joint ideas)
- **Everyday English** (Informal English)

12
- Reported statements and questions
- Reported commands
- Vocabulary
- Pronunciation
- Phrasal verbs
- Revision
- **Reading and speaking** (A death)
- **Listening and speaking** (My way)
- **Writing** (Correcting mistakes 2)

Program and Course Outcomes:

1. Develop academic essay writing proficiency
2. Promote reading skills
3. Expand academic vocabulary through reading
4. Promote speaking ability through group discussions and debates
5. Promote critical thinking skills

CE4101 English Language 4-(2-2-0-0)

Designation as a 'required' or 'elective' course:

This is a required course for the Civil Engineering Program.

Course Description:

This course is designed to enable the students to achieve academic oral and written communication to the standard required at university level. The course integrates all the language skills with emphasis on writing, and it stimulates students' imagination, and promotes personal expression. Students, in this course, are trained to apply critical thinking skills to a wide range of challenging subjects from diverse scientific topics. Course activities include writing various types of academic essays, acquiring advanced academic vocabulary, and getting involved in group discussions and debates. In addition, the course also includes other skills to consolidate the main skills, such as further readings in civil engineering.

Recommended Textbook(s):

John & Liz Soars, "New Headway Plus- Beginner Student's Book", 10th ed 2014

Prerequisites:

CE1101 English Language 3

Course Topics:

1.
- **Grammar** (The tense system and spoken English)
- **Vocabulary** (Compound of words lifestyle, home town, house-proud)
- **Reading** (A home from home-two people describe their experiences of living abroad)
- **Listening** ('things I miss from home')
- **Speaking** (Exchanging information about people who live abroad)
- **Everyday English** (Social expressions)
- **Writing** (Applying for a job)

2.
- **Grammar** (Present perfect, simple and continuous, and spoken English)
- **Vocabulary** (Hot verbs, make, do make way, do damage)
- **Reading** ('Paradise Lost'- how tourism is destroying the object of its affection)
- **Listening** (An interview Tashi Wheeler about her travels as child with parents)
- **Speaking** (Information Gap)
- **Everyday English** (Exclamations)
- **Writing** (Informal letters and correcting mistakes)

3.
- **Grammar** (Narrative tenses, past simple, Conts, and Perfect)
- **Vocabulary** (books and films)
- **Reading** (Jane Austen-one of the world's most downloaded authors)
- **Listening** (The money jigsaw-a news item from BBC's radio)
- **Speaking** (Retelling a news story, responding to a news)
- **Everyday English** (Showing interest and surprise)
- **Writing** (Narrative writing 1)

4.
- **Grammar** (questions and negatives and spoken English)
- **Vocabulary** (Prefixes and Antonyms in context)
- **Reading** ('Diana and Elvis shot JFK!)
- **Listening** ('My most memorable lie'-people confess to untruths)
- **Speaking** (Discussion-good and bad lies)
- **Everyday English** (Being polite)
- **Writing** (Linking ideas)

5.
- **Grammar** (Future forms and spoken English)
- **Vocabulary** (Hot verbs-take, put)
- **Reading** ('Today's teenagers are just fine')
- **Listening** arranging to meet-three friends decide a time and a place to get together)
- **Speaking** (Future possibilities in your life)
- **Everyday English** (Telephone conversations)
- **Writing** (writing Emails)

6.
- **Grammar** (Expression of quantity)
- **Vocabulary** (Words with variable stress)
- **Reading** (A profile of two famous brands)
- **Listening** (Radio advertisements-what's the product? What are the selling points?)
- **Speaking** (A lifestyle survey)
- **Everyday English** (Business expression, Numbers, Fractions, decimals, date, time…)
- **Writing** (A consumer survey)

7.
- **Grammar** (Modals and related verbs 1, spoken English, Declarative questions, and Question expressing surprise)
- **Vocabulary** (Hot verb-get)
- **Reading** ('Meet the kippers'-an article about grown-up children who won't leave home)
- **Listening** (Getting married-an Indian lady talks about her marriage)
- **Speaking** (The pros and cons of arranged marriage)
- **Everyday English** (Exaggeration and understatement)
- **Writing** (Arguing your case)

8.
- **Grammar** (Relative clauses)
- **Vocabulary** (Adverb collocations and adverb adjectives)
- **Reading** ('Chukotka, the coldest place on earth'-an article about a remote territory of Russia)
- **Listening** (Extreme experiences-people describe their experiences in extreme weather conditions)
- **Speaking** (Making descriptions longer, talking about your experiences)
- **Everyday English** (The world around)
- **Writing** (Describing places)

9.
- **Grammar** (Expressing habit)
- **Vocabulary** (Homonyms and Homophones)
- **Reading** ('People and their money-an article about three very different people)
- **Listening** (A teacher I will never forget-people describe a teacher who made a lasting impression on them)
- **Speaking** (Discussion-a teacher I'll never forget)
- **Everyday English** (Making your point)
- **Writing** (Writing of talking)

10.
- **Grammar** (Modal auxiliary verbs 2)
- **Vocabulary** (Synonyms)
- **Reading** ('How the West was won'-the story of settlers in nineteenth -century America)
- **Listening** (Hilaire Belloc's Tales for children)
- **Speaking** (The murder game-one man drops dead in a country house :)
- **Everyday English** (Metaphors and idioms-the body)
- **Writing** (Formal and informal letters and Emails)

11.
- **Grammar** (Hypothesizing)
- **Vocabulary** (Word pairs)
- **Reading** ('Have you ever wondered'? -the answers to some important questions in life)
- **Listening** (The interpretation of dreams-paul's amazing dream)
- **Speaking** (Practicing a conversation and describing your dreams)
- **Everyday English** (Moans and groans)
- **Writing** (narrative writing 2)

12.
- **Grammar** (Articles)
- **Vocabulary** (Hot words-life and time)
- **Reading** ('you are never too old'-A life in the day of Mary Hobson, who gained her PhD aged)
- **Listening** (happy days-people talk about what make them happy and unhappy)
- **Speaking** (Discussion-the different ages of life, and their pros and cons)
- **Everyday English** (Linking and commenting)
- **Writing** (Adding emphasis in writing)

Program and Course Outcomes:

1. Develop academic essay writing proficiency
2. Promote reading skills
3. Expand academic vocabulary through reading
4. Promote speaking ability through group discussions and debates
5. Promote critical thinking skills

CE4102 Management and Leadership Skills (2-2-0-0)

Designation as a 'required' or 'elective' course:

This is a required course for the Civil Engineering Program.

Course Description:

This course is designed for engineering students who are interested in advancing into management and leadership roles. You will gain a perspective on what it is like to be an engineering leader. You will develop awareness of your own strengths and weaknesses as a leader when you are placed in charge of a project. You will learn how to leverage your strengths and control your weaknesses. You will also learn how to manage relationships with your team members and how to set up a creative environment for your team to motivate each team member to reach his or her potential. You will also learn how to deal with different ethical issues that are related to engineering field.

Recommended Textbook(s):

1- Benator, Barry and Thumann, Albert "**Project Management and Leadership Skills for Engineering and Construction Projects**." 2003, The Fairmont Press, Inc., USA
2- Fleddermann, C. B. (2012). **Engineering Ethics**. Upper Saddle River, NJ: Prentice Hall.
3- Code of Ethics- Iraqi Engineers Association

Prerequisites:

None

Course Topics:

1. **Introduction to leadership**
   - Leadership definition
   - Can one person make a difference?
   - Why is leadership important for engineers?
   - Are leaders born or made?
   - Personality assessment
2. **Leadership and management styles**
   - Command leadership vs. servant leadership
   - Characteristics of servant leader
   - Management styles
   - Leader or manger?
   - The outstanding leader competencies
3. **Effective team leadership**
   - What is team
   - Why work in teams?
   - Different types of teams
   - Team roles
   - Role of team leader
4. **Practical Implementation**
   - Time management (first things first)
   - Project related activities

Conducting Effective Meetings
Giving effective feedback
Recognition and reward

5. **Communication**
   Communication types
   Thoughts emotion and communication (head, heart and hands)
   What influences our communication
   Damaging communication habits
   Connecting with others
   Peer communication assessment
6. **Leadership and management styles**
   Management styles
   Attributes of the engineering leader
   Modern leadership
   Characteristics of servant leader
   Command leadership vs. servant leadership
7. **Professional Ethics**
   Definition
   Origins
   Principles
8. **Introduction to Engineering Ethics**
   Professional Codes of Ethics
9. **Ethical Issues in Engineering Practice**
   1 -Safety Considerations
   2- The Role of Good Design
      A- Sustainable design and design for all
      B- Safety and risk in Design
   3- Environmental Ethics
10. **Steps in Confronting Moral Dilemmas**
11. **Case Studies**

Course Learning Outcomes:
Following completion of this course, students will be able to:

1. Explain the basic concepts of leadership.
2. Build power and influence.
3. Add value to their sphere of influence
4. Give and receive feedback, actively listen, provide supportive communication, and coach and counsel their team members.

College Requirements Courses

CE1201 Calculus 1 (3-3-1-0)

Designation as a 'required' or 'elective' course:
This is a required course for the Civil Engineering Program.

Course Description:
This course provides a comprehensive guide and up-to-date treatment of engineering mathematics with an in-depth overview of the many mathematical. It is intended to introduce students of engineering, physics, mathematics, computer science, and related fields to those areas of applied mathematics that are most relevant for solving practical problems.

Recommended Text Book:

1. Stewart, J., Clegg, D. K., & Watson, S. (2020). *Calculus: early transcendentals*. Cengage Learning.
2. Thomas, G. B., Haas, J., Heil, C., & Weir, M. (2018). *Thomas' Calculus*. Pearson Education Limited.
3. Stroud, K. A., & Booth, D. J. (2020). *Engineering mathematics*. Bloomsbury Publishing.

Prerequisites:
None

Course Topics:

1. Tangent line and slope problems.
2. Drawing of functions
3. Continuity and limit of functions
4. Limits at infinity, horizontal asymptote. infinite limits, vertical asymptotes and drawing of functions
5. Derivative of functions and rates of change. Differentiation of polynomials, product and quotient rules
6. Derivatives of exponential, logarithmic, and trigonometric functions
7. Chain rule and implicit differentiations
8. Applications of differentiation maximum and minimum values. the mean value theorem
9. Derivative of hyperbolic functions and indeterminate forms and l'hospital's rule.
10. Optimization problems and anti-derivative of functions

Course Learning Outcomes:
By the end of successful completion of this course, the student will be able to:

1. To develop mathematical skill so that students are able to sketch the graph of various functions and evaluate Limits by using different techniques including L'Hopital's Rule.
2. Apply mathematical methods and principals in solving various derivative problems from Engineering fields, involving applications of derivatives.
3. Demonstrate algebraic facility with algebraic topics including linear, quadratic, exponential, logarithmic, and trigonometric functions,
4. Compute derivative and anti- derivative of algebraic, trigonometric, inverse trigonometric, exponential, logarithmic, and apply them to solve problems in a wide range of engineering applications.

CE1202 Calculus 2 (3-3-1-0)
Designation as a 'required' or 'elective' course:
This is a required course for the Civil Engineering Program.

Course Description:
This course provides a comprehensive guide and up-to-date treatment of engineering mathematics with an in-depth overview of the many mathematical. It is intended to introduce students of engineering, physics, mathematics, computer science, and related fields to those areas of applied mathematics that are most relevant for solving practical problems.

Recommended Text Book:
1. Stewart, J., Clegg, D. K., & Watson, S. (2020). *Calculus: early transcendentals*. Cengage Learning.
2. Thomas, G. B., Haas, J., Heil, C., & Weir, M. (2018). *Thomas' Calculus*. Pearson Education Limited.
3. Kreyszig, E., Stroud, K. and Stephenson, G., 2008. Advanced engineering mathematics. *Integration*, *9*(4).

Prerequisites:
CE1201 Calculus 1

Course Topics:
1. Fundamentals of Integrals
2. Definite and indefinite integrals
3. Integration Techniques -Integration by Parts.
4. Integration Techniques- Trigonometric Integrals.
5. Integration Techniques- Partial Fractions.
6. Applications of Integrals- Arc Length and Surface area
7. Applications of Integrals- Volumes (Disk, Washer, Shell)
8. Polar Coordinates - Common Polar Coordinate Graphs.
9. Polar Coordinates - Tangents with Polar Coordinates, Curves defined by parametric equations.
10. Sequences and Series.
11. Power series and their convergence test

Course Learning Outcomes:
By the end of successful completion of this course, the student will be able to:

1. Evaluate of definite, indefinite and improper integrals by using different integration techniques.
2. To determine arc length, surface area and volume by using the applications of integration techniques.
3. Define polar coordinate graphs and solve related problems including area, arc length and volume.
4. Identify the properties of sequences and their limits with identifying standard convergent operations of power series.

CE1203 Physics (4-3-0-2)
Designation as a 'required' or 'elective' course:
This is a required course for the Civil Engineering Program.

Course Description:
This is the first course in the two-semester sequence of calculus-based introductory physics courses designed to meet the needs of student majoring in Engineering. The course is a survey of the concepts, principles, methods and major findings of classical Physics. Primarily, it covers Newtonian mechanics, and thermal Physics, with topics include: Physics and measurement, Vectors, kinematics and dynamics of motion of a single particle in one and two dimensions, work and energy, system of particles, linear momentum and collisions, kinematics and dynamics of rotational motion, equilibrium of rigid bodies, and elasticity, fluid static and fluid dynamics, oscillatory motion, wave motion, and temperature and thermal equilibrium.

