University of Anbar
College of Engineering
Civil Engineering Department
Iraq-Ramadi

Curriculm for Civil Engineering Departemnt

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Mission Statement

The mission of the Department of Civil Engineering is to provide comprehensive quality education to the students in civil engineering, and to adequately prepare them to meet the existing challenges in their profession and be capable of handling them in the future. Upon graduation, students will have acquired sufficient skills in critical thinking, problem solving and communication to achieve a successful career. Their background will provide them the opportunity to pursue graduate programs with ease, enabling them to take up a future role in teaching and research, if they so choose. During the course of their study, they will develop the spirit of team work and understand the desirability of following professional ethics in order to effectively serve the community.

Program Outcomes:

The graduates of the B.Sc. in Civil Engineering program will:

- Engage in Civil Engineering profession in public and private sectors including, but not limited to, relevant governmental sectors, consulting firms, contracting companies, marketing and real estate investments;
- Engage in ongoing professional development activities by pursuing graduate studies and / or other learning opportunities to respond to the arising challenges;
- Advance in responsibility and leadership in their careers.

Program Outcomes (ABET):

a. An ability to apply knowledge of mathematics, science, and engineering
b. An ability to design and conduct experiments, as well as to analyze and interpret data
c. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
d. An ability to function on multidisciplinary teams
e. An ability to identify, formulate, and solve engineering problems
f. An understanding of professional and ethical responsibility
g. An ability to communicate effectively
h. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
i. A recognition of the need for, and an ability to engage in life-long learning
j. A knowledge of contemporary issues
k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Civil Engineering Program: Mapping PO's to PEO's

Program Outcomes	Program Educational Objectives		
	1	2	3
a	√		
b	√		
c	√		
d	√	√	
e	√		
f	√	√	√
g	√		
h	√	√	
i	√	√	
j	√	√	√
k	√		√

Course descriptions

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 (3 hour = 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 consequence of the course in each requirements

Graduation Requirements

Requirements	*Credit hours*
University Requirements	**13**
College Requirements	**40**
Department Requirements	**80**
CE Elective Classes	**12**
Total	**145**

University Requirements: 13 Credit Hours

Course No.	*Course Title*	*Cr. Hours*	*Weekly hours*
CE 1101	**Arabic Language**	**3**	**3**
CE 1102	**Human Rights**	**1**	**1**
CE 1103	**English Language-1**	**3**	**3**
CE 2104	**English Language-2**	**3**	**3**
CE 2105	**Democracy**	**1**	**1**
CE 3106	**Management and Leadership skills**	**2**	**2**
	Total	**13**	**13**

College Requirements: 40 Credit Hours

Course No.	*Course Title*	*Cr. Hours*	**Weekly hours**		
			Lec.	**Tut.**	**Lab**
CE 1201	**Calculus-1**	**3**	**3**	**1**	**-----**
CE 1202	**Calculus-2**	**3**	**3**	**1**	**-----**
CE 1203	**Physics-1**	**4**	**3**		**3**
CE 1204	**Physics-2**	**4**	**3**		**3**
CE 1205	**Chemistry-1**	**4**	**3**		**3**
CE 1206	**Computer Science**	**3**	**2**	**1**	**3**
CE 1207	**Engineering Drawing**	**4**	**3**	**1**	**3**
CE 2208	**Calculus-3**	**3**	**3**	**1**	**-----**
CE 2209	**Calculus-4**	**3**	**3**	**1**	**-----**
CE 2210	**Engineering Statistics**	**3**	**3**		**-----**
CE 3211	**Engineering Numerical Methods**	**3**	**2**	**1**	**3**
CE 3212	**Engineering Economy**	**3**	**3**		**-----**
	Total	**40**	**34**	**7**	**18**

Department Requirements: 80 Credit Hours

Course No.	*Course Title*	*Cr. Hours*	Weekly hours		
			Lec.	Tut.	Lab
CE 1301	Engineering Geology	3	3	1	-------
CE 1302	Statics	3	3	1	-------
CE 2303	Construction Materials	3	3		-------
CE 2304	Construction Materials Lab	1	------		3
CE 2305	Dynamics	3	3	1	------
CE 2306	Strength of Materials	3	3	1	-------
CE 2307	Strength of Materials Lab	1	----		3
CE 2308	Engineering Surveying-1	3	3	1	------
CE 2309	Engineering Surveying Lab-1	1	------		3
CE 2310	Electrical Circuit	3	3	1	-------
CE 2311	Concrete Properties	3	3		------
CE 2312	Concrete Properties Lab	1	------		3
CE 3313	Fluid Mechanics	3	3	1	------
CE 3314	Fluid Mechanics Lab	1	------		3
CE 3315	Building Construction	3	2		3
CE 3316	Hydrology	3	3	1	-------
CE 3317	Structure-1	3	3		-----
CE 3318	Structure-2	3	3		-----
CE 3319	Reinforced Concrete Design-1	3	3		------
CE 3320	Reinforced Concrete Design-2	3	3		-------
CE 3321	Soil Mechanics	3	3	1	-------
CE 3322	Soil Mechanics Lab	1	3		-------
CE 3323	Construction Management	3	3		-----
CE 4324	Steel Structure	3	3	1	-------
CE 4325	Foundations Engineering-1	3	3	1	------
CE 4326	Traffic Engineering	3	3	1	-----
CE 4327	Highway Engineering	3	3	1	-----
CE 4328	Highway Engineering Lab	1	------		3
CE 4329	Sanitary and Environmental Engineering	3	3	1	-----
CE 4330	Sanitary and Environmental Engineering Lab	1	-----		3
CE 4333	Method of Construction and Estimation	3	3	1	-----
CE 4332	Senior Design I	2	2		
CE 4333	Senior Design II	1	-		3
	Total	80	74	15	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 (12 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 (Structural Analysis & Design)	CE 4335	Computer Applications in Civil Engineering	3	3	1	
	CE 4336	Reinforced Concrete Design-3	3	3	1	
	CE 4337	Foundation Engineering 2	3	3	1	
	CE 4338	Design of Prestressed structures	3	3	1	
Group B (Geotechnical Eng.)	CE 4335	Computer Applications in Civil Engineering	3	3	1	
	CE 4337	Foundation Engineering 2	3	3	1	
	CE 4339	Earth Retaining Structures	3	3	1	
	CE 4340	Selected Topics in geotechnical Engineering	3	3	1	
Group C (Hydraulics & Environmental Eng.)	CE 4335	Computer Applications in Civil Engineering	3	3	1	
	CE 4341	Environmental Impact Assessment (EIA)	3	3	1	
	CE 4342	Hydraulic Application in Environmental Eng.	3	3	1	
	CE 4343	Water quality modeling and control	3	3	1	
Group D (Transportation Eng.)	CE 4335	Computer Applications in Civil Engineering	3	3	1	
	CE 4344	pavement design	3	3	1	
	CE 4345	Highway Materials	3	3	1	
	CE 4346	Transportation Planning	3	3	1	
Group E (Construction Management)	CE 4335	Computer Applications in Civil Engineering	3	3	1	
	CE 4347	Project Management	3	3	1	
	CE 4348	Operation Research	3	3	1	
	CE 4349	Quality Management	3	3	1	
		Total	52	52	20	

