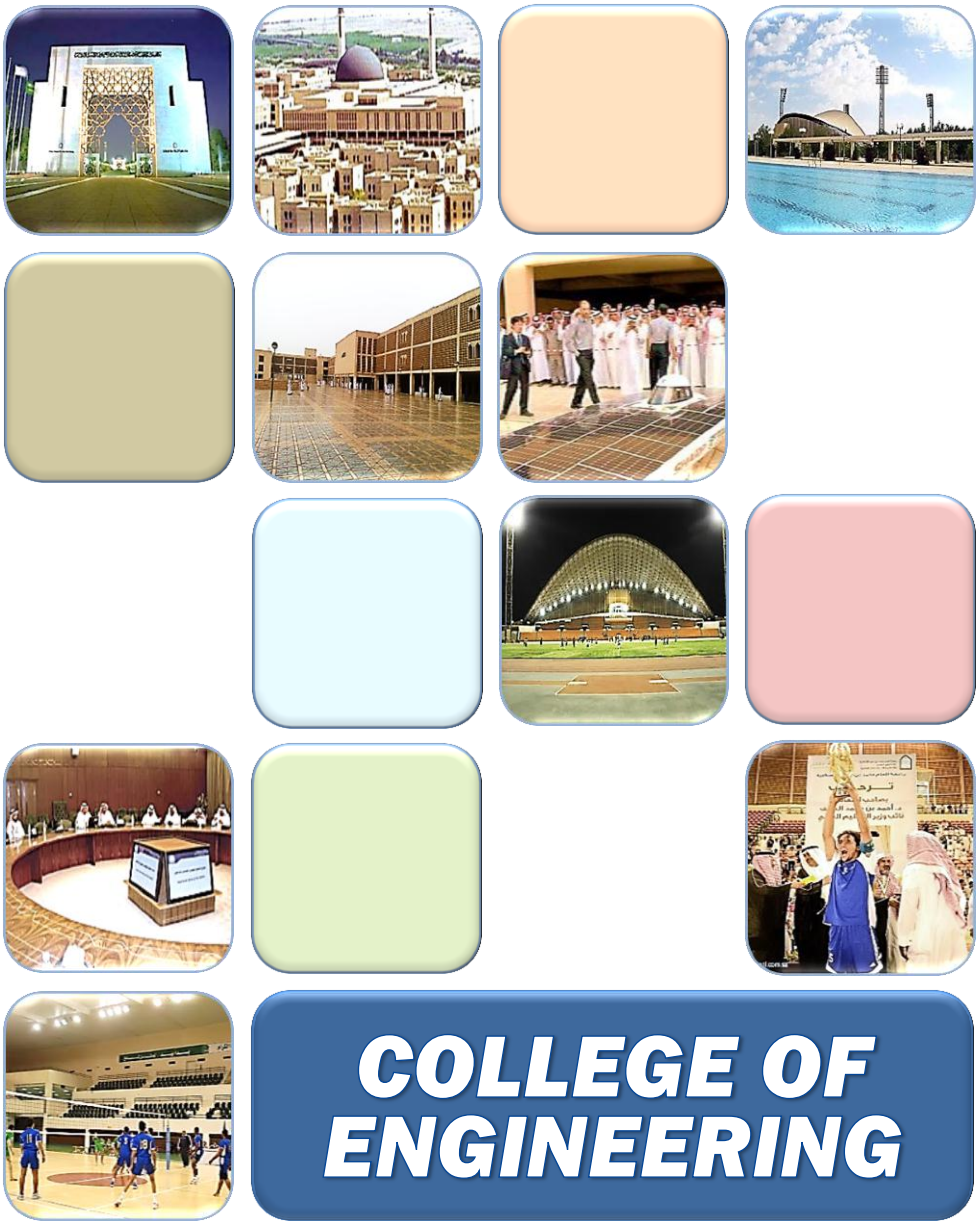
Al Imam Mohammad Ibn Saud Islamic University



COLLEGE OF ENGINEERING

COLLEGE GUIDE 2013

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COLLEGE OF ENGINEERING GUIDE


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Preface

All praise and thanks are due to Allah Subhanahu wa Taala and peace and blessings of Allah be upon Prophet Muhammad Sallallahu Alaihay Wassallam.

I am very pleased to bring to you this revised 2013/2014 (1434/1435 H) edition of the College of Engineering Guide. The first edition of the Engineering Guide was published in 2010 when the first batch of engineering students was inducted into the program. At this point in time, these students have now entered the final year of their engineering studies and very soon InshaAllah our engineering graduates would begin entering the job market. Over the years, the College of Engineering has grown in stature with several new labs in operation and a much larger student population. The College recognizes the need of keeping its curriculum up-to-date with the advances in technology. For this purpose, a Committee was set-up to review and revise the curriculum. Representatives from each Engineering Department in the College of Engineering were included in the Committee. This revised edition of the Engineering Guide is the result of a three-year untiring effort of the Committee which used all means such as faculty/student feedbacks, comparison of our curriculum with the curricula of some other renowned national and international Universities to revise this Guide.

It contains detailed information about the five bachelor's degree programs in Civil, Mechanical, Electrical, Chemical and Architectural Engineering offered in the College of Engineering. It would serve as the study plan for the students in each Engineering Major and would be used as reference by the students as well as their faculty advisors during the entire period of study.

Finally, I would like to express my deep gratitude to His Excellency, Prof. Sulaiman Abdullah Aba Al-Khail, the President of the University, for the continuous support extended to the College of Engineering since its inception. The College values this support as it is crucial for its development and in attaining the high standards that it has set for itself.

Prof. Abdullah Ibrahim Almarshad

Dean, College of Engineering

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Introduction to the College of Engineering

The establishment of the College of Engineering at Al-Imam Mohammad Ibn Saud Islamic University was approved by the Custodian of the Two Holy Mosques through the Chairman of the Council of Ministers. The Ministry of Higher Education granted formal approval to it in its 48th meeting held on 27/12/1428H and official notification was issued through wire No. 5151/PB dated 3/7/1429 H.

The College of Engineering is one of several new colleges established at Al-Imam Mohammad Ibn Saud Islamic University. Studies in the College of Engineering began in the academic year 1430/1431. 170 students were admitted to the Preparatory year classes in the first group of students. The students who successfully passed the Preparatory year were accepted into the various four year bachelor's degree programs offered by the College of Engineering.

The Preparatory year is meant to prepare the students to meet the challenges of engineering education, treat the academic deficiencies if any, and to make them read, write and understand the English language which is the language of instruction in the College of Engineering. Students who successfully pass the Preparatory year are admitted to one of the engineering programs in the College of Engineering where they study for another four years to complete the 135 credit hours (course + lab) work for a bachelor's degree in the engineering program to which they have been admitted. Apart from conventional and specialized engineering courses, our engineering curriculum is strengthened with courses in Mathematics, Computer and Basic Sciences, Communication and Project Management skills, Engineering Economy and Professional Ethics that would not only make our graduates versatile but would also give them edge in the job market over other graduating engineers within the Kingdom of Saudi Arabia.

Objectives of the College of Engineering

1. To maintain a high standard of engineering education, research, and community service.
2. To produce qualified graduate engineers in a variety of engineering disciplines, thus fulfilling the engineering manpower requirements of the Kingdom.
3. To produce graduate engineers who can contribute in the national developmental programs and extend cooperation to other engineering institutions with similar objectives.
4. To produce engineering graduates who are not only equipped with scientific knowledge but are also committed to Islamic principles, morals and values.

5. To strengthen students' knowledge base and skills in the fields of Science, Engineering and Economics.
6. To produce graduates with the highest professional capabilities, skills and creative abilities.
7. To produce graduates who can contribute to the overall development of society through conferences, workshops, symposia and by participating in other training and development programs.

Departments of the College of Engineering

1. Department of Chemical Engineering
2. Department of Civil Engineering
3. Department of Mechanical Engineering
4. Department of Electrical Engineering
5. Department of Architectural Engineering

Admission Regulations

Introduction

The College of Engineering at Al-Imam Mohammad Ibn Saud Islamic University wishes to attract and admit distinguished students who have graduated from the General Secondary or the Secondary System (Natural Science). Requirements for admission to the College of Engineering include the following general and specific requirements:

1. General requirements for admission to the University

The applicant:

a) must either have Saudi nationality or a non-Saudi national whose mother has Saudi nationality.
b) must be of good conduct.
c) must have graduated from the General Secondary or Secondary System (Natural Sciences) either in the year being applied for or one-year prior to the year being applied for.
d) must be medically fit.
e) must submit the following documents together with the application:
   i. The original and four (4) true copies of the Secondary Education Certificate.
   ii. The original and two (2) true copies of the Certificate of Good Conduct.
   iii. Four (4) color photographs of size 4 cm × 6 cm.
   iv. Three (3) copies of the National Personal Identity card along with the original ID for verification.

v. Result of the test of qualification (Qudurat) conducted by the National Centre for Measurement and Evaluation in Higher Education.
vi. Result of the test (Tahseeli) conducted by the National Centre for Measurement and Evaluation in Higher Education.

2. Specific Requirements for Admission to the College of Engineering

a) Passing the General Certificate of Secondary Education in the Natural Sciences and Mathematics with a cumulative percentage of at least 85%.
b) Taking the general capacity test (Qudurat) administered by the National Centre for Measurement and Evaluation in Higher Education. The applicant can take this test and submit its results either in the year admission is sought or a year prior to the year for which admission is desired. For further information on the test, please visit the website http://www.qiyas.org
c) Obtaining test grades for (Tahseeli) in the year in which admission is desired. Testing is done by the National Centre for Measurement and Evaluation in Higher Education. For further information on the test, please visit http://www.qiyas.org
d) Must agree to be a full-time student.

3. Acceptance Criteria

Acceptance is based on merit using the cumulative percentage calculated using the results of the following three examinations. The weight of each examination is as follows.

1. General Secondary (Thanawiya) Examination - (weight = 30%).
2. Qudurat Test – (weight = 30%)
3. Tahseeli Test – (weight = 40%)

Examination	Converted score
General Secondary School (Thanawiya)	0.3 × (General Secondary School Examination %)
Test (Qudurat)	0.3 × (Qudurat test score %)
Test (Tahseeli)	0.4 × (Tahseeli test score %)
Cumulative Percentage (100%)	**Total**

Students admitted to the Preparatory year program study in the program for one year. Upon successful completion, they become eligible to apply to the College of Engineering. After completion of a minimum of fifteen 15 credit hours in the College of Engineering, the students select an area of specialization (department). Acceptance to a specific department is based on students' cumulative grade point average (GPA) in Level-1.

4. Transfer Regulations

Students may seek transfer to the College of Engineering from different Colleges within Al-Imam Mohammad Ibn Saud Islamic University, as well as from other recognized Universities or Colleges as per the following rules:

a) Transfer from the Colleges of Sciences at Al-Imam University

i. Must meet all the requirements for admission to the freshman year.
ii. Transfer must be from a College of Science (Medicine, Science, Computer Science or similar Colleges).
iii. Must have a grade point average/cumulative average of at least 3.5/5 in all Science subjects.
iv. Must complete at least 75% of the required coursework (approximately 102 credit hours) in the College of Engineering.
v. Transfer of credit hours with a grade point average of "Good" and above will be credited as long as the course contents are similar and the coursework completion limit mentioned above in (iv) is not exceeded.

b) Transfer from Colleges of Engineering of other Universities

i. Must meet all the requirements for admission to the freshman year.
ii. Must have a minimum grade point average/cumulative average of 3.5/5, or 2.5/4.
iii. Must not have been expelled for disciplinary/academic reasons from the University from which transfer is sought.
iv. Must complete at least 60% of the required coursework (approximately 81 credit hours) in the College of Engineering if the transfer is sought from an Engineering College; or at least 75% (approximately 102 credit hours) if the transfer is sought from a College of Science.
v. Transferred credit hours will be credited if the courses completed outside are considered equivalent (similar in course content) to those offered by the College of Engineering at Al Imam University. Transferred credit hours will not be counted in the calculation of cumulative grade point average but will be listed in the student transcript record.

Further details of admission procedures and requirements can be obtained from the office of the Dean of Registration or using the following link: http://www.imamu.edu.sa/support_deanery/admissions.

Chemical Engineering Program

Chemical Engineering Program

Introduction

Chemical Engineering is a branch of engineering that deals with the natural sciences such as chemistry, physics, biology, microbiology, and biochemistry, along with mathematics and economics. The design, development and operation of plant, equipment, and chemical processes aim to transform the raw material or feedstock into a product with an economic value, taking into account the preservation of the environment and safety of workers and equipment.

The large number of industries which depend on the synthesis and processing of chemicals and materials place the chemical engineer in great demand. In addition to traditional examples such as the chemical, energy and oil industries, opportunities in biotechnology, pharmaceuticals, electronic device fabrication, and environmental engineering are increasing. The unique training of the chemical engineer becomes essential in these areas whenever processes involve the chemical or physical transformation of matter. For example, chemical engineers working in the chemical industry investigate the creation of new polymeric materials with important electrical, optical or mechanical properties. This requires attention not only to the synthesis of the polymer, but also to the flow and forming processes necessary to create a final product. In biotechnology, chemical engineers have responsibilities in the design of production facilities that use microorganisms and enzymes to synthesize new drugs. Problems in environmental engineering that engage chemical engineers include the development of processes (catalytic converters, effluent treatment facilities) to minimize the release of or deactivate products harmful to the environment.

To carry out these activities, the chemical engineer requires a qualitative and quantitative understanding of both the engineering and scientific principles underlying these technological processes. This is reflected in the curriculum of the chemical engineering department which includes the study of applied mathematics, material and energy balances, thermodynamics, fluid mechanics, energy and mass transfer, separation technologies, chemical reaction kinetics and reactor design, and process design. These courses are built on a foundation in the sciences of chemistry and physics.

Vision

To develop a nationally recognized undergraduate chemical engineering program, reflecting excellence in education and scientific research and community service in Saudi Arabia.

Mission

Preparing students to be chemical engineers, having the necessary skills to excel in their professional career, able to implement innovative research; training them to be able to offer their services and expertise to their profession and their community according to international standards.

Program Objectives

1. Provide students with a strong foundation of basic knowledge of engineering sciences.
2. Provide students with the knowledge and skills required to design and analyze chemical/petrochemical processes, taking into account health, safety, environment and social impacts.
3. Provide students with the essential knowledge and skills required to work and communicate effectively with others, maintaining professional ethics.
4. Prepare students to meet the challenges of research and development in the chemical/petrochemical industry directly, and in collaboration with other disciplines.

Program Outcomes

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.

Overview of the Curriculum

Course Coding

The Chemical Engineering courses are tabled and numbered in such a manner to recognize each course regarding its subject area, year level, and semester offered. The symbol CHE denotes Chemical Engineering and each number is made of 3 digits. Each digit represents specific information about the course as follows:

The first digit denotes the year level of the course according to student's study plan as follows:

First Digit	Year Level of Course
1	First year
2	Second year
3	Third year
4	Fourth year

The second digit as per the following Table represents the field/specialization within a Department:

Second Digit	Field/Specialization
0	Fundamental Engineering, and Universal Skills Courses
1	Conservation and Conversion of Mass, and Energy Courses
2	Heat and Mass Transfer, Fluid Mechanics, Unit Operations, and Chemical Engineering Thermodynamics Courses
3	Modeling, Simulation, Control, and Applied Mathematics Courses
4	Material Science, and Polymer Engineering Courses
5	Technological Applications, Desalination, Petroleum Refining, and Petrochemical Processes Courses
6	Design, Specification, Safety, and Environment Courses
7	Research, Seminars, and Special Topics Courses
8	Biosystems, Food Processes, and Pharmaceutical industries Courses
9	Design Projects Courses

The third digit denotes the sequence number of the course in a certain field/specialization in a given year. The **number 9** as the third digit is reserved for Engineering Training and Special Topic courses.

Example: CHE 221 means

Code	First Digit	Second Digit	Third Digit
CHE	**2**	**2**	**1**
Department (Chemical Engineering)	Year Level (Second year)	Field (Thermodynamics)	First Thermodynamics course in the second year

Undergraduate Curriculum of the Chemical Engineering Program

The curriculum leading to the degree of Bachelor of Science in Chemical Engineering requires **135 credits** and is organized as follows:

University Requirement	**14** Credit Hours	Islamic, Humanities, and Social Science courses
College Requirement	**57** Credit Hours	Math, Basic Science, and Fundamental Engineering courses
Department Requirement	**64** Credit Hours	Both Compulsory and Elective courses

1. General University Requirements

All students in the College of Engineering at Al-Imam University are required to take 14 credit hours of course work as detailed in the following Table irrespective of the engineering discipline they are in:

Course Code	Course Name	Credit
QUR 100	Quran Kareem I	2
QUR 150	Quran Kareem II	2
QUR 200	Quran Kareem III	2
QUR 250	Quran Kareem IV	2
IDE 133	Tawheed	2
LIT 102	Arabic Language writing Skills	2
HIST 102	History of Saudi Arabia	2
Total		**14**

2. College of Engineering Requirements

57 credit hours of basic Sciences, fundamental Engineering courses, and communication skills must be taken by all students in the undergraduate program of chemical engineering as college requirement. The specified courses provide the foundation of studying chemical engineering. These courses are listed in the following table:

Course Code	Course Name	Credit	Prerequisite	Co-requisite
MATH 105	Calculus I	4	None	
MATH 106	Calculus II	4	MATH 105	
MATH 226	Linear Algebra	3	MATH 106	
MATH 235	Differential Equations	3	MATH 106	
STAT 215	Probability and Statistics in Engineering	3	MATH 106	
CHEM 103	General Chemistry	4	None	
CHEM 202	Organic Chemistry	3	CHEM 103	
CHEM 203	Organic Chemistry Lab	1		CHEM 202
CHEM 222	Physical Chemistry	3	CHEM 103	
CHEM 223	Physical Chemistry Lab	1		CHEM 222
PHYS 117	Physics I	3	None	PHYS 119
PHYS 119	Physics Lab I	1	None	PHYS 117
PHYS 118	Physics II	3	PHYS 117, PHYS 119	PHYS 120
PHYS 120	Physics Lab II	1	PHYS 117,	PHYS 118
CS 107	Computer Programming	3	MATH 105	
ENGL 201	Technical English Writing	3	None	
GE 101	Engineering Graphics and Design	3	None	
GE 203	Fundamental of Electrical Engineering	3	MATH 106, PHYS 118, PHYS 120	
GE 301	Numerical Methods in Engineering	3	MATH 235 CS 107	
GE 302	Professional Ethics for Engineers	2	None	
GE 303	Engineering Economy	3	MATH 106	
GE 399	Engineering Training	0	Completion of 90 Cr.H.	
Total		**57**		

3. Chemical Engineering Department Requirements

64 credit hours of chemical engineering courses, both compulsory **(55 Credit Hours)** and elective **(9 Credit Hours)**, must be taken by all students in the undergraduate program. These courses are listed in the following table:

A. Chemical Engineering Compulsory Courses

Course Code	Course Name	Credit	Prerequisite	Co-requisite
CHE 211	Principles of Chemical Engineering I	3	CHEM 103	
CHE 213	Principles of Chemical Engineering II	2	CHE 211	
CHE 221	Chemical Engineering Thermodynamics I	3	CHE 211	
CHE 222	Chemical Engineering Thermodynamics II	3	CHE 221	
CHE 223	Fluid Mechanics	3	CHE 221	
CHE 311	Chemical Reactions Engineering	3	CHE 222	
CHE 321	Heat Transfer	3	CHE 223	
CHE 320	Fluid Mechanics Lab	1	CHE 223	
CHE 323	Heat Transfer Lab	1	CHE 321	
CHE 325	Unit Operations	3	CHE 213, CHE 223	
CHE 326	Mass Transfer	3	CHE 223	
CHE 341	Materials Science and Engineering	3	CHEM 103	
CHE 342	Polymer Science and Engineering	3	CHEM 202	
CHE 421	Separation Processes	3	CHE 326	
CHE 422	Unit Operations Lab	1	CHE 421	
CHE 431	Process Control	3	MATH 235	
CHE 432	Process Control Lab	1		CHE 431
CHE 433	Reaction Engineering Lab	1	CHE 311	
CHE 461	Chemical Processes and Plant Design	3	CHE 311, CHE 341	
CHE 462	Process Synthesis and Modeling	3	GE 301	
CHE 481	Biochemical Engineering	2	CHE 311	
CHE 4**	Elective I	3	Refer to the elective courses	
CHE 4**	Elective II	3	Refer to the elective courses	
CHE 4**	Elective III	3	Refer to the elective courses	
CHE 491	Graduation Project-I	1	Department Approval	
CHE 492	Graduation Project-II	3	CHE 491	
Total		**64**		

B. Chemical Engineering Elective Courses

The 9 credits of technical-elective courses must be taken from the areas of specialization as listed below:

1. Energy and Air Pollution Control

Course Code	Course Name	Credit	Prerequisite
CHE 412	Energy Conversion and Management	3	CHE 321
CHE 413	Renewable Energy	3	CHE 223
CHE 414	Solar Energy	3	CHE 321
CHE 415	Fuel Cells	3	CHE 326
CHE 416	Air Pollution Control	3	CHE 326
CHE 471	Special Topics	3	CHE 326

2. Materials Engineering

Course Code	Course Name	Credit	Prerequisite
CHE 441	Electrochemical Engineering and Corrosion	3	CHE 326
CHE 442	Nanomaterials Technology	3	CHE 325
CHE 443	Polymer Chemistry and Engineering	3	CHE 325
CHE 471	Special Topics	3	CHE 326

3. Petroleum and Petrochemical Industries

Course Code	Course Name	Credit	Prerequisite
CHE 444	Petroleum Refining	3	CHE 325
CHE 445	Petrochemical Processes	3	CHE 325
CHE 471	Special Topics	3	CHE 326

4. Desalination

Course Code	Course Name	Credit	Prerequisite
CHE 451	Desalination	3	CHE 325
CHE 452	Membrane Technology	3	CHE 326
CHE 453	Water and Wastewater Treatment	3	CHE 326
CHE 471	Special Topics	3	CHE 326

5. Bioengineering

Course Code	Course Name	Credit	Prerequisite
CHE 482	Bioprocess Engineering	3	CHE 481
CHE 483	Bioseparations Engineering	3	CHE 481
CHE 484	Applications in Biological Engineering	3	CHE 481
CHE 471	Special Topics	3	CHE 326

Chemical Engineering Undergraduate Curriculum

First Year (Freshman)

First Level

No.	Course Code	Course Name	Hours			
			Credit	Theory	Lab	Tut
1	QUR 100	Quran Kareem I	2	2		
2	CHEM 103	General Chemistry	4	3	2	
3	MATH 105	Calculus I	4	4		1
4	PHYS 117	Physics I	3	3		
5	PHYS 119	Physics Lab I	1		2	
6	GE 101	Engineering Graphics and Design	3	2	2	
Total Semester Hours			**17**	**14**	**6**	**1**

Second Level

No.	Course Code	Course Name	Hours			
			Credit	Theory	Lab	Tut
1	QUR 150	Quran Kareem II	2	2		
2	CS 107	Computer Programming	3	2	2	
3	MATH 106	Calculus II	4	4		1
4	PHYS 118	Physics II	3	3		
5	PHYS 120	Physics Lab II	1		2	
6	CHE 211	Principles of Chemical Engineering I	3	3		1
Total Semester Hours			**16**	**14**	**4**	**2**
Cumulative Credit Hours			**33**	**28**	**10**	**3**

