
بسم الله الرحمن الرحيم

COLLEGE OF ENGINEERING GUIDE

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Preface to the 3rd Edition

It is my pleasure to present you the updated College Guide at the beginning of the 2017/2018 academic year as the 3rd Edition.

I would like to thank all administrators and faculty members who have participated in this edition and all previous editions. This College Guide has been built up as a result of combined untiring efforts from the first day of establishing the College up to date.

This edition of the College Guide states the vision and mission of the college along with departmental mission and vision to be in line with the vision and mission of the university. Some corrections have been made on some parts of the Guide including admission policy along with its procedures, which can be followed by the fresh students. Each of the four academic departments has compiled the degree requirement and detail course description. An easy way to follow flowchart of the degree path along with the four-year program schedule is given in each departmental section.

We are planning to have this College Guide as a comprehensive reference in the next edition for both faculty members and students. Some parts are going to be added that would explain policies, procedures, and all needed forms of all academic and administrative affairs. We are working hard to have it ready for the next academic year 2018/2019.

I hope this College Guide with the current edition would be useful to students in understanding the degree requirements and following the academic courses schedule within the whole study plan of their academic department. Also, this guide would help faculty members in providing academic advices to students.

Dean, College of Engineering
Al Imam Mohammad Ibn Saud Islamic University

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 Council of Ministers. The Ministry of Higher Education granted formal approval on 27/12/1428H (05/01/2008 AD). The academic program began in the academic year 1430/1431H (2008/2009AD). Each year about 140 students are admitted to the following four departments of the college after fulfilling the admission criteria:

(i) Civil Engineering
(ii) Electrical Engineering
(iii) Mechanical Engineering
(iv) Chemical Engineering

Vision

To be well-recognized for engineering education, cutting-edge research and services to the society integrated with genuine Islamic values and principles.

Mission

To prepare graduates for entry into engineering practice and graduate programs by providing an excellent educational environment which ensures the intellectual, professional and personal growth of the students. The college also strives to meet the challenges of innovative research for the social and industrial needs.

Objectives

The college of Engineering bears the following objectives:

1. Exemplify excellence and innovation in pursuit and delivery of knowledge to maintain high standards of engineering education.

2. Produce engineers with strong technical, interpersonal and leadership skills to fulfill the engineering workforce requirement.

3. Provide national leadership in elevating the role of engineering profession.

4. Contribute to the societal needs of knowledge-based economy and sustainable development of technology through innovative research.

Admission Regulations

The College of Engineering at Al Imam Mohammad Ibn Saud Islamic University aims to attract and admit distinguished students who have graduated from a Saudi high school. The admission process of the College of Engineering goes through two stages.

The first stage is to be admitted to the university in the applied science path of the Preparatory Program. This program is meant to strengthen student in English, mathematics and basic Science along with some general skills that are helpful for the admitted students to start their academic programs. The requirements for admission to the university are described in the website of admission and registration deanship at:

https://units.imamu.edu.sa/deanships/admission/Pages/default.aspx

The next stage is to be admitted to the college of Engineering. The requirements for the admission are as follow:

a) A minimum cumulative score of 80% from the three exams with the weight shown below

Examination and weight	Converted Score
General Secondary School (Thanawiya) 30%	0.3 × (General Secondary School Examination%)
Test of qualification ("Qudurat") 30%	0.3 × (Qudurat score %)
Test ("Tahseeli")(Science) 40%	0.4 × (Tahseeli test score %)
Cumulative Percentage (100%)	Total

The applicant can take "Qudurat" and submit its results either in the year admission is sought or a year prior to that. "Tahseeli" (Science) must be obtained in the year in which admission is desired. These two tests are conducted by the National Centre for Assessment. For further information on the test, please visit http://www.qiyas.org

b) Complete the Preparatory Program in Applied Science track. Top students from the merit list will be admitted to the College of Engineering according to the capacity of the college and the preference of each individual.

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 as per the following regulations:

a) Change of department within the college of engineering at Al Imam University

i. Must complete first level courses under any department of the College of Engineering.
ii. Must be approved by the academic department which the student wish to enroll.

b) Transfer from the other colleges of Al Imam University

i. Must meet all the requirements for admission to the College of Engineering.
ii. Transfer must be from Colleges of Science, Medicine or Computer Science.
iii. Must have a grade point average/cumulative average of at least 3.75 out of 5 and a minimum of B grade in all science courses.
iv. Must complete at least 75% of the required coursework (approximately 102 credit hours) in the College of Engineering.

Transfer of credit hours with a minimum of C grade 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.

c) Transfer from engineering colleges of other universities

i. Must meet all the requirements for admission to the College of Engineering which is described in the previous section.
ii. Must have a minimum grade point average/cumulative average of 3.75 out of 5, or 2.75 out of 4 and a minimum of B grade in all science courses
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.
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.

https://units.imamu.edu.sa/deanships/admission/Pages/default.aspx

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 and sewage distribution systems. Civil engineers are also concerned with flood control, landslides, air and 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. It is designed to develop engineers who have a strong background in Mathematics and Basic Science, engineers who are articulate, and 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.