Recommended Civil Engineering Department course plan by semester

First Year

First Semester					Second Semester				
Course Title	*Credit Hours*	Weekly hours			*Course Title*	*Credit Hours*	Weekly hours		
		Lec.	Tut.	Lab.			Lec.	Tut.	Lab.
Calculus (1)	3	3	1	--	Calculus (2)	3	3	1	--
Physics (1)	4	3		3	Physics (2)	4	3	--	3
Chemistry (1)	4	3		3	Engineering Drawing	4	3	1	3
Computer science	3	2	1	3	Statics	3	3	1	
Arabic Language	3	3		--	English Language-1	3	3	--	--
Engineering Geology	3	3	1	--	Human Rights	1	1	--	--
Total	20	17	3	9	Total	18	16	3	6

Second Year

First Semester					Second Semester				
Course Title	*Credit Hours*	Weekly hours			*Course Title*	*Credit Hours*	Weekly hours		
		Lec.	Tut.	Lab.			Lec.	Tut.	Lab.
Calculus (3)	3	3	1		Calculus (4)	3	3	1	-
Engineering Surveying (1)	3	3	1		Strength of Materials	3	3	1	-
Engineering Surveying (1) Lab	1			3	Strength of Materials Lab	1	-	-	3
Construction Materials	3	3			Concrete Properties	3	3		
Construction Materials Lab	1			3	Concrete Properties Lab	1			3
Dynamics	3	3	1	-	Engineering Statistics	3	3	-	-
English Language-2	3	3			Electric Circuits	3	3	1	-
					Democracy	1	1	-	-
Total	17	15	3	6	Total	18	16	3	6

Third Year

First Semester					Second Semester				
Course Title	*Credit Hours*	Weekly hours			*Course Title*	*Credit Hours*	Weekly hours		
		Lec.	Tut.	Lab.			Lec.	Tut.	Lab.
Fluid Mechanics	3	3	1		Reinforced Concrete (2)	3	3		
Fluid Mechanics Lab	1			3	Soil Mechanics	3	3	1	
Structure (1)	3	3			Soil Mechanics Lab	1			3
Reinforced Concrete (1)	3	3			Engineering Economy	3	3		
Engineering Numerical Methods	3	2	1	3	Structure (2)	3	3		
Construction Management	3	3			Hydrology	3	3		
Building Construction	3	2		3	Management and Leadership skills	2	2		
Total	19	16	2	9	Total	18	17	1	3

Practical Training -Supervised 160 hrs training period at any approved engineering concern (consulting, contracting, industrial, government), intended to provide students with hands-on experience at the work place. Evaluation is based on daily performance, supervisors' input, student's report, and short presentation. [*Prerequisite:* Departmental approval]

Fourth Year

First Semester					Second Semester				
Course Title	*Cr. Hours*	Weekly hours			*Course Title*	*Cr. Hours*	Weekly hours		
		Lec.	Tut.	Lab			Lec.	Tut.	Lab
Steel Structure	3	3	1		Sanitary and Environmental Engineering	3	3	1	
Foundation Engineering (1)	3	3	1		Sanitary and Environmental Engineering Lab	1			3
Traffic Engineering	3	3	1		Method of Construction and Estimation	3	3	1	
Senior Design I	2	2			Highway Engineering	3	3	1	
CE Elective Class	3	3	1		Highway Engineering Lab	1			3
CE Elective Class	3	3	1		Senior Design II	1			3
					CE Elective Class	3	3	1	
					CE Elective Class	3	3	1	
Total	17	17	5		Total	18	15	5	9

Program Outcome Curriculum Map according to ABET Criterion

		a	b	c	d	e	f	g	h	i	j	k
First year-Semester 1												
	Calculus (1)	X										
	Physics (1)	X	X					X				X
	Chemistry (1)	X	X					X				X
	Arabic Language							X				
	Computer science	X	X		X	X		X				X
	Engineering Geology	X	X	X	X	X						
First year-Semester 2												
	Calculus (2)	X										
	Physics (2)	X	X					X				
	Engineering Drawing	X	X					X				X
	Statics	X		X	X	X						X
	English Language-1							X				
	Human Rights						X					
Second year-Semester 1												
	Calculus (3)	X										
	Engineering Surveying (1)	X		X								
	Engineering Surveying (1) Lab	X	X			X						X
	Construction Materials	X		X		X		X			X	X
	Construction Materials Lab		X			X		X				X
	Dynamics	X		X	X	X						X
	English Language-2							X				
Second year-Semester 2												
	Calculus (4)	X										
	Strength of Materials	X		X		X			X			
	Strength of Materials Lab	X	X	X		X						
	Concrete Properties			X							X	X
	Concrete Properties Lab		X	X							X	X

	Engineering Statistics	**X**	**X**									**X**
	Electric Circuits	**X**										**X**
	Democracy						**X**					

Third year-Semester 1

	Fluid Mechanics	**X**		**X**								
	Fluid Mechanics Lab		**X**		**X**							
	Structure (1)	**X**		**X**								
	Reinforced Concrete Design (1)	**X**				**X**						
	Engineering Numerical Methods	**X**		**X**	**X**							**X**
	Construction Management			**X**	**X**							**X**
	Building Construction	**X**		**X**		**X**	**X**		**X**			**X**

Third year-Semester 2

	Reinforced Concrete Design (2)	**X**				**X**						
	Soil Mechanics	**X**		**X**								**X**
	Soil Mechanics Lab	**X**	**X**	**X**	**X**							**X**
	Engineering Economy	**X**	**X**							**X**		**X**
	Structure (2)	**X**		**X**								
	Hydrology	**X**		**X**								**X**
	Management & leadership skills						**X**					

Fourth year-Semester 1

	Steel Structure	**X**		**X**		**X**						**X**
	Foundation Engineering (1)	**X**		**X**		**X**						**X**
	Traffic Engineering	**X**		**X**		**X**	**X**		**X**	**X**		**X**
	Senior Design I	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
	CE Elective Class	**X**		**X**	**X**	**X**	**X**					
	CE Elective Class	**X**		**X**	**X**	**X**	**X**					

Fourth year-Semester 2

	Sanitary and Environmental Engineering	**X**		**X**		**X**						
	Sanitary and Environmental Engineering Lab	**X**	**X**	**X**								
	Highway Engineering	**X**		**X**	**X**	**X**						**X**

	Highway Engineering Lab	**X**	**X**	**X**	**X**							
	Method of Construction and Estimation	**X**		**X**		**X**	**X**		**X**			**X**
	Senior Design II	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
	CE Elective Class	**X**		**X**	**X**	**X**	**X**					
	CE Elective Class	***X***		***X***	***X***	***X***	***X***					

University Requirements Courses

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Prepared by Khalid R. Mahmood (Ph.D.)-Assistant Professor

CE 1101 Arabic Language-(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 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):

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

CE 1102 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:

- The definition of freedom and the right
- Origin of the right in the eyes of Islamic law
- Elements and Types of the Human right
- Rights and economic freedoms
- Islam and Slavery
- Human rights objectives
- The use of freedom and the right general project
- The right of a Muslim