Second Year (Sophomore)

Third Level

No.	Course Code	Course Name	Hours			
			Credit	Theory	Lab	Tut
1	QUR 200	Quran Kareem III	2	2		
2	CHEM 222	Physical Chemistry	3	3		1
3	CHEM 223	Physical Chemistry Lab	1		2	
4	MATH 226	Linear Algebra	3	3		1
5	GE 203	Fundamentals of Electrical Engineering	3	3		1
6	CHE 213	Principles of Chemical Engineering II	2	2		1
7	CHE 221	Chemical Engineering Thermodynamics I	3	3		1
Total Semester Hours			**17**	**16**	**2**	**5**
Cumulative Credit Hours			**50**	**44**	**12**	**8**

Fourth Level

No.	Course Code	Course Name	Hours			
			Credit	Theory	Lab	Tut
1	QUR 250	Quran Kareem IV	2	2		
2	LIT 102	Arabic Language Skills	2	2		
3	CHEM 202	Organic Chemistry	3	3		1
4	CHEM 203	Organic Chemistry Lab	1		2	
5	MATH 235	Differential Equations	3	3		1
6	CHE 222	Chemical Engineering Thermodynamics II	3	3		1
7	CHE 223	Fluid Mechanics	3	3		1
Total Semester Hours			**17**	**16**	**2**	**4**
Cumulative Credit Hours			**67**	**60**	**14**	**12**

Third Year (Junior)

Fifth Level

No.	Course Code	Course Name	Hours			
			Credit	Theory	Lab	Tut
1	ENGL 201	Technical English Writing	3	3		
2	GE 302	Professional Ethics in Engineering	2	2		
3	GE 301	Numerical Methods in Engineering	3	3		1
4	CHE 321	Heat Transfer	3	3		1
5	CHE 320	Fluid Mechanics Lab	1		2	
6	CHE 341	Materials Science and Engineering	3	3	1	
7	CHE 342	Polymer Science and Engineering	3	3		
Total Semester Hours			**18**	**17**	**3**	**2**
Cumulative Credit Hours			**85**	**77**	**17**	**14**

Sixth Level

No.	Course Code	Course Name	Hours			
			Credit	Theory	Lab	Tut
1	IDE 133	Tawheed	2	2		
2	STAT 215	Prob. and Statistics in Engineering	3	3		1
3	GE 303	Engineering Economy	3	3		1
4	CHE 311	Chemical Reaction Engineering	3	3		1
5	CHE 323	Heat transfer Lab	1		2	
6	CHE 326	Mass Transfer	3	3		1
7	CHE 325	Unit Operations	3	3		1
Total Semester Hours			**18**	**17**	**2**	**5**
Cumulative Credit Hours			**103**	**94**	**19**	**19**

Fourth Year (Senior)

Seventh Level

No.	Course Code	Course Name	Credit	Hours Theory	Lab	Tut
1	HIST 102	History of Saudi Arabia	2	2		
2	GE 399	Engineering Training	0			
3	CHE 421	Separation Processes	3	3		1
4	CHE 433	Reaction Engineering Lab	1		2	
5	CHE 461	Chemical Processes and Plant Design	3	3		1
6	CHE462	Process Synthesis and Modeling	3	3		
7	CHE 481	Biochemical Engineering	2	2		
8	CHE 4**	Elective I	3	3		
9	CHE 491	Graduation Project I	1	1		
Total Semester Hours			**18**	**17**	**2**	**2**
Cumulative Credit Hours			**121**	**111**	**21**	**21**

Eighth Level

No.	Course Code	Course Name	Credit	Hours Theory	Lab	Tut
1	CHE 422	Unit Operations Lab	1		3	
2	CHE 431	Process Control	3	3		1
3	CHE 432	Process Control Lab	1		2	
4	CHE 4**	Elective II	3	3		
5	CHE 4**	Elective III	3	3		
6	CHE 492	Graduation Project II	3	3		
Total Semester Hours			**14**	**12**	**5**	**1**
Cumulative Credit Hours			**135**	**123**	**26**	**22**

Course Description

1. General College Courses

This section contains the descriptions of the fundamental engineering courses that are required by the College of Engineering. The courses are listed in numerical order. Each entry has the number of hours of credit for the course, the prerequisites, and a brief description.

MATH 105: Calculus I **4 Credit Hours**

Differential calculus and basic integral calculus including the fundamental theorem of calculus and Taylor's theorem with remainder. It includes most of the elementary topics in the theory of real-valued functions of a real variable: limits, continuity, derivatives, maxima and minima, integration, area under a curve, volumes of revolution, trigonometric, logarithmic and exponential functions and techniques of integration.

MATH 106: Calculus II **4 Credit Hours**

All techniques of integration (substitution, by parts, trigonometric substitutions, partial fractions, miscellaneous substitutions etc.), conic sections, polar coordinates, and infinite series. Vector analysis: Euclidean space, partial differentiation, multiple integrals, the integral theorems of vector calculus.

MATH 226: Linear Algebra **3 Credit Hours**

Basic concepts and techniques of linear algebra; includes systems of linear equations, matrices, determinants, vectors in n-space, and eigenvectors, together with selected applications, such as Markov processes, linear programming, economic models, least squares and population growth.

MATH 235: Differential Equations **3 Credit Hours**

Techniques and applications of ordinary differential equations: First order equations, linear equations of higher order, systems of linear equations with constant coefficients, reduction of order, including Fourier series and boundary-value problems, and an introduction to partial differential equations.

STAT 215: Probability and Statistics in Engineering **3 Credit Hours**

Emphasizes basic probability concepts, random variables and probability, expectations and moments, functions of random variables, some important discrete distributions, some important continuous distributions. This including descriptive statistics, observed data and graphical representation, parameter estimation, model verification, linear models and linear regression, and hypothesis testing in both nonparametric and normal models.

PHYS 117: Physics-I **3 Credit Hours**

Vectors. Motion in one, two and three dimension. Acceleration and free fall, force and motion, and analysis of forces. Newton's laws. Circular motion. Work: the transfer of mechanical energy. Conservation of momentum. Rotation. Conservation of angular momentum. Elasticity and Fluid mechanics.

PHYS 118: Physics-II **3 Credit Hours**

Oscillations. Sound waves. Heat and Thermodynamics. Electricity and Magnetism: Coulomb's law, electric fields, Gauss' Law, electric potential, potential energy, capacitance, currents and resistance. Electrical energy and power, direct current circuits, Kirchhoff's rules. Magnetic fields, motion of charged particle in a magnetic field, sources of the magnetic field and energy in a magnetic field. Ampere's law, Faraday's law of induction, self-inductance. Alternating current circuits, the RLC series circuit, power in an A.C. circuit, resonance in RLC services circuit.

CHEM 103: General Chemistry **4 Credit Hours**

The course covers fundamental observations, laws, and theories of chemistry at the introductory level. Topics include Atoms/Molecules, Stoichiometry, Acids/Bases, Solutions, Equilibria, Gases, Solids, Liquids, Thermodynamics, Kinetics, Quantum Theory, The periodic table, and Chemical bonding.

CHEM 202: Organic Chemistry **3 Credit Hours**

The following topics are covered in this course: Electronic structure and bonding. Acids and bases. An introduction to organic compounds: Nomenclature, physical properties, and representation of structure. Alkenes: Structure, nomenclature, and an introduction to reactivity. Thermodynamics and kinetics, and reactions of alkenes. Stereochemistry: The arrangement of atoms in space. The stereochemistry of addition reactions, reactions of alkynes. Introduction to multistep synthesis. Electron Delocalization and resonance. More about molecular orbital theory, and reactions of dienes. Ultraviolet and visible spectroscopy. Reactions of alkenes radicals: Substitution reactions of alkyl halides, elimination reactions of alkyl halides. Competition between substitution and elimination reactions of alcohols, ethers, and epoxides.

CHEM 203: Organic Chemistry Lab **1 Credit Hour**

The following experiments are performed in this lab: Laboratory basic technique. Determination of elements in organic compounds, separation of ink pigments by ascending paper chromatography, separation of ink pigments by descending paper chromatography, separation of amino acid by ascending and descending chromatography. Determination of functional groups (aldehyde, acetone carboxylic acid, functional test for carbohydrate, fats and proteins. Determination of boiling point of organic liquid by simple distillation technique. Instrumental methods of chemical analysis (practical).

CHEM 222: Physical Chemistry **3 Credit Hours**

In this course students will study the laws of classical thermodynamics followed by applications to the properties of gases, liquids, and solids, as well as to solutions, phase, and chemical equilibrium. Kinetic theory of gases at equilibrium.

CHEM 223: Physical Chemistry Lab **1 Credit Hour**

The main experiments are: Buffer solution, pH measurements. Activation energy for 1st order and second order reaction. Evaluation of thermodynamics properties. EMF of a cell, equilibrium constant from EMF measurement. Molecular weight determination of high polymers. Potentiometer titrations. Kinetic study of the halogenations of acetone, and kinetic study of the inversion of cane sugar. Radius of a molecule from viscosity measurement. Heat of neutralization of a strong acid with a strong base. Activity co-efficient of silver acetate from solubility measurement. Determination of thermodynamic quantities for a reaction using concentration cell. Determination of activity co-efficient and transport numbers using concentration cell. Molecular weight determination by cryscopic method, and Molecular weight determination by ebullioscoic method.

CS 107: Computer Programming **3 Credit Hours**

Fundamental principles, concepts, and methods of computing, with emphasis on applications in engineering. Basic problem solving and programming techniques, fundamental algorithms and data structures. Use of computers in solving engineering and scientific problems.

ENGL 201: Technical English Writing **3 Credit Hours**

The course examines the basic requirements of technical style and organizational patterns used in a variety of business and technical documents. Students learn and practice how to condense extensive information into the fewest words possible without sacrificing content. The course also covers how to identify the audiences and apply various styles to each. Students hone their skills by writing various types of proposals, informal and formal reports, procedures manuals and oral presentations. Finally, the course gives students a command of the design principals and production processes required for truly effective technical communications. Students will be required to complete a capstone project that incorporates every aspect of technical writing learned in the course.

GE 101: Engineering Graphics and Design **3 Credit Hours**

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

GE 203: Fundamental of Electrical Engineering **3 Credit Hours**

Integrated introduction to selected fundamental concepts and principles in electrical engineering: circuits, electromagnetics, communications, electronics, controls, and computing. Laboratory experiments and lectures focus on a design and construction project

GE 301: Numerical Methods in Engineering **3 Credit Hours**

This course covers the various numerical techniques to solve computational engineering problems. Main topics of this course are: introduction to numerical methods, floating-point computation, systems of linear equations, approximation of functions and integrals, the single nonlinear equation, and the numerical solution of ordinary differential equations, applications in engineering, and programming.

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

The course examines ethical theories, moral norms and case studies to provide an overview of the ethical use of technology and associated responsibilities of engineers towards society, environment, clients, employers and coworkers. Ethical problem-solving techniques are elaborated with examples. Concepts of whistle blowing, intellectual copyrights, plagiarism, conflict of interests, safety, occupational hazards and cost-benefit risk are explored in the light of engineering codes of ethics and legal aspects of ethical and professional misconduct.

GE 303: Engineering Economy **3 Credit Hours**

Time value of money formulas, application of time value of money formulas. Project selection using net present worth analysis using the common multiple and study period methods, one and two parameter sensitivity analysis. Bond cash flows and pricing, loan amortization and determining the remaining principle on a loan, project selection using annual equivalent worth, project selection using the incremental net present worth. Annual depreciation and book value using straight line, declining balance and MACRS methods. Annual cash flow and net present worth. Discounted benefit/cost ratio for a public project and determine if it meets the criterion. Inflation in estimating future cash flows, and defender/challenger replacement analysis using net present worth.

GE 399: Engineering Training **0 Credit Hour**

Eight weeks training in a relevant industry under the supervision of a faculty member. Each student must submit a technical report about his achievements during the training in addition to fulfilling any other requirements as assigned by the department.

2. Compulsory Chemical Engineering Courses

CHE 211: Principles of Chemical Engineering I **3 Credit Hours**

The course introduces the student to chemical engineering and the roles of the chemical engineer. The emphasis is on engineering problem analysis, units and dimensions, engineering calculations, processes and process variables, and fundamentals of material balances that involve single-phase and multiphase systems.

CHE 213: Principles of Chemical Engineering II **2 Credit Hours**

This course will cover the energy balance for chemical processes using first law and second law of thermodynamics for reactive and non-reactive processes. The main topics are: Energy and energy balances, balances on nonreactive processes, balances on reactive processes. Computer-aided balance calculations. Balances on transient processes. Case studies: Production of chlorinated polyvinyl chloride. Steam reforming of natural gas and subsequent synthesis of methanol. Scrubbing of sulfur dioxide from power plant stack gases.

CHE 221: Chemical Engineering Thermodynamics I **3 Credit Hours**

The main objectives of the course are to prepare students to use thermodynamics in engineering practice and to provide a sound basis for subsequent courses in fluid mechanics and heat transfer. The course covers the following topics: introductory concepts and definitions; evaluating properties; energy and the first law of thermodynamics; control volume analysis using energy; the second law of thermodynamics; using entropy; exergy analysis.

CHE 222: Chemical Engineering Thermodynamics II **3 Credit Hours**

The main areas presented in this course are the calculation for non-ideal solution and residual properties, Vapor liquid equilibrium (VLE) theory and chemical equilibrium. Main topics in this course are: The thermodynamic properties of real substances. Equilibrium and stability in one-component systems .Thermodynamics of multicomponent mixtures and solutions. The estimation of the Gibbs-free energy and fugacity of a pure component and in a mixture, vapor-liquid equilibrium in solutions. Other types of phase equilibria in fluid solutions involving solids. Chemical equilibrium. The balance equations for chemical reactors and electrochemistry.

CHE 223: Fluid Mechanics **3 Credit Hours**

This course emphasizes the physical concepts of fluid mechanics and using governing equations to solve the related problems. Main topics in this course are: Basic concepts, dimensional analysis and scale up, fluid properties, fluid static, conservation principles, pipe flow and Bernoulli's equation. internal flow applications, pumps and compressors, compressible flow, flow measurement, and control and two phase flow.

CHE 311: Chemical Reaction Engineering **3 Credit Hours**

This course applies the concepts of reaction rate, stoichiometry and equilibrium to the analysis of chemical reaction systems. Analysis and interpretation of kinetic data and catalytic phenomena. Derivation of rate expressions from reaction mechanisms and equilibrium or steady state assumptions. Design of chemical reactors via chemical kinetics, transport, and mass and energy balances. Topics in this course include: chemical kinetics, batch, plug flow and well-stirred reactors for chemical reactions; heterogeneous catalysis; heat and mass transport in reactors, including diffusion to and within catalyst particles.

CHE 321: Heat Transfer **3 Credit Hours**

The course introduces the students to the fundamentals of heat transfer, and enable them to solve practical problems. Special emphasis is giving on a systematic development of the theory of heat transfer and gives the essential solution methods for heat transfer problems. The following topics are covered: introduction to the concept of heat transfer; introduction to conduction; one-dimensional steady-state conduction; two-dimensional steady-state conduction; transient conduction; introduction to convection: external flow and internal flow; free convection; boiling and condensation; heat exchangers design; radiation heat transfer.

CHE 320: Fluid Mechanics Lab **1 Credit Hour**

The lab experiments cover the major equipment used in fluid mechanics via the following experiments: viscosity and density measurements, type of flow, friction losses, venture and orifice flow meters, pressure drop due to friction through valves, and study of pump types and performance.

CHE 323: Heat Transfer Lab **1 Credit Hour**

The experiments of this course are designed to cover the following concept: thermal Conductivity, double pipe heat exchanger, free convection, forced convection, extended surface, and film wise and drop wise condensation - nucleate boiling.

CHE 325: Unit Operations **3 Credit Hours**

Mechanical unit operations encompass all the processes that run through the influence of mechanical forces or force fields. The basic operations include: characterization of solid particles; storage of solids; drag and drag coefficients; flow through beds of solids; mechanics of particle motion; settling; fluidization; size reduction; screening; filtration; gravity sedimentation processes; separation by centrifuges; separation by cyclones; crystallization processes; separation by membrane and evaporation.

CHE 326: Mass Transfer **3 Credit Hours**

The main goal of the course is to introduce the student to the theory and applications of Mass transfer. Topics to be covered: introduction to mass transfer and diffusion, molecular diffusion in gases and liquids, convective mass transfer coefficients, mass transfer between phases, membrane, absorption with and without chemical reactions, and principles of unsteady-state mass transfer.

CHE 341: Materials Science and Engineering **3 Credit Hours**

This course covers principles that govern the properties and behavior of engineering materials, atomic structures, interatomic forces, amorphous and crystalline structures, phase transformations. Mechanical properties and characterization of engineering materials. Capabilities and limitations of different materials: metals, polymers, ceramics. Engineering materials degradation and corrosion.

CHE 342: Polymer Science and Engineering **3 Credit Hours**

This course covers chemistry and Physics of polymers. Fundamentals of polymer synthesis; addition and condensation polymers. Mechanisms and kinetics of polymerization reactions. Polymerization techniques; suspension and emulsion. Properties of polymeric materials and polymers reinforced by fibers. Polymers manufacturing techniques. Polymer rheology. Methods of polymer fabrication; casting, blow molding, injection molding, extrusion. Polymeric solutions. Degradation

CHE 421: Separation Processes **3 Credit Hours**

The course introduces an equilibrium stage approach to absorption/stripping, distillation, solvent extraction. Graphical methods are introduced as well as the concepts of minimum number of stages, minimum solvent or stripping agent rate and minimum reflux ratio. The concept of humidity and the use of psychrometric charts are introduced

CHE 422: Unit Operation Lab **1 Credit Hour**

The lab cover the major equipment used in industrial chemical processes and the following experiments are expected to be performed: packed and tray distillation, packed-column gas absorption, liquid-liquid extraction, humidification/dehumidification in cooling towers, tray drying, evaporation, filtration, fluidization, screen analysis and size reduction.

CHE 431: Process Control **3 Credit Hours**

The course covers process dynamics in time and Laplace domains, input/output relationships, basic components of control systems, design of single-loop feedback control systems: stability, tuning, and synthesis techniques. Applications to chemical engineering processes. The principles of automatic control, feed-forward and feed-back strategies. Regulatory and servomechanism modes. Controller types: Proportional, integral and derivative actions. Feedback process control design. The dynamic response and stability of processes according to their characteristics. The form of perturbation and control action are examined.

CHE 432: Process Control Lab **1 Credit Hour**

The lab experiments are designed to explain the theory of the process control and its design. The best controller operating parameters will be determine for each experiment. The main experiments are: Temperature control, level control, pressure control, flow control, process modules and lab view programs.

CHE 433: Reaction Engineering Lab **1 Credit Hour**

The lab covers the major equipment used in reaction engineering and its design. The following experiments are expected to be performed: CSTR Reactor, PFR Reactor, Batch Reactor, CSTRs in series and Catalytic Reactor. Also covers the analytical measurements such Scanning Electron Microscopy (SEM) and Mass Spectrometry (MS).

CHE 461: Chemical Processes and Plant Design **3 Credit Hours**

The course provides a comprehensive guide to process and plant design for typical chemical engineering industries. It covers the theories and procedures for the design of chemical engineering equipments. The course outline is: Introduction to design; fundamentals of material balances; fundamentals of energy balances and energy utilization; flow sheeting; piping and instrumentation; costing and project evaluation; materials of construction; design information and data; safety and loss prevention; equipment selection, specification, and design; separation columns (distillation, absorption, heat transfer equipment, mechanical design of process equipment); general site considerations.

CHE 462: Process Synthesis and Modeling **3 Credit Hours**

The following topics are covered: Strategy for the conceptual design of industrial chemical processes; rules of thumb for chemical engineers, simulation to assist process synthesis, reactor-separator network synthesis, introduction to product design and molecular structure design, reaction-path synthesis, efficiency and sustainability in the chemical industry. Case study.

CHE 481: Biochemical Engineering **2 Credit Hours**

This course provides integration of the principles of chemical engineering, biochemistry, and microbiology with applications to the biochemical processes. Quantitative, problem-solving methods are emphasized. Topics include: cellular biology, polymeric cell compounds, enzyme and microbial kinetics, application of industrial enzymes, and cell growth cycle, fermentation and sterilization, bioreactors.

CHE 491: Graduation Project I **1 Credit Hour**

The student choose a specific problem in chemical engineering and tackle it experimentally or theoretically. flow sheet, material and energy balances, process and site selection analysis.

CHE 492: Graduation Project II **3 Credit Hours**

The course enable the student to have comprehensive analysis and development of the process; application of chemical engineering design principles to the design of a major chemical plant equipment and plant design, and economic analysis; safety, and environmental factors; oral presentation, and final technical report.

3. Elective Courses

CHE 412: Energy Conversion and Management **3 Credit Hours**

The course topics are types of energy, principles of energy conversion, steam generation and steam turbine performance, gas turbine, dual cycle analysis, types of fuels, combustion of fuels, heating value of fuels (GHV, NHV); production and combustion of biomass fuels. Energy consumption and Environmental pollution.

CHE 413: Renewable Energy **3 Credit Hours**

The course topics are concept of sustainability, wind energy, solar energy, hydraulic energy, geothermal energy, tidal power, solid wastes energy, and biofuel energy; nuclear energy; fuel cells, hybrid systems.

CHE 414: Solar Energy **3 Credit Hours**

The course topics are sun nature, sun-earth movement; calculation of extraterrestrial solar radiation; solar angles; measurements and calculations of hourly, daily, and monthly insolation on horizontal and inclined surfaces; solar energy collection systems; solar energy storage systems; industrial utilization of solar energy.

CHE 415: Fuel Cells **3 Credit Hours**

The goal of the course is to introduce the student to the theory and applications of fuel cells. Topics to be covered: fuel cell concept, hydrogen generation and storage, electrode reactions, types of fuel cells. electrodes materials, performance of a fuel cell and factors which affect the performance of a fuel cell.

CHE 416: Air Pollution Engineering **3 Credit Hours**

The goal of the course is to make the students familiar with techniques for measuring and controlling pollutants in order to design the pollution control equipment. Topics to be covered: Specific pollutants, sources and effects, particle dynamics and deposition mechanisms. effects of particulate matter, control of particulate matter, photochemistry, combustion-related pollutants, role of the automobile and power plant, air pollution meteorology, air pollution transport, building ventilation and pollutant penetration, sources and major indoor air pollutants, radon, global warming and greenhouse gases.

CHE 441: Electrochemical Engineering **3 Credit Hours**

The course covers the elements of electrochemical processing as they derive from electrochemical fundamentals. of Electrochemistry application in engineering. Basic thermodynamics and kinetics of electrochemical reactions, with emphasis on electrochemical techniques in order to illustrate how electrochemical parameters of electrode reactions can be determined and used for different applications. The use of electrochemistry in the field of corrosion, electroplating ،extractive metallurgy and fuel cells will be highlighted.

CHE 442: Nanomaterials Technology **3 Credit Hours**

The content of the course introduce the scientific principles and theories relevant at the nanoscale dimension, properties and characterization of nonmaterials, current and future nanotechnology applications in engineering materials, electronics, energy and desalination.