Physics Lab.1
This is the Lab-based course covering the subject matter of CE1203 Physics. The course presents an introduction to the methods of experimental physics Emphasis is on developing student's skills in experimental techniques, data analysis, and scientific reporting of lab work. During the course students execute a series of experiments on Kinematics of motion, kinetic and potential energy, Oscillatory motion, Thermal properties of matter, and Viscosity. The course includes computer-based experiments on Classical Mechanic

Recommended Text Book:
R.D. Knight, Physics for Scientists and Engineers, 2nd ed., Pearson 2008

For lab
Laboratory Manual, Compiled by Instructor

Prerequisites:
Concurrent requirement with CE1201 Calculus 1

Course Topics:
1- Physics and Measurement
1.1- Standards of Length , Mass and Time
1.2- Density of Atomic Mass
1.3- Dimensional Analysis
1.4- Conversion of Units
1.5- Estimate and Order of Magnitude Calculations
1.6- Significant Figures

2- Motion in One Direction
2.1- Particle Model
2.2- Position, Velocity and Speed
2.3- Instantaneous Velocity and Speed
2.4- Acceleration

2.5- One-Dimensional Motion with Constant Acceleration
2.6- Freely Falling Object

3- Vectors
3.1- Coordinate System
3.2- Vector and Scalar Quantity
3.3- Some Properties of Vectors
3.4- Adding Vectors
3.5- Subtracting Vectors
3.6- Component of Vectors and Unit Vectors

4- Motion in Two Dimension
4.1- The Position, Velocity and Acceleration Vectors
4.2- Two-Dimensional Motion with Constant Acceleration
4.3- Projectile Motion
4.4- Horizontal Range and Maximum Height of a Projectile
4.5- Uniform Circular Motion
4.6- Tangent and Radial Acceleration
4.7- Relative Velocity and Relative Acceleration

5- The Laws of Motion
5.1- Newton's First Law and Inertial Frames
5.2- Mass
5.3- Newton's Second Law
5.4- The Gravitational Force and weight
5.5- Newton's Third Law
5.6- Forces and Friction
5.7- Experimental Observations

6- Circular Motion and Other Applications of Newton's Law
6.1- Non uniform Circular Motion
6.2- Resistance Force Proportional to Object Speed
6.3- Air Drag at High Speed

7- Temperature
7.1- Zeroth Law of Thermodynamics
7.2- Thermometers and The Celsius Temperature Scale
7.3- The Constant Volume Gas Thermometer and The Absolute Temperature Scale
7.4- Thermal Expansion and of Solids and Liquids
7.5- The Unusual Behavior of Water
7.6- Macroscopic Description of an Ideal Gas

8- Energy and Energy Transfer
8.1- Work Done by Constant Force
8.2- The Scalar Product of Two Vectors
8.3- Work Done by Varying Force

8.4- Work DONE by a Spring
8.5- Kinetic Energy and the Work-Kinetic Energy Theorem
8.6- Conservations of Energy
8.7- Situations Involving Kinetic Energy
8.8- Power
8.9- Energy and the Automobile

Physics 1 Lab
Mechanical Physics Experiments
1- Determination The Density of Solid Materials
2- Verification of Hooks Law
3- Determination the Value of Gravity Acceleration (Simple Pendulum)
4- Determination the Coefficient of Viscosity
5- Measurement of Liquid Density
6- Verification of Newton's Second Law
7- Verification of continuity Equation
8- Determination the Mechanical Equivalent of Heat
9- Determination the Specific Heat Capacity of a Solid
Course Learning Outcomes:
Students will learn:

1. Describe the translational motion of a single particle in terms of position and inertial frames, inertia, velocity, acceleration, linear momentum and force.
2. Describe the rotational motion of a rigid body using the concepts of rotation angle, angular velocity, angular acceleration, angular momentum, moment of inertia, and torque.
3. Identify the forces acting on ordinary mechanical systems to be gravity and electromagnetics (Drag force, frictional force, normal force, etc.).
4. State the fundamental laws of kinematics and dynamics of rotational motion of a rigid body and use them to solve problems on simple rotational motion.
5. Analyze the translational and rotational motion using a scalar approach based on the concepts of work, conservative and non-conservative forces, potential energy and conservation of mechanical energy.
6. State the two conditions of static and dynamic equilibrium of a point particle and a rigid body, and use them to solve problems of static equilibrium.
7. Define and calculate the following parameters of oscillatory and wave motion: amplitude, period, frequency, angular frequency, speed of a wave, energy transported, Power and intensity;
8. Describe Simple Harmonic Motion qualitatively and quantitatively.
9. Recognize and analyze some wave characteristics: principle of superposition, interference, diffraction, reflection, transmission, refraction, standing waves and Resonance.
10. Define what is meant by: temperature, specific and molar heats of capacity.

CE1204 Chemistry (4-3-0-2)
Designation as a 'required' or 'elective' course:
This is a required course for the Civil Engineering Program.

Course Description:
Chemistry and Measurement and significant figures. Atoms, molecules and ions. Formulas and names. Stoichiometry and chemical calculations. Chemical reactions. Thermochemistry and enthalpy changes. Quantum theory of the atom and electron configuration. Chemical bonding and molecular geometry. The Lab. Section presents Safety in the Lab. Measurement of mass, volume and density. Identification of an unknown compound. Qualitative analysis of anions. Empirical formula of a compound. Thermal decomposition of hydrates. Stoichiometric determination. Acidbase and redox titrations. Enthalpy of reactions.

Recommended Textbook(s):
Chang R. & College W.,Chemistry, McGraw Hill 9th ed., 2007
Laboratory Manual, Compiled by Instructor

Prerequisites:
Concurrent requirement with CE1201 Calculus 1

Course Topics:
1. Measurements. Handling Numbers. Dimensional Analysis in Solving Problems Recognize chemical safety and hazardous materials icons, and apply laboratory safety rules.
2. Atomic Number, Mass Number, and Isotopes. The Periodic Table. Molecules and Ions.
   Describe laboratory instruments and some basic techniques used in the chemistry laboratory, including balances and standard volumetric equipment.
3. Chemical Formulas. Naming Compounds. Atomic Mass. Avogadro's number and Molar Mass of an Element.
   Describe and use UV/VIS spectrophotometric methods of analysis**.**
4. Molecular Mass. The Mass Spectrometer. Percent Composition of Compounds. Experimental Determination of Empirical Formulas. Chemical Reactions and Chemical Equations.
   Describe how to Prepare accurate laboratory reports of their experimental results.
5. Amounts of Reactants and Products. Limiting Reagent Calculations. Reaction Yield**.**
6. General Properties of Aqueous Solutions. Precipitation Reactions. Acid-Base Reactions. Oxidation-Reduction Reactions.
7. Concentration of Solutions. Acid-Base Titrations. Gases. Pressure.
8. The Ideal Gas Equation. Gas Stoichiometry. Partial Pressures
9. The Nature of Energy and Types of Energy. Energy Changes in Chemical Reactions. Introduction to Thermodynamics.

10. Enthalpy of Chemical Reactions. Calorimetry. Standard Enthalpy of Formation and Reaction.
11. From Classical Physics to Quantum Theory. Bohr's Theory of the Hydrogen Atom. Quantum Numbers. Atomic Orbitals.
12. Electron Configuration.
Development of the Periodic Table. Periodic Classification of the Elements. Periodic Variation in Physical Properties.
13. Ionization Energy. Electron Affinity
Lewis Dot Symbols. The Ionic Bond. The Covalent Bond. Electro negativity. Writing LewisStructures. Formal Charge and Lewis Structures.
14. The Concept of Resonance. Exceptions to the Octet Rule.
Bond Energy. Molecular Geometry. Dipole Moment.
Spectrophotometric Analysis of tetracycline
15. Valence Bond Theory.
Hybridization of Atomic Orbital's. Hybridization in Molecules Containing Double and Triple Bonds. Delocalized Molecular Orbital's.

Lab. Section

1. Safety, Lab Check-in
Mass and Volume Measurements.
2. Qualitative Analysis of Anions: Part I
3. Qualitative Analysis of Anions: Part II
4. The Empirical Formula of a Metal Oxide
5. Volumetric Analysis: Standardization of Sodium Hydroxide and Determination of Molar Mass of an Acid
6. Applications of Volumetric Analysis: Determination of Active Ingredients of Commercial Bleach and Vinegar.
7. Evaluation of the Universal Gas Constant, R
8. Heat of Formation of Magnesium Oxide
9. UV/VIS Spectroscopy and Spectrophotometry
10. Spectrophotometric Analysis of Aspirin
11. Synthesis of Alum and Crystal Growth

Course Learning Outcomes:

By the end of successful completion of this course, the student will be able to:

1. Define the structure of the atom in terms of the nucleus with protons and neutrons, and electrons.
2. Write and balance chemical equations, name inorganic compounds and ions and describe the properties of the main group elements.

3. Carry out chemical calculations, including mass relations in chemical reactions, limiting reagent and reaction yield calculations, and calculations involving reactions taking place in solution
4. Understand the concept of oxidation-reduction, calculate oxidation numbers, and balance redox reactions.
5. Apply the ideal gas law in solving problems involving the gas phase
6. Solve problems in chemical thermodynamics and calorimetry.
7. Predict the electronic structure of atoms and ions from quantum theory, and relate the position of an element in the periodic table to its electronic structure and to the physical and chemical properties of the elements.
8. Describe the principles of chemical bonding and write Lewis structures
9. Predict the geometry of the electron pairs and the shape of molecules using VSEPR theory, predict bond polarity and molecular dipoles
10. Describe the valence bond theory, predict the hybridization of atoms in molecules, and describe bonding in molecules with single, double and triple bonds in terms of and π bonds, and delocalized molecular orbitals

CE1205 Fundamentals of Electrical Engineering (3-2-1-2)
Designation as a 'required' or 'elective' course:
This is a required course for the Civil Engineering Program.

Course Description:
This course introduces the basics of electric circuits, series and parallel connection, and DC circuit analysis. Additionally, the course presents ohms law, Kirchhoff laws for solving series parallel circuits. Furthermore, it introduces circuit theorem and their analysis; including mesh, nodal, and superposition theorems. Thevenin and Norton theorems are also included. Finally, the course introduces capacitors and inductor into the circuit and how to deal with it under dc condition.

Recommended Textbook(s):
1. Alexander and Sadiku "Fundamentals of Electric Circuits" Third Edition McGraw Hill.
2. Boylestad, R. L., Introductory Circuit Analysis (10th Edition).

Prerequisites:
• CE1202 Calculus 2

Course Topics:
1. Introduction to electrical engineering
2. Charge, current, and voltage
3. Ohms law
4. Kirchhoff laws
5. Star delta analysis
6. Nodal analysis
7. Mesh analysis
8. Source transformation
9. Superposition theorem
10. Thevenin circuits
11. Norton circuits
12. Capacitor C
13. Inductor L
14. *Circuit analysis including R, L, and C*

Program and Course Outcomes:

By the end of successful completion of this course, the student will be able to:

1. Understand the basic concept of electrical circuits.
2. Solve series and parallel DC circuits.

3. Apply Methods of Analysis and Circuit Theorems to solve DC circuits.
4. Solve series/parallel circuits with capacitors and inductors.

Laboratory

1	Introduction to the LAB
2	Ohm's law
3	Kirchhoff's current and voltage law
4	series-parallel network
5	Superposition theorem
6	Thevenin's theorem
7	Norton's theorem
8	LAB final exam

CE1206 Computer science-(3-2-1-2)
Designation as a 'required' or 'elective' course:
This is a required course for the Civil Engineering Program.

Course Description:
This course introduces a basic knowledge about computer scince and fundementals of computer programming that necessary for Engineering students.

Recommended Textbook(s):
By Topics

Prerequisites:
None

Course Topics:

1. Computer Fundamentals and safety
2. Computer Components
3. Operation system
4. Introduction to MS-Word
5. Insert objects in MS-Word
6. Additional tasks in MS-Word
7. Introduction to MS-Power Point
8. Introduction to MS-Excel

Program and Course Outcomes:

By the end of this course students will be able to :

1. Identify computer components
2. Able to use operation system
3. Familiar with MS- Word programm
4. Familiar with microsoft – powerpoint
5. Familiar with MS-excel.

CE1207 Engineering Drawing (3-2-2-2)
Designation as a 'required' or 'elective' course:
This is a required course for the Civil Engineering Program.

Course Description:
This course discusses the fundamental concepts of engineering graphics. It gives also an introduction to computer graphics using CAD software. The following topics are covered: Drawing conventions such as standards, line types and dimensioning; drawing of inclined and curved surfaces; deducting the orthographic views from a pictorial; drawing full and half sections; deducting an orthographic view from given two views; pictorial sketching (isometric and oblique).

Recommended Textbook(s):
Interpreting Engineering Drawings, Jensen, C.H. and Helsel, G.D., 7th ed., Thomson Delmar Learning, 2007

Prerequisites:
None

Course Topics:
1. Introduction: graphic language, standards, instruments, letters…etc
2. Basics for interpreting drawings, line types, types of drawings and sketches
3. Orthographic views. Deducing front, top, and side views from a pictorial
4. Dimensioning
5. Sectional views: full and half sections
6. Drawing a missed view from given two
7. Pictorial sketching: isometric and oblique

Program and Course Outcomes:
1. Recognize the value of engineering graphics as a language of communication.
2. Infer the nature of engineering graphics, the relationships between 2D and 3D environments.
3. Comprehend and deduce orthographic projections of an object.
5. Visualize wide variety of objects and drawing the missing views.
6. Comprehend and deduce section views
7. Produce three dimensional drawings utilizing CAD software

CE1208 Engineering Mechanics (Statics) (3-3-1-0)
Designation as a 'required' or 'elective' course:
This is a required course for the Civil Engineering Program.

Course Description:
This course is an introduction to learning and applying the principles required to solve engineering mechanics problems. Concepts will be applied in this course from previous courses you have taken in basic math and physics. The course addresses the modeling and analysis of static equilibrium problems with an emphasis on real world engineering applications and problem solving.

Recommended Textbook(s):

R.C. Hibbeler, Engineering Mechanics: Statics, Prentice Hall, 12th ed., 2010.