Program and Course Outcomes:

- Evaluate Human rights
- Preservation of human rights in Islam
- Evaluation of relationship between human rights and democracy

CE 1103 English Language-1-(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 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):
Ewer J.R. & Latore G. "A Course in Basic Scientific English", Longman Group United Kingdom (1984)

Prerequisites:
None

Course Topics:

The Scientific Attitude-Simple present active
Numbers and Mathematics-Simple present passive
Scientific Methods and the Methods of Science-Simple Past active and passive
Pure and Applied Science
Directed research?
Science and International Co-operation
Efficiency in Engineering Operations (Optimum Conversion)

Program and Course Outcomes:

1. Develop academic writing proficiency and critical thinking skills
2. Help students to conduct effective searches of printed and electronic resources
3. Develop skills for correctly using external sources to support ideas in an academic paper/topics in civil engineering
4. Provide students with an understanding of academic integrity (how to avoid plagiarism)
5. Familiarize students with the conventions of academic papers in APA 'style
6. Support a classroom community that involves constructive exchange of ideas

CE 2104 English Language-2-(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 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):

Ewer J.R. & Latore G. "A Course in Basic Scientific English", Longman Group United Kingdom (1984)

Prerequisites:

CE 1103 English language-1

Course Topics:

- Underdevelopment and the Sciences
- Sources of error in Scientific Investigations
- Straight and Crooked Thinking
- Science and The Future
- The Role of Chance in Scientific Discovery
- The Scientist and the Government
- Water Supplies-A Growing Problem

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

CE 2105 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:
CE 1102 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:

- Learn what democracy?
- Democratic approach in Islam and its applications
- Accepts differing views
- Evaluation of pressure groups

CE 3106 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 to give the student the required skills in Management and leadership that he/she needs in his/her career life

Recommended Textbook(s):
By Topics

Prerequisites:
None

Course Topics:

- Management Concept
- Leadership Concept
- Difference between Management and Leadership
- Concept of leadership skills and approach of changing
- Objective achievement and planning Concept
- Leadership skills for Engineers
- What is an Engineer?
- The Engineer as a problem solver
- The need for Engineering
- Problem Solving approach
- Problem solving Skill
- Creative problem Solving
- Engineering Communication
- Communication Skill
- Leadership Skills and marketing
- Leadership of Life
- Thinking and smart skills
- Skills of working market and commerce
- Marketing of search, service, and ideas
- Marketing of Leader and leader of changing
- Time management and
- Engineering Education and accreditation

Program and Course Outcomes:

1. Learning Required Skills for Engineering
2. Learning Required Skills of Management
3. Learning required Skills of Leadership
4. Learning Smart Thinking
5. Learning Approach of Changing

College Requirements Courses

College Requirements Courses

CE 1201 – 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:
Limits and continuity. Differentiation. Applications of derivatives. Integration. Inverse functions. Applications of the Integral

Recommended Textbook(s):
Calculus, Early Transcendentals By James Stewart, 6th Edition, 2008, Brooks/Cole

Prerequisites:
None

Course Topics:
1. *The Tangent and Velocity Problems. The Limit of a Function*
2. *Calculating Limits Using the Limit Laws. Continuity*
3. *Limits at Infinity, Horizontal Asymptote. Infinite Limits, Vertical Asymptotes. Derivatives and Rates of Change*
4. *The Derivative as a Function. Differentiation of Polynomials. The Product and Quotient Rules*
5. *Derivatives of Trigonometric Functions. The Chain Rule*
6. *Implicit Differentiation. Related Rates*
7. *Maximum and Minimum Values. The Mean Value Theorem*
8. *How Derivatives Affect the Shape of a Graph. Summary of Curve Sketching*
9. *Optimization Problems. Antiderivatives*
10. *Areas and Derivatives. The Definite Integral. The Fundamental Theorem of Calculus*
11. *The Indefinite Integral and Net Change Theorem. The Substitution Rule. Areas between Curves*
12. *Volumes. Volumes by Cylindrical Shells. Average Value of a Function*
13. *Exponential and Logarithmic Functions. Derivative and Integrals Involving Logarithmic Functions. Inverse Functions. Derivative and Integrals Involving Exp Functions.*
14. *Derivative and Integrals Involving Inverse Trig Functions. Hyperbolic Functions and Hanging Cables. Indeterminate Forms and L'Hospital's Rule.*

Program and Course Outcomes:
1. *Evaluate Limits of functions using various techniques including L'Hopital's Rule*
2. *Discuss the continuity functions*
3. *Identify the properties of inverse functions and their derivatives*
4. *Find the derivative of algebraic, trigonometric, exponential, and logarithmic functions*
5. *Sketch the graph of a function using the information for the first and second derivatives*
6. *Solve problems involving applications of derivatives including, related rates and optimization*
7. *Identify the definition and properties associated with definite integrals*
8. *Solve problems using the Fundamental Theorem of Calculus*
9. *Evaluate integrals using the method of substitution*
10. *Solve problems involving applications of integrals including finding volume of solids of revolution and area between curves*

CE 1202 – 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:
Transcendental functions. Techniques of integration. Sequences and infinite series. Parametric equations and polar coordinates

Recommended Textbook(s):
Calculus, 8th edition (2007) by Howard Anton, (John Wiley & Sons, Inc, New York). Chapters:7,8,10&11

Prerequisites:
CE 1202-Calculs 2

Course Topics:
1. Review of inverse functions. Inverse trigonometric functions.
2. The derivative of inverse trigonometric functions. Hyperbolic functions.
3. Inverse hyperbolic functions and their derivatives.
4. Integrals involving inverse trigonometric and inverse hyperbolic functions.
5. Integration by Parts. Trigonometric Integrals.
6. Trigonometric Substitution. Integrating Rational Functions by Partial Fractions.
7. Types of Improper Integrals and Methods of Evaluation
8. Sequences and their limits, monotone sequences
9. Infinite series. The comparison.
10. Ratio and Root tests. Alternating series.
11. Conditional convergence. Maclaurin and Taylor series, and their approximation. Power series.
12. Differentiating and Integrating Power series.
13. Polar coordinates. Curves defined by parametric equations
14. Tangent lines and length for parametric and polar curves. Area in polar coordinates.