CHE 443: Polymer Chemistry and Engineering **3 Credit Hours**

The course topics are polymer chemistry and reactions; polymerization mechanisms; thermodynamics of polymer solutions, morphology, crystallization and mechanical properties; polymer processing equipment and technology; reactive polymeric resins and biological applications of macromolecules.

CHE 444: Petroleum Refining **3 Credit Hours**

This course covers the origin and composition of petroleum. Crude oil analysis and evaluation. Petroleum products and their uses. Refinery structure. Then it covers the main operation units in a typical refinery operations and processes: Atmospheric & vacuum distillation, fluid catalytic cracking, platforming, hydro-desulfurization and hydrotreating processes. Chemical treatment. Asphalt production. Lube oils production. Refinery Utilities. Standards and specifications of fuels.

CHE 445: Petrochemical Processes **3 Credit Hours**

The course covers the main process technologies used in petrochemical industries such as thermal and catalytic cracking processes. Basic, intermediate and final petrochemicals. Synthesis gas and derivatives, ethylene, propylene, butene, BTX, and their derivatives. Competing technologies.

CHE 451: Desalination **3 Credit Hours**

The course focuses on desalination fundamentals and other industrial aspects. These fundamentals are necessary to analyze and evaluate the performance for any of the existing and known desalination processes. The content is: Introduction. Single Effect Evaporation, Vapor compression, Multi Effect Evaporation and Multi Stage Flash distillation. Reverse Osmosis, Associated processes. Economic analysis.

CHE 452: Membrane Technology **3 Credit Hours**

The main objective of the course is to introduce a detailed descriptions of the fundamentals and applications of the membrane separation processes. Membrane module designs is presented beside the following: Overview of membrane science and technology. Membrane transport theory, Membrane and modules and Concentration polarization. Reverse osmosis. Ultra filtration, Micro filtration. Gas separation. Pervaporization, Ion exchange membrane and electrodialysis. Carrier facilitated transport , Medical application and Other membrane processes

CHE 453: Water and Wastewater Treatment **3 Credit Hours**

This course covers the technologies that are applied to the treatment and purification of drinking water and wastewater. The methods and technologies discussed are a combination of physical, chemical and thermal techniques. The following topics are covered: an overview of water and wastewater characterization and treatment, filtration, chemical additives to enhance filtration, filter media, pressure and cake filtration, cartridge filters, sand filtration, sedimentation, clarification, flotation, and coalescence membrane separation technologies, ion exchange and carbon adsorption, water sterilization technologies, treating the sludge, microbiology of wastewater treatment.

CHE 482: Bioprocess Engineering **3 Credit Hours**

The course emphasis is on engineering principles of biochemical processes and conversion of biological agents to food, pharmaceuticals, biofuels, and chemicals. Microbiology and metabolic pathways, and enzyme reactions. Concept of dissolved oxygen demand (DOD), and chemical oxygen demand (COD). Gas and liquid system (aeration). Fermentation kinetics. Enzyme immobilization, transport phenomena in biological systems. Design and modeling of single and multi-stage bioreactors. Sterilization. scale-up of bioreactors.

CHE 483: Bioseparation Engineering **3 Credit Hours**

The course covers the bioseparation processes that lead to obtaining the desired product from bioprocess. The main topics are: biotechnology overview, composition and structure of cells and fluids, protein structure and analysis/protein stabilization/protein, refolding, product physicochemical characteristics as the basis of separation procedures, cell disruption , centrifugation, flocculation, microfiltration, ultrafiltration, and diafiltration, crystallization, electrophoresis, liquid/liquid extraction, precipitation, dialysis/electrodialysis, reverse osmosis, drying.

CHE 484: Applications in Biological Engineering **3 Credit Hours**

This course provides an overview of the research and applications of Biological Engineering such as bioprocessing, biotechnology, transport processes, biosensors, bioremediation, biological materials, and biomedicine.

Civil Engineering Program

Civil Engineering Program

Introduction

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

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

The career paths available to the civil engineer are many and varied and can involve a wide range of activities, tools, situations, clients, and venues from conceptual design of facilities that do not yet exist to forensic study of facilities that have failed to perform as expected, from advanced simulation of complex systems to the management of people and projects, from private consulting to public service. In addition to the educational objectives that apply to all engineering programs, the civil engineer must be as well prepared for a career that traverses this considerable professional breadth as for a career focused on a single professional activity. The civil engineering curriculum is designed specifically to meet this educational challenge by emphasizing fundamental knowledge, transferable skills, and lifelong learning. The civil engineering program comprises of six main disciplines: (1) structural engineering, (2) transportation engineering, (3) environmental engineering, (4) geotechnical engineering, (5) water resources engineering, and (6) construction engineering and management. While each discipline has its own special body of knowledge and engineering tools, they all rely on the same fundamental core principles. Civil engineering projects often draw expertise from many of these disciplines.

Civil engineering curriculum is designed to develop engineers who have a strong background in mathematics and science, engineers who are articulate, and engineers who understand the nature of their special role in society and the impact of their work on the progress of civilization. The curriculum is designed to guarantee a certain breadth of knowledge of the civil engineering disciplines through a set of core courses and ensure depth and focus in certain disciplines through core and elective area of specialization. The curriculum develops the basic engineering tools necessary to solve problems in the field of civil engineering.

Vision

To attain excellence in Civil Engineering education, research, and community service.

Mission

Our mission is to contribute to the advancement of the community through:

1. Providing high quality civil engineering education that builds up successful career of competitive and creative engineers.
2. Conducting research that generates new technologies which enhance the quality of life in a sustainable manner.
3. Meeting the needs of industrial, governmental organizations and the general community for engineering expertise, through training, consultancy, and research.

Program Educational Objectives

Consistent with the mission and goals of the College of Engineering at Imam University and based upon the input and needs of its constituents, the Civil Engineering Program will produce graduates who will achieve the following educational objectives:

1. Progress in successful professional careers in civil and environmental engineering or related fields, and/or enroll in studies at the graduate level;
2. Engage in problem solving and application of engineering principles to address the needs of society, and practice effective management, communication, and leadership skills;
3. Demonstrate a commitment to life-long learning to respond to the rapid pace of change in civil and environmental engineering, become professionally licensed, and participate in professional society activities; and
4. Contribute to work force diversity as members and leaders of multidisciplinary teams.

Program Outcomes

The civil engineering program endeavors that the students attain the following outcomes stated by 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.

Overview of the Curriculum

Course coding

Civil Engineering courses are numbered in such a manner to recognize each course according to the area of specialization and the year level. The symbol CE stands for Civil Engineering and each number is made of 3 digits. Each digit represents specific information about the course as follows:

The first digit according to the following table denotes the year level of the course as per student's plan of study:

First Digit	Level of Course
1	First year
2	Second year
3	Third year
4	Fourth year

The second digit as per the following table represents the field/specialization within a department:

Second Number	Specialization
1	Materials and Structural Engineering
2	Transportation Engineering
3	Environmental Engineering
4	Water Resources Engineering
5	Geotechnical Engineering
6	Construction Engineering and Management
9	Design Projects Courses

The third digit denotes the sequence number of the course in a certain field/specialization in a given year. The number 9 as the third digit is reserved for Engineering Training and Special Topic courses within a specialty of civil engineering.

Example: CE 421 means

Code	First Digit	Second Digit	Third Digit
CE	4	2	1
Department (Civil Engineering)	Level (Fourth year)	Field (Transportation Engineering)	The first course in transportation in the fourth year

Undergraduate Curriculum of Civil Engineering Program

The curriculum leading to the degree of Bachelor of Science in Civil Engineering requires **135 credits** and is organized as follows:

University Requirement	**14** Credit hours	Islamic, Humanities, and Social Science courses
College Requirement	**52** Credit hours	Math, Basic Science, and Fundamental Engineering
Department Requirement	**69** Credit hours	Both compulsory and elective

1. General University Requirements

Fourteen hours of credits must be taken as a University requirement. Courses will be taken from the list assigned by Al-Imam University and according to the specified rules and regulations. A suggested list is as follows:

Course Code	Course Name	Credits
QUR 100	Quran Kareem I	2
QUR 150	Quran Kareem II	2
QUR 200	Quran Kareem III	2
QUR 250	Quran Kareem IV	2
IDE 133	Tawheed	2
LIT 102	Arabic Language Skills	2
HIST 102	History of Saudi Arabia	2
Total		**14**

2. College of Engineering Requirements

The following courses are required in the undergraduate curriculum in civil engineering. These courses provide the foundation for the study of civil engineering:

Course Code	Course Name	Credits	Prerequisite	Co-requisite
MATH 105	Calculus I	4	None	
MATH 106	Calculus II	4	MATH 105	
MATH 226	Linear Algebra	3	MATH 106	
MATH 235	Differential Equations	3	MATH 106	
STAT 215	Probability and Statistics in Engineering	3	MATH 106	
CS 107	Computer Programming	3	MATH 105	
CHEM 103	General Chemistry	4	None	
PHYS 117	Physics I	3		PHYS 119
PHYS 119	Physics I lab	1		PHYS 117
PHYS 118	Physics II	3	PHYS 117, PHYS 119	PHYS 120
PHYS 120	Physics II lab	4	PHYS 117, PHYS 119	PHYS 118
ENGL 201	Technical English Writing	3	None	
GE 101	Engineering Graphics and Design	3	None	
GE 201	Statics	3	MATH 106, PHYS 117, PHYS 119	
GE 202	Dynamics	3	GE 201	
GE 301	Numerical Methods in Engineering	3	CS 107, Math 235	
GE 302	Professional Ethics for Engineers	2	None	
GE 303	Engineering Economy	3	MATH 106	
GE 399	Engineering Training	0	Completion of 90 Cr.H.	
Total		**52**		

3. Civil Engineering Department Requirements

Sixty nine credit hours of civil engineering courses, both compulsory **(60 Credit hours)** and elective **(9 Credit hours)**, must be taken by all students in the undergraduate program. These courses are listed in the following table:

A. Civil Engineering Compulsory Courses

Course Code	Course Title	Credits	Prerequisite	Co-requisite
CE131	Environmental Chemistry	2	CHEM 103	
CE 211	Solid Mechanics	3	GE 101 GE 201 MATH 235	
CE 210	Civil Engineering Materials	2	GE 201	CE 211
CE 213	Civil Engineering Materials Lab	1		CE 210
CE 221	Engineering Surveying	3	CS 107 GE 101	STAT 215
CE 241	Fluid Mechanics	3	MATH 235 GE 201	
CE 311	Structural Engineering	4	CE 211 MATH 226	
CE 310	Concrete Properties	2	CE 213	
CE313	Reinforced Concrete Design	3	CE 311	CE310
CE 321	Transportation Engineering	3	CE 221 CE 210	
CE 322	Transportation Engineering Lab	1		CE 321
CE 331	Environmental Engineering	3	CE 131 CE 241	
CE 332	Environmental Engineering Lab	1		CE 331
CE 340	Water Resources Engineering	3	CE 241 STAT 215	
CE 344	Water Resources Eng. Lab	1		CE 340
CE 351	Geotechnical Engineering	3	CE 211	

Course Code	Course Title	Credits	Prerequisite	Co-requisite
CE 352	Geotechnical Engineering Lab	1		CE 351
CE 411	Steel Structures	3	CE 311	
CE 421	Transportation Facility Design	3	CE322 CE 321 CE 351	
CE 422	Civil Engineering Systems	3	CE 461	
CE 451	Foundation Engineering	3	CE 313 CE 351 CE352	
CE 461	Construction Engineering and Management	3	GE 303 CE313	CE 421
CE 462	Construction Contracts and Specifications	2	CE461	
CE 4**	Elective I	3	Refer to the elective courses	
CE 4**	Elective II	3	Refer to the elective courses	
CE 4**	Elective III	3	Refer to the elective courses	
CE 491	Graduation Project I	1	Department approval	
CE 492	Graduation Project II	3	CE491	
Total		**69**		

B. Civil Engineering Elective Courses

The value of focusing on one area of study is twofold. First, it provides a basic education that allows a B.S. graduate to work productively in that field. Second, it provides an education that prepares the student for graduate work in that field. The advanced technical electives are selected to satisfy the requirements of the area of emphasis (a major field within civil engineering). At least 9 hours of credits must be taken and must be in the area of emphasis that is chosen to be an appropriate program of study within one of the six disciplines of civil engineering as follows:

1. Structural Engineering

Course Code	Course Name	Credits	Prerequisite
CE 412	Indeterminate Structural Analysis	3	GE 301 CE 313
CE 413	Advanced Reinforced Concrete Design	3	CE 313
CE 414	Bridge Engineering	3	CE 412
CE 415	Prestressed Concrete	3	CE 313
CE 416	Structural Dynamics	3	CE 412
CE 417	Advanced Concrete Materials	3	CE 310
CE 419	Special Topics in Structural Engineering	3	To be determined by the Instructor

2. Transportation Engineering

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

3. Environmental Engineering

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

4. Water Resources Engineering

Course Code	Course Name	Credits	Prerequisite
CE 441	Surface Hydrology	3	CE 340
CE 442	Hydraulic Analysis and Design	3	CE 340
CE 443	Groundwater Engineering	3	CE 340
CE 444	Urban Hydrology and Hydraulics	3	CE 340
CE 445	Water Resources Management	3	CE 340
CE 449	Special Topics in Water Resources Engineering	3	To be determined by the Instructor

5. Geotechnical Engineering

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

6. Construction Engineering and Management

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

Civil Engineering Undergraduate Curriculum

First Year (Freshman)

First Level

No.	Course Code	Course Name	Credits	Hours Theory	Lab	Tut
1	QUR 100	Quran Kareem I	2	2		
2	MATH 105	Calculus I	4	4		1
3	PHYS 117	Physics I	3	3		
4	PHYS 119	Physics I lab	1		2	
5	CHEM 103	General Chemistry	4	3	2	
6	GE 101	Engineering Graphics and Design	3	2	2	
Total Semester Hours			**17**	**14**	**6**	**1**

Second Level

No.	Course Code	Course Name	Credits	Hours Theory	Lab	Tut
1	ENGL 201	Technical English Writing	3	3		
2	CS 107	Computer Programming	3	2	2	
3	MATH 106	Calculus II	4	4		1
4	PHYS 118	Physics II	3	3		
5	PHYS 120	Physics II Lab	1		2	
6	CE 131	Environmental Chemistry	2	2		1
Total Semester Hours			**16**	**14**	**4**	**2**
Cumulative Credit Hours			**33**	**28**	**10**	**3**

Second Year (Sophomore)

Third Level

No.	Course Code	Course Name	Hours			
			Credits	Theory	Lab	Tut
1	QUR 150	Quran Kareem II	2	2		
2	LIT 102	Arabic Language Skills	2	2		
3	STAT 215	Probability and Statistics in Engineering	3	3		1
4	MATH 235	Differential Equations	3	3		1
5	GE 201	Statics	3	3		1
6	CE 221	Engineering Surveying	3	2	2	1
Total Semester Hours			**16**	**15**		**4**
Cumulative Credit Hours			**49**	**43**	**12**	**7**

Fourth Level

No.	Course Code	Course Name	Hours			
			Credits	Theory	Lab	Tut
1	QUR 200	Quran Kareem III	2	2		
2	MATH 226	Linear Algebra	3	3		1
3	GE 202	Dynamics	3	3		1
4	CE 211	Solid Mechanics	3	3		1
5	CE 210	Civil Engineering Materials	2	2		1
6	CE 213	Civil Engineering Materials Lab	1		2	
7	CE 241	Fluid Mechanics	3	3		1
Total Semester Hours			**17**	**16**	**2**	**5**
Cumulative Credit Hours			**66**	**59**	**14**	**12**

Third Year (Junior)

Fifth Level

No.	Course Code	Course Name	Credits	Hours Theory	Lab	Tut
1	QUR 250	Quran Kareem IV	2	2		
2	GE 301	Numerical Methods in Engineering	3	3		1
3	CE 311	Structural Engineering	4	4		1
4	CE 321	Transportation Engineering	3	3		1
5	CE 322	Transportation Engineering Lab	1		2	
6	CE 351	Geotechnical Engineering	3	3		1
7	CE 352	Geotechnical Engineering Lab	1		2	
Total Semester Hours			**17**	**15**	**4**	**4**
Cumulative Credit Hours			**83**	**74**	**18**	**16**

Sixth Level

No.	Course Code	Course Name	Credits	Hours Theory	Lab	Tut
1	IDE 133	Tawheed	2	2		
2	GE 303	Engineering Economy	3	3		1
3	CE 310	Concrete Properties	2	1	2	
4	CE 313	Reinforced Concrete Design	3	3		1
5	CE 331	Environmental Engineering	3	3		1
6	CE 332	Environmental Engineering Lab	1		2	
7	CE 340	Water Resources Engineering	3	3		1
8	CE 344	Water Resources Engineering Lab	1		2	
Total Semester Hours			**18**	**15**	**6**	**4**
Cumulative Credit Hours			**101**	**89**	**24**	**20**

Summer

No.	Course Code	Course Name	Credit	Hours Theory	Lab	Tut
1	GE 399	Engineering Training	0	0	0	0
Total Semester Hours			**0**	**0**	**0**	**0**
Cumulative Credit Hours			**101**	**89**	**24**	**20**

Fourth Year (Senior)

Seventh Level

No.	Course Code	Course Name	Credits	Hours Theory	Lab	Tut
1	HIST 102	History of Saudi Arabia	2	2		
2	CE 411	Steel Structures	3	3		1
3	CE 421	Transportation Facility Design	3	3		1
4	CE 451	Foundation Engineering	3	3		1
5	CE 461	Construction Engineering and Management	3	3		1
6	CE 4**	Elective I	3	3		1
7	CE 491	Graduation Project I	1		2	
Total Semester Hours			**18**	**17**	**2**	**5**
Cumulative Credit Hours			**119**	**106**	**26**	**25**

Eighth Level

No.	Course Code	Course Name	Credits	Hours Theory	Lab	Tut
1	GE302	Professional Ethics for Engineers	2	2		
2	CE 422	Civil Engineering Systems	3	3		1
3	CE 462	Construction Contracts and Specifications	2	2		1
4	CE 4**	Elective II	3	3		1
5	CE 4**	Elective III	3	3		1
6	CE 492	Graduation Project II	3		6	
Total Semester Hours			**16**	**13**	**6**	**4**
Cumulative Credit Hours			**135**	**119**	**32**	**29**

Course Description

1. General College Courses

This section contains the description of fundamental engineering courses that are required by the College of Engineering. The courses are listed in numerical order. Each entry has the number of hours of credits for the course, the prerequisites, and a brief description.

MATH 105: Calculus-I **4 Credit Hours**

Differential calculus and basic integral calculus including the fundamental theorem of calculus and Taylor's theorem with remainder. It includes most of the elementary topics in the theory of real-valued functions of a real variable: limits, continuity, derivatives, maxima and minima, integration, area under a curve, volumes of revolution, trigonometric, logarithmic and exponential functions and techniques of integration.

MATH 106: Calculus-II **4 Credit Hours**

All techniques of integration (substitution, by parts, trigonometric substitutions, partial fractions, miscellaneous substitutions etc.), conic sections, polar coordinates, and infinite series. Vector analysis: Euclidean space, partial differentiation, multiple integrals, the integral theorems of vector calculus.

MATH 226: Linear Algebra **3 Credit Hours**

Basic concepts and techniques of linear algebra; includes systems of linear equations, matrices, determinants, vectors in n-space, and eigenvectors, together with selected applications, such as Markov processes, linear programming, economic models, least squares and population growth.

MATH 235: Differential Equations **3 Credit Hours**

Techniques and applications of ordinary differential equations: First order equations, linear equations of higher order, systems of linear equations with constant coefficients, reduction of order, including Fourier series and boundary-value problems, and an introduction to partial differential equations.

STAT 215: Probability and Statistics in Engineering **3 Credit Hours**

Emphasizes basic probability concepts, random variables and probability, expectations and moments, functions of random variables, some important discrete distributions, some important continuous distributions. This including descriptive statistics, observed data and graphical representation, parameter estimation, model verification, linear models and linear regression, and hypothesis testing in both nonparametric and normal models.

PHYS 117: Physics-I **3 Credit Hours**

Vectors. Motion in one, two and three dimension. Acceleration and free fall, force and motion, and analysis of forces. Newton's laws. Circular motion. Work: the transfer of mechanical energy. Conservation of momentum. Rotation. Conservation of angular momentum. Elasticity and Fluid mechanics.

PHYS 118: Physics-II **3 Credit Hours**

Oscillations. Sound waves. Heat and Thermodynamics. Electricity and Magnetism: Coulomb's law, electric fields, Gauss' Law, electric potential, potential energy, capacitance, currents and resistance. Electrical energy and power, direct current circuits, Kirchhoff's rules. Magnetic fields, motion of charged particle in a magnetic field, sources of the magnetic field and energy in a magnetic field. Ampere's law, Faraday's law of induction, self-inductance. Alternating current circuits, the RLC series circuit, power in an A.C. circuit, resonance in RLC services circuit.

CHEM 103: General Chemistry **4 Credit Hours**

The course covers fundamental observations, laws, and theories of chemistry at the introductory level. Topics include Atoms/Molecules, Stoichiometry, Acids/Bases, Solutions, Equilibria, Gases, Solids, Liquids, Thermodynamics, Kinetics, Quantum Theory, The periodic table, and Chemical bonding.

ENGL 201: Technical English Writing **3 Credit Hours**

The course examines the basic requirements of technical style and organizational patterns used in a variety of business and technical documents. Students learn and practice how to condense extensive information into the fewest words possible without sacrificing content. The course also covers how to identify the audiences and apply various styles to each. Students hone their skills by writing various types of proposals, informal and formal reports, procedures manuals and oral presentations. Finally, the course gives students a command of the design principals and production processes required for truly effective technical communications. Students will be required to complete a capstone project that incorporates every aspect of technical writing learned in the course.

CS 107: Computer Programming **3 Credit Hours**

Fundamental principles, concepts, and methods of computing, with emphasis on applications in engineering. Basic problem solving and programming techniques, fundamental algorithms and data structures. Use of computers in solving engineering and scientific problems.

GE 101: Engineering Graphics and Design **3 Credit Hours**

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

GE 201: Statics **3 Credit Hours**

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

GE 202: Dynamics **3 Credit Hours**

Kinematics and kinetics of particles. Kinematics of rigid bodies; translation and fixed-axis rotation relative to translating axes, general planar motion, fixed-point rotation and general motion. Kinetics of rigid bodies: Planar motion, work-energy method. Momentum and collision, Design of cams, gears and linkages.

GE 301: Numerical Methods in Engineering **3 Credit Hours**

Introduction to numerical methods for students in science and engineering, Topics include floating-point computation, systems of linear equations, approximation of functions and integrals, the single nonlinear equation, and the numerical solution of ordinary differential equations. Applications in science and engineering: include some programming as well as the use of high quality mathematical library routines.

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

The course examines ethical theories, moral norms and case studies to provide an overview of the ethical use of technology and associated responsibilities of engineers towards society, environment, clients, employers and coworkers. Ethical problem-solving techniques are elaborated with examples. Concepts of whistle blowing, intellectual copyrights, plagiarism, conflict of interests, safety, occupational hazards and cost-benefit risk are explored in the light of engineering codes of ethics and legal aspects of ethical and professional misconduct.