Prerequisites:
CE1203 Physics
CE1202 Calculus 2

Course Topics:
1. **General Principles:** Fundamental concepts, units of measurement, force vectors: force system resultants: moment of a force, moment of a couple, addition of a system of coplanar forces.
2. **Equilibrium of a Particle**: Condition for the equilibrium of a particle, free-body diagram and three-dimensional force systems.
3. **Equilibrium of a Rigid Body**: Conditions for rigid-body equilibrium, support reactions.
4. **Structure Analysis:** Simple trusses, the method of joints, zero-force members, the method of sections, frames and machines.
5. **Center of Gravity and Centroid:** Center of Gravity, Center of Mass, and the Centroid of a Body
6. **Moments of Inertia:** Definition of moments of inertia for areas, and parallel-axis theorem for an area.
7. **Friction:** Characteristics of dry friction, problems involving dry friction, and frictional forces on flat belts.

Program and Course Outcomes:
By the end of successful completion of this course, the student will be able to:

1. To understand the principles of mechanics to determine resultant forces of a system in rectangular or nonrectangular coordinates
2. To construct free-body diagrams and identify their appropriate equilibrium equations in terms of reaction forces in a frame structure and the connection forces in trusses.
3. An ability to analyse systems that include frictional forces.
4. An ability to locate centroid of an area and calculate second moments of inertia.

CE2201 Calculus 3 (3-3-1-0)
Designation as a 'required' or 'elective' course:
This is a required course for the Civil Engineering Program.

Course Description:
Advanced topics in calculus, including vectors and vector-valued functions, partial differentiation, Lagrange multipliers, multiple integrals, and Jacobians; application of the line integral, including Green's Theorem, the Divergence Theorem, and Stokes' Theorem.

Recommended Textbook(s):
1. Thomas' Calculus Early Transcendentals 12th Edition.by George B. Thomas Jr. (Author), Maurice D. Weir (Author), Joel R. Hass (Author).
2. Calculus, by H. Anton, I. Bivens, and S. Davis, 8th Edition, 2002, Wiley

Prerequisites:
CE1202 Calculus 2

Course Topics:
1- Vectors and the Geometry of Space
Three-Dimensional Coordinate Systems
Vectors
The Dot Product
The Cross Product
Lines and Planes in Space
Cylinders and Quadric Surfaces

2- Vector-Valued Functions and Motion in Space
Curves in Space and Their Tangents
Integrals of Vector Functions; Projectile Motion
Arc Length in Space
Curvature and Normal Vectors of a Curve
Tangential and Normal Components of Acceleration

3- Partial Derivatives
Functions of Several Variables
Limits and Continuity in Higher Dimensions
Partial Derivatives
The Chain Rule
Directional Derivatives and Gradient Vectors
Tangent Planes and Differentials
Extreme Values and Saddle Points
Lagrange Multipliers

4- Multiple Integrals
Double and Iterated Integrals over Rectangles
Double Integrals over General Regions
Area by Double Integration
Triple Integrals in Rectangular Coordinates

5- Integration in Vector Fields (Vector Analysis)
Vector Fields and Line Integrals
Green's Theorem in the Plane
Stokes' Theorem
The Divergence Theorem and a Unified Theory

Program and Course Outcomes:

1. Perform calculus operations on vector-valued functions, including derivatives, integrals curvature, displacement, velocity, acceleration, and torsion.
2. Perform calculus operations on functions of several variables, including partial derivatives, directional derivatives, and multiple integrals.
3. Find extrema and tangent planes.
4. Solve problems using the Fundamental Theorem of Line Integrals, Green's Theorem, The Divergence Theorem and Stokes' Theorem.
5. Apply the computational and conceptual principles to the solutions of real-world problems.

CE2202 Calculus 4 (3-3-1-0)
Designation as a 'required' or 'elective' course:
This is a required course for the Civil Engineering Program.

Course Description:
Differential Equations, begins with some definitions and terminology and mathematical models used in a differential equations course. First-order and higher-order differential equations, along with the methods of solutions and their applications are introduced. Modeling with higher-order, Laplace transform, and systems of linear first-order differential equations are covered. At the end, students learn series solutions of linear equations. Numerical methods are covered throughout the course. This course focuses on differential equations and their applications in science and engineering.

Recommended Textbook(s):
• Differential Equations with Boundary-Value Problems, seventh edition. Dennis G. Zill, Michael R Cullen. Copyright 2009, Brooks/Cole. ISBN-13: 978-0-495-10836-8
• Differential Equations with Boundary-Value Problems Student Solutions Manual. Warren S. Wright, Dennis G. Zill, Carol D. Wright. Copyright 2009, Brooks/Cole Publishing Company. ISBN 978-0-495-38316-1.

Prerequisites:
CE2201 Calculus 3

Course Topics:
1. Ordinary differential Equations
   Classify differential equations by order, linearity, and homogeneity
2. First order linear differential equations
   use separation of variables to solve differential equations
   solve exact differential equations
   use variation of parameters to solve differential equations
   solve first order linear differential equations
   Bernoulli equation
   Application of first Order Differential Equations
3. Higher order Differential Equations
   Solutions of Homogeneous Linear D.E with constant coefficients
   Solutions of Inhomogeneous Linear D.E with constant coefficients
   The Method of Undetermined Coefficients
   Method of Variation of Parameters
   The Euler-Cauchy Differential Equations
   Reduction of Order
   Applications of Higher Order Differential Equations
4. Simultaneous Linear Differential Equations
   Elimination of dependent variables by differentiation
   Elimination of dependent variables using operator equation
   Solution by Cramer rule

5. Fourier series
    - Periodic functions
    - Trigonometric series
    - Bounds of a Function
    - Continuity of a Function
    - Euler Coefficients
    - Even and Odd Functions
    - Half Range Expansion
    - Applications
6. Laplace Transforms
    - Properties of Laplace Transforms
    - Inverse of Laplace transforms
    - Solution of Ordinary D.E's by Laplace transforms
        - D.E's with constant coefficients
        - D.E's with variable coefficients:
    - Solution of Simultaneous Linear D.E's by Laplace transforms

Program and Course Outcomes:
By the end of the course students will be able to:

1. Classify differential equations by order, linearity, and homogeneity
2. Solve first order linear differential equations
3. Solve linear equations with constant coefficients
4. Use separation of variables to solve differential equations
5. Solve exact differential equations
6. Use variation of parameters to solve differential equations
7. Use the method of undetermined coefficients to solve differential equations
8. Determine whether a system of functions is linearly independent using the Wronksian
9. Model real-life applications using differential equations
10. Use power series to solve differential equations
11. Use Laplace transforms and their inverses to solve differential equations
12. Solve systems of linear differential equations using matrix techniques and eigenvalues
13. Use numerical methods to solve differential equations

CE3201 Engineering Statistics (3-3-0-0)
Designation as a 'required' or 'elective' course:
This is a required course for the Civil Engineering Program.

Course Description:
Statistical Engineering models are based on mathematics and probability theory. This course provides students with a working knowledge of fundamental statistics principles and probability in addition to a preface to the regression and correlation analysis. By the end of the semester, students should be able to determine when each of the various topics we have covered is appropriate to use, and to apply them to practical engineering situations or problems. This course will cover techniques on data collection and presentation, descriptive statistics, basic elements of probability theory, sampling techniques and theory, statistical estimation, hypothesis testing and regression analysis.

Recommended Textbook(s):
1. Elementary Statistics A Step by Step Approach, Eighth Edition, By Allan G. Bluman.
2. Probability and Statistics For Engineers and Scientists, Fourth Edition, By Sheldon Ross.

Prerequisites:
CE1202 Calculus 2

Course Topics:
Fundamentals (Introduction to Statistics)
1. Introduction
2. Descriptive and Inferential Statistics
3. Variables and Types of Data
4. Data Collection and Sampling Techniques
5. Observational and Experimental Studies

Presentation of a Statistical Data
1. Introduction
2. Organizing Data
3. Grouped Frequency Distributions or Frequency Distributions Table
4. Graphs: Histograms, Frequency Polygons, and Ogive
5. Other Types of Graphs

Data Description
1. Measures of Central Tendency (Mean, Median and Mode)
2. Measures of Variation
   2.1. Population Variance and Standard Deviation
   2.2. Sample Variance and Standard Deviation
   2.3. Variance and Standard Deviation for Tabulated Data

2.4. Range
3. Coefficient of Variation

Probability and Counting Rules

1. Sample Spaces and Probability
2. Tree diagram
3. Basic Probability Rules
4. Venn Diagram
5. The Addition Rules for Probability
6. The Multiplication Rules and Conditional Probability
7. Conditional Probability
8. Counting Rules
   8.1. Permutations
   8.2. Combinations
9. Probability and Counting Rules

Discrete Probability Distributions

1. Probability Distributions
2. Mean, Variance, Standard an Deviation
3. The Binomial Distribution
4. The Poisson Distribution

Continuous Probability Distributions
The Normal Distribution

1. Normal Distributions
2. Applications of the Normal Distribution
3. Normal Distributions Formula
4. The Standard Normal Distribution
5. Finding Areas Under the Standard Normal Distribution Curve (Table Method)
6. A Normal Distribution Curve as a Probability Distribution Curve
7. Applications of the Normal Distribution
8. Determining Normality
9. The Normal Distribution Approximation to the Binomial Distribution

Confidence Intervals and Sample Size

1. Preface
2. Confidence Intervals for the Mean When σ is Known
   2.1. A point estimate
   2.2. An interval estimate
   2.3. Confidence Intervals
3. Sample Size
4. t-Distribution
3. Confidence Intervals for the Mean When σ is Unknown
4. The chi-square Distribution
5. Confidence Intervals for Variances and Standard Deviations
   5.1. Confidence Interval for a Variance

5.2. Confidence Interval for a Standard Deviation

Hypothesis Testing

1. Preface
2. Steps in Hypothesis Testing—Traditional Method
   2.1. The null hypothesis (H_0)
   2.2. The alternative hypothesis (H_1)
   2.3. The level of significance
3. *z* Test for a Mean
4. P-Value Method for Hypothesis Testing
5. t Test for a Mean
6. z Test for a Proportion
7. X^2 Test for a Variance or Standard Deviation

Testing the Difference Between Two Means, Two Proportions, and Two Variances

1. Preface
2. Testing the Difference Between Two Means: Using the z Test
3. Testing the Difference Between Two Means of Independent Samples: Using the t Test
4. Testing the Difference Between Two Means: Dependent Samples
5. Testing the Difference Between Two Variances

Correlation and Regression

1. Preface
2. Scatter Plots and Correlation
3. Regression
4. Coefficient of Determination and Standard Error of the Estimate.

Program and Course Outcomes:

On completion of this course, the student should be able to:

- use a number of methods and techniques for collecting and presentation the sets of data;
- calculation and demonstration the center tendency and variation of data;
- compute the probabilities in a simple cases and using the rules of probability in computing;
- give an account of the concept random variable and be able to use some common probability distributions;
- understand the meaning of the central limit theorem;
- use point and interval estimates for some typical statistical problems;
- apply elementary regression for fitting measured data.

CE3202 Engineering Numerical Methods (3-2-1-2)
Designation as a 'required' or 'elective' course:
This is a required course for the Civil Engineering Program.

Course Description:
The numerical methods course involves solving engineering problems drawn from all fields of engineering. The numerical methods include: error analysis, roots of nonlinear algebraic equations, solution of linear and transcendental simultaneous equations, matrix and vector manipulation, curve fitting and interpolation, numerical integration and differentiation, solution of ordinary and partial differential equations.

Recommended Textbook(s):
Numerical Methods for Engineers, S. C. Chapra and R. P Canale, McGraw-Hill, 6th edition 2010.

Prerequisites:
CE1206 Computer Science
CE2202 Calculus 4

Course Topics:
Part-I: Basic Tools

Unit-1: Error Analysis
- Measuring Errors
- Sources of Error
- Consistency, Order, Smoothness and Convergence

Unit-2: Roots of equations (**Nonlinear Equations)**
- Bisection Method
- False-Position Method (Optional)
- Newton-Raphson Method
- Secant Method (Optional)

Unit-3: Simultaneous Linear algebraic Equations
- Direct Methods
  - Review of Determinants and Matrices
  - Cramer's Rule
  - Gauss-Elimination method (simple and partial pivoting methods)
  - Gauss-Jordan Method
  - Matrix Inversion method
- Indirect (Iterative) Method
  - Jacobi Method
  - Gauss-Seidel Method
  - Successive Over-Relaxation Method

Unit-4: Numerical Differentiation and Integration

- Numerical differentiation using difference method
- Numerical Integration, Trapezoid and Simpson's Rules
- Extrapolation of Errors

Unit-5: Interpolation and Curve Fitting

- Direct Fit Polynomial
- Least Squares Method
- Logarithmic regression (Optional)
- Exponential regression (Optional)
- Linear interpolation , Quadratic Interpolation
- Lagrange Interpolation (Optional)
- Newton Divided Difference Interpolation (Optional)

Part-II: Numerical Solutions of Ordinary Differential Equations

Unit-6: Initial Value Problem

- Euler's Method
- Runge-Kutta 2nd
- Runge-Kutta 4th
- Higher Order Equations

Unit-7: Boundary Value Problem

- Equilibrium (Finite Difference) Method

Part-III: Numerical Solutions of Partial Differential Equations

Unit-8: PDEs

- Elliptic Equations
- Parabolic Equations
- Hi-parabolic Equations

Advanced Application (Case Studies based on each department interests).

Program and Course Outcomes:

1. Be aware of the mathematical background for the different numerical methods introduced in the course.

2. Understand the different numerical methods to solve the algebraic equations and to solve system of linear and non linear equations.

3. Understand the different numerical methods for interpolation, differentiation, integration and solving set of ordinary differential equations.

4. Understand how numerical methods afford a mean to generate solutions in a manner that can be implemented on digital computers.

5. Use the built in functions in MATLAB and EXCEL.

6. Create MATLAB functions for solving numerical engineering problems.

7. Work on multidisciplinary projects.

CE4201 Final Year Project 1 (3-2-1-2)

Designation as a 'required' or 'elective' course:

This is a required course for the Civil Engineering Program.

Course Description:

Problem statement, design concept, simulation work and hardware concept, or field work carried out in accordance with a preapproved project plan under the supervision of faculty member(s).