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 includes planning and design of various facilities such as residential and service buildings, roads, bridges, tunnels, airports, water supply systems, water pumping stations, sewage networks, purification and water treatment plants, dams, and irrigation projects. Civil engineering also includes supervision on the construction of such facilities. In addition, it comprises the study and analysis of existing facilities for the purposes of development and maintenance and develops solutions for existing problems.

A graduate of civil engineering can work in the following fields:

- Construction companies.
- Local and international engineering consulting offices.
- Engineering departments in the government as well as the private sector.
- Maintenance and operation departments in the government and private sectors.
- Specifications and standards authorities.
- Asphalt and concrete factories.
- Manufacturing of building materials.
- Ministries directly related to certain specialization like; Ministry of Housing, Ministry of Transport, Ministry of Water and Electricity, and Ministry of Environment, Water and Agriculture.
- Specialized research organizations and centers in the field of civil engineering.
- Public transportation Agencies.
- Construction materials and testing laboratories.
- Civil Engineering academic fields at universities and colleges.
- Technical Training Institutes.

Vision

A civil engineering department renown for excellent learning experience, innovative research and community service while adhering to the Islamic values and principles.

Mission

The mission of Civil Engineering department is to produce competent civil engineers, advancement of scientific knowledge through research, and to provide valuable services to civil engineering profession and society.

Goals

1. Provide high quality education that prepares our graduates for civil engineering practice and graduate studies,

2. Develop necessary skills in our graduates that allows them to be professional leaders and vibrant contributors to the society, and

3. Maintain a program of study that is consistent with the current and future needs of civil engineering profession.

Program Educational Objectives

Graduates of the Civil Engineering program at Al Imam Mohammad Ibn Saud Islamic University are expected to:

1. Successfully commence their career as practicing civil engineers and/or pursue graduate studies and research in related fields,

2. Analyze, design and implement sustainable engineering solutions to real world problems considering realistic constraints and societal needs,

3. Demonstrate commitment to lifelong learning and professional development to stay current in modern engineering practice and contemporary issues, and

4. Advance to increasing levels of responsibility and leadership in their professional roles.

Student Outcomes

We expect our graduates to have:

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 Codes

The General Engineering, Core and Technical Elective courses are numbered to recognize each course according to the area of specialization and the year level. Each course code contains two-letters symbol followed by three-digits.

Symbol	Description
GE	General Engineering Courses
CE	Civil Engineering Core Courses and Technical Electives

The first digit denotes the year level of the course according to the study plan:

First Digit	Level of Course
1	First Year (Freshman)
2	Second Year (Sophomore)
3	Third Year (Junior)
4	Fourth Year (Senior)

The second digit represents the field/specialization within the department:

Second Number	Specialization
0	General Engineering
1	Materials and Structural Engineering
2	Transportation Engineering
3	Environmental Engineering
4	Water Resources Engineering
5	Geotechnical Engineering
6	Construction Engineering and Management
9	Graduation Project

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

For example, CE 421 refers to:

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 Engineering

Undergraduate Curriculum

The curriculum leading to the degree of **Bachelor's degree of Civil Engineering** is organized as follows:

General Education	**17** Credit Hours	**17** Contact Hours
Mathematics and Basic Science	**33** Credit Hours	**42** Contact Hours
General Engineering	**17** Credit Hours	**22** Contact Hours
Core Courses and Technical Electives	**69** Credit Hours	**100** Contact Hours
Total	**136**	**181**

1. General Education

These courses are specifically required for all engineering students to meet particular requirements of the University.

Course Code	Course Title	Credits
QUR 100	Quran Kareem	2
QUR 150	Quran Kareem	2
QUR 200	Quran Kareem	2
QUR 250	Quran Kareem	2
IDE 133	Tawheed (Monotheism)	2
ART 102	Arabic Composition	2
HST 102	History of Saudi Arabia	2
ENG 201	Technical English Writing	3
	Total Credit Hours:	**17**

2. Mathematics and Basic Science

To achieve proficiency in Mathematics and Basic Science, students are required to take the following courses.

Course Code	Course Title	Credits	Pre-requisite	Corequisite
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	
STA 215	Probability and Statistics in Engineering	3	MATH 106	
CHEM 103	General Chemistry	4	None	
PH 117	Physics I	3	None	
PH 119	Physics I Lab	1		PH 117
PH 118	Physics II	3	PH 117 PH 119	
PH 120	Physics II Lab	1	PH 117 PH 119	PH 118
MATH 345	Numerical Methods	4	MATH 226 MATH 235 CS 107	
	Total Credit Hours:	**33**		

3. General Engineering

The following courses are required as *General Engineering* courses in the undergraduate curriculum of Civil Engineering program.