GE 303: Engineering Economy **3 Credit Hours**

Time value of money formulas, application of time value of money formulas. Project selection using net present worth analysis using the common multiple and study period methods, one and two parameter sensitivity analysis. Bond cash flows and pricing, loan amortization and determining the remaining principle on a loan, project selection using annual equivalent worth, project selection using the incremental net present worth. Annual depreciation and book value using straight line, declining balance and MACRS methods. Annual cash flow and net present worth. Discounted benefit/cost ratio for a public project and determine if it meets the criterion. Inflation in estimating future cash flows, and defender/challenger replacement analysis using net present worth.

GE 399: Engineering Training **0 Credit Hours**

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

2. Compulsory Civil Engineering Courses

This section contains all of the course descriptions for 200, 300, 400 level courses to be taught through the Civil Engineering department.

CE 131: Environmental Chemistry **2 Credit Hours**

Water quality implications for environmental and engineering activities. Water characteristics. Examples of engineering and environmental problems affected by chemical processes. Order of reaction in chemical and biochemical processes. Principles of chemistry of natural waters, water supplies, wastewaters, hazardous wastes. Stoichiometry, equilibrium, solubility, kinetics, organic chemistry, biochemistry, analytical techniques. Examples from water/wastewater practice to illustrate applications.

CE 211: Solid Mechanics **3 Credit Hours**

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

CE 210: Civil Engineering Materials **2 Credit Hours**

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

CE213: Civil Engineering Materials Lab **1 Credit Hour**

This course introduces the concepts, procedures, tools and equipment used to measure and evaluate engineering properties of civil engineering materials, including reinforcing steel, metals, aggregate, cement, asphalt, polymers and timber.

CE 221: Engineering Surveying **3 Credit Hours**

Introduction to surveying and photogrammetry. Horizontal and vertical distance measurement, angles and direction, traverses, errors and their compensation, control and construction surveys; coordinate geometry; area computations; topographic maps; introduction to horizontal and vertical curves; Lab and field practice with modern surveying equipment.

CE 241: Fluid Mechanics **3 Credit Hours**

Study of fluid properties, hydrostatics, friction loss, dimensional analysis, statics, and dynamics of compressible and incompressible fluids; continuity, energy, and momentum principles; laminar and turbulent flow; general concepts of boundary layer flow.

CE 310: Concrete Properties **2 Credit Hours**

Concrete constituent materials, concrete mix design, concrete production, transportation and placing operations, fresh and hardened concrete properties and testing, hot weather concreting, durability, admixtures and special types of concrete. The laboratory is an essential part where fresh and hardened concrete testing will be conducted including the non-destructive testing methods.

CE 311: Structural Engineering **4 Credit Hours**

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

CE 313: Reinforced Concrete Design **3 Credit Hours**

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

CE 321: Transportation Engineering **3 Credit Hours**

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

CE 322: Transportation Engineering Lab **1 Credit Hour**

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

CE 331: Environmental Engineering **3 Credit Hours**

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

CE 332: Environmental Engineering Lab **1 Credit Hour**

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

CE 340: Water Resources Engineering **3 Credit Hours**

Quantitative aspects of water in the earth's environment and its engineering implications, including design and analysis of systems directly concerned with use and control of water; quantitative introduction to hydrology, hydraulic engineering, and water resources planning.

CE 344: Water Resources Engineering lab **1 Credit Hour**

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

CE 351: Geotechnical Engineering **3 Credit Hours**

Introduction to geotechnical engineering, Soil formation, Soil composition, Soil classification, Excavation, grading and compacted fill, Ground water and permeability, Stress distribution in soils, Effective stress concept, Compressibility and settlement analysis, Consolidation, Soil strength.

CE 352: Geotechnical Engineering Lab **1 Credit Hour**

Soil description and identification, Specific gravity test, Moisture content test, Sieve analysis and hydrometer test, Atterberg limits tests, Standard and modified compaction tests, California bearing ratio test, Constant and falling head permeability tests, Consolidation test, Direct shear test, Unconfined compression test, Triaxial compression test.

CE 411: Steel Structures **3 Credit Hours**

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

CE 421: Transportation Facility Design **3 Credit Hours**

Study of geometric elements of transportation facilities, with emphasis on analysis and design for safety. Pavement analysis, design, and rehabilitation.

CE 422: Civil Engineering Systems **3 Credit Hours**

Introduction to the formulation and solution of civil engineering problems. Major topics are: mathematical modeling, and optimization. Techniques including classical optimization, linear and nonlinear programming, network theory, critical path methods, simulation, decision theory, and dynamic programming are applied to a variety of civil engineering problems.

CE 451: Foundation Engineering **3 Credit Hours**

Introduction to foundation engineering, General requirements of foundations, Selection of foundation types, Bearing capacity theories, Analysis and design of shallow foundations, Foundation settlement, Lateral earth pressure, Excavation and retaining walls, Slope stability analysis.

CE 461: Construction Engineering and Management **3 Credit Hours**

Introduction to the construction processes: planning and scheduling, estimating and project control, productivity models, construction equipment, quality control, construction safety, sustainable construction practices, and construction econometrics.

CE 462: Construction Contracts and Specifications **2 Credit Hours**

Application of the construction contracts, drawings, and specifications to the construction process is explained. The methodology, procedures and organizational techniques involved in preparing and evaluating a competitive bid are discussed. Types of construction contracts, general and special conditions of contract, standard specifications and contract forms are covered with examples. Procedures for systematic handling of changes, claims and disputes are clarified along with their legal implications.

CE 491: Graduation Project I **1 Credit Hour**

Students will choose certain design projects from a range of topics in all specialization of Civil Engineering.

CE 492: Graduation Project II **3 Credit Hours**

Continuation of CE 491, comprehensive analysis and design of the selected topic. The student is required to report his findings in an approved technical report, and do an oral presentation.

3. Civil Engineering Elective Courses

CE 412: Indeterminate Structural Analysis **3 Credit Hours**

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

CE 413: Advanced Reinforced Concrete Design **3 Credit Hours**

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

CE 414: Bridge Engineering **3 Credit Hours**

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

CE 415: Prestressed Concrete **3 Credit Hours**

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

CE 416: Structural Dynamics **3 Credit Hours**

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

CE 417: Advanced Concrete Materials **3 Credit Hours**

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

CE 419: Special Topics in Structural Engineering **3 Credit Hours**

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

CE 423: Pavement Engineering **3 Credit Hours**

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

CE 424: Urban Transportation Planning **3 Credit Hours**

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

CE 425: Traffic Engineering **3 Credit Hours**

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

CE 426: Public Transportation Systems **3 Credit Hours**

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

CE 427: Traffic Safety **3 Credit Hours**

This course applies of principles of engineering, behavioral science, and vision science to preventing traffic collisions and subsequent injury. A systematic approach to traffic safety will be presented in this course, and will include 1) human behavior, vehicle design, and roadway design as interacting approaches to preventing traffic crashes and 2) vehicle and roadway designs approaches to preventing injury once a collision has occurred.

CE 429: Special Topics in Transportation Engineering **3 Credit Hours**

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

CE 431: Design of water and wastewater treatment systems **3 Credit Hours**

Characterization of water and wastewater; Design of water distribution networks and sewerage systems; Design of water treatment systems; Wastewater Treatment design; Design basics of non-conventional treatment methods including: adsorbers, aeration towers and membrane processes; processing of sludge, and water reuse**.**

CE 432: Environmental Impact Assessment (EIA) **3 Credit Hours**

Study of environmental impacts of engineering projects on the environmental components of water, air, and soil. Social, economical and cultural impacts will also be studied. Various impacts will be identified and predicted and mitigational measures will be suggested.

CE 433: Water Quality Engineering **3 Credit Hours**

Fundamental theory underlying the unit processes utilized in the treatment of water for domestic and industrial usage, and in the treatment of domestic and industrial wastewaters.

CE 434: Solid and Hazardous Waste Eng. and Management **3 Credit Hours**

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

CE 435: Air Pollution Engineering **3 Credit Hours**

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

CE 439: Special Topics in Environmental Engineering **3 Credit Hours**

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

CE 441: Hydraulic Analysis and Design **3 Credit Hours**

Hydraulic analysis and design of engineering systems: closed conduits and pipe networks; hydraulic structures, including spillways, stilling basins, and embankment seepage; selection and installation of hydraulic machinery.

CE 442: Surface Hydrology **3 Credit Hours**

Study of descriptive and quantitative hydrology dealing with the distribution, circulation, and storage of water on the earth's surface; discusses principles of hydrologic processes and presents methods of analysis and their applications to engineering and environmental problems.

CE 443: Groundwater Engineering **3 Credit Hours**

Physical properties of groundwater and aquifers, principles and fundamental equations of porous media flow and mass transport, well hydraulics and pumping test analysis, role of groundwater in the hydrologic cycle, groundwater quality and contamination.

CE 444: Urban Hydrology and Hydraulics **3 Credit Hours**

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

CE 445: Water Resources Management **3 Credit Hours**

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

CE 449: Special Topics in water resources Engineering **3 Credit Hours**

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

CE 452: Soil Mechanics and Behavior **3 Credit Hours**

Physical and chemical properties of soils, Clay minerals, Soil structure, Shear strength and deformation, Pore pressure parameters, Effective stress analysis, Consolidation and settlement analysis, Introduction to unsaturated soil mechanics.

CE 453: Geosystems Engineering Design **3 Credit Hours**

Stability of shallow foundations, Analysis and design of piles and deep foundations, Rafts and combined footings, Foundations under lateral loads, Dewatering of foundations, Embankments, Introduction to earth retention systems.

CE 454: Soil and Site Improvement **3 Credit Hours**

Problematic soils, Need of soil improvement, Methods and principles for improving engineering properties of soils, Mechanical, chemical, electrical and thermal stabilization, Use of geosynthetics in geotechnical and geo-environmental applications.

CE 455: Geotechnical Investigations **3 Credit Hours**

Structure of ground investigation, Sources of information, Planning, management and control, Site exploration techniques, Geophysical testing methods, Geotechnical instrumentation, Geotechnical report writing.

CE 456: Geotechnical Earthquake Engineering **3 Credit Hours**

Introduction to earthquake engineering, Basic earth features and earthquake principles, Common earthquake effects/damages, Site investigation for geotechnical earthquake engineering, Liquefaction, bearing capacity of foundations, Retaining wall and slope stability analysis, Seismic microzonation, Site improvement methods to mitigate earthquake effects.

CE 459: Special Topics in Geotechnical Engineering **3 Credit Hours**

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

CE 463: Construction Planning **3 Credit Hours**

Project definition; scheduling and control models; material, labor and equipment allocation; optimal schedules; project organization; documentation and reporting systems; and management and control.

CE 464: Decision and Risk Analysis **3 Credit Hours**

Development of modern statistical decision theory and risk analysis, and application of these concepts in civil engineering design and decision making; Bayesian statistical decision theory, decision tree, utility concepts, and multi--objective decision problems; modeling and analysis of uncertainties, practical risk evaluation, and formulation of risk-based design criteria, risk benefit trade-offs, and optimal decisions.

CE 465: Construction Cost Analysis **3 Credit Hours**

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

CE 466: Construction Productivity **3 Credit Hours**

Introduction of the application of scientific principles to the measurement and forecasting of productivity in construction engineering. Conceptual and mathematical formulation of labor, equipment, and material factors affecting productivity.

CE 467: Quality and Safety Management in Construction **3 Credit Hours**

Introduction to quality management (QM), Quality Standards, Development and implementation of quality management systems, quality indicators, quality audits, Importance of construction safety, safety culture, health and safety hazards, personal protective equipment, OSHA Standards, new trends in safety and safety promotion.

CE 469: Special Topics in Construction Eng. and management **3 Credit Hours**

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

Mechanical Engineering Program

Mechanical Engineering Program

Introduction

Mechanical engineering is one of the core disciplines of engineering. It encompasses a large number of sub-disciplines that are at the heart of both traditional and leading edge technologies. Mechanical engineers can be found in leadership roles in almost any sector of industry, ranging from electronics and aerospace to civil transportation and consumer household products. The program is also designed to prepare students for graduate studies in mechanical and materials engineering. The undergraduate mechanical engineering program recognizes that students have a variety of career path objectives within the wide variety of industrial environments available to mechanical engineers. The mechanical engineering students do earn a *concentration* during their senior year. Concentrations give them the chance to specialize in one area of mechanical engineering. They can choose to take elective courses related to one group of specialty.

Vision

Prepare mechanical engineers to apply and deliver the related modern technology in the field of Mechanical Engineering in developing and enhancing the Saudi and the international societies.

Mission

The Mechanical Engineering Department mission is to provide highly skilled mechanical engineers with international standard in education, training, and advanced scientific research.

Program Educational Objectives

Engineering is the application of scientific principles to achieve practical goals such as the design, construction, and operation of efficient and economical structures, equipment, and systems. As engineers, graduates of the Mechanical Engineering Department:

1. Will be able to integrate fundamental principles of mathematics, natural and engineering sciences, as well as the mechanical engineering knowledge, to seek solutions for engineering challenges in an interdisciplinary environment.
2. Can successfully begin engineering or other professional careers, or pursue graduate studies.
3. Will be committed to integrate ethical and social codes, environmental regulations, and safety issues into their professional careers.
4. Will be effective communicators to technical and non-technical audiences.

5. Will have the ability to pursue research and advanced studies in areas such as composite and advanced materials, nanomaterials, environmental engineering, renewable energy, computer-aided design and computational fluid dynamics.
6. Will be able to identify contemporary challenges and propose a plan of action to tackle them.

Program Outcomes

Upon completion of the degree, graduates from the Mechanical Engineering Department will:

a. Have the ability to apply knowledge of mathematics, science, and engineering.
b. Have the ability to design and conduct experiments as well as analyze and interpret data.
c. Have the ability to design a system, component, or process to meet desired needs.
d. Have the ability to function on multi-disciplinary teams.
e. Have the ability to identify, formulate, and solve engineering problems.
f. Have the understanding of professional and ethical responsibility.
g. Have the ability to communicate effectively.
h. Have the broad education to understand the impact of engineering solutions in a global and societal context.
i. Be able to recognize the importance for engaging in life-long learning practices.
j. Be knowledgeable in contemporary engineering and scientific issues.
k. Have the ability to use techniques, skills, and modern engineering tools necessary for engineering practice.
l. Will be aware of the safety requirements and will have the ability to apply safety rules and regulations at their work places.
m. Will have the ability to work at a professional level for both thermal and mechanical systems from conceptualization to the final design and realization of such systems.

Overview of the Curriculum

Course Coding

The Mechanical Engineering courses are numbered in such a manner to recognize each course according to the area of specialization, the year level, and the sequence in which it would be offered. The symbol ME stands for Mechanical Engineering and each number is made up of 3 digits. Each digit represents specific information about the course as follows:

The first digit according to the following Table denotes the year level of the course as per students' plan of study:

First Digit	Level of Course
1	First year
2	Second year
3	Third year
4	Fourth year

The second digit as per the following Table represents the field/specialization within a Department:

Second Digit	Specialization
0	Engineering Fundamentals and Universal Skill Courses
1	Materials and Solid Mechanics
2	Thermal and Fluid Sciences
3	Control Theory and System Dynamics
4	Power Generation and Energy Conversion
5	Heating, Ventilation, and Air Conditioning (HVAC)
6	Manufacturing Engineering and Safety
7	Computational Methods
9	Graduation Project Courses, Seminar or Engineering Training

The third digit denotes the sequence number of the course in a certain field/specialization in a given year. The **number 9** as the third digit is reserved for Engineering Training and Special Topic courses.

Example: ME 451 means

Code	First Digit	Second Digit	Third Digit
ME	**4**	**5**	**1**
Department (Mechanical Engineering)	**Level** (Fourth year)	**Field** (HVAC)	The sequence number of the field courses

Undergraduate Curriculum of the Mechanical Engineering program

The curriculum leading to the degree of Bachelor of Science in Mechanical Engineering requires **135 Credit Hours** and is organized as follows:

University Requirement	**14** Credit Hours	Islamic, humanities, and social science courses
College Requirement	**58** Credit Hours	Math, Basic Science, and Fundamental Engineering courses
Department Requirement	**63** Credit Hours	Both compulsory and elective courses

1. General University Requirements

All students in the College of Engineering at Al-Imam University are required to take 14 credit hours of course work as detailed in the following Table irrespective of the engineering discipline they are in:

Course Code	Course Name	Credit Hours
QUR 100	Quran Kareem I	2
QUR 150	Quran Kareem II	2
QUR 200	Quran Kareem III	2
QUR 250	Quran Kareem IV	2
IDE 133	Tawheed	2
LIT 102	Arabic Language Skills	2
HIST 102	History of Saudi Arabia	2
	Total	**14**

2. College of Engineering Requirements

The total number of credit hours required by the College of Engineering is 58. The details are listed in the table below:

Course Code	Course Name	Credit Hours	Prerequisite
MATH 105	Calculus-I	4	None
MATH 106	Calculus-II	4	MATH 105
MATH 226	Linear Algebra	3	MATH 106
MATH 235	Differential Equations	3	MATH 106

STAT 215	Probability and Statistics in Engineering	3	MATH 106
CHEM 103	General Chemistry	4	None
PHYS 117	Physics-I	3	None
PHYS 119	Physics-I Lab	1	None
PHYS 118	Physics-II	3	PHYS 117 PHYS 119
PHYS 120	Physics-II Lab	1	PHYS 117 PHYS 119
CS 107	Computer Programming	3	MATH 105
ENGL 201	Technical English Writing	3	None
GE 101	Engineering Graphics and Design	3	None
GE 201	Statics	3	MATH 106 PHYS 117 PHYS 119
GE 202	Dynamics	3	GE 201
GE 205	Fundamentals of Electrical Engineering	3	MATH 106 PHYS 118 PHYS 120
GE 301	Numerical Methods in Engineering	3	CS 107 MATH 235
GE 302	Professional Ethics for Engineers	2	None
GE 303	Engineering Economy	3	MATH 106
GE 399	Engineering Training	0	Completion of 90 Cr. H.
GE 401	Project Management	3	MATH 106
Total		**58**	

3. Mechanical Engineering Department Requirements

The course requirements of the Mechanical Engineering Department are divided into two parts. The first part consists of compulsory courses which have a total of 54 credit hours. The second part comprises of technical elective courses which have a total number of 9 credit hours. Details of these requirements, including the areas of the technical elective courses, are listed below:

A. Mechanical Engineering Compulsory Courses

The following 54 credit hours must be taken by all students in the Mechanical Engineering Program:

Course Code	Course Name	Credit Hours	Prerequisite	Co-requisite
ME 211	Materials Science and Engineering	3	CHEM 103 MATH 105	
ME 212	Mechanics of Materials -I	3	GE 201 ME 211	
ME 213	Mechanics of Materials Lab	1		ME 212
ME 221	Thermodynamics - I	3	CHEM 103 MATH 106	
ME 222	Fluid Mechanics	3	ME 221 GE 201 MATH 235	
ME 311	Mechanics of Materials - II	3	ME 212	
ME 324	Heat Transfer	3	ME 222	
ME 322	Thermo-fluids Lab	1		ME 222
ME 323	Thermodynamics - II	3	ME 221	
ME 325	Heat Transfer Lab	1		ME 324
ME 331	Mechanics of Machines	3	MATH 226 GE 202	
ME 332	System Dynamics and Modeling	3	GE 202 GE 301 ME 324	
ME 361	Industrial Safety	1	None	
ME 362	Machine Design	3	GE 101 ME 331	
ME 363	Manufacturing Technology	3	GE 101 ME 211	
ME 364	Manufacturing Technology Lab	1		ME 363
ME 431	Automatic Control	3	GE 205 ME 332	
ME 441	Internal Combustion Engines	3	ME 323	
ME 442	Power and Desalination Plants	3	ME 323	
ME 451	HVAC Systems	3	ME 321	
ME 491	Graduation Project - I	1	Department Approval	
ME 492	Graduation Project - II	3	ME 491	
Total		**54**		

B. Mechanical Engineering Elective Courses

Students in the mechanical engineering program need to select three technical elective courses totaling 9 credit hours from one of the following areas in the field of mechanical engineering:

1. Materials Engineering and Processing

Course Code	Course Name	Credit Hours	Prerequisite
ME 411	Mechanical Behavior of Materials	3	ME 311
ME 412	Nanomaterials	3	ME 311 ME 363
ME 413	Corrosion Engineering	3	ME 211
ME 414	Processing of Polymer Materials	3	ME 211 ME 363
ME 415	Tribology	3	ME 324 ME 362
ME 419	Special Topics	3	To be determined by the Instructor

2. Control Theory and System Dynamics

Course Code	Course Name	Credit Hours	Prerequisite
ME 432	Mechanical Vibrations	3	MATH 226 ME 332
ME 433	Mechatronics	3	CS 107 GE 202 GE 203
ME 434	Introduction to Robotics	3	CS 107 GE 202 GE 203
ME 435	Automotive Control	3	ME 431
ME 439	Special Topics	3	To be determined by the Instructor

3. Thermal Sciences, Power Generation and Energy Conversion

Course Code	Course Name	Credit Hours	Prerequisite
ME 421	Design and Analysis of Thermal Systems	3	ME 323
ME 443	Turbomachinery	3	ME 323
ME 444	Gas Turbine Engines	3	ME 323
ME 445	Introduction to Nuclear Energy	3	ME 323
ME 446	Power Engineering	3	ME 323
ME 449	Special Topics	3	To be determined by the Instructor

4. Manufacturing Engineering and Safety

Course Code	Course Name	Credit Hours	Prerequisite
ME 461	Computer Aided Design/Computer Aided Manufacturing	3	ME 363
ME 462	Advanced Manufacturing Technology	3	ME 363
ME 463	Metal Forming	3	ME 311 ME 363
ME 464	Risk Assessment and Safety Management	3	STAT 215 GE 303
ME 469	Special Topics	3	To be determined by the Instructor

5. Computational Methods in Mechanical Engineering

Course Code	Course Name	Credit Hours	Prerequisite
ME 471	Introduction to Finite Element Methods	3	MATH 226 GE 301
ME 472	Engineering Optimization	3	GE 301
ME 473	Computational Fluid Dynamics	3	GE 301 ME 323
ME 479	Special Topics	3	To be determined by the Instructor

Mechanical Engineering Undergraduate Curriculum

First Year (Freshman)

First Level

No.	Course Code	Course Name	Credit	Hours Theory	Lab	Tut
1	QUR 100	Quran Kareem - I	2	2		
2	CHEM 103	General Chemistry	4	3	2	
3	MATH 105	Calculus - I	4	4		1
4	PHYS 117	Physics - I	3	3		
5	PHYS 119	Physics - I Lab	1		2	
6	GE 101	Engineering Graphics and Design	3	2	2	
Total Semester Hours			**17**	**14**	**6**	**1**

Second Level

No.	Course Code	Course Name	Credit	Hours Theory	Lab	Tut
1	LIT 102	Arabic Language Skills	2	2		
2	QUR 150	Quran Kareem - II	2	2		
3	ENGL 201	Technical English Writing	3	3		
4	MATH 106	Calculus - II	4	4		1
5	CS 107	Computer Programming	3	2	2	
6	PHYS 118	Physics - II	3	3		
7	PHYS 120	Physics - II Lab	1		2	
Total Semester Hours			**18**	**16**	**4**	**1**
Cumulative Credit Hours			**35**	**30**	**10**	**2**