Recommended Textbook(s):

By Topics

Prerequisites:

By Topics

Course Topics:

 Topics will vary in accordance with the specific project assigned.

 Topics common to all projects:

1. Environmental Impacts
2. Transportation impact analysis
3. Economic project analysis
4. Professional Ethics
5. Safety issues

Program and Course Outcomes:

 To guide the students such a way that the students carry out a comprehensive work on the chosen
topic which will stand them in good stead as they face real life situations.

CE4202 Final Year Project 2 (3-2-1-2)

Designation as a 'required' or 'elective' course:

This is a required course for the Civil Engineering Program.

Course Description: Continuation of CE 4332 work-Analytical, design, experimental, or field work carried out in accordance with a preapproved project plan under the supervision of faculty member(s).

Recommended Textbook(s):

By Topics

Prerequisites:

By Topics

Course Topics:

 Topics will vary in accordance with the specific project assigned.

 Topics common to all projects:

1. Environmental Impacts
2. Transportation impact analysis
3. Economic project analysis
4. Professional Ethics
5. Safety issues

Program and Course Outcomes:

 To guide the students such a way that the students carry out a comprehensive work on the chosen

topic which will stand them in good stead as they face real life situations.

DEPARTMENT REQUIREMENTS COURCES

CE1301 Applied Physics (3-3-0-0)
Designation as a 'required' or 'elective' course:
This is a required course for the Civil Engineering Program.
Course Description:

This is the second semester, calculus-based introductory physics course that follows CE 1203. It is a Continuation of the survey of principles of classical physics presented in CE 1203 Topics studied include. properties of matter (elasticity), viscosity principles , centroids and centers of gravity , moments of inertia, virtual work and energy methods, and sound and magnetism

Recommended Textbook(s):
Modern Engineering Physics, K. Vijaya Kumar, S. Chandralingam S. Chand & Co. Pvt. Ltd.
R.C. Hibbeler, Engineering Mechanics: Statics, Prentice Hall, 12th ed., 2010.

Prerequisites:
CE1201 Calculus 1
CE1203 Physics

Course Topics:

1. PROPERTIES OF MATTER (ELASTICITY):

   Elastic and plastic bodies–Definition-stress, strain-Definitions–Hooke's law – statement-three types of strain–Elastic and plastic limit–Young's modulus, Bulk-modulus, Rigidity modulus and Poisson's ratio–Definitions-Uniform and non-uniform bending of beams-

2. VISCOSITY:-

   Viscosity–Definition-Coefficient of viscosity-Definition, SI-unit and dimensional formula -Stream line flow, turbulent flow-Explanation-Critical velocity, Surface tension & angle of contact-Definitions-Expression for surface tension of a liquid by capillary rise method.

3. CENTROIDS AND CENTERS OF GRAVITY

   Areas, Lines , and Volumes .

4. MOMENTS OF INERTIA

   Moment of Inertia of Areas , Moment of Inertia of Masses

5. FRICTION

Coefficients of Friction , Angle of Friction , Types of Frictions: Axle, Disk, Wheel, and Belt

6. VIRTUAL WORK AND ENERGY METHODS

   Principle of Virtual Work and its Applications

7. SOUND AND MAGNETISM:

   Wave motion–Introduction and definition–Audiable range-Infrasonic-Ultrasonics-Progressive waves, longitudinal and transverse waves–Examples- Amplitude, wave length, period and frequency of a wave.

Applied Physics Syllabus Course Outcomes:

- Design, characterization and study of properties of material help the students to prepare new materials for various engineering applications.
- Apply friction forces and analyze their different applications.
- Calculate center of gravity, centroids, and moments of inertia.
- Understand methods of virtual work

CE1302 Construction Materials (3-2-1-2)

Designation as a 'required' or 'elective' course:

This is a required course for the Civil Engineering Program.

Course Description:

This course is designed for students to understand compositions, engineering behaviors, and design methods of various civil engineering materials, including steel; Wood, soil, aggregate, Portland cement concrete, and asphalt cement concrete. Evaluation of material performance under applied loads for engineering applications. Physical properties of concrete, metals, plastics and wood. Exercises include study of the variability of materials

Recommended Textbook(s):

Kenneth N. Derucher, George P. Korfiatis, and A. Samer Ezeldin, Materials for Civil and Highway
Engineers, Prentice Hall, 4th ed., 1998.
Laboratory Manual, Compiled by Instructor

Prerequisites:

None

Course Topics:

1. Introduction,
2. Engineering materials,
3. Mechanical properties,
4. Specification,
5. Stress and strain,
6. Brick, Production of bricks, Testing of brick, Specification of bricks,
7. Binding materials, Gypsum, Line,
8. Wood, Defects of wood, Uses of wood,
9. Cement, Production of cement, Types of cement, Testing of cement,
10. Finishing materials, Paints,
11. Insulating material,
12. Tiles,
13. Metals,
14. Building stone,
15. Glass Building block,
16. Concrete block,
17. Sanitary works, Pipes,
18. Water,
19. New building materials

Program and Course Outcomes:

At the end of this course the students should have learnt about the various materials, both conventional and modern, that are commonly used in civil engineering construction. Further he/she
should be able to appreciate the criteria for choice of the appropriate materials and the various
tests for quality control in the use of these materials.

Lab Section

1. Compressive Strength of Brick
2. Absorption of Brick
3. Effloresces of Brick
4. Compressive Strength of Gypsum
5. Modulus of Rapture of Gypsum
6. Extension of Gypsum
7. Standard Consistence of Gypsum
8. General Shape of Tiles
9. Modulus of Rapture of Tiles
10. Compressive Strength of Wood
11. Tensile Strength of Steel Reinforcement

Program and Course Outcomes:

1. Become familiarized with basic material testing procedures.
2. Learn writing and communication skills.
3. Learn to critically evaluate laboratory procedures and the resulting data, including data manipulation by computer.
4. Learn to work in teams.
5. Develop the ability to conduct experiments, testing wood, plastic, steel, aluminum, aggregate and cement.
6. Develop the ability to identify, formulate and solve engineering problems involving experiments with stress and strain.
7. Develop written communication skills related to reporting of experimental test results.
8. Develop the ability to use computer spreadsheets as a tool to analyze laboratory testing methods and subsequent data.

CE2301 Concrete Properties (4-3-1-2)

Designation as a 'required' or 'elective' course:

This is a required course for the Civil Engineering Program.

Course Description:

Constituent materials, chemical and mineral admixtures, concrete mix design, fresh and hardened properties of concrete and special concrete. Lab techniques, preparation of concrete samples, compressive and flexural strength determination.

Recommended Textbook(s):

John Newman and B S Choo, Advanced Concrete Technology Set: Advanced Concrete Technology

2: Concrete Properties, ELSEVIER, 2003

Laboratory Manual, Compiled by Instructor

Prerequisites:

CE1204 Chemistry 1

CE1302 Construction Materials

Course Topics:

- Cement-Different types-Chemical composition and Properties-IS Specifications-
- Aggregates-Classification-Mechanical properties -Grading requirements-
- Quality of water for use in concrete
- Accelerators-Retarders- Plasticisers- Super plasticizers- Water proofers-Mineral Admixtures like Fly Ash, Silica Fume , Ground Granulated Blast Furnace Slag and Metakaoline-Their effects on concrete properties
- Principles of Mix Proportioning-Properties of concrete related to Mix Design- Physical properties of materials required for Mix Design-Design Mix and Nominal, Mix-BIS and ACI Methods of Mix Design-Mix Design Examples
- Workability, Segregation and Bleeding
- Light weight and Heavy weight concretes-High strength concrete-Fibre reinforced concrete-Ferrocement-Ready mix concrete-SIFCON-Shotcrete-Polymer, concrete-High performance concrete-Their production, properties and applications

Program and Course Outcomes:

- Students are introduced to the concrete as construction materials.
- Students will learn about the constituent materials of concrete include-aggregates, cements, and water.
- Students will learn about the behavior and properties of concrete.
- Students will introduce to the mix design procedure.
- Students will learn about the properties and behavior of special type of concrete and their applications.

Lab Section:

- Tests on cement
- Tests on Aggregates and water
- Design-Mix Design Examples
- Tests for workability of concrete-Slump Test and Compacting

 Determination of Compressive and Flexural strength
 Determination of Young's Modulus

Program and Course Outcomes:

 The course will be provided the students with background and skills in designing and testing
Concrete mixture.

CE2302 Building Construction (3-2-1-2)

Designation as a 'required' or 'elective' course:

This is a required course for the Civil Engineering Program.

Course Description:

This course is aiming to provide student with fundamental information that would be needed duringthe study as an engineering student and also to prepare the student to understand many topics that related to the future study and in practicing the civil engineering afterwards. The design methods and calculation are out of the aim of this course as they are given in other courses; however, the construction methods that are related to the common civil engineers work are targeted. The topics of this course are almost presented in parallel with real construction stages

to make it easy to be followed.

Recommended Textbook(s):

B.C. Punmaia 'Building construction' reprinted 2005

R. Chudley 'building construction handbook, 7th edition, 2008

Prerequisites:

CE1302 Construction Materials

CE2301 Concrete properties

Course Topics:

1. Introduction to building construction including stages of construction and buildings type
2. Earthwork: excavations and earth filling
3. Footing and foundation
4. Piles: uses and types
5. Concrete works: mixing, transport, pumping, compaction, finishing and curing
6. Brickwork
7. Walls: types and function
8. Floors and roofs
9. Arches, lintels and sills
10. Damp proofing
11. Doors and windows
12. Joints in buildings
13. Structural drawing

Program and Course Outcomes:

At the end of this course, student should be able to understand the construction methods and also be

able to briefly understand each stage in a construction project. Additionally, the details of a building should be understood in terms of both materials and construction stages.

CE2303 Engineering Geology (3-3-0-0)
Designation as a 'required' or 'elective' course:
This is a required course for the Civil Engineering Program.
Course Description:
Interpretation of geology for the purpose of planning, siting, design, and construction of engineered facilities. Includes an overview of geology, engineering geologic mapping, and specific consideration of engineering applications such as dams, reservoirs, and tunnels.
Recommended Textbook(s):
Terry R. West, Geology Applied to Engineering, Waveland Press, 1995.

Prerequisites:
None

Course Topics:

Introduction	***Laboratory***
The Earth and Its Systems	*Plate Tectonics; Divergent Plate*
Minerals	*Boundaries; Transform Plates*
Igneous Rocks	*Convergent Plate Boundaries; Plumes and Hotspots; Geologic Time*
Sedimentary Rocks	*Minerals*
Metamorphic Rocks	*Igneous Rocks*
Rock Mechanics	*Sedimentary Rocks*
Structural Deformations	*Metamorphic Rocks*
Weathering and Erosion	*Maps and Air Photos; Structural Geology*
Soils, Soil Hazrds and Land Subsidence	*Mass Movement; Groundwater*
Groundwater	*Karst Topography*
Subsurface Contamination and Remediation	*Stream Erosion and Deposition*
Mass Movement and Slope Stability	*Shoreline Processes; Eolian Processes*
Rivers	*Field Trip*
Oceans and Coasts	

Program and Course Outcomes:
a. Ability to categorize rocks by their origin and engineering properties.
b. Ability to apply engineering science principles to rock masses and discontinuities in engineering
design e.g. rock slopes.
c. Ability to work in a group.
d. To know how to obtain rock properties required for some design applications.

CE 3313 –Fluid Mechanics-(3-3-1-0)

Designation as a 'required' or 'elective' course:

This is a required course for the Civil Engineering Program.

Course Description: Fundamental concepts. Properties of fluids. Fluid Statics. Momentum and energy equations, applications. Bernoulli equation, applications. Dimensional analysis and similitude. Introduction to viscous flows and boundary layers. Internal flows, laminar and turbulent flows. Head loss and friction factor. Flow over immersed bodies (external flow). Lift and drag. Lab techniques, calibration principles, fluid and flow measurements

Recommended Textbook(s):

Bruce R. Munson, Donald F. Young, Theodore H. Okiishi, and Wade W. Huebsch, Fundamentals
of Fluid Mechanics, John Wiley & Sons, 6th ed., 2009.
Laboratory Manual, Compiled by Instructor

Prerequisites:

CE2305 Dynamics,
CE1203 Physics

Course Topics:

1. Physics and measurement; Kinematics of motion of a single particle in one and two dimensions;
Kinematics of projectile and circular motion.
2. Dynamics of motion of a single particle and multiple objects in one and two dimensions and Newton's Laws; Free body diagrams; Various types of mechanical forces; Application on the use
of Newton's Laws.
3. Work and energy; Conservative systems and the concept of potential energy; Conservation of
mechanical energy.
4. System of particles; Linear momentum; Conservation of linear momentum and collisions; Elastic
and Inelastic collisions; Center of mass.
5. Kinematics and Dynamics of rotational motion; Torque; Moment of inertia; Angular momentum;
Static equilibrium of rigid bodies; Elasticity and concepts of stress and strain..
6. Phases of matter; Pressure and density, Equations of Fluid static; Equations of fluid dynamics:
Continuity and Bernoulli's equations.
7. Oscillating systems; Simple Harmonic Motion (SHM) ; Energy of SHM ; Damped oscillations;
Forced oscillations and Resonance .
8. Types of waves :Transverse and Longitudinal; Traveling waves ; Wave speed ; The wave equation ; Power and intensity in wave motion ; Reflection and transmission of wave ; The principle of superposition ; Interference of waves ; Standing waves ; Resonance
9. Macroscopic and microscopic description of matter; Concept of temperature and thermal equilibrium (zeroth law of thermodynamics); Measuring temperature; Thermal expansion of solids and liquids.
10. Heat; Work; First Law of Thermodynamics; Thermodynamic Processes.

Program and Course Outcomes:

1. Describe the SI unit system and convert units.
2. Describe the translational motion of a single particle in terms of position and inertial frames, ,
inertia, velocity, acceleration, linear momentum and force.
3. Describe the rotational motion of a rigid body using the concepts of rotation angle, angular velocity, angular acceleration, angular momentum, moment of inertia, and torque.
4. State the Newton's three laws of motion and apply them to solve problems on one and two dimensional translational motion.