Course Code	Course Title	Credits	Prerequisite	Corequisite
GE 103	Engineering Graphics and Design	3	None	
CS 107	Computer Programming	3	MATH 105	
GE 201	Statics	3	MATH 106 PH 118 PH 120	
GE 202	Dynamics	3	GE 201	
GE 302	Professional Ethics for Engineers	2	None	
GE 303	Engineering Economy	3	MATH 106	
GE 399	Engineering Training	0	Completion of 90 Credits	
	Total Credit Hours:	**17**		

4. Core Courses and Technical Electives

Seventy credit hours of Civil Engineering courses (61 credits of core courses and 9 credits of technical electives) must be taken by the students in undergraduate Civil Engineering program. These courses are listed as follows:

A. Core Courses

Course Code	Course Title	Credits	Prerequisite	Corequisite
CE 210	Civil Engineering Materials	2		STA 215
CE 211	Solid Mechanics	3	GE 103 GE 201 MATH 235 CE 210	
CE 213	Civil Engineering Materials Laboratory	1	ENG 201	CE 210
CE 221	Engineering Surveying	3	CS 107 GE 103	
CE 231	Fundamentals of Environmental Engineering	3	CHEM 103	CE 241
CE 241	Fluid Mechanics	3	MATH 235	

Course Code	Course Title	Credits	Prerequisite	Corequisite
			GE201	
CE 310	Concrete Properties	2	CE213	CE 313
CE 311	Structural Engineering	4	CE 211 GE 202 MATH 226	
CE313	Reinforced Concrete Design	3	MATH 345 CE 311	CE310
CE 321	Transportation Engineering	3	CE 221 CE 210	
CE 322	Transportation Engineering Laboratory	1		CE 321
CE 331	Environmental Engineering Processes	3	CE 231 CE 241	
CE 332	Environmental Engineering Laboratory	1		CE 331
CE 340	Water Resources Engineering	3	CE 241 STA 215	
CE 344	Water Resources Engineering Laboratory	1		CE 340
CE 351	Geotechnical Engineering	3	CE 211 CE 241	
CE 352	Geotechnical Engineering Laboratory	1		CE 351
CE 411	Steel Structures	3	CE 311	
CE 421	Transportation Facility Design	3	CE321 CE 322	
CE 422	Civil Engineering Systems	2	CE 461	
CE 451	Foundation Engineering	3	CE 313 CE 351 CE352	
CE 461	Construction Engineering and Management	3	GE 303 MATH 345	
CE 462	Construction Contracts and Specifications	2	CE461	
CE 4**	Elective I	3	Refer to the elective course	
CE 4**	Elective II	3	Refer to the elective course	

Course Code	Course Title	Credits	Prerequisite	Corequisite
CE 4**	Elective III	3	Refer to the elective course	
CE 491	Graduation Project I	1	CE 313 CE 321 CE 331 CE 340 CE 351	
CE 492	Graduation Project II	3	CE491	
	Total Credit Hours:	**69**		

B. Technical Electives

Students must take nine credits of elective courses to satisfy the requirements of Graduation Project and the selected area of specialization (Structural, Transportation, Environmental, Water Resources, Geotechnical, or Construction Engineering and Management). The technical electives in each area of specialization are as follows:

1. Structural Engineering

Course Code	Course Title	Credits	Prerequisite
CE 412	Indeterminate Structural Analysis	3	MATH 345 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 Title	Credits	Prerequisite
CE 423	Traffic Engineering	3	Corequisite CE 421
CE 424	Pavement Engineering	3	CE 421

Course Code	Course Title	Credits	Prerequisite
CE 425	Urban Transportation Planning	3	Corequisite CE 421
CE 426	Public Transportation Systems	3	Corequisite CE 421
CE 427	Traffic Safety	3	Corequisite CE 421
CE 429	Special Topics in Transportation Engineering	3	To be determined by the Instructor

3. Environmental Engineering

Course Code	Course Title	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 Title	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