Second Year (Sophomore)

Third Level

No.	Course Code	Course Name	Hours			
			Credit	Theory	Lab	Tut
1	QUR 200	Quran Kareem - III	2	2		
2	MATH 226	Linear Algebra	3	3		1
3	MATH 235	Differential Equations	3	3		1
4	GE 201	Statics	3	3		1
5	ME 211	Materials Science and Engineering	3	3		1
6	ME 221	Thermodynamics -I	3	3		1
	Total Semester Hours		17	17		5
	Cumulative Credit Hours		**52**	**47**	**10**	**7**

Fourth Level

No.	Course Code	Course Name	Hours			
			Credit	Theory	Lab	Tut
1	QUR 250	Quran Kareem -IV	2	2		
2	STAT 215	Probability and Statistics in Engineering	3	3		1
3	GE 202	Dynamics	3	3		1
4	GE 203	Fundamentals of Electrical Engineering	3	3		1
5	ME 212	Mechanics of Materials -I	3	3		1
6	ME 213	Mechanics of Materials Lab	1		2	
7	ME 222	Fluid Mechanics	3	3		1
	Total Semester Hours		**18**	**17**	**2**	**5**
	Cumulative Credit Hours		**70**	**64**	**12**	**12**

Third Year (Junior)

Fifth Level

No.	Course Code	Course Name	Hours			
			Credit	Theory	Lab	Tut
1	IDE 133	Tawheed	2	2		
2	GE 301	Numerical Methods in Engineering	3	3		1
3	ME 311	Mechanics of Materials -II	3	3		1
4	ME 321	Heat Transfer	3	3		1
5	ME 322	Thermo-fluids Lab	1		2	
6	ME 331	Mechanics of Machines	3	3		1
7	ME 361	Industrial Safety	1	1		
Total Semester Hours			**16**	**15**	**2**	**4**
Cumulative Credit Hours			**86**	**79**	**14**	**16**

Sixth Level

No.	Course Code	Course Name	Hours			
			Credit	Theory	Lab	Tut
1	GE 303	Engineering Economy	3	3		1
2	ME 323	Thermodynamics -II	3	3		1
3	ME 324	Heat Transfer Lab	1		2	
4	ME 332	System Dynamics and Modeling	3	3		1
5	ME 362	Machine Design	3	3		1
6	ME 363	Manufacturing Technology	3	3		1
7	ME 364	Manufacturing Technology Lab	1		2	
Total Semester Hours			**17**	**15**	**4**	**5**
Cumulative Credit Hours			**103**	**94**	**18**	**21**

Summer

No.	Course Code	Course Name	Hours			
			Credit	Theory	Lab	Tut
1	GE 399	Engineering Training	0	0	0	0
Total Semester Hours			**0**	**0**	**0**	**0**
Cumulative Credit Hours			**103**	**94**	**18**	**21**

Fourth Year (Senior)

Seventh Level

No.	Course Code	Course Name	Credit	Hours Theory	Lab	Tut
1	GE 401	Project Management	3	3		
2	ME 431	Automatic Control	3	2	2	1
3	ME 441	Internal Combustion Engines	3	2	2	1
4	ME 451	HVAC systems	3	2	2	1
5	ME 4**	Elective - I	3	3		
6	ME 491	Graduation Project - I	1		2	
Total Semester Hours			**16**	**12**	**8**	**3**
Cumulative Credit Hours			**119**	**106**	**26**	**24**

Eighth Level

No.	Course Code	Course Name	Credit	Hours Theory	Lab	Tut
1	HIST 102	History of Saudi Arabia	2	2		
2	GE 302	Professional Ethics in Engineering	2	2		
3	ME 442	Power and Desalination Plants	3	2	2	1
4	ME 4**	Elective II	3	3		
5	ME 4**	Elective III	3	3		
6	ME 492	Graduation Project - II	3		6	
Total Semester Hours			**16**	**12**	**8**	**1**
Cumulative Credit Hours			**135**	**118**	**34**	**25**

Course Description

1. General College Courses

This section contains the descriptions of the fundamental engineering courses that are required by the College of Engineering. The courses are listed in numerical order. Each entry has the number of hours of credit for the course, the prerequisites, and a brief description.

MATH 105: Calculus-I **4 Credit Hours**

Differential calculus and basic integral calculus including the fundamental theorem of calculus and Taylor's theorem with remainder. It includes most of the elementary topics in the theory of real-valued functions of a real variable: limits, continuity, derivatives, maxima and minima, integration, area under a curve, volumes of revolution, trigonometric, logarithmic and exponential functions and techniques of integration.

MATH 106: Calculus-II **4 Credit Hours**

All techniques of integration (substitution, by parts, trigonometric substitutions, partial fractions, miscellaneous substitutions etc.), conic sections, polar coordinates, and infinite series. Vector analysis: Euclidean space, partial differentiation, multiple integrals, the integral theorems of vector calculus.

MATH 226: Linear Algebra **3 Credit Hours**

Basic concepts and techniques of linear algebra; includes systems of linear equations, matrices, determinants, vectors in n-space, and eigenvectors, together with selected applications, such as Markov processes, linear programming, economic models, least squares and population growth.

MATH 235: Differential Equations **3 Credit Hours**

Techniques and applications of ordinary differential equations: First order equations, linear equations of higher order, systems of linear equations with constant coefficients, reduction of order, including Fourier series and boundary-value problems, and an introduction to partial differential equations.

STAT 215: Probability and Statistics in Engineering **3 Credit Hours**

Emphasizes basic probability concepts, random variables and probability, expectations and moments, functions of random variables, some important discrete distributions, some important continuous distributions. This including descriptive statistics, observed data and graphical representation, parameter estimation, model verification, linear models and linear regression, and hypothesis testing in both nonparametric and normal models.

PHYS 117: Physics-I **3 Credit Hours**

Vectors. Motion in one, two and three dimension. Acceleration and free fall, force and motion, and analysis of forces. Newton's laws. Circular motion. Work: the transfer of mechanical energy. Conservation of momentum. Rotation. Conservation of angular momentum. Elasticity and Fluid mechanics.

PHYS 119: Physics-I Lab **1 Credit Hour**

The course contains lab experiments related to the theory covered in PHYS 117.

PHYS 118: Physics-II **3 Credit Hours**

Oscillations. Sound waves. Heat and Thermodynamics. Electricity and Magnetism: Coulomb's law, electric fields, Gauss' Law, electric potential, potential energy, capacitance, currents and resistance. Electrical energy and power, direct current circuits, Kirchhoff's rules. Magnetic fields, motion of charged particle in a magnetic field, sources of the magnetic field and energy in a magnetic field. Ampere's law, Faraday's law of induction, self-inductance. Alternating current circuits, the RLC series circuit, power in an A.C. circuit, resonance in RLC services circuit.

PHYS 120: Physics-II Lab **1 Credit Hour**

The course contains lab experiments related to the theory covered in PHYS 118.

CHEM 103: General Chemistry **4 Credit Hours**

The course covers fundamental observations, laws, and theories of chemistry at the introductory level. Topics include Atoms/Molecules, Stoichiometry, Acids/Bases, Solutions, Equilibria, Gases, Solids, Liquids, Thermodynamics, Kinetics, Quantum Theory, The periodic table, and Chemical bonding.

ENGL 201: Technical English Writing **3 Credit Hours**

The course examines the basic requirements of technical style and organizational patterns used in a variety of business and technical documents. Students learn and practice how to condense extensive information into the fewest words possible without sacrificing content. The course also covers how to identify the audiences and apply various styles to each. Students hone their skills by writing various types of proposals, informal and formal reports, procedures manuals and oral presentations. Finally, the course gives students a command of the design principals and production processes required for truly effective technical communications. Students will be required to complete a capstone project that incorporates every aspect of technical writing learned in the course.

CS 107: Computer Programming **3 Credit Hours**

Fundamental principles, concepts, and methods of computing, with emphasis on applications in engineering. Basic problem solving and programming techniques, fundamental algorithms and data structures. Use of computers in solving engineering and scientific problems.

GE 101: Engineering Graphics and Design **3 Credit Hours**

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

GE 201: Statics **3 Credit Hours**

Forces, moments, and couples, resultants of force systems, equilibrium analysis and free-body diagrams; analysis of forces acting on members of trusses, frames, etc. Shear-force and bending-moment distributions; Coulomb friction; centroids. Center of mass, moment of inertia, polar moment of inertia, and product of inertia. Virtual work; hydrostatic pressure, Applications of statics in design.

GE 202: Dynamics **3 Credit Hours**

Kinematics and kinetics of particles. Kinematics of rigid bodies; translation and fixed-axis rotation relative to translating axes, general planar motion, fixed-point rotation and general motion. Kinetics of rigid bodies: center of mass, mass moment of inertia, product of inertia, principal-axes, parallel-axes theorems. Planar motion, work-energy method. Design of cams, gears and linkages.

GE 203: Fundamental of Electrical Engineering **3 Credit Hours**

Integrated introduction to selected fundamental concepts and principles in electrical engineering: circuits, electromagnetics, communications, electronics, controls, and computing. Laboratory experiments and lectures focus on a design and construction project

GE 301: Numerical Methods in Engineering **3 Credit Hours**

Introduction to numerical methods for students in science and engineering, Topics include floating-point computation, systems of linear equations, approximation of functions and integrals, the single nonlinear equation, and the numerical solution of ordinary differential equations. Applications in science and engineering: include some programming as well as the use of high quality mathematical library routines.

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

The course examines ethical theories, moral norms and case studies to provide an overview of the ethical use of technology and associated responsibilities of engineers towards society, environment, clients, employers and coworkers. Ethical problem-solving techniques are elaborated with examples. Concepts of whistle blowing, intellectual copyrights, plagiarism, conflict of interests, safety, occupational hazards and cost-benefit risk are explored in the light of engineering codes of ethics and legal aspects of ethical and professional misconduct.

GE 303: Engineering Economy **3 Credit Hours**

Time value of money formulas, application of time value of money formulas. Project selection using net present worth analysis using the common multiple and study period methods, one and two parameter sensitivity analysis. Bond cash flows and pricing, loan amortization and determining the remaining principle on a loan, project selection using annual equivalent worth, project selection using the incremental net present worth. Break-even points. Annual depreciation and book value using straight line, declining balance and MACRS methods. Annual cash flow and net present worth, Discounted benefit/cost ratio for a public project and determine if it meets the criterion. Inflation in estimating future cash flows, and defender/challenger replacement analysis using net present worth.

GE 399: Engineering Training (8 weeks) **0 Credit Hour**

Training in industry under the supervision of a faculty member. Each student must submit a technical report about his achievements during the training in addition to fulfilling any other requirements as assigned by the department.

GE 401: Project Management **3 Credit Hours**

This course concentrates on the general methodology of managing a technical project from concept to operational use, with emphasis on the functions, roles, and responsibilities of the project manager. Topics include career aspects of project management, business factors affecting the project and the manager and project organization. Planning, scheduling using arrow networks, execution, and communications, Project life cycle, risk analysis; interface management, design review, design control assessment, reporting, and reaction to critical problems. Characteristics of construction industry, design and construction process, labor, material, and equipment utilization. Cost estimation, construction pricing and contracting, construction planning, cost control, monitoring accounting, and management systems construction.

2. Compulsory Mechanical Engineering Courses

This section contains all of the course descriptions for 200, 300, 400 level courses to be taught through the Mechanical Engineering Department.

ME 211: Materials Science and Engineering **3 Credit Hours**

Atomic structure and interatomic bonding. Material microstructures, dislocations and defects. Mechanical properties of metals, polymers, ceramics and composites. Diffusion in materials. Strengthening mechanisms in materials. Fracture, fracture mechanics, fatigue, creep. Phase diagrams and phase transformations. Composite materials.

ME 212: Mechanics of Materials-I **3 Credit Hours**

Statics: moment and force resultants, equilibrium. Mechanics of deformable bodies: stress-strain, classification of materials behavior, generalized Hooke's law. Engineering applications: axial loads, torsion of circular rods and tubes, bending and shear stresses in beams.

ME 213: Mechanics of Materials Lab **1 Credit Hour**

Material testing against tension, compression, impact etc., strain gages measurement of deflection and bending.

ME 221: Thermodynamics-I **3 Credit Hours**

Introduction to engineering thermodynamics. First law, second law, system and control volume analysis. Properties and behavior of pure substances, applications to thermodynamic systems operating in a steady state and transient processes. Heat transfer mechanisms. Typical power producing cycles and refrigerators. Ideal gas mixtures and moist air properties.

ME 222: Fluid Mechanics **3 Credit Hours**

Fluid basic definitions, units and fluid properties, Fluid statics, conservation of mass, momentum equation, Navier Stokes Equations, and energy in a fixed and moving control volumes, Bernoulli's equation and its application, Differential analysis of fluid flow, dimensional analysis and similitude, energy equation for pipe flow, laminar and turbulent flow, Surface resistance and boundary layer flow, and lift and drag.

ME 311: Mechanics of Materials-II **3 Credit Hours**

Deflection of beams, combined stresses, stress and strain transformation. Statically indeterminate beams. Elastic and plastic behavior, failure theories and the use of energy methods. Beams buckling. Analysis and design of thick-walled pressure vessels.

ME 324: Heat Transfer **3 Credit Hours**

Heat transfer by conduction, convection, radiation. Heat storage, energy conservation. Steady-state and transient conduction heat transfer. Thermal circuit modeling, multidimensional conduction. Surface radiation properties, enclosure radiation exchange. Surface convection by fluid streams over objects. Nondimensional numbers. Laminar and turbulent flow, Boiling and condensation. Heat exchangers analysis. Design of thermal systems. Problem solving and design.

ME 322: Thermo-fluids Lab **1 Credit Hour**

Introduction to basic fluid mechanics instrumentation, experimental verification and reinforcement of the analytical concepts introduced in ME 320. Pressure drop in pipes, fittings and centrifugal pump performance.

ME 323: Thermodynamics-II **3 Credit Hours**

Thermodynamic power and refrigeration systems. Availability and evaluation of thermodynamic properties, general thermodynamic relations, equations of state, and compressibility factors. Chemical reactions, combustion, gaseous dissociation. Phase equilibrium. Design and optimization of thermal systems.

ME 325: Heat Transfer Lab **1 Credit Hour**

Practices and measurement techniques for heat transfer and thermal systems. Experimental-problem solving applied to heat transfer.

ME 331: Mechanics of Machines **3 Credit Hours**

Position, velocity and acceleration analysis of linkages using graphical and analytical methods; cam profile design; gears and gear trains; dynamic force analysis; balancing of rotating and reciprocating masses; cam and reciprocating engine dynamics; flywheels and gyroscopes.

ME 332: System Dynamics and Modeling **3 Credit Hours**

Developing mathematical models of dynamic systems, including mechanical, electrical, electromechanical, and fluid-thermal systems, and representing these models in transfer function and state space form. Analysis of dynamic system models, including time and frequency responses. Theory of single and multi-degree-of-freedom systems with an introduction to continuous systems. Determination of equations of motion, including natural frequency for free vibration and amplitude of forced vibration. Introduction to linear feedback control techniques. Synthesis and analysis by analytical and computer methods.

ME 361: Industrial Safety **1 Credit Hour**

Accident: causes and costs. Appraising safety performance and risk assessment. Analysis of accident causes. Accident reports and records. Job safety analysis, plant inspection, and accident investigation. Plant layout, arrangement, and housekeeping. Maintenance and safety. Material handling and safety. Machine guarding. Explosion and fire prevention. Personal protection, first aid, and planning for emergencies.

ME 362: Machine Design **3 Credit Hours**

Application of engineering mechanics and materials science to the analysis and design of mechanical components such as bolted connections, springs, gears, bearings and shafts. Design for dynamic loading conditions. Principles of hydrodynamic lubrication. Introduction to computer-aided design. Case studies with appropriate topics

ME 363: Manufacturing Technology **3 Credit Hours**

Introduction to manufacturing. Metal Casting (melting, solidification, furnaces, expendable and permanent mold casting). Bulk deformation processes (hot and cold forming processes, workability and limits of forming, rolling, forging, extrusion, wire and bar drawing). Sheet metal processes (formability of sheets, shearing, blanking, punching, bending, drawing, dies and presses, and special forming processes of sheet metal). Processing of polymers. Metal powders and ceramics. Principles of metal cutting (machining theory and processes, turning, milling, drilling, grinding, special machining processes, chips formation, cutting tools and forces, production machines). Welding processes. Mechanical assembly, Heat treatment of metals.

ME 364: Manufacturing Technology Lab **1 Credit Hour**

Practical demonstration and learning of various production processes such as casting, forming, welding, metal cutting, machining etc.

ME 431: Automatic Control **3 Credit Hours**

Theory and analysis of linear closed-loop control systems containing electronic, hydraulic, and mechanical components. Differential equations. Laplace transforms. Stability, Nyquist and Bode diagrams are covered.

ME 441: Internal Combustion Engines **3 Credit Hours**

Introduction to internal combustion engine systems and mechanical design. Consideration of factors affecting engine design and performance using principles of engineering science. Analysis of common engine systems for reciprocating and continuous flow internal combustion engines.

ME 442: Power and Desalination Plants **3 Credit Hours**

First and second law analysis of steam and gas turbine cycles. Availability analysis. Steam Power Plants. Steam Generation Systems. Boiler Components and Auxiliaries. Steam Turbines. Turbine Applications Condensers and Feed Heater Designs. Scale Formation and Prevention. Single and multi-effect boiling desalting systems. Multistage flash desalination. Vapor compression systems.

ME 451: HVAC Systems **3 Credit Hours**

Qualitative and quantitative study in concepts of basic air-conditioning with focus on buildings including building envelope, moist air thermodynamics, human comfort. Thermal load calculations, thermal behavior of buildings, HVAC systems/equipment, and design of space air-conditioning and its relationship to architectural design.

ME 491: Graduation Project-I **1 Credit Hour**

The Graduation Project integrates the various components of the curriculum into a comprehensive design exercise. This course covers the preliminary phase of the Project. In this phase, the students choose a topic and a faculty advisor; define the project scope which may include theoretical design, experimentation, fabrication or computer simulation and modeling. By the end of the semester, they should complete the Project Goals/Objectives, Project Execution Plan, a thorough literature review and some initial work as defined in the Execution Plan. They must submit a preliminary report of the work done at the end of the semester.

ME 492: Graduation Project-II **3 Credit Hours**

This course is a continuation of ME 491 and is the final phase of the Project in which students complete all the remaining work related to theoretical design, experiments, fabrication or computer programming. They write a Project Report in English and present the work orally.

3. Elective Courses

Materials Engineering and Processing:

ME 411 Mechanical Behavior of Materials **3 Credit Hours**

Studies of stresses and strains in two- and three-dimensional elastic problems. Failure theories and yield criteria. Analysis and design of load-carrying members. Energy methods and stress concentrations. Elastic and plastic behavior. Fatigue and fracture, and Composite materials.

ME 412: Nanomaterials **3 Credit Hours**

Constituents and interfacial bonding. Manufacturing techniques. Microstructure and micromechanics. Theory of anisotropy. Classical laminate theory. Composite-material testing and characterization. Failure and damage. Composite structure design.

ME 413: Corrosion Engineering **3 Credit Hours**

Aqueous corrosion phenomena of the mixed potential theory. Corrosion testing, measuring and control. Case studies.

ME 414: Processing of Polymer Materials **3 Credit Hours**

Behavior, processing and applications of plastics; how fundamental characteristics of polymers influence the properties of plastics. Emphasis on the design and manufacture of plastic parts.

ME 415: Tribology **3 Credit Hours**

Nature of solid surfaces. Interaction of solid surfaces. Friction of metals and non-metals (mechanisms, theories, applications). Wear of metals and non-metals (types, mechanisms, theories, applications). Lubrication (methods, types, theories, applications). Lubricants (types, utilization). Selection of materials for tribology applications. Surface Engineering.

ME 419: Special Topics in Materials Engineering and Processing 3 Credit Hours
Topics relevant to specialization of Materials Processing to strengthen student's knowledge in this field. Any course from other engineering department or university must be approved by the ME Department Council.

Control Theory and System Dynamics:

ME 432: Mechanical Vibrations 3 Credit Hours
Theory of single and multi-degree-of-freedom systems with an introduction to continuous systems. Determination of equations of motion, including natural frequency for free vibration and amplitude of forced vibration. Design of discrete and continuous systems for transient and harmonic excitations.

ME 433: Mechatronics 3 Credit Hours
Focus on the fundamentals of design-oriented mechanical, electrical and computer systems integration. Specifically, analog and digital electronic design, data acquisition, transducers, actuator technologies and control, design with microprocessors and embedded electronics, and application of control theory.

ME 434: Introduction to Robotics 3 Credit Hours
Forward and inverse kinematics of robot manipulators, path planning, motion planning for mobile robots. Dynamics of robot manipulators, control algorithms, computed torque algorithm, adaptive control algorithms and current topics in mobile robots. Cooperative motion planning of mobile robots and formation control.

ME 435: Automotive Control 3 Credit Hours
Basic engine operation; lambda control, speed control, knock control, fuel injection timing control, ignition control of SI engines; driveline modeling, automatic transmission control, clutch phasing control; wheel model, complete vehicle model; observers, friction coefficient estimators, tire contact patch force estimators; anti-lock brake control, traction control, yaw stability control; drive-by-wire systems.

ME 439: Special Topics in Control Theory and System Dynamics 3 Credit Hours
Topics relevant to specialization of Control Theory and System Dynamics to strengthen student's knowledge in these fields. Any course from other engineering department or university must be approved by the ME Department Council.

Thermal Sciences, Power and Energy Conversion:

ME 421: Design and Analysis of Thermal Systems 3 Credit Hours
Application of energy concepts to thermal fluid design problems. Modeling and optimization of thermal systems with a focus on heat-pumping equipment, such as vapor compression, absorption, and some advanced heat-pumping cycles. Students combine the use of thermodynamics, heat transfer, fluid mechanics, and numerical methods to develop and apply mathematical models for the analysis and optimization of specific equipment.

ME 443: Turbomachinery **3 Credit Hours**

Applying energy, momentum, and continuity equations of thermo-fluids to turbomachinery. Blade geometry and aerodynamics. Performance and design parameters. Turbomachine design.

ME 444: Gas Turbine Engines **3 Credit Hours**

Basic operating principles and analysis of performance characteristics of gas turbine engines for aircraft and vehicular propulsion and stationary power. Turbojet, turbofan, turboshaft cycle analysis. Analysis of flow through compressors, turbines, combustors, inlets, nozzles, and regenerators. Component matching and off-design performance.

ME 445: Introduction to Nuclear Energy **3 Credit Hours**

Introduction to the fundamentals of nuclear engineering, including power plant design fuel cycle and fuel design. Reactor physics, reactor theory and design and reactor thermo-hydraulics. Radiation protection and safety. Fuel reprocessing and recycling.

ME 446: Power Engineering **3 Credit Hours**

Rankine cycle analysis, fossil-fuel steam generators, energy balances, fans, pumps, cooling towers, steam turbines, availability (second law) analysis of power systems, energy management systems, and rate analysis.

ME 449: Special Topics in Thermal Sciences, Power and Energy Conversion **3 Credit Hours**

Topics relevant to specialization of Thermal Science, Power, and Energy Conversions to strengthen student's knowledge in these fields. Any course from other engineering department or university must be approved by the ME Department Council.