5. Represent graphically the problem of motion of a physical system using the free-body diagram
technique.
6. Identify the forces acting on ordinary mechanical systems to be gravity and electromagnetism
(Drag force,
frictional force, normal force, etc.).
7. State the fundamental laws of kinematics and dynamics of rotational motion of a rigid body and
use them to solve problems on simple rotational motion.
8. Analyse the translational and rotational motion using a scalar approach based on the concepts of
work,
conservative and non conservative forces, potential energy and conservation of mechanical energy.
9. Describe and solve problems of the motion of many-particle system by employing the concept of
centre of mass, law of conservation of mechanical energy, Principle of momentum and angular momentum conservation.
0. State the two conditions of static and dynamic equilibrium of a point particle and a rigid body,
and use them to solve problems of static equilibrium.
11. Describe and solve some problems on the elastic properties of materials using the following
elasticity concepts and relations: Rigidity ; Plasticity ; Plastic deformation ; stress and strain ; Bulk stress and strain ; Bulk deformation and bulk modulus; Linear tensile stress and strain ; Young's modulus; Shearing.
12. Analyze the problems of static fluid in terms of density and pressure, and fluid at motion using
the continuity equation and Bernoulli's equation.
13. Define and calculate the following parameters of oscillatory and wave motion : amplitude, period, frequency, angular frequency, speed of a wave, energy transported , Power and intensity;
14. Describe Simple Harmonic Motion qualitatively and quantitatively.
15. Recognize and analyze some wave characteristics: principle of superposition, interference, diffraction, reflection, transmission, refraction, standing waves and Resonance.
16. Illustrate some applications of harmonic and wave motion in a wide variety of physical

situations.
17. Define what is meant by: temperature, specific and molar heats of capacity.
18. State zeroth and first laws of thermodynamics and use them to solve some related problems.
19. Explain the theory of heat energy transfers and apply it in some simple situations.

Lab Section
Lab 1 Fluid Properties
Lab 2 Fluid Statics
Lab 3 Bernoulli Equation
Lab 4 Velocity Profiles
Lab 5 Sluice Gate
Lab 6 Conservation of Momentum
Lab 7 Drag Force
Lab 8 Weir Flow
Program and Course Outcomes:
 The students will obtain knowledge in experimental procedures and processes.
 The students will learn how to express uncertainty in experimental measurements by taking replicate readings, computing standard deviations, and rigidly following rules for significant digits.
 The students will learn how to apply numerical methods to recorded data, such as regression of
linearized functions and numerical integration.
 The students will learn how to take basic fluids measurements like viscosity, density, velocity,
pressure, and flow rates by a variety of methods.

CE2305 Dynamics (3-3-1-0)

Designation as a 'required' or 'elective' course:

This is a required course for the Civil Engineering Program.

Course Description:

Fundamental concepts of kinematics and kinetics with application of particles and plane motion of rigid bodies, Rectilinear and curvilinear motion of particles. Newton's second law, impulse and momentum methods, impact, Dynamics of systems of particles, Kinematics of rigid bodies. Plane

motion of rigid bodies: Forces and accelerations

Recommended Textbook(s):

R.C. Hibbeler, Engineering Mechanics: Dynamics, Prentice Hall, 12th ed., 2010.

Prerequisites:

CE1203 Physics

CE1208 Statics

Course Topics:

1. Kinematics of particles:

-Rectilinear motion

-Curvilinear motion

2. Kinetics of particles: Newton's 2nd law

- Linear momentum and rate of change of linear momentum

- Equation of motion and Dynamic equilibrium

- Angular momentum and rate of change of angular momentum

- Equation of motion in terms of radial and transverse components

- Conservation of angular momentum

- Newton's law of gravitation

3. Kinetics of particles: Energy and momentum methods

- Principle of work and energy

- Power and efficiency

- Conservation of energy

- Principle of impulse and momentum

- Direct and oblique impact

4.Kinematics of rigid bodies

- Translation

- Rotation about a fixed axis

- General plane motion

5.Plane motion of rigid bodies: Forces and acceleration

- Equation of motion for a rigid body

- Angular momentum of a rigid body in plane motion

- Plane motion of a rigid body. D' Alembert's principle

Program and Course Outcomes:

1 Use rectangular, normal-tangential, and polar coordinate systems to describe the motion (kinematics) of a particle, system of particles, and rigid bodies.

2 Use Newton's Second Law, Work-Energy, and Impulse-Momentum principles to determine the

kinetics of particles, systems of particles, and rigid bodies.

3 Understand and solve introductory vibration problems.

4 In applying the above principles, continue to develop a systematic, orderly procedure for solving
engineering problems and design mechanical device using their knowledge in Dynamics.

CE2306 Strength of Materials 1 (3-3-1-0)

Designation as a 'required' or 'elective' course:

This is a required course for the Civil Engineering Program.

Course Description: External forces and concept of stress. Stresses and strains, Axial loading and axial deformation,Hook's law, Statically indeterminate members, Stresses due to temperature. Torsion. Internal forces in beams, pure bending. Transverse loading and shear stresses in beams and thin-walled pressure vessels, beam deflection. Multiaxial loading. Transformation of stresses and strains. Principal stresses and strains. Axially compressed members and buckling of columns.

Recommended Textbook(s):

R.C. Hibbeler, Mechanics of Materials, Prentice Hall, 7th ed., 2007.

Prerequisites:

CE1208 Statics

Course Topics:

1. Introduction
2. Equilibrium
3. Stresses
4. Strains
5. Mechanical Properties
6. Axial Load
7. Torsion
8. Flexure
9. Transverse Shear
10. Stress Transformation
11. Beam Design
12. Buckling of Columns

Program and Course Outcomes:

1. Understand concept of stress and strain.
2. Understand relation between stress and strain
3. Ability to identify and solve statically indeterminate problems
4. Ability to analyze and design circular shafts under torsion
5. Ability to analyze stress conditions in beams under general eccentric loading
6. Ability to determine shear stress and shear flow in beams under transverse loading
7. Ability to transform stress
8. Ability to solve analysis and design problems related to material response to load.

CE2307 Strength of Materials 2 (3-2-1-2)

Designation as a 'required' or 'elective' course:

This is a required course for the Civil Engineering Program.

Course Description:

Testing of various materials under axial compression, tension, flexure, torsion, impact, fatigue. Use of electrical, mechanical and photoelastic strain measuring equipment.

Recommended Textbook(s):

Laboratory Manual, Compiled by Instructor

Prerequisites:

CE 2306 Strength of Materials 1

Course Topics:

1. Tensile strength test of metals
2. Torsion of circular shaft and direct shear test
3. Stress concentration around a circular hole; Electric strain gage technique
4. Fatigue tests of metal alloys
5. Beam stress analysis by photo-elasticity method
6. Analysis of statically indeterminate beam
7. Critical column load test

Program and Course Outcomes:

- Students will obtain knowledge in experimental procedures and processes.
- Students will attain the ability to deliver effective written communication.
- Students will attain skills in the use of state-of-the-practice facilities and equipment.
- *Students will learn how to perform uniaxial tension test, compression test, torsion test, and fatigue test.*
- *Students will learn how to measure strain using dial gauge, electrical strain gauge, and photoelasticity.*
- *Students will learn how to analyze experimental data and how to present them in technical reports.*

CE2308 Engineering Surveying 1 (3-2-1-2)
Designation as a 'required' or 'elective' course:
This is a required course for the Civil Engineering Program.
Course Description:
This course introduces knowledge about Chain surveying, Compass surveying, Plane table surveying, Levelling, Theodolite surveying and Engineering surveys. Experience with a wide variety of common surveying equipment, including use and operation of levels, theodolites, total station equipment. Prior to graduation, computer applications and field exerci ses prepare students for civil engineering employment early in their careers.

Recommended Textbook(s):
Charles D. Ghilani, Paul R. Wolf, Elementary Surveying, Prentice Hall, 12th ed., 2008.
Laboratory Manual, Compiled by Instructor

Prerequisites:
CE1202 Calculus 2
Course Topics:
- INTRODUCTION AND CHAIN SURVEYING
- COMPASS SURVEYING AND PLANE TABLE SURVEYING
- LEVELLING AND APPLICATIONS
- THEODOLITE SURVEYING
- ENGINEERING SURVEYS

Program and Course Outcomes:
1. Students will obtain knowledge in:
a). Mathematics – *Students in this class will use basic mathematical skills in real world calculations*
b). Science – *Scientific procedures in surveying show the student the necessity of redundant information and methods for determining and evaluating errors.*
c). Engineering – *Surveying is one of the original and most recognized civil engineering skills.*
2. Expose students to state-of-the-art and state-of-the-practice facilities and equipment
3. Students will learn to use equipment similar in type and quality to those professional surveyors
use in their businesses.

Lab Section
1. Measuring distances using pacing and conventional taping
2. leveling with an autolevel and high rod
3. profile leveling
4. Measuring angles
5. total station
Program and Course Outcomes:
1. Educate students in the fundamentals of plane surveying,
2. Develop an ability to solve surveying problems utilizing fundamental engineering principles as

well as the latest computational and measurement tools. This will be done as individuals and as
members of student field survey teams.
3. Exhibit an understanding of the role of engineering surveyors in the civil and environmental engineering profession

CE2309 Engineering Surveying 2 (3-2-1-2)
Designation as a 'required' or 'elective' course:
This is a required course for the Civil Engineering Program.

Course Description:
This course introduces knowledge about areas and volumes. Then, it moves to horizontal curves and types of horizontal curves. In addition, this course demonstrates photogrammetry, GPS measurements and GIS.

Recommended Textbook(s):
Elementry Surveying An Introduction to Geomatics by Charles D. Ghilani & Paul R. Wolf

Prerequisites:
Engineering Surveying 1

Course Topics:

1. Areas
2. Volume computations.
3. Horizontal curves.
4. Vertical curves
5. Global Position System (GPS)
6. Basic principle of remote sensing
7. Introduction to Geographic Information System (GIS).

Program and Course Outcomes:
1. Show the ability to work within a team environment.
2. Establish an ability to solve plane surveying problems by proper mathematics.
3. To provide the knowledge and skill in curve ranging.
4. Learn to apply total stations and other surveying equipment to make observations.
5. Develop an understanding of the basic principles of remote sensing, geographic information system GIS and global position system GPS.

Lab.

1. Measuring distances using total station.
2. Area computation using total station.
3. Area computation (map)
4. Total station application.
5. Volume computation using total station.
6. Laying out of circular curve by deflection angles method.
7. GPS applications.
8. Types of remote sensing data.
9. GIS programs

CE3301 Structures 1 (3-3-1-0)

Designation as a 'required' or 'elective' course:

This is a required course for the Civil Engineering Program.

Course Description:

Preparation of influence lines and effect of rolling loads. Introduce classical methods in analysing

indeterminate structures (trusses, beams and plane frames).

Recommended Textbook(s):

Kenneth M. Leet, Chia-Ming Uang, Anne M. Gilbert, Fundamentals of Structural Analysis, McGraw-Hill, 4th ed., 2011.

Prerequisites:

CE1208 Statics

CE2306 Strength of Materials 1

Course Topics:

- ROLLING LOADS
- INFLUENCE LINE FOR STATICALLY DETERMINATE STRUCTURES
- STATICALLY INDETERMINATE STRUCTURES
- INDETERMINATE TRUSSES
- SLOPE DEFLECTION METHOD
- MOMENT DISTRIBUTION METHOD

Program and Course Outcomes:

Students will learn about the:-

1. Concept of rolling loads and study its characteristics in structures.
2. Preparation of influence line diagrams for statically determinate structures.
3. Analysis of indeterminate structures (beams, frames and trusses) for internal forces, deflections

etc.

4. Classical methods – slope deflection method – use in analysing indeterminate beams and plane

frames with and without sway.

5. Moment distribution method – Iterative method often used in analysing indeterminate structures

CE3302 Structures 2 (3-3-1-0)

Designation as a 'required' or 'elective' course:

This is a required course for the Civil Engineering Program.

Course Description:

This course introduced advanced methods like matrix methods of structural analysis of structures,

plastic theory, analysis of special structures like arches and suspension cables and influence line

for indeterminate structures

Recommended Textbook(s):

Kenneth M. Leet, Chia-Ming Uang, Anne M. Gilbert, Fundamentals of Structural Analysis, McGraw-Hill, 4th ed., 2011.

Prerequisites:

CE3301 Structures 1

Course Topics:

- INFLUENCE LINES-STATICALLY INDETERMINATE STRUCTURES
- ARCHES AND SUSPENSION CABLES
- PLASTIC ANALYSIS OF STRUCTURES
- MATRIX FORCE METHOD- FLEXIBILITY METHOD
- MATRIX STIFFNESS METHOD

Program and Course Outcomes:

Students will learn about the:-

1. Preparation of influence line diagrams for indeterminate structures.
2. Analysis of arches and suspension cables.
3. Plastic theory and its application in analysis of indeterminate structures.
4. Matrix methods of analysis – Flexibility method and stiffness method – which are basis for almost all structural analysis software available

CE3303 Reinforced Concrete Design 1 (3-3-1-0)

Designation as a 'required' or 'elective' course:

This is a required course for the Civil Engineering Program.

Course Description:

This course introduced Material properties, Flexural theories, Un-cracked section, Working stress

method, Ultimate strength, Design and analysis of Singly Rectangular, doubly, T-section, irregular

section beams, Shear analysis and design, Continuous beams, One way slab, Short columns, Long

columns, Bond, anchorage, development length, Cracked and deflection

Recommended Textbook(s):

Arthur H. Nilson, David Darwin, Charles W. Dolan, Design of Concrete Structures, McGraw-Hill,

14th ed., 2004.