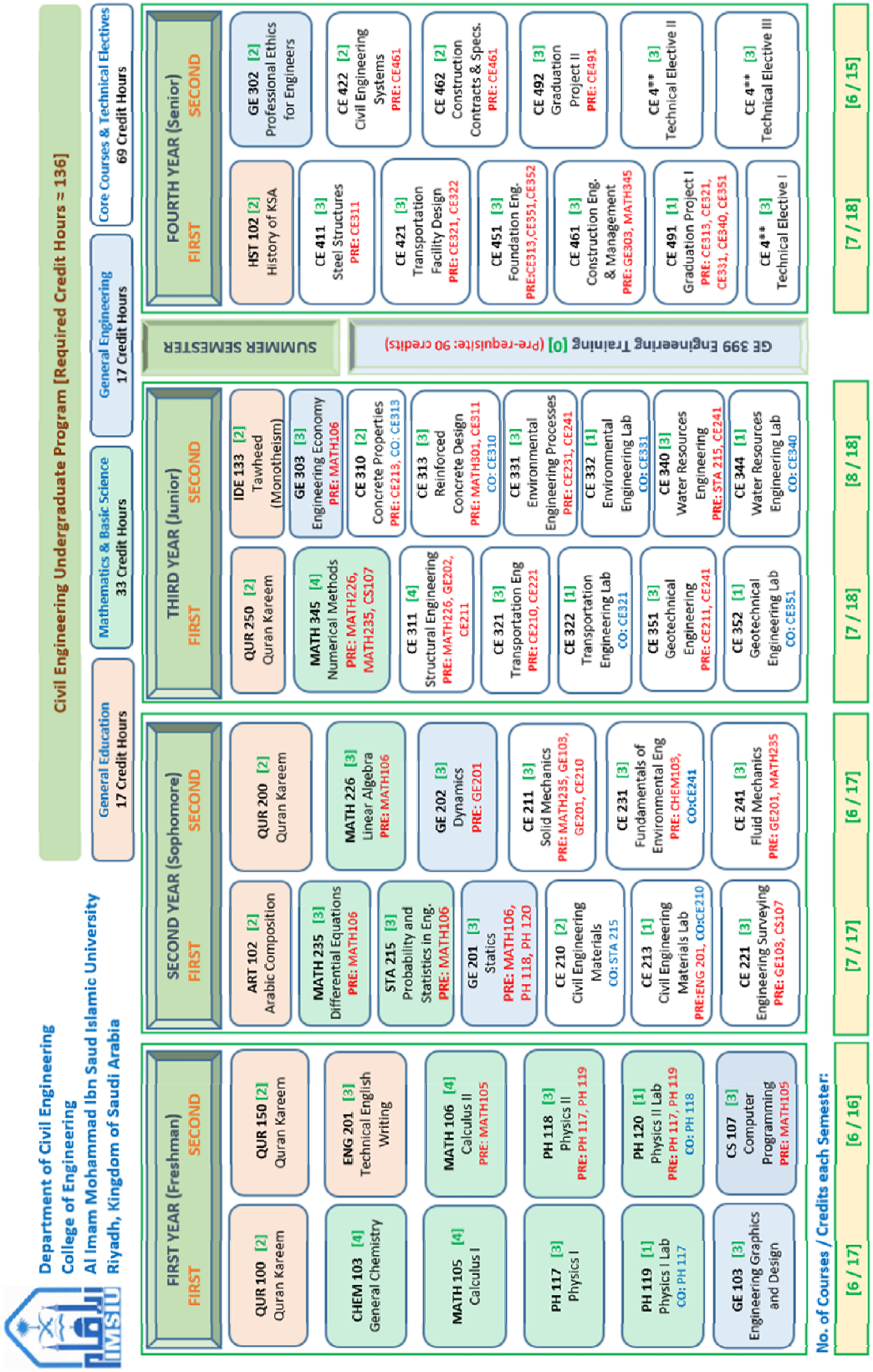
5. Geotechnical Engineering

Course Code	Course Title	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 451
CE 459	Special Topics in Geotechnical Engineering	3	To be determined by the Instructor

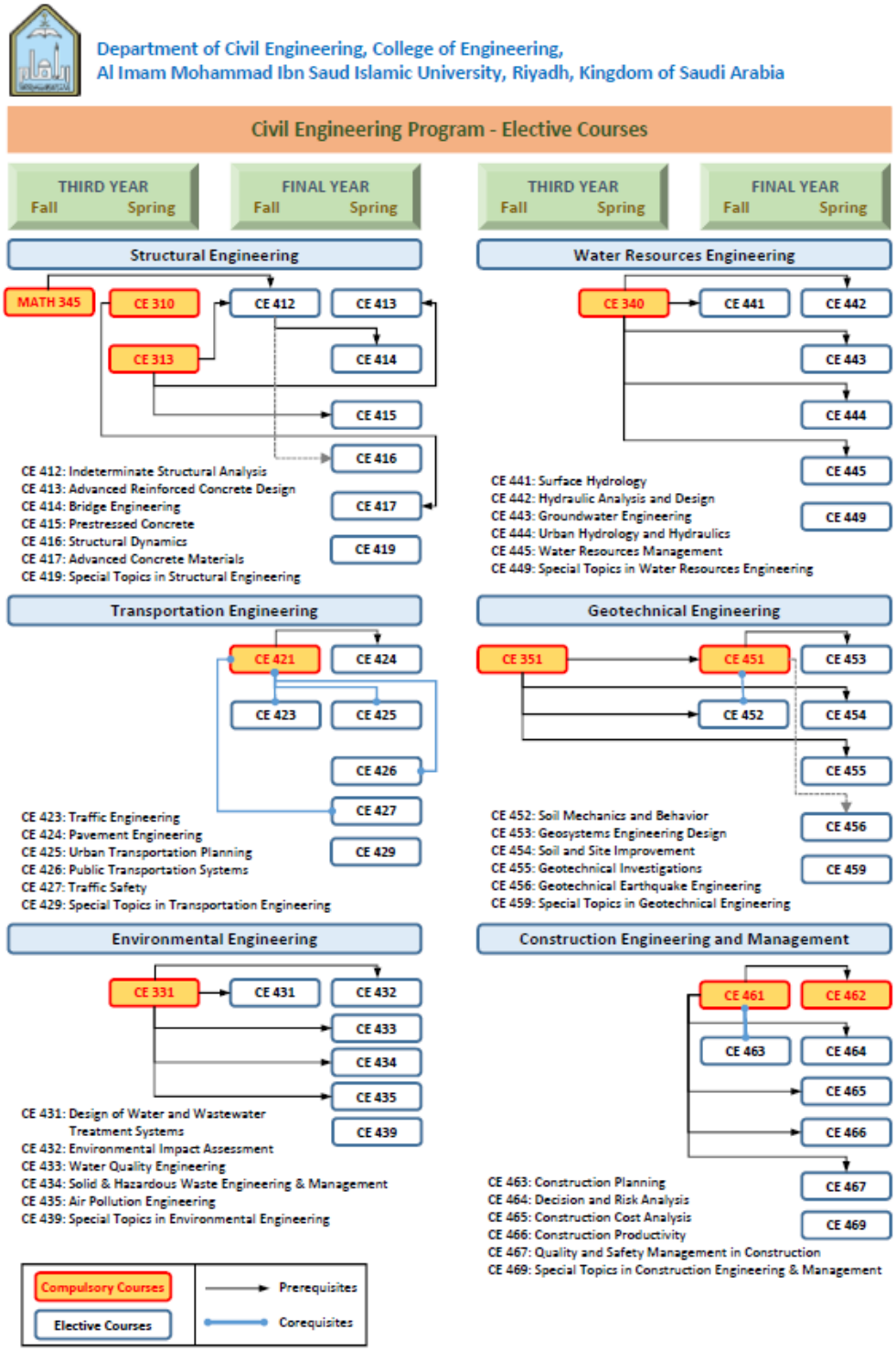
6. Construction Engineering and Management