Manufacturing Engineering and Safety:

ME 461: Computer Aided Design and Computer Aided Manufacturing (CAD/CAM) **3 Credit Hours**

Introduction to Computer-Aided Engineering. Computer applications in mechanical design. Geometric modeling and solid modeling. CAD packages and CAD databases. Rapid prototyping. Production economics. High volume production systems and FMS. Automated flow lines. Automated assembly and line balancing. Automated material handling and storage. Group technology. Computer-aided process planning CAPP. Numerical control and NC part programming. DNC, CNC, and adaptive control. Industrial robots. CAQC and automated inspection. Automated control systems. Programmable controllers, industrial automation sensors, actuators, and motors. Automation computer networks.

ME 462: Advanced Manufacturing Technology **3 Credit Hours**

Non-traditional machining: Principles, Ultrasonic, Water-Jet, Electrochemical, Electric-Discharge, Plasma-Arc, Laser-Beam, Electron-Beam. Numerical control of machine tools: Automation of manufacturing processes, numerical control, coordinate systems, types and components of CNC systems, programming for CNC, adaptive control. Computer Integrated Manufacturing CIM.

ME 463: Metal Forming **3 Credit Hours**

Yield criteria, Plastic stress- strain relation. Plane stress and plane strain problems. Determination of flow equation. Applications: instability in thin vessels, thick vessels subjected to internal pressure, and beam under pure bending. Classification of metal forming processes. Bulk deformation processes. Technique of analysis; slab method, upper bound method. Slip line field, application to indentation problem, forging, rolling, extrusion, and rod and wire drawing equipment and dies.

ME 464: Risk Assessment and Safety Management **3 Credit Hours**

Basic concepts of risk, reliability and hazard potential. Elements of risk assessment. Statistical methods for risk assessments. Control charts. Appraisal of advanced techniques. Fault tree analysis. Failure mode and effect analysis. Quantitative Structure-Activity Relationship analysis. Fuzzy model for risk assessment. Also, using current industry leadership, this course involves analysis of safety program organization, supervision and management.

ME 469: Special Topics in Manufacturing Engineering and Safety **3 Credit Hours**

Advanced topics relevant to the specialization of manufacturing engineering and safety to strengthen student's knowledge in these fields. Any course from other engineering department or university must be approved by the ME Department Council.

Computational Methods:

ME 471: Introduction to Finite Element Methods **3 Credit Hours**

Virtual formulation. Finite element analysis: shape formation, equilibrium conditions, element classification, assembly of elements, modeling methodology. Structures and elements: trusses, beams, 2-D solids, 3-D solids, axisymmetric solids, thin-walled structures. Dynamic analysis. Heat transfer and thermal analysis.

ME 472: Engineering Optimization **3 Credit Hours**

The applications of optimization techniques in solving engineering problems. Linear programming. Non-linear programming. Dynamic programming. Integer programming. Stochastic programming. Genetic algorithms. Heuristic methods. Queuing theory. Transportation. New optimization methods.

ME 473: Computational Fluid Dynamics **3 Credit Hours**

Physical and mathematical foundations of computational fluid mechanics with emphasis on applications. Solution methods for model equations and the Euler and the Navier-Stokes equations. The finite volume formulation of the equations. Classification of partial differential equations and solution techniques. Truncation errors, stability, conservation, and monotonicity. Computer projects.

ME 479: Special Topics in Computational Methods in Mechanical Engineering **3 Credit Hours**

Topics relevant to specialization of Computational Methods to strengthen students' knowledge in this field. Any course from other engineering department or university must be approved by the ME Department Council.

Electrical Engineering Program

Electrical Engineering Program

Introduction

Electrical engineering department offers concentrations in two areas: Communications and Instrumentations. The program is designed to educate engineers for technical as well as management positions in industry and to prepare students for graduate study in electrical engineering and related fields. Because of the rapid evolution of electronics technology, most undergraduate courses emphasize fundamental aspects of a given topic or field. Upper level courses dealing with specialized topics incorporate material of particular current importance. Independent work is highly valued, offering opportunities for juniors and seniors to study a specialized topic in detail, to participate in the research program of a faculty member, to learn and apply creative problem-solving skills, and to achieve a sense of accomplishment by carrying out a project through from start to finish.

Mission

The mission of the Department of Electrical Engineering (EE) is to provide a high-quality education in electrical engineering for our students and to instill in them the attitudes, values, and vision that will prepare them for lifetime of success, continued learning, and leadership in their chosen careers.

Program Educational Objectives

1. Electrical engineering graduates should be engaged in the practice of electrical in industry, education, and public service.
2. Graduates will create technological solutions to meet societal needs using electrical engineering principles, tools, and practices.
3. Graduates should be prepared for admission to top graduate programs.
4. Graduates should be motivated toward and engaged in continuous professional development, through individual effort and advanced professional education.
5. Graduates should provide technical leadership, with an understanding of the broader ethical and societal impact of technological developments, and the importance of diversity in the workforce.
6. Electrical Engineering graduates will engage in life-long learning and demonstrate leadership in their chosen fields of work.
7. Graduates will be recognized for critical and independent thinking skills.

Program Outcomes

All graduates of the Electrical Engineering Program are expected to have:

a. Knowledge of basic sciences, and engineering sciences necessary to analyze and design complex devices and systems containing hardware and software.

b. Ability to design and conduct experiments, as well as to interpret data.

c. Ability to design a system or component that meets a specified need.

d. Ability to function in a multi-disciplinary team.

e. Ability to identify, formulate and solve electrical engineering problems.

f. Professional and ethical responsibility.

g. Ability to communicate effectively (written and oral).

h. Understanding of the impact of engineering solutions in a global and societal context.

i. Recognition of the need for life-long learning.

j. Demonstrate knowledge of contemporary issues.

k. Demonstrated an ability to use the techniques, skills, and modern tools necessary for engineering practice.

Overview of the Curriculum

Course Coding

The Electrical Engineering courses are numbered in such a manner to recognize each course according to the area of specialization, the year level, and the semester to be offered. The symbol EE stands for Electrical Engineering and each number is made of 3 digits.

The first digit denotes the year level of the course according to student's study plan as follows:

First Digit	Level of Course
1	First year
2	Second year
3	Third year
4	Fourth year

The second digit denotes the course field/specialization as follows

Second Digit	Specialization
0	Fundamental Engineering and Universal Skills Courses
2	Electric Circuits and Electronics
3	Digital systems and Signals
4	Sensors and Instrumentation
5	Communications
6	Control
7	Electromagnetics, Electric Machines and Power systems
8	Special Topics
9	Graduation Projects

The third digit denotes the sequence number of course in a certain field/specialization in a given year.

Example: EE 471 means

Code	First Digit	Second Digit	Third Digit
EE	**4**	**7**	**1**
Department (Electrical Engineering)	Level (Fourth year)	Field (Power systems)	First course offered in power systems

Undergraduate Curriculum of Electrical Engineering Program

The total credit hours required for the Bachelor of Science in Electrical Engineering is 135 credit hours including the preparatory year. This will require three years of study in addition to the preparatory year. The general education requirements of the Engineering Program are the same for all students and completed in the first years. This will give students a solid base of knowledge in math, science, computer skills, and English language. These credit hours are divided into three different categories. These categories are listed as follows:

University Requirement	**14** credit hours	Islamic, Humanities, and Social Science Courses
College Requirement	**52** credit hours	Math, Basic Science, and Fundamental Engineering
Department Requirement	**69** credit hours	Both compulsory and elective

1. General University Requirements

All students in the College of Engineering are required to take 14 credit hours of course work as detailed in the following table irrespective of the engineering discipline they are in:

Course Code	Course Name	Credit Hours
QUR 100	Quran Kareem I	2
QUR 150	Quran Kareem II	2
QUR 200	Quran Kareem III	2
QUR 250	Quran Kareem IV	2
IDE 133	Tawheed	2
LIT 102	Arabic Writing Skills	2
HIST 102	History of Saudi Arabia	2
Total		**14**

2. College of Engineering Requirements

The students are required to take 52 credit hours of general engineering courses. The following table lists these courses as follows:

Course Code	Course Name	Credit Hours	Prerequisite	Co-requisite
MATH 105	Calculus I	4	None	
MATH 106	Calculus II	4	MATH 105	
MATH 226	Linear Algebra	3	MATH 106	
MATH 235	Differential Equations	3	MATH 106	
STAT 215	Probability and Statistics in Engineering	3	MATH 106	
CHEM 103	General Chemistry	4	None	
PHYS 117	Physics I	3	None	PHYS 119
PHYS 119	Physics Lab I	1	None	PHYS 117
PHYS 118	Physics II	3	PHYS 117, PHYS 119	PHYS 120
PHYS 120	Physics Lab II	1	PHYS 117, PHYS 119	PHYS 118
CS 107	Computer Programming	3	MATH 105	
ENGL 201	Technical English Writing	3	None	
GE 101	Engineering Graphics and Design	3	None	
GE 204	Engineering Thermodynamics	3	MATH 106, CHEM 103	
GE 301	Numerical Methods in Engineering	3	MATH 235 CS 107	
GE 302	Professional Ethics in Engineering	2	None	
GE 303	Engineering Economy	3	MATH 106	
GE 399	Engineering Training	0	Completion of 90 Cr. Hrs.	
GE 401	Project Management	3	MATH 106	
Total		**52**		

3. Electrical Engineering Department Requirements

The course requirements of the Electrical Engineering Department are divided into two parts. The first part consists of compulsory courses which have a total of 60 credit hours. The second part comprises of technical elective courses which have a total number of 9 credit hours. Details of these requirements, including the areas of the technical elective courses, are listed below:

Electrical Engineering Compulsory Courses

The following 60 credit hours must be taken by all students in the Electrical Engineering program:

Course Code	Course Name	Credit Hours	Prerequisite
EE 221	Fundamentals of Electric Circuits	3	Math 105 Phys 118 Phys 120
EE 222	Electrical Circuits Analysis	3	EE 221
EE 223	Fundamentals of Electronic Devices	3	EE 221
EE 226	Electric Circuit Lab	1	EE 221
EE 231	Digital Logic Circuits	3	Math 105
EE 232	Signals & Systems	3	EE 221
EE 233	Digital Logic Circuits Lab	1	EE 231
EE 271	Electromagnetics	3	Math 106 Phys 118 Phys 120
EE 321	Electronic Devices & Applications	3	EE 223
EE 323	Fundamentals of Electronic Devices lab	1	EE 223 EE 226
EE 324	Electronic Devices & Applications Lab	1	EE 321 EE 323
EE 331	Digital Systems	3	CS 107 EE 231
EE 332	Digital Systems Lab	1	EE 331 EE 233
EE 341	Sensors and Transducers	3	EE 222
EE 351	Introduction to Communication Engineering	3	EE 232 Math 235 EE 271
EE 361	Introduction to Control Systems	3	EE 232
EE 371	Electric Drives	3	EE 222 EE 271
EE 431	Digital Signal Processing	3	EE 351 GE 301
EE 451	Digital Communication	3	EE 351
EE 452	Communications Lab I	1	EE 351
EE 453	Telecommunication Networks	3	EE 351
EE 454	Communications Lab II	1	EE 451 EE 452
EE 461	Introduction to Instrumentation & Control Lab	1	EE 361
EE 471	Power systems	3	EE 371

EE 491	Graduation Project I	1	Department Approval
EE 492	Graduation Project II	3	EE 491
EE 4xx	Elective I	3	Refer to the elective courses
EE 4xx	Elective II	3	Refer to the elective courses
EE 4xx	Elective III	3	Refer to the elective courses
Total		**69**	

A. Electrical Engineering Elective Courses

Electrical Engineering department has two areas of specialization. A student will take at least three courses from one of the following two options:

1. Communications and Electronics

Course Code	Course Name	Credit Hours.	Prerequisite
EE 455	Mobile Wireless Communications	3	EE 451
EE 456	Information Theory and Coding	3	EE 451
EE 457	Mobile and Wireless Networks	3	EE 451
EE 433	Digital Image Processing	3	EE 431
EE 421	Communication Electronics	3	EE 321 EE 351
EE 458	Fiber optic communications	3	EE 451 EE 223
EE459	Satellite Communications	3	EE 451
EE 481	Special Topics in Communications	3	To be determined by the Instructor

2. Instrumentation and Control

Course Code	Course Name	Credit Hours	Prerequisite
EE 462	Applied Control Engineering	3	EE 361
EE 441	Advanced Sensors and Actuators	3	EE 361
EE 463	Digital Control Systems	3	EE 341, EE 361
EE 464	Programmable Logic Controllers	3	EE 331, EE 361
EE 442	Advanced Instrumentation	3	EE 361
EE 443	Industrial Electronics	3	EE 321, EE 361
EE 466	Control Systems Design	3	EE 361
EE 467	Intelligent Controllers	3	EE 361
EE 444	Applied Instrumentation	3	EE 361
EE 482	Special Topics in Instrumentation and Control	3	To be determined by the Instructor

Electrical Engineering Undergraduate Curriculum

First Year (Freshman)

First Level

No.	Course Code	Course Name	Credit	Hours		
				Theory	Lab	Tut
1	QUR 100	Quran Kareem I	2	2		
2	CHEM 103	General Chemistry	4	3	2	
3	MATH 105	Calculus I	4	3		1
4	PHYS 117	Physics I	3	3		
5	PHYS 119	Physics Lab I	1		2	
6	GE 101	Engineering Graphics and Design	3	2	2	
Total Semester Hours			**17**	**13**	**6**	**1**

Second Level

No.	Course Code	Course Name	Credit	Hours		
				Theory	Lab	Tut
1	QUR 150	Quran Kareem II	2	2		
2	PHYS 118	Physics II	3	3		
3	PHYS 120	Physics Lab II	1		2	
4	MATH 106	Calculus II	4	3		1
5	CS 107	Computer programming	3	2	2	
6	ENGL 201	Technical English Writing	3	3		
Total Semester Hours			**16**	**13**	**4**	**1**
Cumulative Credit Hours			**33**	**26**	**10**	**2**

Second Year (Sophomore)

Third Level

No.	Course Code	Course Name	Credit	Hours		
				Theory	Lab	Tut
1	QUR 200	Quran Kareem III	2	2		
2	IDE 133	Tawheed	2	2		
3	MATH 235	Differential Equations	3	3		1
4	GE 204	Engineering Thermodynamics	3	3		1
5	EE 221	Fundamentals of Electric Circuits	3	3		1
6	EE 231	Digital Logic Circuits	3	3		1
Total Semester Hours			**16**	**16**		**4**
Cumulative Credit Hours			**49**	**42**	**10**	**6**

Fourth Level

No.	Course Code	Course Name	Credit	Hours		
				Theory	Lab	Tut
1	QUR 250	Quran Kareem IV	2	2		
2	EE 222	Electrical Circuits Analysis	3	3		1
3	EE 223	Fundamentals of Electronic Devices	3	3		1
4	EE 226	Electric Circuits Lab	1		2	
5	EE 232	Signals and Systems	3	3		1
6	EE 233	Digital Logic Circuits Lab	1		2	
7	EE 271	Electromagnetics	3	3		1
Total Semester Hours			**16**	**14**	**4**	**4**
Cumulative Credit Hours			**65**	**56**	**14**	**10**

Third Year (Junior)

Fifth Level

No.	Course Code	Course Name	Credit	Hours		
				Theory	Lab	Tut
1	STAT 215	Probability and Statistics in Engineering	3	3		1
2	MATH 226	Linear Algebra	3	3		1
3	GE 302	Professional Ethics in Engineering	2	2		
4	EE 321	Electronic Devices & Applications	3	3		1
5	EE 323	Fundamentals of Electronic Devices lab	1		2	
6	EE 331	Digital Systems	3	3		
7	EE 341	Sensors and Transducers	3	3		1
Total Semester Hours			18	17	2	4
Cumulative Credit Hours			**83**	**73**	**16**	**14**

Sixth Level

No.	Course Code	Course Name	Credit	Hours		
				Theory	Lab	Tut
1	LIT 102	Arabic Writing Skills	2	2		
2	HIST 102	History of Saudi Arabia	2	2		
3	GE 301	Numerical Methods in Engineering	3	3		1
4	EE 324	Electronic Devices & Applications Lab	1		2	
5	EE 332	Digital Systems Lab	1		2	
6	EE 351	Introduction to Communication Engineering	3	3		1
7	EE 361	Introduction to Control Systems	3	3		1
8	EE 371	Electric Drives	3	3		1
Total Semester Hours			**18**	**16**	**4**	**4**
Cumulative Credit Hours			**101**	**89**	**20**	**18**

Summer

No.	Course Code	Course Name	Credit	Hours		
				Theory	Lab	Tut
1	GE 399	**Engineering Training**	0	0	0	0
Total Semester Hours			**0**	**0**	**0**	**0**
Cumulative Credit Hours			**101**	**89**	**20**	**18**

Fourth Year (Senior)

Seventh Level

No.	Course Code	Course Name	Credit	Hours		
				Theory	Lab	Tut
1	GE 303	Engineering Economy	3	3		1
2	GE 401	Project Management	3	3		
3	EE 431	Digital Signal Processing	3	3		1
4	EE 451	Digital Communication	3	3		1
5	EE 452	Communications Lab I	1		2	
6	EE 461	Introduction to Instrumentation & Control Lab	1		2	
7	EE 4**	Elective I	3	3		
8	EE 491	Graduation Project I	1		2	
		Total Semester Hours	**18**	**15**	**6**	**3**
		Cumulative Credit Hours	**119**	**104**	**26**	**21**

Eighth Level

No.	Course Code	Course Name	Credit	Hours		
				Theory	Lab	Tut
1	EE 453	Telecommunication Networks	3	3		
2	EE 454	Communications Lab II	1		2	
3	EE 471	Power Systems	3	3		1
4	EE 4**	Elective II	3	3		
5	EE 4**	Elective III	3	3		
6	EE 492	Graduation Project II	3		6	
		Total Semester Hours	**16**	**12**	**8**	**1**
		Cumulative Credit Hours	**135**	**116**	**34**	**22**

Course Description

1. General College Courses

This section contains the descriptions of the fundamental engineering courses that are required by the College of Engineering. The courses are listed in numerical order. Each entry has the number of hours of credit for the course and a brief description.

MATH 105: Calculus-I **4 Credit Hours**

Differential calculus and basic integral calculus including the fundamental theorem of calculus and Taylor's theorem with remainder. It includes most of the elementary topics in the theory of real-valued functions of a real variable: limits, continuity, derivatives, maxima and minima, integration, area under a curve, volumes of revolution, trigonometric, logarithmic and exponential functions and techniques of integration.

MATH 106: Calculus-II **4 Credit Hours**

All techniques of integration (substitution, by parts, trigonometric substitutions, partial fractions, miscellaneous substitutions etc.), conic sections, polar coordinates, and infinite series. Vector analysis: Euclidean space, partial differentiation, multiple integrals, the integral theorems of vector calculus.

MATH 226: Linear Algebra **3 Credit Hours**

Basic concepts and techniques of linear algebra; includes systems of linear equations, matrices, determinants, vectors in n-space, and eigenvectors, together with selected applications, such as Markov processes, linear programming, economic models, least squares and population growth.

MATH 235: Differential Equations **3 Credit Hours**

Techniques and applications of ordinary differential equations: First order equations, linear equations of higher order, systems of linear equations with constant coefficients, reduction of order, including Fourier series and boundary-value problems, and an introduction to partial differential equations.

STAT 215: Probability and Statistics in Engineering **3 Credit Hours**

Emphasizes basic probability concepts, random variables and probability, expectations and moments, functions of random variables, some important discrete distributions, some important continuous distributions. This including descriptive statistics, observed data and graphical representation, parameter estimation, model verification, linear models and linear regression, and hypothesis testing in both nonparametric and normal models.

PHYS 117: Physics-I **3 Credit Hours**

Vectors. Motion in one, two and three dimension. Acceleration and free fall, force and motion, and analysis of forces. Newton's laws. Circular motion. Work: the transfer of mechanical energy. Conservation of momentum. Rotation. Conservation of angular momentum. Elasticity and Fluid mechanics.

PHYS 118: Physics-II **3 Credit Hours**

Oscillations. Sound waves. Heat and Thermodynamics. Electricity and Magnetism: Coulomb's law, electric fields, Gauss' Law, electric potential, potential energy, capacitance, currents and resistance. Electrical energy and power, direct current circuits, Kirchhoff's rules. Magnetic fields, motion of charged particle in a magnetic field, sources of the magnetic field and energy in a magnetic field. Ampere's law, Faraday's law of induction, self-inductance. Alternating current circuits, the RLC series circuit, power in an A.C. circuit, resonance in RLC services circuit.

PHYS 119: Physics Lab-I **1 Credit Hour**

This lab course will contain experiments based on theory covered in PHYS 117.

PHYS 120: Physics Lab-II **1 Credit Hour**

This lab course will contain experiments based on theory covered in PHYS 118.

CHEM 103: General Chemistry **4 Credit Hours**

The course covers fundamental observations, laws, and theories of chemistry at the introductory level. Topics include Atoms/Molecules, Stoichiometry, Acids/Bases, Solutions, Equilibria, Gases, Solids, Liquids, Thermodynamics, Kinetics, Quantum Theory, The periodic table, and Chemical bonding.

CS 107: Computer Programming **3 Credit Hours**

Fundamental principles, concepts, and methods of computing, with emphasis on applications in engineering. Basic problem solving and programming techniques, fundamental algorithms and data structures. Use of computers in solving engineering and scientific problems.

ENGL 201: Technical English Writing **3 Credit Hours**

The course examines the basic requirements of technical style and organizational patterns used in a variety of business and technical documents. Students learn and practice how to condense extensive information into the fewest words possible without sacrificing content. The course also covers how to identify the audiences and apply various styles to each. Students hone their skills by writing various types of proposals, informal and formal reports, procedures manuals and oral presentations. Finally, the course gives students a command of the design principals and production processes required for truly effective technical communications. Students will be required to complete a capstone project that incorporates every aspect of technical writing learned in the course.

GE 101: Engineering Graphics and Design **3 Credit Hours**

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

GE 204: Engineering Thermodynamics **3 Credit Hours**

Introduction to engineering thermodynamics. First law, second law, system and control volume analysis. Properties and behavior of pure substances, applications to thermodynamic systems operating in a steady state and transient processes. Heat transfer mechanisms. Typical power producing cycles and refrigerators. Ideal gas mixtures and moist air properties.

GE 301: Numerical Methods in Engineering **3 Credit Hours**

Introduction to numerical methods for students in science and engineering, Topics include floating-point computation, systems of linear equations, approximation of functions and integrals, the single nonlinear equation, and the numerical solution of ordinary differential equations. Applications in science and engineering: include some programming as well as the use of high quality mathematical library routines.

GE 302: Professional Ethics in Engineering **2 Credit Hours**

The course examines ethical theories, moral norms and case studies to provide an overview of the ethical use of technology and associated responsibilities of engineers towards society, environment, clients, employers and coworkers. Ethical problem-solving techniques are elaborated with examples. Concepts of whistle blowing, intellectual copyrights, plagiarism, conflict of interests, safety, occupational hazards and cost-benefit risk are explored in the light of engineering codes of ethics and legal aspects of ethical and professional misconduct.