Prerequisites:

CE1208 Statics

CE2306 Strength of Materials 1

Concurrent with CE3301 Structures 1

Course Topics:

1. Introduction
2. Materials
3. Load & Resistance Factors
4. Rectangular Single Reinforced Beams & Cover Requirements
5. T-Beams, Beams with Compression Reinforcement
6. Shear Analysis & Design
7. Development Lengths, Anchorage, and Splices of Reinforcement
8. Continuous Beams & One-Way Slabs
9. Column Analysis & Design
10. Bond, anchorage and development length
11. Cracked and deflection

Program and Course Outcomes:

Students will learn how to design reinforced concrete beams for flexure and shear, one-way slabs,

columns subject to axial and bending force using ACI 318-08.

CE3304 Reinforced Concrete Design 2 (3-3-1-0)

Designation as a 'required' or 'elective' course:

This is a required course for the Civil Engineering Program.

Course Description:

Deflection control of two way slabs, Direct design method of two way slabs, Shear in two way slabs, Equivalent frame method of two way slabs, Yield line analysis and design (Virtual work) of slabs.

Recommended Textbook(s):

Arthur H. Nilson, David Darwin, Charles W. Dolan, Design of Concrete Structures, McGraw-Hill, 14th ed., 2004.

Prerequisites:

CE3303 Reinforced Concrete Design 1

Course Topics:

1. Introduction
2. Two –way slabs
3. Direct design method
4. Equivalent Frame method
5. Yield line theory

Program and Course Outcomes:

Students will exposed to advanced topics in structural design comprising of two-slabs and reinforced concrete structures, yield line theory, and prestressed concrete structures

CE3305 Construction Management (3-3-0-0)

Designation as a 'required' or 'elective' course:

This is a required course for the Civil Engineering Program.

Course Description:

This course inculcates the fundamental principles of construction planning and management as applicable in Civil Engineering Projects.

Recommended Textbook(s):

Clifford J. Schexnayder, Richard E. Mayo, Construction Management Fundamentals, McGraw-
Hill, 2nd ed., 2008.

Prerequisites:

None

Course Topics:

CONSTRUCTION PROJECT FORMULATION
CONSTRUCTION PLANNING AND SCHEDULING
RESOURCE PLANNING
RESOURCE ALLOCATION AND CONTROL
OPTIMISATION TECHNIQUES

Program and Course Outcomes:

1. To introduce a concepts of projects formulation
2. To impart the idea about planning and scheduling of activities.
3. To introduce the concepts of resource planning and allocation and control.
4. To provide a bird's eye view of optimization techniques.

CE3306 Engineering Economy (3-3-0-0)

Designation as a 'required' or 'elective' course:

This is a required course for the Civil Engineering Program.

Course Description:

Principles of Engineering Economy. Equivalence and compound interest formula. Single payment model. Uniform payment model. Gradient payment model. Decision criteria for single and multiple alternatives: Present worth, annual worth, future worth, internal rate of return, and benefit cost ratio. Before and after tax analysis.

Recommended Textbook(s):

Leland Blank and Anthony Tarquin, Engineering Economy, McGraw-Hill, 6th ed., 2005.

Prerequisites:

CE1202 Calculus 2

Course Topics:

Introduction: Investment Explained.

Interest and Financial Mathematics. Simple interest. Compound interest. Graphical Conventions Single Payment. Uniform Series. Arithmetic Gradient

Nominal and Effective Interest Rates

Interest and Principal Separation

Present Worth Analysis. Present Worth Analysis.

Investment in Bonds.

Use computer software (MS Excel) to perform basic economical analyses

Annual Worth Analysis

Rate of Return Analysis3

Analysis of Public Projects. The Benefit-Cost-Analysis

Depreciation Methods

Depreciation Analysis using Computer software (MS Excel)

Income Taxes. After tax analyses

Effects of Inflation, Loans

Breakeven Analysis

Program and Course Outcomes:

1. Understand the basic concepts and terminology used in engineering economics. This includes single payment, uniform series, arithmetic gradient, and nominal and effective interest rates.

2. Evaluate alternatives based on

- *Present worth analysis*
- *Annual worth analysis*
- *Benefic/Cost analysis*
- *Internal rate of return analysis*

3. Calculate depreciations and understand the impact of inflation

4. Use computer software to perform economical analyses

5. Perform before and after tax analysis

6. Perform breakeven analysis for a single project and between two alternatives

7. Recognize the economic impact of engineering solution

CE3307 Soil Mechanics 1 (3-2-1-2)

Designation as a 'required' or 'elective' course:

This is a required course for the Civil Engineering Program.

Course Description:

Soil composition, physical and chemical properties, and classifications; water movement and seepage problems; effective stress concept, stress distribution in soil mass, consolidation, shear

strength , compaction and soil improvement. Classification of soils and determination of their properties through tests; grain size analysis,

Atterberg limits, relative density, Proctor soil compaction testing, permeability, consolidation, unconfined, direct shear, and Triaxial compression .

Recommended Textbook(s):

Braja M. Das, Fundamentals of Geotechnical Engineering, Cengage Learning, 3rd ed., 2008

Braja M. Das, Soil mechanics laboratory manual, Oxford University press, 6th ed, 2002

Prerequisites:

CE2303 Engineering Geology

CE2306 Strength of Materials 1

CE2304 Fluid Mechanics

Course Topics:

1. Geotechnical Engineering – Introduction
2. Soil Deposits & Grain-Size Analysis
3. Weight-Volume Relationships & Soil Classification
4. Soil Compaction
5. Hydraulic Conductivity & Seepage
6. Stresses in a Soil Mass
7. Consolidation
8. Shear Strength of Soil
9. Soil Improvement

Program and Course Outcomes:

1. Provide the description and classification of soil and analysis of stresses in soils under different
loading conditions.
2. To develop an understanding of the principles of effective stress in saturated soils, and its application to one dimensional compression and consolidation.
3. Familiarize the students an understanding of permeability and seepage of soils.
4. To develop an understanding of the shear strength soil

Lab Section

1. Water content determination (Oven drying method).
2. Grain size distribution – Sieve analysis.
3. Determination of Specific gravity by Pycnometer and density bottle method.
4. Determination of Liquid and Plastic limit (Casagrande method).
5. Determination of Shrinkage limit of soil
6. Determination of moisture-density relationship (Standard Proctor's).
7. Determination of Permeability by Constant and Variable head method.

8. Determination of in-situ density by sand replacement and core cutter method.
9. Determination of Relative density – Sand.
10. Unconfined compression test for fine grained soils
11. Triaxial Compression Test
12. Direct shear test.

Program and Course Outcomes:

 To provide the hands on training in determination of Engineering and index properties of soils,
applied in field problems.
 Familiarize the students to do the experiments
 To provide the knowledge on the use of experimental results pertaining to foundation problems

CE3308 Soil Mechanics 2 (3-2-1-2)

Designation as a 'required' or 'elective' course:

This is a required course for the Civil Engineering Program.

Course Description:

The first part of this course introduces the students to some practical aspects of geotechnical engineering where site soil has to be examined for potential engineering problems on the subjects of high compressibility/ collapsibility, low shear strength and liquefaction susceptibility. The second part of the course describes a number of common ground improvement techniques that are broadly practiced worldwide.

Recommended Textbook(s):

Coduto D.P., Kitch W. A. and Yeung A. R., 2016, "Foundation design: Principles and practices", 3rd edition, , USA, Pearson, ISBN 0-13-341198-3.

Han J., 2015, "Principles and Practices of Ground Improvement", John Wiley & Sons, Inc., Hoboken, New Jersey.

Prerequisites:

Soil Mechanics I

Course Topics:

1. Problematic soils
a. high compressibility and low strength soils
b. expansive soils
c. Collapsible soils
2. Ground improvement techniques
   a. Traditional compaction
   b. Rapid impact compaction
   c. Deep dynamic compaction
   d. Vibro-compaction
   e. Ground drainage
   f. Ground dewatering
   g. Ground consolidation

Program and Course Outcomes:

By the successful completion of this course, the student will be able to:

1. identify problematic soils and their potential risk on civil infrastructures.
2. develop proper solutions to geotechnical problems.
3. stimulate creativity and novelty in geotechnical engineering.

CE3309 Hydrology (3-3-1-0)
Designation as a 'required' or 'elective' course:
This is a required course for the Civil Engineering Program.
Course Description:
Hydrologic cycle, precipitation and runoff data, groundwater hydraulics, infiltration, peak runoff calculations, application to water resources problems.

Recommended Textbook(s):
Warren Viessman Jr., Gary L. Lewis, Introduction to Hydrology, Prentice Hall, 5th ed., 2003.
Prerequisites:
CE2304 Fluid Mechanics
CE3201 Engineering Statistics
Course Topics:
1. Introduction
2. Hydrologic measurement
3. Statistical methods in hydrology
4. Precipitations and related applications
5. Water loss, infiltration, and direct runoff
6. Watershed response and runoff analysis
7. Unit hydrograph
8. Flood routing: channel & reservoir routing

Program and Course Outcomes:
 The course will assist students in developing an ability to identify, formulate, and solve theories will be illustrated by examples of engineering applications.
 The students will learn the theory of water infiltration and evaporation and their effects on estimation of available water and flood analysis.
engineering problems.
 The students will learn how to define hydrologic cycle, return periods, and design floods in an
engineering way.
 The students will learn precipitation and streamflow measurements and their relationships to
engineering designs.
 The students will learn the basics of statistical theories and their applications in frequency analysis for engineering designs.
 The students will learn theories of frequency analysis for design storms and design floods. These

 The students will learn theories of unit hydrograph and applications on flood forecast including
peak discharge and time of peak occurrence.
 The students will learn theories of flood routing including reservoir and channel routing in flood
forecasting.
 The students will learn hydrology, hydrologic cycle, precipitation, streamflow, evaporation,

infiltration, aquifer and groundwater.
 The students will become familiar with applications of binominal distribution used for defining
the return period in engineering design.
 The students will learn history of normal distribution and its application and relationship to hydraulic designs.
 The students will be exposed to other statistical distributions including Pearson and log-Pearson distributions and their applications in flood analysis.

CE3310 Traffic Engineering (3-3-1-0)

Designation as a 'required' or 'elective' course:

This is a required course for the Civil Engineering Program.

Course Description:

Traffic engineering is concerned with the safety of public, the efficient use of transportation resources, and the mobility of people and goods. Traffic engineers are called on to protect the environment while providing mobility, to preserve a scarce public resource (capacity) while working with others to assure safety and security.

Recommended Textbook(s):

Nicholas J. Garber and Lester A. Hoel, Traffic and Highway Engineering, Cengage Learning, 4th ed. 2009 and 2010.

Prerequisites:

None

Course Topics:

Introduction to transportation planning process
Basic elements of transportation planning
Urban transportation planning
Demand forecasting approach
Characteristics of the driver, pedestrian, vehicle, and the road
Traffic engineering studies
Fundamental principles of traffic flow
Intersection design
Intersection control
Capacity and level of service at signalized intersections
Airport and railway engineering

Program and Course Outcomes:

1. To know the characteristics of traffic elements.
2. To know the traffic control measures.
3. To study about the driver and pedestrian behaviour.
4. To study about the scope of traffic management.

CE4301 Hydraulic Structures (3-3-0-0)
Designation as a 'required' or 'elective' course:
This is a required course for the Civil Engineering Program.

Course Description:
Introduction to open channel flow, Concept ,Definitions and Diffusion Equation., Advection Diffusion Equation, Mixing in River, Turbulent Diffusion and Dispersion ,Solution to Advective
Reacting Diffusion Eq.

Recommended Textbook(s):
1-Hydraulics ln Civil and Environmental engineering, Chadwick, Morfett and Borthwick, 2004,U.K
2-Civil Engineering Hydraulics, Martin Marriott, London, 2010.

Prerequisites:
CE 3311 Fluid Mechanics
CE 3316 Hydrology

Course Topics:
- Uniform and steady flow in open channel.
- Specific energy diagram
- Fundamental Eqs. of mass and heat transport
- Evaluating transport coefficient in the environment.
- Turbulent dispersion and mixing.
- Dispersion coefficient.
- Sediment Transport

Program and Course Outcomes:
Students should be able:
- To know the basic environmental fluid mechanics
- To understand the fundamental of open channel hydraulics
- To know advective and diffusion phenomena.
- To estimate the longitudinal dispersion coefficients
- To know storm management model.

CE4302 Foundation Engineering 1 (3-3-1-0)

Designation as a 'required' or 'elective' course:

This is a required course for the Civil Engineering Program.

Course Description:

Subsurface investigation; foundation selection and design criteria; bearing capacity of shallow foundations, settlement of shallow foundations, design of footings and rafts, introduction to deep foundation.

Recommended Textbook(s):

Donald P. Coduto, Foundation Design Principles and Practices, Prentice Hall, 2nd ed., 2001.

Prerequisites:

CE3307 Soil Mechanics 1

Course Topics:

- SITE INVESTIGATION AND SELECTION OF FOUNDATIONS
- BEARING CAPACITY OF FOUNDATIONS
- SETTLEMET OF FOUNDATIONS
- DESIGN OF FOOTINGS AND RAFTS
- INTRODUCTION TO DEEP FOUNDATION

Program and Course Outcomes:

- To develop an understanding of the behavior of foundations for engineering structures and to gain knowledge of the design methods that can be applied to practical problems.
- Provide the students with a basic understanding of the essential steps involved in a geotechnical site investigation.
- Introduce to the students, the principal types of foundations and the factors governing the choice of the most suitable type of foundation for a given solution.
- Familiarize the student with the procedures used for : a) bearing capacity and settlement estimation, b) end bearing capacity, c) skin friction

CE4303 Highway Engineering (3-2-2-2)

Designation as a 'required' or 'elective' course:

This is a required course for the Civil Engineering Program.

Course Description:

This course introduce the various components of Highway Engineering, highway planning, engineering surveys for highway alignment, Design of Geometric Elements of Highways and Urban roads, skill on evaluation of the pavements and to decide appropriate types of maintenance. This course introduces Desirable Properties and Testing of Highway Materials.

Recommended Textbook(s):

Nicholas J. Garber and Lester A. Hoel, Traffic and Highway Engineering, Cengage Learning, 4th ed. 2009 and 2010.