Course Code	Course Title	Credits	Prerequisite
CE 463	Construction Planning	3	Corequisite 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

Core Courses - Flow Chart



Technical Electives – Flow Chart



First Year (Freshman)

First Semester

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

Second Semester

No.	Course Code	Course Title	Credits	Hours		
				Theory	Lab	Tutorial
1	QUR 150	Quran Kareem	2	2		
2	ENG 201	Technical English Writing	3	3		
3	MATH 106	Calculus II	4	4		1
4	PH 118	Physics II	3	3		
5	PH 120	Physics II Lab	1		2	
6	CS 107	Computer Programming	3	2	2	
Total Semester Hours			**16**	**14**	**4**	**1**
Cumulative Hours			**33**	**28**	**10**	**2**

Second Year (Sophomore)

Third Semester

No.	Course Code	Course Title	Hours			
			Credits	Theory	Lab	Tutorial
1	ART 102	Arabic Composition	2	2		
2	MATH 235	Differential Equations	3	3		1
3	STA 215	Probability and Statistics in Engineering	3	3		1
4	GE 201	Statics	3	3		1
5	CE 210	Civil Engineering Materials	2	2		1
6	CE 213	Civil Engineering Materials Lab	1		2	
7	CE 221	Engineering Surveying	3	2	2	1
Total Semester Hours			**17**	**15**	**4**	**5**
Cumulative Hours			**50**	**43**	**14**	**7**

Fourth Semester

No.	Course Code	Course Title	Hours			
			Credits	Theory	Lab	Tutorial
1	QUR 200	Quran Kareem	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 231	Fundamentals of Environment Eng.	3	3		1
6	CE 241	Fluid Mechanics	3	3		1
Total Semester Hours			**17**	**17**		**5**
Cumulative Hours			**67**	**60**	**14**	**12**

Third Year (Junior)

Fifth Semester

No.	Course Code	Course Title	Credits	Hours		
				Theory	Lab	Tutorial
1	QUR 250	Quran Kareem	2	2		
2	MATH 345	Numerical Methods	4	4		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			**18**	**16**	**4**	**4**
Cumulative Hours			**85**	**76**	**18**	**16**

Sixth Semester

No.	Course Code	Course Title	Credits	Hours		
				Theory	Lab	Tutorial
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 Processes	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 Hours			**103**	**91**	**24**	**20**

Engineering Training

No.	Course Code	Course Title	Hours			
			Credit	Theory	Lab	Tutorial
1	GE 399	Engineering Training	0	0	0	0

Fourth Year (Senior)

Seventh Semester

No.	Course Code	Course Title	Hours			
			Credits	Theory	Lab	Tutorial
1	HST 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 491	Graduation Project I	1		2	
7	CE 4**	Technical Elective I	3	3		1
Total Semester Hours			**18**	**17**	**2**	**5**
Cumulative Hours			**121**	**108**	**26**	**25**

Eighth Semester

No.	Course Code	Course Title	Hours			
			Credits	Theory	Lab	Tutorial
1	GE 302	Professional Ethics for Engineers	2	2		
2	CE 422	Civil Engineering Systems	2	2		1
3	CE 462	Construction Contracts and Specifications	2	2		1
4	CE 492	Graduation Project II	3		6	
5	CE 4**	Technical Elective II	3	3		1
6	CE 4**	Technical Elective III	3	3		1
Total Semester Hours			**15**	**12**	**6**	**4**
Cumulative Hours			**136**	**120**	**32**	**29**

Course Descriptions

1. General Education

ENG 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

2. Mathematics and Basic Science

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.