Program and Course Outcomes:
1. Identify the properties of inverse trigonometric functions, hyperbolic, and inverse hyperbolic functions.
2. Find the derivatives and integrals of inverse trigonometric, hyperbolic, and inverse hyperbolic functions.
3. Evaluate the indefinite and improper integrals by using different integration techniques.
4. Identify the properties of sequences and their limits.
5. Use various tests to determine convergence of series.
6. Perform standard operations with convergent power series, including the method of differentiating and integrating term by term.
7. Use Taylor and Maclaurin series to approximate functions.
8. Sketch the graphs of parametric and polar equations.
9. Use parametric and polar equations to solve applied problems including area and arc length

CE 1203 – Physics-1-(4-3-0-3)

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.
The subject matter of the course will be covered in The Lab-based section which 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 Textbook(s):
R.D. Knight, Physics for Scientists and Engineers, 2nd ed., Pearson 2008
Laboratory Manual, Compiled by Instructor

Prerequisites:
Concurrent requirement with CE 1201 Calculus-1

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*

Lab. Section

1. Orientation. Introduction to Error Analysis/ Part (I). Introduction to Error Analysis/ Part (II)

2. Experiment 0: Measurements and Data Analysis
3. Experiment 1: Analyzing the kinematic components of 1Dmotion by using motion sensor
4. Experiment 2: Determination of the Acceleration of Gravity by studying Free fall
5. Experiment 3: Verification of Newton's Second Law
6. Experiment 4: Conservation of mechanical energy
7. Experiment 5: Verification of Work –energy theorem
8. Experiment 6: Static Equilibrium of a rigid object
9. Experiment 7: Determination of the Acceleration of Gravity using the Simple Pendulum
10. Experiment 8: Verification of Hook's Law
11. Experiment 9: Determination of the speed of Sound in Air using a resonance tube
12. Experiment 10: Determination of the Coefficient of Viscosity
13. Experiment 11: Determination of the Mechanical Equivalent of Heat
14. Experiment 12: Determination of Specific Heat Capacity of a solid

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, angularacceleration, 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.
10. 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

1. Test experimentally some of the physical laws and theories taught in lecture room.
2. Fit observed data with mathematically modeled physical phenomenon.
3. Use a variety of physical measuring devices e.g. Micrometer, Vernier Caliper, Stop watch,Power Supply, Voltmeter, Ammeter, and CRO.
4. Estimate the uncertainty by applying the rules of Standard Deviation in the case of repeated measurements of a single quantity and by employing the technique of Least-Squares Fitting in the case of experiment that involves the measurement of several values of two or more different quantities.
5. Apply the technique of error propagation to estimate and manipulate the uncertainty in directly and indirectly measurement of physical quantities.
6. Evaluate some uncertainty related quantities, namely accuracy and precision, confidence level, discrepancy, and significance of a discrepancy, and utilize them to determine the sources of experimental errors, and to discuss how to minimize the uncertainties in the funded results.
7. Incorporate computer in measuring and analyzing the experimental result.
8. Communicate scientific results in a written manner through presenting a word-processed report on the conducted experiment.
9. Measure, determine, and graph the basic components of 1D motion: position, velocity, and acceleration.
10. Verify Newton's second law experimentally through observing, and measuring some common forces that occur in our everyday life e.g. gravity, g f friction S f & K f , and tension T .
11. Inspect the laws of conservation of energy for rotating and non-rotating systems.
12. Test practically the correctness of the two conditions of static equilibrium.
13. Analyze experimentally some features of oscillatory and wave motion by studying SHM using simple pendulum, and semi-ideal spring, and examining resonance of closed and open air columns.
14. Check experimentally the Viscosity property of a fluid by measuring the Coefficient of Viscosity of engine oil by Stokes method.
15.Construct simple DC circuit and design simple thermal experiment to measure the mechanical equivalent of heat, and specific heat capacity of a solid

CE 1204 – Physics 2-(4-3-0-3)

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 Electrostatics, Electric charge and electric field , Coulomb's law, electric potentials, Capacitance and dielectric , currents, , Resistance Ohm's law, Electromotive force , Direct current circuits, magnetism, Magnetic field and magnetic forces, Sources of magnetic field , Biot-Savart Law, and Ampere's law , induction, Faraday's Law ,Maxwell's equations, electromagnetic radiation, wave motion, and physical and geometrical optics. The Lab. section presents an introduction to the methods of experimental physics. Emphasis is on experimental, data analysis, and written presentation skills of lab work. During the course students execute a series of experiments on electrostatic fields, Magnetic fields, Induction, DC circuits, and AC circuits.

Recommended Textbook(s):
R.D. Knight, Physics for Scientists and Engineers, 2nd ed., Pearson 2008
Laboratory Manual, Compiled by Instructor

Prerequisites:
CE 1201 Calculus-1
CE 1203 Physics 1

Course Topics:
1. *Electric charge; Coulomb's law; Superposition of forces; Electric field; Electric fields of simple geometric static charge configuration; Electric field lines; Electric field around conductors in e.s. equilibrium; Electric dipole field; dipole moment and torque on a dipole. Concept of field; Electric field flux and Gauss's law.*
2. *10/13 Profile of Physics Courses Servicing Engineering III.4. Course Topics & Matrix Topics To Be Covered Teaching Duration Learning Outcomes Assessment Tools Part(I) Electrostatics: Electric charge; Coulomb's law; Superposition of forces; Electric field; Electric fields of simple geometric static charge configuration; Electric field lines; Electric field around conductors in e.s. equilibrium; Electric dipole field; dipole moment and torque on a dipole. Concept of field; Electric field flux and Gauss's law. 4 Weeks A.1, A.2, A.3, A.6 _ Assignments _ Quizzes _ Tutorial _ Exam 1,3 Electric potential energy; Electric potential difference (Voltage); Equipotential lines; Energy stored in simple charge configurations, Potential due Electric dipole.*
3. *Capacitors and their capacitance; Capacitors in series and in parallel; Energy stored in a capacitor.*
4. *Current; resistance and Voltage ; Ohm's law; Resistivity; Conductivity; Electromotive force(emf) ; Power ;Kirchhoff's laws; RC circuits*
5. *Gauss's law in magnetism ; Lorentz's force law; Force on a current-carrying wire; Force between currentcarrying wires; Torque on a current loop; Magnetic field; Magnetic field due to steady current; Magnetic dipoles; Ampere's law; Biot-Savart Law; magnetic flux; Magnetic materials: Dia-,Para-, and Ferro-magnetism*
6. *Induced emf; Faraday's law; Lenz's law; Energy stored in a magnetic field. Eddy currents; Inductors; Mutual and self inductance; Energy stored in an inductor; Transformers.*
7. *AC voltage and current; simple Ac circuits and applications; Impedance and phases. LR, LC, and LRC circuits*

8. Ampere's law and displacement current; Maxwell's equations; Electromagnetic waves; Light and electromagnetic wave; Geometrical optics.

Lab. Section

Experiment 0: Measurements and Data Analysis
Experiment 1: Verification of Ohm's Law
Experiment 2: Temperature Dependence of Electrical Resistance
Experiment 3: The Relationship between the Fusing Current of a Conducting wire and its diameter
Experiment 4: Electrical conduction through semiconductor
Experiment 5: Determination of Dielectric Constant
Experiment 6: Cathode-ray oscilloscope Operation and Basic Measurements
Experiment 7: Measurement of Time constant of an RC Circuit
Experiment 8: Some electrical properties of transformers
Experiment 9: Properties of a series resonant circuit
Experiment 10: Charge to mass ratio of the electron
Experiment 11: Laser diffraction

Program and Course Outcomes:

1. Explain the origin of electromagnetic phenomena in view of modern atomic theory.
2. Define and calculate the basic physical quantities of electrostatics for the case of simple static charge distribution; namely: Coulomb's force, electrostatic field, electric Flux, electrostatic potential, voltage, and capacitance.
3. Represent the electric and magnetic field graphically for various charge distributions.
4. Draw the equipotential lines of electric potential for various simple charge configurations.
5. Define and calculate the basic physical quantities of Magnetostatics for the case of simple steady current distribution; namely magnetic force, magnetic field, and magnetic dipole moment.
6. Describe and explain the effects due to the electric and magnetic properties of materials.
7. Classify matter according to its response to external magnetic field: Ferromagnetism, Paramagnetism, and Diamagnetism.
8. Define and determine the basic quantities of 1D steady electrodynamics; specifically: current, current density, voltage, Resistance, resistivity, conductivity, emf, and power.
9. Explain the formation of Eddy's current in a conducting materials.
10. Illustrate the phenomena of electromagnetic induction and self and mutual inductance.
11. state the fundamental laws and theorems of Electricity & Magnetism in their integral and differential forms , namely: Coulomb's law, Gauss's law, Ohm's Law , Kirchhoff's Rules ,Lorentz force law, Biot-Savart law, Ampere's circuital theorem, Faraday's law, and Lenz's law.
12. Apply the knowledge of the fundamental laws and theorems of Electricity & Magnetism in solving problems involving simple dynamic charge configurations, Analyze simple DC and AC circuits.
13. State the fundamental equations that govern all electromagnetic phenomena, Maxwell's four equations.
14. State the basic properties of electromagnetic waves.
15. Explain the fundamental laws of geometrical optics.

Lab. Section

1 Test experimentally some of the physical laws and theories taught in lecture room.
2 Fit observed data with mathematically modeled physical phenomenon.

3 Use a variety of electrical measuring instruments and tools, e.g. AC/DC Power Supply, Voltmeter, Ammeter, Multimeter, CRO, Resistor ,Transformer, Coil , and Capacitor and utilize them to construct simple AC and DC circuits.

4 Estimate the uncertainty by applying the rules of Standard Deviation in the case of repeated measurements of a single quantity and by employing the technique of Least-Squares Fitting in the case of experiment that involves the measurement of several values of two or more different quantities.

5 Apply the technique of error propagation to estimate and manipulate the uncertainty in directly and indirectly measurement of physical quantities

6 Evaluate some uncertainty related quantities, namely accuracy and precision, confidence level, discrepancy, and significance of a discrepancy, and utilize them to determine the sources of experimental errors, and to discuss how to minimize the uncertainties in the funded results.

7 Incorporate computer in measuring and analyzing the experimental result.

8 Communicate scientific results in a written manner through presenting a word-processed report on the conducted experiment.

9 Check experimentally the phenomenon of increasing of the capacitance of a capacitor when a dielectric fills the space between its plates.

10 Verify Ohm's law experimentally for different resistors setting, and use it to measure the resistivity, and conductivity of aluminum and copper.

11 Test experimentally the relation between the electrical current near the melting point of a conducting wire and its diameter.

12 Practice the exponential behavior of charging –discharging of a capacitor in an RC circuit and measure the long and short time constant of the circuit.

13 Check experimentally the linear temperature dependence of the electrical resistance of a conducting material and the exponential temperature dependence of the electrical resistance of a semiconducting material, and use the results to Identify the structure of the material.

14 Measure the strength of the local Magnetic Field of the Earth using the Biot-Savart law at the center of a coil.

15 Verify experimentally the expected geometrical behavior of electron moving in electric and magnetic fields, and use the data to estimate the electron charge to mass ratio.

16 Inspect the electrical properties of AC transformer and measure its efficiency.

17 Analyze the resonance phenomenon that occurs in the AC series LRC circuit.

18 Verify the laws of diffraction and the principle of superposition using Laser beam.

CE 1205 – Chemistry 1-(4-3-0-3)

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. Acid-base 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 CE 1201 Calculus-1

Course Topics:
1. *Measurements. Handling Numbers. Dimensional Analysis in Solving Problems*
2. *Atomic Number, Mass Number, and Isotopes. The Periodic Table. Molecules and Ions. Chemical Formulas. Naming Compounds*
3. *Atomic Mass. Avogadro's Number and Molar Mass of an Element. Molecular Mass. The Mass Spectrometer. Percent Composition of Compounds. Experimental Determination of Empirical Formulas. Chemical Reactions and Chemical Equations. Amounts of Reactants and Products. Limiting Reagent Calculations. Reaction Yield*
4. *General Properties of Aqueous Solutions. Precipitation Reactions. Acid-Base Reactions. Oxidation-Reduction Reactions. Concentration of Solutions. Acid-Base Titrations*
5. *Gases. Pressure. The Ideal Gas Equation. Gas Stoichiometry. Partial Pressures*
6. *The Nature of Energy and Types of Energy. Energy Changes in Chemical Reactions. Introduction to Thermodynamics. Enthalpy of Chemical Reactions. Calorimetry. Standard Enthalpy of Formation and Reaction*
7. *From Classical Physics to Quantum Theory. Bohr's Theory of the Hydrogen Atom. Quantum Numbers. Atomic Orbitals. Electron Configuration. The Building-Up (Aufbau) Principle*
8. *Development of the Periodic Table. Periodic Classification of the Elements. Periodic Variation in Physical Properties. Ionization Energy. Electron Affinity*
9. *Lewis Dot Symbols. The Ionic Bond. The Covalent Bond. Electronegativity. Writing Lewis Structures. Formal Charge and Lewis Structures. The Concept of Resonance. Exceptions to the Octet Rule. Bond Energy*
10. *Molecular Geometry. Dipole Moment. Valence Bond Theory. Hybridization of Atomic Orbitals. Hybridization in Molecules Containing Double and Triple Bonds. Delocalized Molecular Orbitals*

Lab. Section
1. *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

Program and Course Outcomes:
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, and9) 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

Lab. Section
1. Recognize chemical safety and hazardous materials icons, and apply laboratory safety rules.
2. Describe laboratory instruments and some basic techniques used in the chemistry laboratory, including balances and standard volumetric equipment.
3. Carry out volumetric methods of chemical analysis including dilutions and titrations, and basic synthetic techniques.
4. Describe and use UV/VIS spectrophotometric methods of analysis.
5. Prepare accurate laboratory reports of their experimental results.
6. Use their knowledge of general chemistry and its applications for further study within the framework of chemistry.

CE 1206 – Computer science-(3-2-1-3)

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

Course Description:
This course introduces the student to computer concepts, control structures, functions, and arrays: single and multidimensional, and string processing found in Visual Basic. The course also examines input/output statements including data file I/O, arithmetic, logical and comparison operators, along with an introduction to classes.