GE 303: Engineering Economy **3 Credit Hours**

Time value of money formulas, application of time value of money formulas. Project selection using net present worth analysis using the common multiple and study period methods, one and two parameter sensitivity analysis. Bond cash flows and pricing, loan amortization and determining the remaining principle on a loan, project selection using annual equivalent worth, project selection using the incremental net present worth. Annual depreciation and book value using straight line, declining balance and MACRS methods. Annual cash flow and net present worth. Discounted benefit/cost ratio for a public project and determine if it meets the criterion. Inflation in estimating future cash flows, and defender/challenger replacement analysis using net present worth.

GE 399: Engineering Training **0 Credit Hour**

Eight weeks training in a relevant industry under the supervision of a faculty member. Each student must submit a technical report about his achievements during the training in addition to fulfilling any other requirements as assigned by the department.

GE 401: Project Management **3 Credit Hours**

This course concentrates on the general methodology of managing a technical project from concept to operational use, with emphasis on the functions, roles, and responsibilities of the project manager. Topics include career aspects of project management, business factors affecting the project and the manager and project organization. Planning, scheduling using arrow networks, execution, and communications, Project life cycle, risk analysis; interface management, design review, design control assessment, reporting, and reaction to critical problems. Characteristics of construction industry, design and construction process, labor, material, and equipment utilization. Cost estimation, construction pricing and contracting, construction planning, cost control, monitoring accounting, and management systems construction.

2. Compulsory Electrical Engineering Courses

EE 221: Fundamentals of Electric Circuits **3 Credit Hours**

Basic laws: Ohm's, KVL, KCL. Resistive networks. Circuit analysis techniques: nodal and mesh analysis. Network theorems: Thevenin's, Norton's, source transformations, superposition, maximum power transfer. Energy storage elements. Phasor technique for steady-state sinusoidal response. Transient analysis of first-order circuits.

EE 222: Electrical Circuits Analysis **3 Credit Hours**

Power calculations. Polyphase circuits. Complex frequency. Frequency response. Magnetically coupled circuits. General two-port networks. Solving circuit problems using Laplace transform. Tuned circuits.

EE 223: Fundamentals of Electronic Devices **3 Credit Hours**

Semiconductor: Different semiconductor materials. Impurity doping. Intrinsic and extrinsic semiconductors. Conductivity, Carrier concentration. Charge densities. Diodes: models and circuit analysis. Diode applications (rectifiers and others). Transistors: bipolar junction, junction field effect and metal-oxide-semiconductor field effect (BJT, JFET & MOSFET). DC and small signal AC analysis. Amplifier configurations.

EE 226: Electric Circuit Lab **1 Credit Hour**

Ohm's law applications, Kirchhoff's Voltage Law, Resistive Circuits, Maximum power transmission, Energy storage elements.

EE 231: Digital Logic Circuits **3 Credit Hours**

Number systems & codes; Boolean Algebra and logic gates; Karnaugh maps; Analysis and synthesis of combinational systems; Decoders, multiplexers, adders and subtractors, PLA's; Types of flip-flops; Memory concept; Counters and shift registers. Introduction to sequential circuit design.

EE 232: Signals and Systems **3 Credit Hours**

Classification of continuous- and discrete-time signals and systems. Linear time-invariant systems. Fourier series. Fourier transform. Laplace transform. Linear circuits and systems concepts. Impulse response. Convolution. Transfer function. Frequency response. Introduction to sampling of analog signals. Introduction to difference equations and z-transform.

EE 233: Digital Logic Circuit Lab **1 Credit Hour**

Hands-on experience to design, construct and analyze different logic circuits. Student will construct logic circuits using integrated circuit (IC), logic breadboard, LEDs, power supply and other basic components. Both combinational and sequential logic circuits will be given in experiments. Design and analyze various digital circuits involving logic gates, multiplexers, decoders, flip-flips, counters and registers is included. Simulation using hardware descriptive language (HDL) such as Verilog will be covered.

EE 271: Electromagnetics **3 Credit Hours**

Coulomb's law. Gauss's law. Electric potential. Electric boundary conditions. Electric dipoles. Resistance, capacitance. Laplace's equation, Biot-Savart law, Ampere's law. Scalar and vector potentials. Magnetic boundary conditions, inductance. Time varying fields, Maxwell's equations. Plane wave propagation. Reflection and refraction. Poynting vector. Introduction to transmission line theory. Introduction to radiation and antennas.

EE 321: Electronics Devices and Applications **3 Credit Hours**

MOS and BJT Amplifier's frequency response. Multistage amplifiers. Differential Amplifiers. Digital logic families (ECL, and CMOS circuits). Operational Amplifiers. Linear and nonlinear op amp applications. Non-ideal characteristics of Op Amps. Oscillators. Active filters.

EE 323: Fundamentals of Electronic Devices Lab **1 Credit Hour**

Practical applications on analog and digital electronic circuits and its construction, operation and characteristics. Feedback circuits and its characteristics.

EE 324: Electronics Devices and Applications Lab **1 Credit Hour**

Introduction to Basic Electronics, Electronic Devices, Semi Conductor Diodes, Wave Shaping using Diodes, Zener Diode Characteristics, Transistor Biasing, H-Parameters, Frequency Analysis, Differential Amplifiers, Types of Feed Back, Characteristics of Operation Amplifier, Oscillatiors, Unit Junction Transistor (UJT).

EE 331: Digital Systems **3 Credit Hours**

Microprocessor hardware and software Models; Addressing modes and techniques; Instruction sets. Assembly language programming and debugging. Memory and input/output mapping. Input and output instructions. Input/output Interfacing. Introduction to interrupts.

EE 332: Digital Systems Lab **1 Credit Hour**

Introduction of microprocessors and their architecture; Assembly language programming and machine code generation; C programming for microprocessor; RAM and EPROM; RS-232C; SCI and Serial port interface; Parallel I/O interface and DMA; DAC and ADC converters; Introduction to real time implementation.

EE 341: Sensors and Transducers **3 Credit Hours**

Principles and operation of sensor devices; Mathematical modeling of physical instrumentation systems; Measurement systems, transducer classification, general input-output configuration, static and dynamic characteristics of a measurement system, Standards and Calibration; Variable resistance transducers: Potentiometers, metal and semiconductor strain gauges and their signal conditioning circuits, strain gauge applications: Load and torque measurement.

EE 351: Introduction to Communication Engineering **3 Credit Hours**

Elements of a communication system. Transmission of signals through linear systems. Representation of baseband and band-pass signals and systems, Signal spectrum. Analog Amplitude Modulation and Demodulation (AM, DSBSC, SSB, VSB). Analog Angle Modulation and Demodulation (PM, FM). Noise representation and analysis: SNR analysis of AM and FM systems. Sampling theorem. QAM multiplexing. Pulse modulation techniques: PAM, PPM, PWM.

EE 361: Introduction to Control Systems **3 Credit Hours**

Review of complex-variable concept, Laplace transform, elementary matrix theory. The Z-transform, Transfer function, Block Diagrams, Signal-flow graphs, State-variable analysis of linear dynamic systems, stability of linear control systems, Root Locus techniques: root counter, Root Loci of Discrete-data control system, time-domain analysis of control systems, frequency-domain analysis of control systems, Time and frequency-domain design of control systems, frequency-domain plots.

EE 371: Electric Drives **3 Credit Hours**

Transformers: performance characteristics, three-phase connections, autotransformers. DC machines: performance equations, generator and motor characteristics, starting and speed control of motors. Synchronous machines: generator and motor operation. Three-phase induction motors: operation, performance calculations, starting and speed control. Single phase induction motors. Small synchronous motors. Universal motors.

EE 431: Digital Signal Processing **3 Credit Hours**

Z-transforms, system functions. Sampling and aliasing. Digital filter structures, signal flow graphs, elementary FIR/IIR filter design techniques, windows, bilinear and band transformations. Discrete Fourier transform, relationship between DFT and DTFT. Linear and cyclic convolution, application to fast filtering algorithms, windowing.

EE 451: Digital Communications **3 Credit Hours**

Quantization and PCM Encoding. Noise analysis in PCM systems. Baseband pulse transmission (matched filters, intersymbol interference); Eye pattern, Nyquist criteria; Equalization. Error probability analysis. Digital Passband transmission: Coherent PSK,FSK,QPSK,MSK; Noncoherent orthogonal modulation; Power spectra and bandwidth efficiency of binary and quaternary modulation schemes; Information theory: Mutual information and channel capacity; Source coding; Error control coding (channel coding).

EE 452: Communications Lab I **1 Credit Hour**

Introduction to Laboratory equipment such as oscilloscope and spectrum analyzer; Simulation of communication system using scientific-computing software like MATLAB; Analog modulations AM, PM generation and detection; Digital modulations – PCM, line codes, ASK and FSK.

EE 453: Telecommunication Networks **3 Credit Hours**

Overview of Telecommunication Networks. Networking Architectures and Layered Protocols. Circuit-switching Telephone Networks. Multiplexing and Switching. DS and SPONET-SDH. Tele-Traffic Theory and Performance Analysis. Packet Switching Data Networks. DLC Layer, ARQ, and MAC Protocols. Ethernet LANs. The Internet TCP/IP and ATM Standards. Recent Trends in Networking Technologies.

EE 454: Communications Lab II **1 Credit Hour**

Digital representation of analog signal; Entropy and Huffman Encoding; Detection and Estimation; Waveform coding techniques- PCM; QPSK, QAM; Fiber optic communication system measurements, Antennas and microwave measurments

EE 461: Introduction to Instrumentation and Control Lab **1 Credit Hour**

An introduction to MATLAB and LabView, Tutorials and programing aspect from control systems view point, Linear Time-invariant Systems and Representation, Block Diagram Reduction, performance characteristics of first and second order systems, Effect of Feedback on disturbance and Control System Design, Building a VI and modifying signals in LabView, Exercises in LabView, Use The NI USB-6009 for data acquisition and Digital Input / Output

EE 471: Powers Systems **3 Credit Hours**

This course covers the following topics: Basic Concepts and Per Unit Impedances. Phase shift in transformers. Series impedance of transmission lines. Capacitance of transmission lines. Current and voltage relations of transmission lines. Admittance model and network calculations. Impedance model and network calculations. Power flow solutions. Symmetrical fault analysis. Safety considerations.

EE 491: Graduation Project I **1 Credit Hour**

A course that integrates various components of the curriculum in a comprehensive engineering design experience. Design of a complete project including establishment of objectives and criteria, formulation of design problem statements, and preparation of engineering designs. The design may involve experimentation, realization and/or computer project. Submission of a written report is an essential requirement for completion of the course. Team design projects, where appropriate, are highly encouraged.

EE 492: Graduation Project II **3 Credit Hours**

Continuation of the project stared in EE 491. Public oral presentation and submission of final written report of the design project are essential requirements for the completion of the course.

3. Elective Courses

EE 421: Communication Electronics **3 Credit Hours**

Large-signal analysis. RF power amplifiers. Tuned amplifiers. RF oscillators and Mixers; Design of S/H circuits, A/D and D/A converters, and timing (clock generator) circuits. Circuit design using PLL, VCO and multipliers;

EE 433: Digital Image Processing **3 Credit Hours**

Image digitization. Human vision system and color imaging. Image enhancement and histogram techniques. Image edge/line detection. Image transformations and filtering. Image denoising. Geometric operations. Image segmentation. Industrial Applications; Introduction to image compression.

EE 441: Advanced Sensors and Actuators **3 Credit Hours**

Introduction, Fundamental Concepts, Measurement and Error, Sensors, Sensing Electronic Circuits, Mechanical Actuation, Rotational Actuators, Variable Speed Drives, Linear Actuators

EE 442: Advanced Instrumentation **3 Credit Hours**

Micro-machined sensors, Fiber optical sensors, Gas chromatography, Gas detectors, Environment monitoring systems, and soft-sensing techniques.

EE 443: Industrial Electronics **3 Credit Hours**

555 timers. Optoelectronic sensors. Microswitches. Ultrasonic transducers. Thermal sensors. Strain gauges and instrumentation amplifiers. UJT, PUT, multilayer diodes. SCRS and TRIACS. Triggering and power control techniques. Solid state relays. Practical applications

EE 444: Applied Instrumentation **3 Credit Hours**

Signal conditioning: E/I tranducers, AC and DC bridges, design of bridges, operational amplifier circuits, LP and HP filters, power supplies, reference voltages, analog multiplexers/ de-multiplexers. Data acquisition systems, SCADA systems, interface cards, isolations, intrinsic safety, nondestructive testing, visual programming, data communications, smart transmitters, filed busses. Process and instrumentation diagrams

EE 455: Mobile Wireless Communications **3 Credit Hours**

Overview of Wireless Networks. Cellular Mobile Systems and Frequency Reuse. Path Loss and Fading Channel Models. Performance of Digital Modulations over Fading Channels. Multiple Access Techniques (FDMA, TDMA, and CDMA). Interference and Capacity Analysis. Link Budget and System Design. Current Applications (2/2.5/2.75 G, 3G, 4G, etc).

EE 456: Information Theory and Coding **3 Credit Hours**

Communication System Models, Introduction to Information Theory, Source Coding, Lossless Data Compression (Huffman algorithm), Lossy Digital Waveform Coding. Channel Coding and Error Control Codes. AWGN in Digital Communication Systems. Optimum Signal Detection and Matched Filter Receivers, Error Performance Analysis of Digital Modulations (ASK, PSK, QAM, FSK).

EE 457: Mobile and Wireless Networks **3 Credit Hours**

This course may cover the following topics: Basics of mobile and wireless networking. Architectures and communication protocols for wireless sensor networks, wireless local area networks, ad-hoc networks, cellular systems, WiMAX, and Wireless Mesh Networks. Latest networking technologies in wireless networks and mobile computing, network quality of service, network programmability.

EE 458: Fiber Optic Communications **3 Credit Hours**

Basics of light, Ray representation of light, Fiber optic types, transmission characteristics: attenuation and dispersion, Bit rate and distance limits: link budget calculations, Light sources: LEDs and Semiconductor Lasers, Light detectors: PIN and APDs, Digital transmission: PDH, SDH/SONET, WDM systems

EE 459: Satellite Communications **3 Credit Hours**

Overview of Satellite Systems. Orbits and Launching Methods. Satellite Architecture, Communication Transponders and Antenna Subsystems. Modulation Schemes and Multiple Access Techniques (FDMA, TDMA, and CDMA). Link Budget Analysis and System Performance. Examples of Current Applications in Satellite Communications (LEO, MEO, GEO).

EE 462: Applied Control Engineering **3 Credit Hours**

Introduction to process control. Feedback and feed forward control configurations. Modeling of dynamic systems: Time delays, high order systems, multivariable systems. Process identification. Analysis and controller design performances. PID controller tuning. Intelligent controller tuning. Advanced control techniques. Process interaction and decoupling control. Introduction to distributed computer control systems and digital control issues.

EE 463: Digital Control Systems **3 Credit Hours**

This course is an extension to what has been presented in EE 232 which includes: Discrete time systems - Sampling process, aliasing, stability; Z-transform techniques; Difference equations and state space representation; Simulation of discrete systems; Solution via Z-transform; Stability, controllability and observability of discrete systems; Discretization methods; Pole placement design, observer design, output feedback, linear quadratic regulator design.

EE 464: Programmable Logic Controllers **3 Credit Hours**

Basic concepts of microcontrollers. The structure of programmable logic controllers: I/O, relays, counters and timers. Ladder diagram concept. PLC's intermediate and advanced functions, PLC's instruction sets and data manipulations. PLC's industrial applications in the process control.

EE 466: Control Systems Design **3 Credit Hours**

Transient and Steady State Requirements. Design specifications. Basic classical design techniques: Root locus, Design using root locus. Frequency Response Techniques, Bode plot, Nyquist plot, principle of specifications and controller design in the frequency domain. Controllability and observables, pole placement, and robust control.

EE 467: Intelligent Controllers **3 Credit Hours**

Fuzzy logic and neural network based controllers.

EE 481: Special Topics in Communications & Electronics **3 Credit Hours**

The contents of this course will be in one of the areas of interest in Communications and Electronics. The specific contents of the course will be given in detail at least one semester in advance of that in which it is offered and should be approved by the Electrical Engineering Department Council.

EE 482: Special Topics in Instrumentation & Control **3 Credit Hours**

The contents of this course will be in one of the areas of interest in Instrumentation and Control. The specific contents of the course will be given in detail at least one semester in advance of that in which it is offered and should be approved by the Electrical Engineering Department Council.

Architectural Engineering Program

Architectural Engineering Program

Introduction

Architectural engineering is a building-oriented discipline, which offers students an opportunity to obtain an engineering education specializing in building architecture, building-system integration, and structural and computer-aided design. Architectural engineers are concerned with the task of combining the various building systems provided by today's advanced technology into an integrated whole.

Professional architectural engineers are concerned with the structural integrity of buildings; the design and analysis of HVAC (Heating, Ventilating and Air Conditioning), plumbing, fire protection and electrical systems; acoustic; lighting; energy conservation; building science and the study of building performance; and the management of construction resources and schedules. Graduates of the architectural engineering program will be well prepared for careers as consulting engineers, building contractors, construction managers, structural engineers and knowledgeable specialists in related areas of building design and analysis.

Architectural engineering shares in common with civil and mechanical engineering but is distinct in its exclusive concentration on building projects. Architectural engineering students should have an aptitude in and an appreciation of the following areas of knowledge: basic principles of mathematics; physics and chemistry; manual and computer-aided drafting and design; surveying; construction materials; building systems; engineering mechanics; structural analysis and design; building-system integration; and professional practice and ethics.

In recent years there have been great and rapid developments in construction in Saudi Arabia. Consequently, this has created a growing demand for architects and planners who can address the development problems of new and existing urban areas as well as design and construction projects; and who can combine architecture and engineering abilities for Architects; and planning and engineering abilities for planners in addition to managerial skills that are essential to successfully develop and implement new ideas in the architecture environments. The department of Architectural Engineering has developed distinct programs. This program follows the ABET requirements in terms of the number of Credit Hours required to graduate as well as the course work contents. Graduates from any of this program can join the work force either in the public or private sectors.

Mission

The primary mission of the department is to prepare students for successful careers in professional practice and to conduct research in the design, engineering, and construction of buildings with special emphasis on knowledge and skills suitable for

the Kingdom professional needs of the 21st century and able to ensure successful integration, dissemination, and application of the diverse architectural engineering knowledge inspired by the relevant sciences, engineering and humanities fields.

Program Educational Objectives

The main objective of the Architectural Engineering program is to prepare engineers who are well-grounded in the engineering specialties, and have an understanding of how the building is designed and built and how the engineering systems fit into the building.

Graduates are expected to be working as professionals in an area closely related to architectural engineering, pursuing licensure, and advancing professionally with confidence and experience in one or more of the architectural engineering disciplines of structural, mechanical, electrical, environmental control and construction.

Program Outcomes

1. Apply fundamentals of engineering, mathematics, and science.
2. Design and conduct experiments, as well as using statistics and experimental design to analyze and interpret data.
3. Design a system, component, or process to meet desired needs and criteria.
4. Work on multi-disciplinary teams.
5. Identify, formulate, research and solve engineering problems.
6. Understand professional and ethical responsibility in preparing for effective industry careers.
7. Communicate effectively with oral presentations, written documentations, and graphic depiction.
8. Understand the impact of engineering solutions in a global and societal context.
9. Use techniques, skills, and modern engineering tools necessary for engineering practice.

Overview of the Curriculum

Course Coding

The Architectural Engineering courses are tabled and numbered in such a manner to recognize each course regarding its year level, subject area and sequence number of course in the subject area. The symbol AE denotes Architecture Engineering and each number is made of 3 digits. Each digit represents specific information about the course as follows:

The first digit denotes the year level of the course according to student's study plan as follows:

First Digit	Level of Course
1	First year
2	Second year
3	Third year
4	Fourth year

The second digit as per the following Table represents the field/specialization within the Department:

Second Digit	Specialization
0	Fundamental Architecture Engineering Courses
1	History of Architecture and Architectural Engineering
2	Architecture Graphics, Architecture Design
3	Building materials, Building Envelops and surveying, Computer Applications in Architecture Engineering, construction systems
4	Building Mechanics Systems, HVAC Systems, electricity Systems and elevators,
5	Heat Transfer, Fluid Mechanics and Engineering Thermodynamic Courses
6	Environment Courses and Architecture Sciences, Lighting, Acoustics and Air quality
7	Research, Seminars, Special Topics, and Engineering Training Courses
8	For the Future extension
9	Graduation Projects Courses

The third digit denotes the sequence number of the course in a certain field/specialization in a given year. The number 9 as the third digit is reserved for Engineering Training and Special Topic courses.