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

PH 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

PH 119 Physics I Lab 1 Credit Hour

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

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.

PH 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.

PH 120 Physics II Lab 1 Credit Hour

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

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

STA 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

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 345	Numerical Methods	4 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.

3. General Engineering

GE 103	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.

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 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 including force and acceleration, Newton's second law, energy-work principles, impulse-momentum methods. Planar kinematics and planar kinetics of rigid bodies: translation, rotation about a fixed axis, general plane motion. Introduction to three-dimensional dynamics of rigid bodies.

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 learning experience during training in addition to fulfilling any other requirements as determined by the department.

4. Civil Engineering Core Courses

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, aluminium, aggregates, cement, masonry, wood, and composites. The properties range from elastic, plastic, fracture, porosity, thermal and environmental responses.

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 213 Civil Engineering Materials Lab **1 Credit Hour**

The concepts, procedures, tools and equipment used to measure and evaluate engineering properties of civil engineering materials, including reinforcing steel, metals, aggregate, cement, 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 adjustments, 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 231 Fundamental of Environmental Engineering **3 Credit Hours**

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; Environmental chemistry.

CE 241 Fluid Mechanics **3 Credit Hours**

Introduction to fluid mechanics; unit conversion and dimensions, introduction to fluid properties, basics of hydrostatics, hydrostatic pressure forces on plain and curved surfaces, buoyancy and stability. Introduction to fluid kinematics and conservation of mass. Fluid dynamics and energy equation, venture effect and stagnation point. Types of head losses in pipes, application of flow in pipes. Introduction to momentum.

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. Fresh and hardened concrete testing. 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, behaviour, 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. 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.

CE322 Transportation Engineering Laboratory **1 Credit Hour**

Experimental investigation of 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 Processes **3 Credit Hours**

Physical, Chemical and Biological water and wastewater quality parameters Unit Operation and Unit Process in water treatment design: screening, grit removal, sedimentation, coagulation, flocculation, softening, filtration and disinfection Order of reaction (batch, plug, continuous) and substrate kinetics. Design of sewerage system. Brief description of wastewater treatment system.

CE 332 Environmental Engineering Laboratory **1 Credit Hour**

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

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

Quantitative introduction to water resources in the globe and in SA. Hydraulic design of transmission lines: gravity and pumping systems, pipeline economics, pipe networks. Introduction to open channel hydraulics: uniform flow, critical flow, specific energy, gradually varied flow, rapidly varied flow, flow measurements in open channels. Introduction to hydrology: rainfall data analysis, Time of concentration, Runoff analysis and Rational method. Hydraulic analysis of gravity sewer flow.

CE 344 Water Resources Engineering Laboratory **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, Basics of engineering geology, Soil formation, Soil composition, Soil classification, Excavation, grading and compacted fills, Groundwater and permeability, Stress distribution in soils, Effective stress concept, Compressibility and settlement analysis, Oedometer test, Soil strength.

CE 352 Geotechnical Engineering Laboratory **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 and 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 **2 Credit Hours**

Introduction to the formulation and solution of civil engineering problems. Mathematical modelling, 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 construction industry, project participants, legal structure of organizations, and managing construction resources including money, materials, labor force, and construction equipment. The emphasis is on construction processes: planning and scheduling, estimating and cost control, productivity models, 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. Ethical issues in project administration. The methodology, procedures and organizational techniques involved in preparing and evaluating bids and contracts. Types of construction contracts, general and special conditions of contract, standard specifications and contract. Procedures for systematic handling of variations, claims and disputes and their clarification with their legal implications.

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

Select the graduation project from list of topics in one of the area of specialization in civil engineering, define objectives and scope of the work, review relevant literature, initiate the project and submit a draft report.

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

Continuation of CE 491 with comprehensive work on the selected topic, report writing, and oral presentation.

5. Civil Engineering Technical Electives

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, behaviour, and design of two way slab systems using direct design and equivalent frame methods, design of continuous beams and slender columns, design for torsion; behaviour and design of lateral load resisting systems (moment frames and shear walls); design of combined footings, 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 pre-stressed concrete members; estimation of losses in pre-stressed reinforced concrete members and structures; design of posttensioned 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 Traffic Engineering **3 Credit Hours**

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 424 Pavement Engineering **3 Credit Hours**

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 425 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 modelling: trip generation, trip distribution, modal choice, assignment; transport related land-use models.

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**

Principles of engineering, behavioural science, and vision science to preventing traffic collisions and subsequent injury. A systematic approach to traffic safety, human behaviour, vehicle design, and roadway design as interacting approaches to prevent traffic crashes, vehicle and roadway designs approaches to prevent injury after collision.

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 advanced water treatment systems (adsorbers and membrane processes). Wastewater Treatment design: screening, grit removal, primary and secondary clarification, biological process (suspended and attached growth system), disinfection of the effluent, processing of sludge, and water reuse.

CE 432 Environmental Impact Assessment **3 Credit Hours**

Study of environmental impacts of engineering projects on the environmental components of water, air, and soil. Social, economic and cultural impacts. Identification and prediction of various impacts and mitigation measures.