Recommended Textbook(s):
BYRON S. GOTTFRIED, THEORY AND PROBLEMS OF PROGRAMMING WITH VISUAL BASIC , SCHAUM'S OUTLINE SERIES MCGRAW-HILL, INC. ,2001

Prerequisites:
None

Course Topics:
Visual Basic Statements and Expressions,
Visual Basic Data Types, Variable Declaration, Visual Basic Symbolic Constants
Visual Basic Looping, Visual Basic Branching - If Statements, for … next
do..while, and select case
Visual Basic Functions, Procedure
Arrays, Control Arrays
Database Access and Management, Database Structure and Terminology
ADO Data Control, Data Links
Bound Data Tools, Creating a Virtual Table, Data Manager
Custom Data Aware Controls
Creating a Data Report, Accessing data report
Creating a Data Environment
Adding menus to the application
Laboratory: Programming Exercises and a group project

Program and Course Outcomes:
1-Manipulate the basic components of the Visual Basic language: Constants, Variables, Built-in data types, Arrays, Control Structure, Looping and Functions, Classes.
2-Analyze algorithms and computer code.
3-Design, write, and test a complete program that solves a given problem.
4-Process input data files, analyze them, and make output files using Visual Basic.
5-Use the software environment for coding, compiling, and executing a program.
6-Work productively with peers as a member of an engineering team to implement an Engineering programming project

CE 1207 – Engineering Drawing-(4-3-1-3)

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:
Introduction: graphic language, standards, instruments, letters…etc
Basics for interpreting drawings, line types, types of drawings and sketches
Orthographic views. Deducing front, top, and side views from a pictorial
Dimensioning
Sectional views: full and half sections
Drawing a missed view from given two
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.
4. Visualize wide variety of objects and drawing the missing views.
5. Comprehend and deduce section views
6. Produce three dimensional drawings utilizing CAD software

CE 2208 – 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:
Vector calculus. Functions of several variables. Differentials and applications. Double and triple integrals

Recommended Textbook(s):
Calculus, by H. Anton, I. Bivens, and S. Davis, 8th Edition, 2002, Wiley

Prerequisites:
CE1202-Calculs 2

Course Topics:
1. Rectangular Coordinate systems in 3-space. Vectors
2. Dot product, projections. Cross product
3. Parametric equations of a line. Planes in 3-space
4. Introduction to vector-valued functions. Calculus of vector-valued functions
5. Change of parameters, Arc Length. Unit Tangent, Normal and Binormal vectors
6. Curvature
7. Quadric Surfaces. Functions of two or more variables
8. Limits and continuity. Partial derivatives
9. Differentiability, Local Linearity. The Chain rule
10. Directional derivatives and gradients. Tangent planes and normal vectors
11. Maxima and minima of functions of two variables. Lagrange multipliers
12. Double integrals. Double integrals over non rectangular regions
13. Double integrals in polar coordinates. Triple integrals
14. Cylindrical and spherical coordinates, Triple integrals in cylindrical and Spherical coordinates

Program and Course Outcomes:
1. Recognize the 3-space in different types of coordinates systems.
2. Do operations on vectors.
3. Identify different types of equations of lines, planes and surfaces.
4. Recognize different types of calculus operations of vector-valued functions.
5. Find arc length, unit tangent and normal vectors.
6. Identify the basic properties of the real-valued functions of several variables.
7. Evaluate limits of functions, and discuss their continuity and partial derivatives.
8. Find directional derivatives and gradients and identify their properties.
9. Solve optimization problems involving two or three variables.
10. Evaluate multiple integrals in different types of coordinates systems.

CE 2209 – 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:
First-Order Differential Equations: Initial-value problem. separable variables. Homogeneous equations. Exact equations. Li-near equations. Integrating factor. Bernoulli equation. Applications. Second-Order Differential Equations: Initial-value and Boundary-value problems. Linear differential operators. Reduction of order. Homogeneous equations with constant coefficients. Non-homogeneous equations. Method of undetermined coefficients. method of variation of parameters. some nonlinear equations. Applications. Higher order Differential Equations. Laplace Transforms: Definitions. Properties. Inverse Laplace transforms. Solving initial-value problems. Special functions: Heavy side unit step function. Convolution theorem. System of Linear Differential Equations: Definitions. Elimination method. Application of Linear Algebra. Homogeneous linear systems. Non-homogeneous linear systems. Solving systems by Laplace transforms. Series Solutions: Cauchy-Euler equation method. Solutions about ordinary points. Solutions about singular points. Method of Frobenius. Second Solutions and Logarithm terms. ? Partial Differential Equations: Some mathematical models. Fourier series solutions. Method of separation of variables. The D'Alembert solution of the wave equation.

Recommended Textbook(s):
Fundamentals of Differential Equations bound with IDE CD (5th Edition) by Nagle, Saff and Snider

Prerequisites:
CE 2208– Calculus 3

Course Topics:
1. *Basic Definitions and Terminology: Motivation, Definitions, Classification by type, Classification by order, Linearity, Solutions.*
2. *First-Order Differential Equations: Initial-value problem, Separable variables, Homogeneous equations, Exact equations.Linear equations, Integrating factor, Bernoulli equation, Applications.*
3. *Second-Order Differential Equations: Initial-value and Boundary-value problems, Linear differential operators, Reduction. Of order, Homogeneous equations with constant coefficients, Nonhomogeneous equations, Method of undetermined coefficients, Method of variation of parameters, Some non-linear equations, Applications, Higher order Differential Equations.*
4. *Laplace Transforms: Definitions, Properties, Inverse Laplace transforms, Solving initial value problems. Special functions: Heavyside unit step function, Periodic function, Dirac delta function, Convolution theorem.*
5. *Systems of Linear Differential Equations: Definitions, Elimination method, Application of Linear Algebra, Homogeneous linear systems, Solving systems by Laplace transforms.*
6. *Series Solutions: Cauchy-Euler equations, Solutions about ordinary points, Solutions about singular points. Method of Frobenius, Second solutions and Logarithm terms.*
7. *Partial Differential Equations: Some mathematical models, Fourier series solutions, Method of separation of variables, The D'Alembert solution, Applications.*

Program and Course Outcomes:
1. *Classify differential equations by type, order and linearity*
2. *Determine the solution of linear and nonlinear first order differential equations by using various techniques*
3. *Solve non-homogeneous second order differential equations by using the method of undetermined coefficients and the method of variation of parameters*

4. Solve some non-linear differential equations
5. Use Laplace transforms to solve initial value problems
6. Find the solution of systems of differential equations by using the eigenvalue-eigenvector method
7. Solve applied problems using first order differential equation models
8. Apply second order differential equations to solve vibration models based on real life problems
9. Use the power series method at regular and singular points to solve differential equations
10. Employ the methods of separation and D'Alembert's solution to obtain the solution of known partial differential equations including Laplace, heat and wave equations.

CE 2210 – 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:
Classification of Data. Graphical representation. Arithmetical description. Probability theory, probability of an event and composite events. Addition rule and multiplication rule, independent events. Counting techniques. Random variables and probability distributions. Expected values. Continuous and discrete random variables. Normal distribution. Binomial distribution. Poisson distribution. Joint and marginal probability distributions. Independence of random variables. Covariance and correlation. Random sampling. Unbiased estimates. Statistical intervals and test of hypothesis for a single sample.

Recommended Textbook(s):
William Mendenhall and Terry Sincich, Statistics for Engineering and the Sciences, Prentice Hall, 5th ed., 2007.