Laboratory Manual, Compiled by Instructor

Prerequisites:

CE2308 Engineering Surveying 1

Course Topics:

- HIGHWAY PLANNING AND ALIGNMEN
- GEOMETRIC DESIGN OF HIGHWAYS
- HIGHWAY MATERIALS AND CONSTRUCTION PRACTICE
- HIGHWAY MAINTENANCE

Program and Course Outcomes:

- It educates the students on the various components of Highway Engineering.
- It exposes the students to highway planning, engineering surveys for highway alignment, Design of Geometric Elements of Highways and Urban roads, and Rigid and Flexible pavements design.
- The students further learn the desirable properties of highway materials and various practices adopted for construction.
- It enables the students to develop skill on evaluation of the pavements and to decide appropriate types of maintenance.

Lab Section

Soil – California Bearing Ratio Test, Field Density Test

Aggregate - Crushing, Abrasion, Impact Tests, Water absorption, Flakiness and Elongation indices and Stone polishing value test

Bitumen and Tar - Penetration, Ductility, Viscosity, Binder content and Softening point Tests.

Asphalt Mixtures- Analysis and Binder Recovery, Testing of Bituminous Mixtures, Specific Gravity, Temperature and Density, Core Drilling

Program and Course Outcomes:

- To provide the hands on training in determination of desirable properties of highway materials
- Familiarize the students to do the experiments
- To provide the knowledge on the use of experimental results pertaining to pavement design.

CE4304 Sanitary and Environmental Engineering (3-3-1-2)

Designation as a 'required' or 'elective' course:

This is a required course for the Civil Engineering Program.

Course Description:

This course introduces fundamental concepts in the field of water supply engineering and sanitary engineering This is a required course for the Civil Engineering Program.

Recommended Textbook(s):

Warren Viessman Jr., Mark J. Hammer, Elizabeth M. Perez, Paul A. Chadik, Water Supply & Pollution Control, Prentice Hall, 8th ed., 2009.

Wastewater Engineering (treatment and Reuse) by Metcalf and Eddy,2003

Prerequisites:

CE1204 Chemistry

CE2304 Fluid mechanics

Course Topics:

INTRODUCTION - WATER SUPPLY
SOURCES, QUALITY & STANDARDS OF WATER
CONVEYANCE AND DISTRIBUTION SYSTEM
SANITATION
SEWER MATERIALS, CONSTRUCTION AND APPURTENANCES
WATER TREATMENT
SEWAGE TREATMENT
SECONDARY TREATMENT
SEWAGE DISPOSAL AND SLUDGE TREATMENT
SLUDGE MANAGEMENT AND SOLID WASTE

Program and Course Outcomes:

1. To know the basics, importance, and methods of water supply.
2. To study the various sources and properties of water.
3. To understand the various methods of conveyance of water.
4. To know the basics of sewage, types of sewers and sewer material.
5. To learn the features of various sewer appurtenances
6. To learn the objectives and methods of water treatment and to study the features and function of
different water treatment units.
7. To learn the objectives and methods of sewage treatment and to study the features and function
of different primary treatment units.
8. To study the features and function of different secondary treatment units.
9. To learn the objectives and methods of sewage disposal.
10. To learn the objectives and methods of sludge treatment.

Lab Section

1. Measurement of pH
2. Measurement of Total Dissolved salts
3. Measurement of Conductivity
4. Estimation of Alkalinity
5. Estimation of Hardness by EDTA method

6. Estimation of Residual Chlorine.
7. Estimation of Optimum Coagulant Dose by Jar Test
8. Estimation of Ammonia Nitrogen
9. Estimation of Sulphate
10. Estimation of Chlorides
11. Estimation of D.O. by Wrinkler's methods
12. Estimation of Suspended, Settleable, Volatile and fixed solids.
13. BOD test for water and waste water.
14. COD test for water and waste water.
15. Determination of Turbidity by using Nephlometer.

Program and Course Outcomes:

 To analyse water and sewage volumetrically and using certain equipments.
 To learn to prepare reagents for each experiment.
 To get hand-on experience in the operation of equipments like pH meter, TDS meter, turbidity meter, etc.
 To study to take observations after each titration.
 To study to do calculations and interpret the results obtained using IS specification for drinking
water and waste water (IS 10500-1963 and IS 2490) Curves.

CE4305 Method of Construction and Estimation (3-3-1-0)

Designation as a 'required' or 'elective' course:

This is a required course for the Civil Engineering Program.

Course Description:

Introduction to the various construction techniques, practices and the equipment needed for different types of construction activities. It also covers the various aspects of estimating of quantities of items of works involved in buildings, water supply and sanitary works, road works and irrigation works, the rate analysis, valuation of properties and preparation of reports for estimation of various items.

Recommended Textbook(s):

1. S. W. Nunnally, Construction Methods and Management,8th Edition by, 2010
2. Frank R. Dagostino and Steven J. Peterson, Estimating in Building Construction, Prentice Hall, 7th ed., 2011.

Prerequisites:

CE2201 Calculus 3

CE1302 Construction Materials

Course Topics:

- CONSTRUCTION PRACTICES
- SUB STRUCTURE CONSTRUCTION
- SUPER STRUCTURE CONSTRUCTION
- REPAIR AND REHABILITATION
- CONSTRUCTION EQUIPMENT
- INTRODUCTION TO ESTIMATES
- ESTIMATE OF BUILDINGS
- ESTIMATE OF OTHER STRUCTURES
- SPECIFICATION AND TENDERS
- VALUATION
- REPORT PREPARATION

Program and Course Outcomes:

- Students shall have a reasonable knowledge about the various construction procedures for sub to super structure
- Students shall have a reasonable knowledge about the equipment needed for construction of various types of structures from foundation to super structure.
- Students shall be able to estimate the material quantities, prepare a bill of quantities, make specifications and prepare tender documents
- Students should also be able to prepare value estimates.

CE4306 Steel Structure (3-3-1-0)

Designation as a 'required' or 'elective' course:

This is a required course for the Civil Engineering Program.

Course Description:

Design of Steel Structures including the application of ASD and LRFD methods using the AISC

Manual of Steel Construction.

Recommended Textbook(s):

1. Charles G. Salmon, John E. Johnson and Faris A. Malhas , Steel Structures: Design and Behavior, HarperCollins, 5th Edition), 2008
2. American Institute Of Steel Construction AISC, Steel Construction Manual, 13th Edition, 2006

Prerequisites:

CE3301 Structures 1

CE3302 Structures 2

Course Topics:

- Structural Design Philosophy, an introduction to the LRFD method.
- Properties and behavior of structural steel.
- Strength of tension members, design by codes and specifications.
- Strength of compression members, design by codes and specifications.
- Strength of beams in bending, design by codes and specifications.
- Bending and axial forces in beam-columns, design by codes and specifications.
- Introduction to plastic hinges, collapse mechanism.
- Steel member connections, design by codes and specifications.
- Design of a complete steel structure.

Program and Course Outcomes:

Students shall have the following skills:-

- To identify various loading conditions that are important in structural design and determine/select the critical loading.
- To perform the appropriate structural analysis based on the loading determined above and design the overall structure, determining the required member sizes capable of supporting the loads.They will have to apply their knowledge they acquired in the prerequisite courses such as determining maximum moments and forces and finding the strength of each member.
- To design all connections, which are integral parts of the overall structure based on forces and moments found in the previous steps.
- To produce design drawings necessary for cost estimating needs by management. This includes

quantity take of and construction specifications.

- Be knowledgeable with the national, regional, local codes and engineering standards and be familiar with the professional practice and requirements of structural engineers.
- To use some software for structural analysis and to explore available commercial software

Elective Courses

CE4307 Computer Applications in Civil Engineering (2-1-1-2)
Designation as a 'required' or 'elective' course:
This is elective course for the Civil Engineering Program.
Course Description: Introduction to computer applications in civil engineering, Integration of design, data management, computer programming and problem-solving skills with computer tools and techniques. Topics include systems analysis, optimization, database management, computer programming and optionally data structures. Course includes an application on one of the
engineering programs for each group
Recommended Textbook(s):
S. C. Bloch, Excel for Engineers and Scientists, John Wiley & Sons , 2nd Edition, 2003
Software Manual
Prerequisites:
CE1206 Computer Science
Course Topics:
- Computers as Engineering Tools
- Review of computer basics
- Problem solving
- Excel (Functions in Excel)
- Advanced Excel routines in problem solving
- Optimization
- Basic programming principles
- Macros and Functions
- Modular programming
- Testing and data types
- Decisions and Loops
- General functionality
- Scalar and array operations
- Plot capabilities
- Scripts
- Linear equations and applications to engineering problems
- Matrix computations
- Solving Differential Equations
- Databases
- Software application

Program and Course Outcomes:
Students should be able to:
- Identify the operational features of computer program
- Create user-defined functions (Excel)
- Perform linear algebra and matrix operations related to Civil Engineering systems
- Determine roots of nonlinear equations and solve sets of linear equations
- Construct, interpret and solve simple optimization problems (Excel Solver)

- Develop and program simple engineering analyses (Excel)
- Create and modify simple user interfaces using a programming environment (Excel).
- Application on one of the engineering software

CE4308 Reinforced Concrete Design 3 (2-2-2-0)

Designation as a 'required' or 'elective' course:

This is elective course for the Civil Engineering Program.

Course Description:

Flexural strength of reinforced concrete elements. Flexural ductility of unconfined and confined members with axial loads. Shear and torsional behaviors. Strength of reinforced concrete ductile frames and shear walls. Reinforced concrete detailing.

Recommended Textbook(s):

- *Design of Reinforced Concrete. Jack McCormac, Fifth Edition, Wiley,2008.*
- *Reinforced Concrete a Fundamental Approach, E.G. Nawy, Fifth Edition, Prentice Hall2005,.*

Prerequisites:

CE3303 Reinforced Concrete Design 2

Course Topics:

- Design and detailing of footings and retaining walls
- Design and detailing of beam-column joints (ACI special provisions for seismic design)
- Design of lateral load resisting systems; shear walls, and dual systems
- Serviceability and deflection considerations
- Strut and tie model
- Design of deep beams,
- Deign of columns under bidirectional
- Design of corbels.
- Design of conventional stairs

Program and Course Outcomes:

Students should be able to:

1. analyze, design and detail reinforced concrete frames
2. Apply advanced knowledge and engineering to the analysis and design of reinforced concrete

Members.

3. Ability to undertake problem identification, formulation and solution
4. Ability to undertake time dependent problems.
5. Ability to design with detailing the RC stairs, corbels, and deep beams.

CE4309 Foundation Engineering 2 (2-2-2-0)

Designation as a 'required' or 'elective' course:

This is elective course for the Civil Engineering Program.

Course Description:

Analysis and design of deep foundations (piers, caissons, piles), stability of open cuts, stability and design of sheet-pile walls (cantilever, free and fixed earth support types, ties, wales), design of secant-pile walls.

Recommended Textbook(s):

Donald P. Coduto, Foundation Design Principles and Practices, Prentice Hall, 2nd ed., 2001.

Prerequisites:

CE4302 Foundation Engineering 1

Course Topics:

- *Analysis and design of deep foundations (piers, caissons, piles),*
- *Stability of open cuts,*
- *Stability and design of sheet-pile walls (cantilever, free and fixed earth support types, ties, wales),*
- *Design of secant-pile walls.*

Program and Course Outcomes:

- To familiarize the student with the procedures used to estimate the load capacity of piles and piers.
- To develop an understanding of the behavior of deep foundations for engineering structures and to gain knowledge of the design methods that can be applied to practical problems.
- Provide the students with a basic understanding of the essential steps involved in design and stability of open cuts, sheet-pile walls

CE4310 Design of Prestressed Structures (2-2-2-0)

Designation as a 'required' or 'elective' course:

This is elective course for the Civil Engineering Program.

Course Description:This course focuses on advanced topics prestressed / precast concrete using the provisions of the American Concrete Institute. Beams, slabs, columns, deflections, analysis and design of prestressed members, loss calculations, use of standard precast members. Design and detailing for project implementations.

Recommended Textbook(s):

Prestressed Concrete— A Fundamental Approach, Edward Nawy, Prectice Hall International,
Fifth edition 2006.

Prerequisites:

CE2301 Concrete Properties
CE3303 Reinforced Concrete Design-1

Course Topics:

- Introduction, Basic concepts .
- Materials and systems for prestressing
- Partial loss of prestress
- Flexural design of prestressed concrete elements
- Shear and torsional strength design
- Indeterminate prestressed concrete structures
- Camber, deflection, and crack control
- Prestressed Columns
- Prestressed Slabs (Design charts)

Program and Course Outcomes:

Students should be able to:

- analyze prestressed concrete members and design a precast prestressed concrete bridge beam
- ability to design of prestressing - load balanced method.
- ability to analysis and design of prestressed members loaded in shear and torsion.
- Ability to anchorage zone analysis.
- Ability to check the serviceability limit states (SLS).
- Ability to design prestressed slabs by design charts.

CE4311 Earth Retaining Structures (2-2-2-0)

Designation as a 'required' or 'elective' course:

This is elective course for the Civil Engineering Program.

Course Description: This course introduces the fundamentals and working tools needed for the design and analysis of earth retention systems. Specifically, this course covers the selection, design, and performance of earth retaining structures used for support of fills and excavations. The theory regarding earth pressures and soil-reinforcement interaction are covered in detail. It also includes case histories

illustrating the selection, design and performance of various earth retaining structures

Recommended Textbook(s):

Muni Budhu, Foundations and Earth Retaining Structures, John Wiley & Sons, 2008.

Prerequisites:

CE3307 Soil mechanics 1

Course Topics:

- Introduction
- Types of earth retaining systems
- Earth pressure theory
- Design of externally stabilized fill walls
- Reinforcing elements
- Design of internally stabilized fill walls
- Design of internally stabilized cut walls
- Design of externally stabilized cut walls
- Advances in earth retention systems
- Advances in soil reinforcement

Program and Course Outcomes:

• Identify the types, advantages, and disadvantages of the different earth retaining systems (e.g. gravity structures, geosynthetic-reinforced soil structures, earth anchored systems, soil nailing).