Example: AE 221 means

Code	First Digit	Second Digit	Third Digit
AE	2	2	1
Department (Architectural Engineering)	Level (Second year)	Field (Architectural Design)	First Architectural Design course in the second year

Undergraduate Curriculum of the Architectural Engineering Program

The curriculum leading to the degree of Bachelor of Science in Architectural Engineering requires **135 Credit Hours** and is organized as follows:

University Requirement	**14** credit hours	Islamic, humanities, and social science courses
College Requirement	**46** credit hours	Math, Basic Science, and Fundamental Engineering
Department Requirement	**75** credit hours	Both compulsory and elective

1. General University Requirements

All students in the College of Engineering at Al-Imam University are required to take 14 Credit Hours of course work as detailed in the following Table irrespective of the engineering discipline they are in:

Course Code	Course Name	Credit Hours
QUR 100	Quran Kareem I	2
QUR 150	Quran Kareem II	2
QUR 200	Quran Kareem III	2
QUR 250	Quran Kareem IV	2
IDE 133	Tawheed	2
LIT 102	Arabic Language Skills	2
HIST 102	History of Saudi Arabia	2
Total		**14**

2. College of Engineering Requirements:

Forty six credit hour of Basic Sciences, Fundamental Engineering courses, and Communication Skills must be taken by all students in the undergraduate program of Architectural engineering as college requirement. The specified courses provide the foundation of studying chemical engineering. These courses are listed in the following table:

Course Code	Course Name	Credit Hours	Prerequisite
MATH 105	Calculus I	4	None
MATH 106	Calculus II	4	MATH 105
MATH 235	Differential Equations	3	MATH 106
STAT 215	Probability and Statistics in Engineering	3	MATH 106
CHEM 103	General Chemistry	4	None
PHYS 117	Physics I	3	Co-req. PHYS 119
PHYS 119	Physics I lab	1	Co-req. PHYS 117

PHYS 118	Physics II	3	PHYS 117, PHYS 119 Co-req. PHYS 120
PHYS 120	Physics II lab	1	PHYS 117, PHYS 119 Co-req. PHYS 118
CS 107	Computer Programming	3	MATH 105
ENGL 201	Technical English Writing	3	None
GE 101	Engineering Graphics and Design	3	None
GE 201	Statics	3	MATH 106, PHYS 117, PHYS 119
GE 204	Thermodynamics	3	MATH 106
GE 302	Professional Ethics For Engineers	2	None
GE 303	Engineering Economy	3	MATH 106
GE 399	Engineering Training	0	Completion of 90 credit hours
	Total	**46**	

3. Architectural Engineering Requirements

Seventy five credit hours of architectural engineering courses, both compulsory (66 credit hours) and elective (9 credit hours), must be taken by all students in the undergraduate program. These courses are listed in the following table:

A. Architectural Engineering Compulsory Courses

Course Code	Course Name	Credit Hours	Prerequisite
AE 112	History of Architecture	2	None
AE 132	Building Materials	2	None
AE 221	Architectural Design I	3	GE 101
AE 222	Architectural Design II	3	AE 221
AE 231	Computer Applications in Architecture Design	3	AE 221, CS 107
AE 242	Building Mechanical Systems	3	PHYS 117
AE 321	Architectural Design III	3	AE 222
AE 322	Architectural Design IV	3	AE 321
AE 331	Construction Systems	3	AE 132
AE 341	Electrical Services Design	3	PHYS 117
AE 342	HVAC Systems Design	2	AE 242
AE 351	Plumbing and Fire Protection	3	AE 242
AE 361	Architectural Acoustics	2	PHYS 117
AE 421	Working Drawings	3	AE 221, AE 331
AE 431	Construction Management	3	AE 222
AE 461	Building Illumination	2	PHYS 118

AE 4**	Elective I	3	Refer to the elective courses
AE 4**	Elective II	3	Refer to the elective courses
AE 4**	Elective III	3	Refer to the elective courses
AE 491	Graduation Project I	1	Department Approval
AE 492	Graduation Project II	3	AE 491
CE 211	Solid Mechanics	3	GE 101, GE 201, MATH 235
CE 221	Engineering Surveying	3	CS 107 GE101, Co-req. STAT 215
CE 241	Fluid Mechanics	3	MATH 235 GE 201
CE 311	Structural Engineering	4	CE 211 MATH 226
CE 313	Reinforced Concrete Design	3	CE 311
CE 411	Steel Structures	3	CE 311
Total		**75**	

B. Architectural Engineering Elective Courses

The 9 credit of technical-elective courses must be taken from the areas of specialization as listed below:

Course Code	Course Name	Credit Hours	Prerequisite
AE 433	Building Economy	3	None
AE 434	Computer-Aided Building Design	3	GE101, CS107
AE 443	Introduction to Building Maintenance Management	3	None
AE 453	Solar Energy in Building	3	AE 242
AE 455	Building Energy Analysis	3	AE 242
AE 463	Sound and Vibration Control in Buildings	3	AE 361
AE 464	Day-lighting Analysis and Design	3	AE 461
AE 465	Eco-friendly Architecture	3	None
AE 466	Acoustics Design	3	AE 361
AE 467	Sustaining the Built Environment	3	None
AE 473	Special Topics in Architectural Engineering	3	None

Architectural Engineering Undergraduate Curriculum

First Year (Freshman)

First Level

No.	Course Code	Course Name	Hours			
			Credit	Theory	Lab	Tut
1	QUR 100	Quran Kareem I	2	2		
2	CHEM 103	General Chemistry	4	3	2	
3	MATH 105	Calculus I	4	4		1
4	PHYS 117	Physics I	3	3		
5	PHYS 119	Physics I lab	1		2	
6	GE 101	Engineering Graphics and Design	3	2	2	
Total Semester Hours			**17**	**14**	**6**	**1**
Cumulative Hours			**17**	**14**	**6**	**1**

Second Level

No.	Course Code	Course Name	Hours			
			Credit	Theory	Lab	Tut
1	QUR 150	Quran Kareem II	2	2		
2	ENGL 201	Technical English Writing	3	3		
3	MATH 106	Calculus II	4	4		1
4	PHYS 118	Physics II	3	3		
5	PHYS 120	Physics II lab	1		2	
6	AE 112	History of Architecture	2	2		
7	AE 132	Building Materials	2	1	2	
Total Semester Hours			**17**	**15**	**4**	**1**
Cumulative Hours			**34**	**29**	**10**	**2**

Second Year (Sophomore)

Third Level

No.	Course Code	Course Name	Hours			
			Credit	Theory	Lab	Tut
1	QUR 200	Quran Kareem III	2	2		
2	GE 201	Statics	3	3		1
3	STAT 215	Probability & Statistics in Engineering	3	3		1
4	CS 107	Computer Programming	3	2	2	
5	AE 221	Architectural Design I	3		6	
6	CE 221	Engineering Surveying	3	2	2	1
Total Semester Hours			**17**	**12**	**10**	**3**
Cumulative Hours			**51**	**41**	**20**	**5**

Fourth Level

No.	Course Code	Course Name	Hours			
			Credit	Theory	Lab	Tut
1	QUR 250	Quran Kareem IV	2	2		
2	MATH 235	Differential Equations	3	3		1
3	GE 204	Thermodynamics	3	3		1
4	AE 222	Architectural Design II	3		6	
5	AE 231	Computer Applications in Architecture Design	3	2	2	
6	AE 242	Building Mechanical Systems	3	2	2	
Total Semester Hours			**17**	**12**	**10**	**2**
Cumulative Hours			**68**	**53**	**30**	**7**

Third Year (Junior)

Fifth Level

No.	Course Code	Course Name	Credit	Hours Theory	Lab	Tut
1	IDE 133	Tawheed	2	2		
2	GE 302	Professional Ethics for Engineers	2	2		
3	CE 211	Solid Mechanics	3	3		1
4	CE 241	Fluid Mechanics	3	3		1
5	AE 321	Architectural Design III	3		6	
6	AE 341	Electrical Services Design	3	3		1
Total Semester Hours			**16**	**13**	**6**	**3**
Cumulative Hours			**84**	**66**	**36**	**10**

Sixth Level

No.	Course Code	Course Name	Credit	Hours Theory	Lab	Tut
1	LIT 102	Arabic Language Skills	2	2		
2	CE 311	Structural Engineering	4	4		1
3	AE 342	HVAC Systems Design	2	2		
4	AE 322	Architectural Design IV	3		6	
5	AE 361	Architectural Acoustics	2	3		1
6	AE 351	Plumbing and Fire Protection	3	3		
7	AE 331	Construction Systems	3	3		
Total Semester Hours			**19**	**17**	**6**	**2**
Cumulative Hours			**103**	**83**	**42**	**12**

Summer

No.	Course Code	Course Name	Credit	Hours Theory	Lab	Tut
1	GE 399	Engineering Training	0	0	0	0
Total Semester Hours			**0**	**0**	**0**	**0**
Cumulative Hours			**103**	**83**	**42**	**12**

Fourth Year (Senior)

Seventh Level

No.	Course Code	Course Name	Hours			
			Credit	Theory	Lab	Tut
1	HIST 102	History of Saudi Arabia	2	2		
2	CE 313	Reinforced Concrete Design	3	3		1
3	AE 421	Working Drawings	3	2	2	
4	AE 431	Construction Management	3	3		
5	AE 461	Building Illumination	2	2		1
6	AE 4**	Elective Course I	3	3		
7	AE 491	Graduation Project I	1	1		
Total Semester Hours			**17**	**16**	**2**	**2**
Cumulative Hours			**120**	**99**	**44**	**14**

Eighth Level

No.	Course Code	Course Name	Hours			
			Credit	Theory	Lab	Tut
1	GE 303	Engineering Economy	3	3		1
2	CE 313	Steel Structures	3	3		1
3	AE 4**	Elective Course II	3	3		
4	AE 4**	Elective Course III	3	3		
5	AE 492	Graduation Project II	3	1	5	
Total Semester Hours			**15**	**13**	**5**	**2**
Cumulative Hours			**135**	**112**	**49**	**16**

Course Description

1. General College Courses

This section contains the descriptions of the fundamental engineering courses that are required by the College of Engineering. The courses are listed in numerical order. Each entry has the number of hours of credit for the course, the prerequisites, and a brief description.

MATH 105: Calculus-I **4 Credit Hours**

Differential calculus and basic integral calculus including the fundamental theorem of calculus and Taylor's theorem with remainder. It includes most of the elementary topics in the theory of real-valued functions of a real variable: limits, continuity, derivatives, maxima and minima, integration, area under a curve, volumes of revolution, trigonometric, logarithmic and exponential functions and techniques of integration.

MATH 106: Calculus-II **4 Credit Hours**

All techniques of integration (substitution, by parts, trigonometric substitutions, partial fractions, miscellaneous substitutions etc.), conic sections, polar coordinates, and infinite series. Vector analysis: Euclidean space, partial differentiation, multiple integrals, the integral theorems of vector calculus.

MATH 235: Differential Equations **3 Credit Hours**

Techniques and applications of ordinary differential equations: First order equations, linear equations of higher order, systems of linear equations with constant coefficients, reduction of order, including Fourier series and boundary-value problems, and an introduction to partial differential equations.

STAT 215: Probability and Statistics in Engineering **3 Credit Hours**

Emphasizes basic probability concepts, random variables and probability, expectations and moments, functions of random variables, some important discrete distributions, some important continuous distributions. This including descriptive statistics, observed data and graphical representation, parameter estimation, model verification, linear models and linear regression, and hypothesis testing in both nonparametric and normal models.

CHEM 103: General Chemistry **4 Credit Hours**

The course covers fundamental observations, laws, and theories of chemistry at the introductory level. Topics include Atoms/Molecules, Stoichiometry, Acids/Bases, Solutions, Equilibria, Gases, Solids, Liquids, Thermodynamics, Kinetics, Quantum Theory, The periodic table, and Chemical bonding.

PHYS 117: Physics-I **3 Credit Hours**

Vectors. Motion in one, two and three dimension. Acceleration and free fall, force and motion, and analysis of forces. Newton's laws. Circular motion. Work: the transfer of mechanical energy. Conservation of momentum. Rotation. Conservation of angular momentum. Elasticity and Fluid mechanics.

PHYS 118: Physics-II **3 Credit Hours**

Oscillations. Sound waves. Heat and Thermodynamics. Electricity and Magnetism: Coulomb's law, electric fields, Gauss' Law, electric potential, potential energy, capacitance, currents and resistance. Electrical energy and power, direct current circuits, Kirchhoff's rules. Magnetic fields, motion of charged particle in a magnetic field, sources of the magnetic field and energy in a magnetic field. Ampere's law, Faraday's law of induction, self-inductance. Alternating current circuits, the RLC series circuit, power in an A.C. circuit, resonance in RLC services circuit.

CS 107: Computer Programming **3 Credit Hours**

Fundamental principles, concepts, and methods of computing, with emphasis on applications in engineering. Basic problem solving and programming techniques, fundamental algorithms and data structures. Use of computers in solving engineering and scientific problems.

ENGL 201: Technical English Writing **3 Credit Hours**

The course examines the basic requirements of technical style and organizational patterns used in a variety of business and technical documents. Students learn and practice how to condense extensive information into the fewest words possible without sacrificing content. The course also covers how to identify the audiences and apply various styles to each. Students hone their skills by writing various types of proposals, informal and formal reports, procedures manuals and oral presentations. Finally, the course gives students a command of the design principals and production processes required for truly effective technical communications. Students will be required to complete a capstone project that incorporates every aspect of technical writing learned in the course.

GE 101: Engineering Graphics and Design **3 Credit Hours**

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

GE 201: Statics **3 Credit Hours**

Forces, moments, and couples, resultants of force systems, equilibrium analysis and free-body diagrams; analysis of forces acting on members of trusses, frames, etc. Shear-force and bending-moment distributions; Coulomb friction; centroids. Center of mass, moment of inertia, polar moment of inertia, and product of inertia. Virtual work; hydrostatic pressure, Applications of statics in design.

GE 204: Thermodynamics **3 Credit Hours**

Introduction to engineering thermodynamics. First law, second law, system and control volume analysis. Properties and behavior of pure substances, applications to thermodynamic systems operating in a steady state and transient processes. Heat transfer mechanisms. Typical power producing cycles and refrigerators. Ideal gas mixtures and moist air properties.

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

The course examines ethical theories, moral norms and case studies to provide an overview of the ethical use of technology and associated responsibilities of engineers towards society, environment, clients, employers and coworkers. Ethical problem-solving techniques are elaborated with examples. Concepts of whistle blowing, intellectual copyrights, plagiarism, conflict of interests, safety, occupational hazards and cost-benefit risk are explored in the light of engineering codes of ethics and legal aspects of ethical and professional misconduct.

GE 303: Engineering Economy **3 Credit Hours**

Time value of money formulas, application of time value of money formulas. Project selection using net present worth analysis using the common multiple and study period methods, one and two parameter sensitivity analysis. Bond cash flows and pricing, loan amortization and determining the remaining principle on a loan, project selection using annual equivalent worth, project selection using the incremental net present worth. Annual depreciation and book value using straight line, declining balance and MACRS methods. Annual cash flow and net present worth. Discounted benefit/cost ratio for a public project and determine if it meets the criterion. Inflation in estimating future cash flows, and defender/challenger replacement analysis using net present worth.

GE 399: Engineering Training **0 Credit Hour**

Eight weeks training in a relevant industry under the supervision of a faculty member. Each student must submit a technical report about his achievements during the training in addition to fulfilling any other requirements as assigned by the department.

2. Compulsory Architectural Engineering Courses

AE 112: History of Architecture **2 Credit Hours**

Comprehensive background as well as concentration on individual cultures and their architects from ancient to modern times. Discussion of architectures from around the world. Specific details and expressions of more generalized theories and strategies will be explored.

AE 132: Building Materials **2 Credit Hours**

Properties, behavior, and selection of building materials including wood, laminates, cements, aggregates, concrete, masonry mortar, steel, and finishing materials. Structural and architectural use of traditional and modern building materials. Introduction to basic methods of construction; excavation, foundations, building systems, and construction equipment and general techniques in wood, masonry, and concrete construction. New building materials. Visits to building sites and manufacturers.

AE 221: Architectural Design I **3 Credit Hours**

This course introduces architectural design and the role of the architectural engineer in the building profession. Graphics techniques and methods in architectural design and presentation. Topics such as rendition of value and context; shades and shadows techniques in various types of drawings; perspectives, major characteristics, elements, and types; graphic diagrams; freehand sketching and model-making techniques will be covered. Also this course Introduce the design process in the form of phases, activities, and parties involved. Topics covered include: Description of each phase, activities and objectives; models for problem-solving process in design utilizing graphic thinking. Problem definition, developments of alternatives, evaluation, and selection of solution and communication of a design project are introduced, explored and exercised through both abstract sketches and definitive concrete designs to solve simple design problems. Design problems of complete but simple buildings are introduced.

AE 222: Architectural Design II **3 Credit Hours**

Introduction and appreciation of the design process through dealing with more complex buildings and larger project sites. The concept of building design as a multi-disciplinary approach is introduced. Integration of structural, mechanical and environmental control systems with the building function, form and spaces' organization is emphasized. Basic elements of architectural form and space and how they can be manipulated, organized in the development of a design concept and their visual implications are explored. Considerations of building function, construction materials and systems, cultural, environmental constraints, and climatic influences are emphasized. Individual design thinking is encouraged throughout the studio work.

AE 231: Computer Applications in Architecture Design **3 Credit Hours**

Introduction to Computer-Aided Drafting and Design which includes: 2D drawings, 3D modeling, rendering, and Image processing. Major CAD drafting, and presentation packages will be used for the production, management, and presentation of project information.

AE 242: Building Mechanical Systems **3 Credit Hours**

Introduction to basic concepts, terminology and design methods for building mechanical systems. Thermal comfort, building thermal performance, and heating & cooling load calculation procedures. Fire protection systems and smoke control. Water supply and distribution systems; Waste and drainage systems. Vertical transportation systems. Computer applications.

AE 321: Architectural Design III **3 Credit Hours**

Design large span project appreciation of the design process through dealing with more complex building and larger project sites. The project should include development of system design and analysis techniques such as integrated design of structure, mechanical, electrical and environmental systems with the building function. Advance elements of architectural form and space and how they can be manipulated, organized in the development of a design concept and their visual implications are explored.

AE 322: Architectural Design IV **3 Credit Hours**

Advance design project (multistory building) appreciation of the design process through dealing with more complex buildings and larger project sites. The project should include development of system design and analysis techniques such as integrated design of structure, mechanical, electrical and environmental systems with the building function. The concept of building design as a multi-disciplinary approach is introduced. Advance elements of architectural form and space and how they can be manipulated, organized in the development of a design concept and their visual implications are explored.

AE 331: Construction Systems **3 Credit Hours**

Construction systems including foundation, superstructure, enclosure (walls and roofs), interior finishes, partitions, and ceilings. Construction and detailing of site-built and prefabricated systems. Selection methods and criteria for appropriate design as a function of climate and energy use, labor and material availability, maintenance and replacement patterns, safety, functionality, and cultural context. Course material comprehension is ensured through submission of sketches, to-scale detail drawings and model-development of the introduced systems.

AE 341: Electrical Services Design **3 Credit Hours**

The aim of this unit is to present basic principles of electricity and magnetism as necessary for an understanding of the application of electrical services in buildings; to introduce students to the applications of these principles to electrical distribution in buildings; to outline the principles of electric motors, transformers and switchboard design. The types and use of cables and enclosures in and around buildings; methods of assessment of loads and cable sizes; principles of operation of transformers and motors and the design of switchboards and earthing, emergency evacuation lighting and early warning information systems; and Anti-Lighting System. Also, this course introduces the fundamental principles of lighting design for interior and exterior applications; and a basic understanding of data transmission via copper wire and optical fiber.

AE 342: HVAC Systems Design **2 Credit Hours**

Study of the fundamental principles and engineering procedures for the design of heating, ventilating, and air conditioning systems; HVAC system characteristics; system and equipment selection; duct design and layout. Attention is given to energy conservation techniques and computer applications.

AE 351: Plumbing and Fire Protection **3 Credit Hours**

Study of plumbing systems and fixtures including wastewater, water supply, and venting systems. Study of fire protection systems for buildings including pipe sizing, pumps, sprinklers, gravity and pressure vessels, and controls.

AE 361: Architectural Acoustics **2 Credit Hours**

Noise control criteria and regulations, instrumentation, noise sources, room acoustics, walls, barriers and enclosures, acoustical materials and structures, vibration and noise control systems for buildings.

AE 421: Working Drawings **3 Credit Hours**

An introduction to the production of construction documents used in the building industry. A preliminary building design is developed to include detailed materials, and construction information. A set of drawings is completed including floor plans and elevations, site, foundation, framing and roof plans and details, wall and roof sections and details, interior finish elevations and details, and door and window schedules and details. Drawing skills are developed, office management issues are discussed.

AE 431: Construction Management **3 Credit Hours**

A survey of Construction Management: Basic concepts, preparing the bid package, issues during construction phase, construction contracts, legal structure, time planning/control. Project cash flow; project funding, equipment ownership, equipment productivity, construction operations, construction labor, materials management and safety. Types of specifications, technical division, changes, bonds, liens, general conditions, special conditions and contract documents.

AE 461: Building Illumination **2 Credit Hours**

Concept of light, vision, and color. Luminaries and lamps. Lighting system design procedures; calculation and measurement techniques, evaluation of interior lighting quality, and daylighting. Computer applications in artificial and daylighting analysis and design. Design of lighting systems. Solar energy utilization and daylighting. Integration of lighting systems with mechanical systems for energy conservation and sustainable development.

AE 491: Graduation Project I **1 Credit Hour**

Students will choose certain design projects from a range of topics in all specialization of Civil Engineering.

AE 492: Graduation Project II **3 Credit Hours**

A comprehensive course that integrates various components of the curriculum in a comprehensive engineering design experience. The project should include development of system design and analysis techniques such as integrated design of structure, mechanical, electrical and environmental systems. The design should take place with consideration to appropriate constraints such as economic, safety, reliability, ethics, environmental, social, and cultural factors. Public oral presentations and written reports of the final design are essential requirements for completion of the course. Computer applications and team design projects, where appropriate, are greatly encouraged.

3. Elective Courses

AE 433: Building Economy **3 Credit Hours**

Development of economic performance measures of interest to developers, owners, contractors, and users. Sources of finance and the determinants of the cost of money. Treatment of life cycle costing, economic risk, inflation, forecasting techniques; model building, cost indices, elemental estimating, computerized information systems. Consideration of economic analyses of projects, and building components.

AE 434: Computer-Aided Building Design **3 Credit Hours**

Introduction to Computer-Aided Building Design (CAD) software packages, their potentials, and limitations. Production of building systems design using computers. Use of computers in space planning, cost analysis, structural design, building services layout, mechanical systems, energy analysis, lighting analysis and design, and room acoustics evaluation. Choice of a software upon given conditions. Use and application of selected package(s) for various building applications.

AE 443: Introduction to Building Maintenance Management **3 Credit Hours**

Basic concepts of building maintenance management. Classification of maintenance types, work orders types, planning and scheduling of maintenance works, maintenance contract types. Organizing preventive maintenance activities. Maintenance contract documents.

AE 453: Solar Energy in Buildings **3 Credit Hours**

Principles of solar energy collection, conversion, storage and distribution. Solar water heating, space heating and cooling applications, components and systems. Passive solar strategies. Computer applications.

AE 455: Building Energy Analysis **3 Credit Hours**

Application of thermal sciences to the evaluation of building energy systems; energy estimating methods; computer models for estimating building energy consumption; applications of various energy analysis computer programs; design methods for reducing energy consumption in buildings.

AE 463: Sound and Vibration Control in Buildings **3 Credit Hours**

Noise sources and their effect. Transmission of noise in buildings; air-borne and structure-borne noise. Sound isolation and sound insulating construction. Mechanical systems noise and vibration. Noise control techniques. Computer applications.

AE 464: Daylighting Analysis and Design **3 Credit Hours**

Introduction to daylighting. Sources of daylighting. Solar spectrum and its relationship to daylight availability. Weather phenomenon and daylighting. Concept of cloudiness and design sky: Performance of building materials with respect to daylighting such as reflectivity and absorption. Decomposition and decoloring of materials under daylight. Detailed study of daylight transmission through openings with shading devices. Solar geometry and design of sun-shading devices. Computer and lab methods for the study of daylight in buildings. Design of openings in desert areas with respect to glare and overheating.

AE 465: Eco-friendly Architecture **3 Credit Hours**

These courses will demonstrate the presser of designing Eco-Friendly building appropriate of the Kingdom of Saudi Arabia environmental to meets the requirements of LEED Green Building Rating System. Also the course will look for sustainable and Eco-buildings design such as: internal courtyard; modified wind catching devices; window and opening shading devices; thick, double and light color external walls; and roof thermal treatments (double reflecting roof tops and green roof) to minimize energy consumption and a low carbon footprint. Moreover the study will contains an environmental and climatic analysis of the studied house by introducing the appropriate architectural elements which will help improve the thermal comfort inside the buildings during summer and winter seasons.

AE 466: Acoustics Design **3 Credit Hours**

Acoustical phenomena in enclosed spaces. Sound absorbing materials and constructions. Acoustical requirements for the design of enclosures for speech (e.g. Mosques, studios, auditoriums, and multipurpose halls). Techniques for evaluating room acoustics performance. Sound reinforcement systems; principal uses, basic elements, and loudspeaker systems. Computer applications in sound behavior modeling and evaluation.

AE 467: Sustaining the Built Environment **3 Credit Hours**

The unit will aim to heighten student's awareness of the major environmental and resource issues facing the planners and designers of the built environment; introduce and explore concepts of ecological sustainable development as they apply to the built environment and debate the roles that designers and planners should play in the development of a sustainable future.

AE 473: Special Topics in Architectural Engineering **3 Credit Hours**

Variable contents are selected by the Department of Architectural Engineering and also any important and advanced topics in the field of Architectural Engineering.