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

Fundamental theories underlying the unit processes utilized in water and wastewaters networks system and treatment processes. Ground water quality control processes.

CE 434 Solid & Hazardous Waste Engineering & 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 modelling, 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.

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 Surface Hydrology **3 Credit Hours**

Hydrological analysis of surface water systems, main elements of the hydrological cycle. Water and mass balance. Precipitation and rainfall data frequency analysis, generation of IDF curves, evaporation and evapotranspiration, infiltration. Introduction to GIS for hydrological applications, hydrological properties of catchments, DEM and catchment delineation. Rainfall-runoff modelling, river and reservoir routing using hydrological methods. Hydrological modelling using software packages. Introduction to urban hydrology. Design of culverts and Irish crossings.

CE 442 Hydraulic Analysis and Design **3 Credit Hours**

Hydraulic analysis and design of engineering systems using spreadsheet and professional software. Applications include: closed conduits; pipe networks; hydraulic structures; water bridges, spillways, stilling basins, and gates, embankment seepage; selection and installation of pumps and turbines.

CE 443 Groundwater Engineering **3 Credit Hours**

Introduction to Sub-surface Water Hydrology and Types of Aquifers. Hydraulics of Porous Media, Introduction to Darcy Law, Flow Net and Mass Balance Equations. The Concept of Safe Yield, Storage. Estimation of Groundwater Recharge. Well Hydraulics and Design of Aquifer Pumping Tests. Introduction to Numerical Modelling of Groundwater Flow: Estimation of Flow Net and Seepage Analysis using Spreadsheet and other Programs. Introduction to Groundwater Contamination and Saltwater Intrusion.

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 drainage 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 Behaviour **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 geo-synthetics 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 micro-zonation, 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**

Introduction: Planning and Scheduling, Project Control, Why Schedule Projects, Scheduling and Project Management. Bar/Gantt Charts and Basic Networks: Introduction, Advantages and Disadvantages of Bar Charts, Arrow and Node Networks, Networks versus Bar Charts, Time-Scaled logic Diagrams Resource Allocation, Categories of Resources, Resource Levelling, Materials Management . Schedule Compression and Time Cost Trade-Off: Setting priorities, Accelerating a Project, Direct and Indirect Costs, Recovery Schedules, Potential Issues with uncoordinated acceleration, Optimum Project Scheduling.

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

Basic notions of set theory and probability: Sample space and events; conditional probability; statistical independence, total probability; Bayes theorem. Random variables: univariate and multivariate distributions, expectation, moments. Probabilistic models for engineering analysis: Bernoulli sequence, binomial distribution, Poisson and related distributions, Normal and related distributions, Extreme-value distributions, Other distributions used in statistics. Introduction to decision theory: Basic notions of utility theory, Decision tree, Terminal analysis, Pre-posterior analysis, Decision problems in estimation.

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 mark-ups and profits; and the fundamentals of cost recording for construction cost accounts and cost. Construction Cost analysis.

CE 466 Construction Productivity **3 Credit Hours**

Introduction to the application of scientific principles to the measurement and forecasting of productivity in construction engineering. Conceptual and mathematical formulation of labour, equipment, and material factors affecting productivity, Motivation and construction productivity, Productivity Improvement programs. Learning curves, Fatigue, Overtime, The physical environment, Quality circles, Safety considerations. A System view of construction Productivity, Techniques for measuring productivity: Cost methods.

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

Introduction to quality management, 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. Accidents Causation Theories, Ethics in Safety and OSHA compliance. Construction Equipment and Safety, Accident Investigation, Reporting and Record Keeping, Emergency Response plan, Total Safety Management. Preventing violence in workplace, stress and behaviour based safety, Promoting safety.

CE 469 Special Topics in Construction Engineering and Management **3 Credit Hours**

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

Electrical Engineering Program

Electrical Engineering Program

Introduction

Electrical engineering department offers concentrations in two areas: Communications and Instrumentation. The program is designed to educate engineers for technical as well as management positions in industry and to prepare students for finding engineering solutions to urgent problems by reshaping the environment to meet human needs, while being responsibly aware of all implications. The curriculum provides a sound theoretical background along with current, practical engineering knowledge. 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.

Vision

The Department of Electrical Engineering is committed to providing an excellent education for Electrical Engineering students while contributing to the national economy through innovative research, technology development and transfer to industry.

Mission

The mission of the Department of Electrical Engineering (EE) is to provide high quality education for students through a program that offers challenging hands-on laboratory and design components in conjunction with a thorough foundation in theory, to equip students with the skills to be life-long contributors to their profession and society and to build a strong outreach program that engages with industry, the challenges of innovative research and development in Electrical Engineering.

Program Educational Objectives

The program educational objectives for the electrical engineering program describe accomplishments that graduates are expected to attain after graduation:

PEO1. Serve competently the needs of industry and academia by demonstrating high-quality knowledge, research, and skills in the area of Electrical Engineering

PEO2. Pursue professional development through professional study and self-learning with full gratitude of the importance of professional and ethical responsibility

PEO3. Contribute to the welfare of society through the responsible practice of engineering, leadership, and teamwork.