• Quantify the lateral earth pressures associated with different earth retaining systems.

• Evaluate the mechanical properties of geosynthetics used for soil reinforcement, including aspects related to time-dependent response, long-term performance, and cost-effectiveness.

• Select the most technically appropriate and cost-effective type of retaining wall for a given project based on a clear understanding of the many available systems.

• Complete the design of fill walls using appropriate design methods, factors of safety, and field verification methods.

• Complete the design of cut walls using appropriate design methods, factors of safety, earth pressure diagrams and field verification methods.

• Master the use of design tools for the analysis of both external and internal stability, including the

use of hand calculations as well as state-of-the-practice computer programs.

CE4312 Selected Topics in Geotechnical Engineering (2-2-2-0)

Designation as a 'required' or 'elective' course:

This is elective course for the Civil Engineering Program.

Course Description:

Stability of slopes, design of dewatering systems, characteristics of desert problematic soils (swelling soil, dune sand, salt-bearing soil "Sabkha", liquefiable sand), soil improvement methods (mechanical, chemical), description and use of geosynthetics,, design of liner systems for liquid containments and solid waste landfills

Recommended Textbook(s):

By topics

Prerequisites:

CE3307 Soil Mechanics 1

Course Topics:

- *Stability of slopes,*
- *design of dewatering systems,*
- *characteristics of desert problematic soils (swelling soil, dune sand, salt-bearing soil "Sabkha", liquefiable sand),*
- *soil improvement methods (mechanical, chemical),*
- *description and use of geosynthetics,,*
- *design of liner systems for liquid containments and solid waste landfills*

Program and Course Outcomes:

- To familiarize the student with the procedures used to analysis the stability of slopes
- To Provide the students with a basic understanding of the dewatering systems
- To develop an understanding of the behavior of problematic soils for engineering structures and

to gain knowledge of the design methods that can be applied to practical problems.

- To provide the student with soil improvement techniques
- To introduce basic of geosynthetics engineering
- To develop understanding to the design of liner systems.

CE4313 Environmental Impact Assessment (2-2-2-0)

Designation as a 'required' or 'elective' course:

This is elective course for the Civil Engineering Program.

Course Description:

The purpose of this course is to help decision-makers make well-informed decisions related to proposed projects/activities; Predict environmental impact of actions; Find ways and means to reduce adverse impacts; Shape the actions to suit local environment; Present the predictions and options to the decision-makers;

Recommended Textbook(s):

Y.Anjaneyulu & Valli Manickam, *Environmental Impact Assessment Methodologies, Second Edition, 2007.*

David Liu, *Environmental Engineers; Handbook, 2000.*

Prerequisites:

CE4304 Sanitary and Environmental Engineering

Course Topics:

- Fundamental Approach to Environmental Impact Assessment (EIA).
- EIA Methodologies.
- Environmental Laws and Regulations
- Prediction and Assessment of Impacts on Soil and Ground Water Environment.
- Prediction and Assessment of Impacts on Surface Water Environment.
- Prediction and Assessment of Impacts on Biological Environment.
- Prediction and Assessment of Impacts on the Air Environment.
- Prediction and Assessment of mpacts of Noise on the Environment.
- Application of Remote Sensing and GIS for EIA.

Program and Course Outcomes:

Students should be able :

- To know the basics and fundamentals of Environmental Impact Assessment;
- To know the importance of Environmental Impact Assessment and its Laws and Regulations to control all types of the Environmental Pollutions;
- To know how to analyze the project and estimating type of pollutants and the quantities of pollutants would be generated from projects;
- To learn how to make a link between software like GIS or Remote Sensing and Environmental Impact Assessment.

CE4314 Hydraulic Application in Environmental Engineering (2-2-2-0)

Designation as a 'required' or 'elective' course:

This is elective course for the Civil Engineering Program.

Course Description: Introduction to open channel flow, Concept ,Definitions and Diffusion Equation., Advection Diffusion Equation, Mixing in River, Turbulent Diffusion and Dispersion ,Solution to Advective Reacting Diffusion Eq.

Recommended Textbook(s):

1-Hydraulics ln Civil and Environmental engineering, Chadwick, Morfett and Borthwick, 2004, U.K

2-Civil Engineering Hydraulics, Martin Marriott, London, 2010.

Prerequisites:

CE2304 Fluid Mechanics

CE3309 Hydrology

Course Topics:

- Uniform and steady flow in open channel.
- Specific energy diagram
- Fundamental Eqs. of mass and heat transport
- Evaluating transport coefficient in the environment.
- Turbulent dispersion and mixing.
- Dispersion coefficient.
- Sediment Transport

Program and Course Outcomes:

Students should be able:

- To know the basic environmental fluid mechanics
- To understand the fundamental of open channel hydraulics
- To know advective and diffusion phenomena.
- To estimate the longitudinal dispersion coefficients
- To know storm management model

CE4315 Water quality Modeling and Control (2-2-2-0)

Designation as a 'required' or 'elective' course:

This is elective course for the Civil Engineering Program.

Course Description:

The course introduces the fundamental concepts in the field of Environmental pollution and control, and the techniques used to overcome each type of pollutions.

Recommended Textbook(s):

 Philippe Quevauviller, Olivier Thomas,Andr´e van der Beken,Wastewater Quality Monitoring and Treatment,2006

 E. Roberts Alley, Water Quality Control Handbook, 2007.

Prerequisites:

CE4304 Sanitary and Environmental Engineering

Course Topics:

 Introduction – The Environment ,Water Quality ,General Classification of Pollutants.
 The Theory and Quantification of Water Pollution.
 Sources of Water Pollution.
 Pollutant Classification.
 Water Quality.
 Water Quality Management.
 Environmental Management.
 Water Pollution Regulations
 Regulatory Standards
 Water Pollution Control-Techniques Used
 GIS and Remote Sensing Application in Water Quality Modelling

Program and Course Outcomes:

Students should be able :

 To know the basics and fundamentals of Water Quality and its Control;
 To know all types of the Environmental Pollutions and the ways for treatment;
 To know how to analyze and the pollutants would be generated from projects and to determine them in laboratory;
 To learn how to make a link between software like GIS or Remote Sensing and Water Quality.

CE 4316 Pavement Design (2-2-2-0)

Designation as a 'required' or 'elective' course:

This is elective course for the Civil Engineering Program.

Course Description:

Analysis of different type of stresses, strains, and deflections that occurred in flexible and rigid pavement. Studying the AASHTO1993 structural design method to find rigid pavement slab thickness and different layer thicknesses for flexible pavement in addition to study the effects of traffic loading, environmental, and materials properties. Studying the concepts of serviceability and reliability in AASHTO1993 method.

Recommended Textbook(s):

1. AASHTO Guide for design of pavement structures 1993.

2. Pavement design and materials .By A.T. Papagiannnakis and E. A. Masad, published by Johen

Wiley &sons, USA ,2008.

Prerequisites:

CE3310 Traffic Engineering.

CE4303 Highway engineering**.**

Course Topics:

Introduction

- Pavement material properties
- Layers theory and stresses in flexible pavement.
- Type of stresses in rigid pavement:

1. Stress due to sub grade friction.
2. Stress due to temperature gradients.
3. Stresses due to load locations.

- Slab thickness design of rigid pavement
- AASHTO1993 structure design method procedure for flexible pavement.
- American Asphalt Institute method.

Program and Course Outcomes:

Students should be able to:

- Know the different between flexible and rigid pavement (construction materials, type of stresses, theory of analysis and design, and method of construction).
- Understand in details the AASHTO1993 design method.

CE4317 Highway materials (2-2-2-0)

Designation as a 'required' or 'elective' course:

This is elective course for the Civil Engineering Program.

Course Description:

Highway material classifications .Materials used in constructing, embankment, sub grade, sub base, and, in detail, materials used in flexible and rigid pavement. Standard tests, which can be, applied to exam the validity, compatibility, applicability of these materials and then comparing their results with local road agency specifications. Engineering properties of each material, which used before and after construction? Layer construction methods, which can be apply to achieve necessary requirements.

Recommended Textbook(s):

Principles of pavement engineering. By Nick Thom, 1st edition, University of Nottingham, UK, 2008

Highway Materials, Soils, and Concrete. By Harold N. Atkins, 4th Edition, Prentice Hall, Inc.2003

Prerequisites:

CE3307 Soil Mechanics 1

CE4303 Highway Engineering

Course Topics:

- Introduction
- Types of highway material.
- Soil classifications.
- Unbounded material types and their engineering properties.
- Standard tests of unbounded materials.
- Bounded materials (Hydraulically) and their engineering properties.
- Asphalt cement sources, and production.
- Standard tests of asphalt cement.
- Aggregate properties and important tests
- Blending of aggregate fractions by using graphical and mathematical methods.
- Asphalt concrete mix (methods of mix design)
- Type of asphalt plants (asphalt concrete mix production)
- Flexible pavement construction and maintenance

Program and Course Outcomes:

Students should be able to:

- Know the classification of soils and their engineering properties and how to construct each layer.
- Know standard tests for each type of materials before and after construction.
- Understanding the methods of, aggregate blending, and asphalt mix design methods.
- know asphalt concrete mix production in asphalt plants and constructing of flexible pavement layers in the site.

CE4318 Transportation Planning (2-2-2-0)

Designation as a 'required' or 'elective' course:

This is elective course for the Civil Engineering Program.

Course Description:

Forecasting future travel demand involving extensive data gathering and mathematical modeling from the analysis of travel movement within into and out of the urban area and an integral of traffic engineering

Recommended Textbook(s):

1. Modeling Transport by Juan Dois & Luis-1995

2. Traffic and Highway Engineering by Garber 2010

Prerequisites:

CE3310 Traffic Engineering

CE3201 Engineering Statistics

Course Topics:

- Characteristics of transport problems
- Characteristics of transport demand
- Characteristics of transport supply
- Issues in transport modeling
- Aggregate and disaggregate modeling
- Data Collection method
- Network and zoning system
- Trip Generation modeling
- Trip distribution modeling
- Modal split
- Route assignment

Program and Course Outcomes:

Students should be able to:

- Know how to collect and analysis traffic and land use data
- Develop trip generation and distribution model
- Assign the traffic volume on existing transport network and modes
- Develop a policy for future transport system

CE4319 Project Management (2-2-2-0)

Designation as a 'required' or 'elective' course:

This is elective course for the Civil Engineering Program.

Course Description:

This course expand discussion of change management , managing conflict , communication plans , monitoring project performance it covers concepts and skills that are used by manager to propose ,plan ,secure resource ,budget , and lead project teams to successful completions of their project, it cover cost and managing the risk and discuss the earned value

Recommended Textbook(s):

Cliffored F Gray and Erik W Larson , Project management 2006

Prerequisites:

CE3305 Construction Management

Course Topics:

- Modern project management
- Organization structure
- Estimating project time and costs
- Developing a project plan
- Managing risk
- Earned value rules
- Reducing project duration
- Leadership: being an effective project manager
- Progress and performance measurement and evaluation

Program and Course Outcomes:

Students should be able to:

- Know the importance of project management
- Help them understand why organization have developed formal project management plan
- Every project manager understands risks are inherent in projects
- The discussion of earned value has been completely revised to make it easier for students to understand
- Understand strategies for reducing project duration
- Know the project managers are eager to implement their ideas and manage their staff to successfully complete their project
- Determine what data to be collect ,how, when and who will collect the data analysis the data and reporting

CE4320 Operation Research (2-2-2-0)

Designation as a 'required' or 'elective' course:

This is elective course for the Civil Engineering Program.

Course Description:

This course discuss the formal activities of operation research and the situation of the decision making problem whose solution requires three components alternatives, restrictions and objective criterion for evaluating the alternatives ,the technique is used in a wide range of applications including industry, transportation n ,economics, , the transportation model can be extend to other areas of operation ,including among others inventory control ,employment scheduling and personnel assignment the course include the solution methods of nonlinear programming can be classified direct or indirect algorithms

Recommended Textbook(s):

Hamdy A Taha operation research 2007

Prerequisites:

CE3202 Engineering Numerical Methods

CE2201 Calculus 3

Course Topics:

- Introduction to linear programming
- Graphical linear programming solution
- Simplex method
- Primal – dual relationship
- Decision Making under Certainty, under Risk , under Uncertainty
- Sensitivity analysis of linear programming
- Integer linear programming
- Transportation model
- Non linear programming

Program and Course Outcomes:

Students should be able to:

- Trough operation models are designed to optimize
- solution of model that satisfies a specific objective criterion subject to a set of constraints
- know the transportation model can be solved as regular linear programming
- study how the elements of the optimal simplex tableau are recomputed to reflect new change
- Understand integer programming in which the variable assume integer values
- Know nonlinear programming in which the functions of model are nonlinear

CE4321 Quality Management (2-2-2-0)

Designation as a 'required' or 'elective' course:

This is elective course for the Civil Engineering Program.

Course Description:

This course discuss Monitoring quality costs is essential when implementing a quality management system as this gives relevant information about the balance between efforts and investments, the quality costs are Prevention costs, Appraisal costs, Internal failure costs, external failure costs, it cover seven tools of quality control and The term six sigma refers to a statistical measure with no more than 3.4 defects per million and also it cover Iso 9001 2008.

Recommended Textbook(s):

Total quality management 2009

Prerequisites:

CE3201 Engineering Statistics

Course Topics:

- Improve Productivity and Reduce Cost
- Total Quality management
- Cost of Quality
- *Six Sigma*
- Control Charts and Their Role in Quality Systems
- Quality Management System
- ISO Standards

Program and Course Outcomes:

Students should be able to:

- Know Management's role in TQM is to develop a quality strategy that inflexible enough to be adapted to every department, aligned with the organizational business objectives, and based on customer and stakeholder needs.
- Know Continuous quality improvement came into existence in organization as a different approach to quality and quality systems
- Study Six sigma which is a statistically oriented approach to process improvement that uses variety of tools, including statistical process control.
- Be able to develop business performance priorities.