Prerequisites:
CE 1202 Calculus-2

Course Topics:
1. *Introduction, Data Summary and Presentation*
2. *Probability: Addition rule, conditional probability, multiplication rule and Bayes Theorem.*
3. *Discrete random variables. Probability mass function. Mean and variance of discrete random variables.*
4. *Probability Distribution functions: Uniform, Binomial, Geometric and Negative Binomial, Hyper-geometric and Poisson Distribution.*
5. *Continuous random variables. Probability Density functions.*
6. *Normal Distribution. Approximation to Binomial and Poisson Distribution. Exponential distribution. Other continuous distributions.*
7. *Joint probability function. Multiple discrete and continuous random variables.*
8. *Covariance and correlation. Bivariate Normal Distribution. Linear combination of random variables. Functions of random variables.*
9. *Parameter estimation. Properties of estimators. Method of Moments.*
10. *Method of Maximum likelihood.*
11. *Interval estimation. Inference on the mean of a population: variance known or unknown. Inference on the variance of a normal population*
12. *Hypothesis testing about the mean and Proportion: Small and Large Sample*
13. *Hypothesis testing: Two Populations*

Program and Course Outcomes:
1. Differentiate between a random process and a deterministic process.
2. Deal with sampled data; analyze it using several measures, and present it graphically.
3. Be familiar with probability theory and its applications.
4. Deal with both discrete and continuous random variables.
5.Link the normal distribution to many populations in practice.
6. Design good estimators for various parameters of different populations.
7. Judge statistical hypotheses by carrying statistical tests, using different significance levels.
8. Use statistical software (Excel, Matlab or any other appropriate one) for statistical analysis

CE 3211 – Engineering Numerical methods-(3-2-1-3)

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:
CE 1206 Computer Science
CE 2209 Calculus 4

Course Topics:
Error Analysis
Roots
Solving system of linear equations
Curve Fitting
Polynomial Interpolation
Integration and differentiation
Ordinary differential equations

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.*

CE 3212 – 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:
CE 1202 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

Department Requirements Courses

Department Requirements Courses

CE 1301 – Engineering Geology-(3-3-1-0)

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 and*
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 1302 – Statics-(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 and principles of mechanics, vectors, and force vectors and resultant. Free-body diagram of forces and equilibrium of particles and rigid bodies in two and three dimensions. Moment of a force about a point and about an axis. Equilibrium of rigid body. Analysis of trusses and frames. Shear forces diagrams and bending moment diagrams. Centroids and centers of gravity. Moment of inertia of an area

Recommended Textbook(s):
R.C. Hibbeler, Engineering Mechanics: Statics, Prentice Hall, 12th ed., 2010.

Prerequisites:
CE 1202 Calculus-2

Course Topics:
- *Definition of vectors in 2D and 3D, Physical examples, Analytical and graphical vector additions and subtractions.*
- *Scalar and vector products, Analytical methods and graphical interpretation.*
- *Resultant and equivalence of 2D force system, Analytical and graphical solutions.*
- *Definition of moments and couples, Couples in 2D and 3D systems, Force systems with couples.*
- *Resultant and equivalence of 3D force system, Systems with couples Analytical solutions.*
- *Concept of free body diagram (FBD), Equilibrium of rigid bodies, Equations of equilibrium in 2D and 3D space.*
- *Distributed forces and center of gravity, Determination of Centroids, distributed forces and Centroids of a volume.*
- *Coefficients of friction, friction law, solving systems with friction.*
- *Definition and types of internal forces, getting internal force diagrams in beams and shafts.*
- *Truss structures, various methods of structural analysis, method of sections and method of joints.*
- *Classification of supports.*
- *Moments of Inertia of planar sections, parallel axis theorem, principle axes and principle moments of inertia.*

Program and Course Outcomes:
1. *The students should be able to define and describe the following basic concepts in mechanics such as Space, Time, Mass, Force, Particle, Rigid body, Scalar, Vector, Free vector, Sliding vector, Fixed vector, and perform calculations on summation, Subtraction, Direction cosine, Magnitude, Component, Unit vector, Vector decomposition.*
2. *The students will be able describe and define the following components of Newton's Laws: First law, Second law, Third law, Gravitation law.*
3. *The students should demonstrate an understanding of the following concepts relating to forces: Contact force, Body force, Concurrent force system, Resultant (Combination of a force system), Decomposition of a force (rectangular and non-rectangular), Using triangle law to obtain the resultant will create a couple because forces in rigid body, mechanics are sliding vectors, not free vectors.*
4. *The student will be able to apply the cross product concepts to determine moments.*
5. *The student will be able to calculate the resultants of forces and couples.*

6. *The students will learn the differences and similarities between 2D and 3D systems. Additionally, the students should understand what complications are arise in studying 3D systems, and what is done to deal with these complications*
7. *The student will be able to isolate a mechanical system using Free body diagrams*
8. *The student will be able to identify the statically indeterminate, statically determinate and redundant structure .*
9. *The student will be able to calculate the center of mass of a body, and apply the equations of equilibrium to solve relevant application problems.*
10. *The student will be able to draw shear force and bending moment diagrams.*
11. *The students will be able to design a load carrying structure using truss analysis.*

CE 2303 – Construction Materials-(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 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.

Recommended Textbook(s):
Kenneth N. Derucher, George P. Korfiatis, and A. Samer Ezeldin, Materials for Civil and Highway Engineers, Prentice Hall, 4th ed., 1998.

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.

CE 2304 – Construction Materials Lab.-(1-0-0-3)

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

Course Description:
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):
Laboratory Manual, Compiled by Instructor

Prerequisites:
Concurrent with CE 2303 Construction Materials

Course Topics:

1. *Compressive Strength of Brick*
2. *Absorption of Brick*
3. *Efflorensses 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.

CE 2305 – 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:
CE 1203 Physics-1
CE 1302 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.

CE 2306 – Strength of Materials-(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:
CE 1302 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.

CE 2307 – Strength of Materials Lab.-(1-0-0-3)

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:
Concurrent with CE 2306

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.*

CE 2308 –Engineering Surveying-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 introduces knowledge about Chain surveying, Compass surveying, Plane table surveying, Levelling, Theodolite surveying and Engineering surveys.

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

Prerequisites:
CE 1202 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.

CE 2309 –Engineering Surveying Lab.-1-(1-0-0-3)

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

Course Description:
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 exercises prepare students for civil engineering employment early in their careers.

Recommended Textbook(s):
Laboratory Manual, Compiled by Instructor

Prerequisites:
Concurrent with CE 2308 Engineering Surveying-1

Course Topics:

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

CE 2310 –Electrical Circuits-(3-3-0-0)

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

Course Description:
Basic Concepts: Voltage, current, power, and energy. Independent and dependent voltage and current sources. DC Circuits Analysis: Ohms law, Kirchhoff's current and voltage laws. Series and parallel DC circuits' analysis, nodal analysis, and mesh analysis. Superposition, source transformation, and maximum power transfer theorems, Thevenin's and Norton's theorems. Capacitance and Inductance: series and parallel connections of capacitors and inductors. AC Circuits Analysis: Sinusoidal sources, rms value, phasor representation, complex impedances. Kirchhoff's laws in the phasor domain, parallel and series AC circuits. Experiments will be conducted to support the course including the use of computer software for circuit analysis.

Recommended Textbook(s):
Alexander and Sadiku "Fundamentals of Electric Circuits" Third Edition McGraw Hill.

Prerequisites:
CE 1202 Calculus-2
CE 1204 Physics-2

Course Topics:
- Electric current, voltage, power, and voltage and current sources 3
- Kirchhoff's current law and Kirchhoff's voltage law 3
- Ohm's law and series/parallel connections of resistors 3
- Series/parallel DC circuit analysis 3
- Nodal analysis 3
- Mesh analysis 3
- Superposition theorem 3
- Thevenin's Theorem and Norton's theorem 3
- Source transformation and maximum power transfer theorem 3
- Capacitance and capacitors series/parallel connections 3
- Inductance and inductors series/parallel connections 3
- Sinusoidal sources and phasor representation 3
- Phasor relationships for circuit elements 3
- Series/parallel AC circuit analysis

Program and Course Outcomes:
1.Define concepts of electric current, voltage, power, Kirchhoff's current and voltage laws.
2.Use Ohm's Law in series and parallel connections.
3.Use Thevenin's theorem and Maximum power transfer and superposition theorems for circuit analysis.
4.Apply nodal and mesh analysis to solve DC circuits.
5.Apply superposition and source transformation methods to solve DC circuits.
6.Be familiar with inductors and capacitors properties.
7.Be familiar with the concept of phasors.
8.Solve series/parallel AC circuits.
9.Be familiar with essential EE instruments such as Digital Multimeters, and be able to conduct dc circuit experiments.
10.Be able to analyze electric circuit using simulation software.

CE 2311 –Concrete Properties-(3-3-0-0)

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

Recommended Textbook(s):
John Newman and B S Choo, Advanced Concrete Technology Set: Advanced Concrete Technology 2: Concrete Properties, ELSEVIER, 2003

Prerequisites:
CE 1205 Chemistry-1
CE 2303 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.

CE 2312 –Concrete Properties Lab.-(1-0-0-3)

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

Course Description:
Lab techniques, preparation of concrete samples, compressive and flexural strength determination.

Recommended Textbook(s):
Laboratory Manual, Compiled by Instructor

Prerequisites:
Concurrent with CE 2311 Concrete properties

Course Topics:
- 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.

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.

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.

Prerequisites:
CE 2305 Dynamics,
CE 1203 Physics-1

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.

CE 3314 –Fluid Mechanics Lab-(1-0-0-3)

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

Course Description:
Lab techniques, calibration principles, fluid and flow measurements

Recommended Textbook(s):
Laboratory Manual, Compiled by Instructor

Prerequisites:
Concurrent with CE 3313 Fluid Mechanics

Course Topics:
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.

CE 3315 –Building Construction (3-2-0-3)

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 during the 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:
CE 2303- Construction Materials
CE 2312- 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.

CE 3316 –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:
CE 3313 Fluid Mechanics
CE 2210 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 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 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.
- 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.

CE 3317 –Structures-1-(3-3-0-0)

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:
CE 1302 Statics
CE 2306 Strength of Materials

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

CE 3318 –Structures-2-(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 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:
CE 3317 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

CE 3319 –Reinforced Concrete Design-1-(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 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:
CE 1302 Statics
CE 2306 Strength of Materials
Concurrent with CE 3317 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.

CE 3320 –Reinforced Concrete Design-2-(3-3-0-0)

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:
CE 3319 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

CE 3321 –Soil Mechanics-(3-3-1-0)

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.

Recommended Textbook(s):
Braja M. Das, Fundamentals of Geotechnical Engineering, Cengage Learning, 3rd ed., 2008

Prerequisites:
CE 1301 Engineering Geology
CE 2306 Strength of Materials
CE 3313 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

CE 3322 –Soil Mechanics Lab.-(1-0-0-3)

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

Course Description:
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, Soil mechanics laboratory manual, Oxford University press, 6th ed, 2002

Prerequisites:
Concurrent with CE 3321 Soil Mechanics

Course Topics:
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

CE 3323 –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.

CE 4324 –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:
CE 3317 Structures-1
CE 3318 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

CE 4325 –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:
CE 3321 Soil Mechanics

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

CE 4326 –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.

CE 4327 –Highway Engineering-(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 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.

Recommended Textbook(s):
Nicholas J. Garber and Lester A. Hoel, Traffic and Highway Engineering, Cengage Learning, 4th ed. 2009 and 2010.

Prerequisites:
CE 2308 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.

CE 4328 –Highway Engineering Lab.-(1-0-0-3)

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

Course Description:
This course introduces Desirable Properties and Testing of Highway Materials.

Recommended Textbook(s):
Laboratory Manual, Compiled by Instructor

Prerequisites:
Concurrent with CE 4327 Highway Engineering

Course Topics:
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.

CE 4329 –Sanitary and Environmental Engineering-(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 introduces fundamental concepts in the field of water supply engineering and sanitary engineering

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

Prerequisites:
CE 1205 Chemistry-1
CE 3313 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.

CE 4330 –Sanitary and Environmental Engineering Lab.-(1-0-0-3)

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

Course Description:
This course introduces exposure to water and sewage analysis

Recommended Textbook(s):
Wastewater Engineering (treatment and Reuse) by Metcalf and Eddy,2003

Prerequisites:
Concurrent with CE 4329 sanitary and environmental engineering

Course Topics:
LIST OF EXPERIMENTS
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.

CE 4331 –Method of Construction and Estimation -(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 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:
CE 2208 Calculus-3
CE 2303 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.

CE 4332 –Senior Design I -(2-2-0-0)

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.

CE 4333 –Senior Design II -(1-0-0-3)

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.

CE 4335 Computer Applications in Civil Engineering (3-3-1-0)

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:
CE 1206 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

CE 4336 Reinforced Concrete Design-3- (3-3-1-0)

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:
CE 3320 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.

CE 4337 Foundation Engineering-2- (3-3-1-0)

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:
CE 4325 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

CE 4338 Design of Prestressed Structures (3-3-1-0)

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:
CE 2311 Concrete Properties
CE 3319 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.

CE 4339 Earth Retaining Structures (3-3-1-0)

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:
CE 3321 Soil mechanics

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.

CE 4340 Selected Topics in Geotechnical Engineering (3-3-1-0)

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:
CE 3321 Soil Mechanics

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.

CE 4341 Environmental Impact Assessment (EIA) (3-3-1-0)

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:
CE 4329 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.

CE 4342 Hydraulic Application in Environmental Eng. (3-3-1-0)

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:
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

CE 4343 Water quality Modeling and Control (3-3-1-0)

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:
CE 4329 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 4344 Pavement Design (3-3-1-0)

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:
CE 4324 Traffic Engineering.
CE 4325 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.

CE 4345 Highway materials (3-3-1-0)

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:
CE 3321 Soil Mechanics
CE 4327 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.

CE 4346 Transportation Planning (3-3-1-0)

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:
CE 4326 Traffic Engineering
CE 2210 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

CE 4347 Project Management (3-3-1-0)

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:
CE 3323 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

CE 4348 Operation Research (3-3-1-0)

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:
CE 3211 Engineering Numerical Methods
CE 2208 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

CE 4349 Quality Management (3-3-1-0)

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:
CE 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 a variety of tools, including statistical process control.
- Be able to develop business performance priorities.