Student Outcomes

Student outcomes describe what students are expected to know and be able to do by the time of graduation. These relate to the skills, knowledge, and behaviors that students acquire as they progress through the program. The following are the student outcomes of the Electrical Engineering program:

1. Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. Communicate effectively with a range of audiences
4. Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. Acquire and apply new knowledge as needed, using appropriate learning strategies

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 sequence in which it will be offered. The symbol EE stands for Electrical Engineering and each number is made up of 3 digits.

Symbol	Description
GE	General Engineering (Engineering Fundamentals)
EE	Electrical Engineering (Engineering Depths)

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

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

The following table shows **second digit** denotes the course field/specialization:

Second Digit	Field/Specialization
0	General Engineering
2	ElectricCircuits and Electronics
3	and Digital systemsSignals
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 the course in a certain field/specialization in a given year. **The number 9** as the third digit is reserved for Engineering Training.

Example: EE 471 means

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

Undergraduate Curriculum of Electrical Engineering Program

The total credit hours required for the Bachelor's degree of Electrical Engineering is **136 credit hours** excluding the preparatory year. These credit hours are divided into four different categories. The categories are listed as follows:

General Education	**17** Credit Hours	Islamic, Humanities and Social Science Courses
Mathematics and Science	**33** Credit Hours	Mathematics, Physics, Chemistry, Technical English Writing
General Engineering	**17** Credit Hours	Fundamental Engineering Courses
Core Courses and Technical Electives	**69** Credit Hours	Electrical Engineering Department requirements (Core Courses and Technical Electives)

5. General Education

Seventeen hours of credits must be taken as *General Education*. These courses will be taken from the list assigned by the University according to the specified rules and regulations.

Course Code	Course Title	Credits
QUR 100	Quran Kareem	2
QUR 150	Quran Kareem	2
QUR 200	Quran Kareem	2
ENGL 201	Technical English Writing	3
QUR 250	Quran Kareem	2
IDE 133	Tawheed	2
LIT 102	Arabic Language Skills	2
HIST 102	History of Saudi Arabia	2
	Total Credit Hours:	**17**

6. Mathematics and Science

The following courses in *Mathematics and Sciences* are required in the undergraduate curriculum of Electrical Engineering program.

Course Code	Course Title	Credits	Prerequisite	Corequisite
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	
MATH 345	Numerical Methods	4	CS 107 MATH 226 MATH 235	
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		PHYS 117
PHYS 118	Physics II	3	PHYS 117 PHYS 119	
PHYS 120	Physics II Lab	1	PHYS 117 PHYS 119	PHYS 118
Total Credit Hours:		**33**		

7. General Engineering

The following courses are required as *General Engineering* courses in the undergraduate curriculum of Electrical Engineering program.

Course Code	Course Title	Credits	Prerequisite	Corequisite
GE 103	Engineering Graphics and Design	3	None	
CS 107	Computer Programming	3	MATH 105	
GE 204	Thermodynamics	3	MATH 106, CHEM 103	
GE 302	Professional Ethics for Engineers	2	None	
GE 303	Engineering Economy	3	MATH 106	
GE 399	Engineering Training	0	Completion of 90 Credits	
GE 401	Project Management	3	MATH 345	
Total Credit Hours:		**17**		

8. Core Courses and Technical Electives

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:

A. Electrical Engineering Core Courses

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

Course Code	Course Name	Credit Hours	Prerequisite Corequisite
EE 221	Fundamentals of Electric Circuits	3	Math 105, Phys 118, Phys 120, GE 103
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, ENGL 201
EE 231	Digital Logic Circuits	3	Math 105
EE 232	Signals and Systems	3	EE 221
EE 233	Digital Logic Circuits Lab	1	EE231
EE 271	Electromagnetics	3	Math 106, Phys 118, Phys120
EE 321	Electronic Devices & Applications	3	EE 223
EE 323	Fundamentals of Electronic Devices lab	1	EE226, EE223
EE 324	Electronic Devices & Applications Lab	1	EE321, EE323
EE 331	Digital Systems	3	CS 107, EE 231
EE 332	Digital Systems Lab	1	EE331, EE233
EE 341	Sensors and Transducers	3	EE 222
EE 351	Introduction to Communication Engineering	3	EE 232, Math 235, STAT 215, EE 271
EE 361	Introduction to Control Systems	3	EE 232, EE341, GE204
EE 371	Electric Drives	3	EE 222, EE 271

Course Code	Course Name	Credit Hours	Prerequisite Corequisite
EE 431	Digital Signal Processing	3	EE 351, MATH 345, MATH 226
EE 451	Digital Communication	3	EE 351
EE 452	Communications Lab I	1	EE351, EE451
EE 453	Telecommunication Networks	3	EE 351
EE 454	Communications Lab II	1	EE541, EE452
EE 461	Introduction to Instrumentation & Control Lab	1	EE361
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**	

B. Electrical Engineering Technical Elective Courses

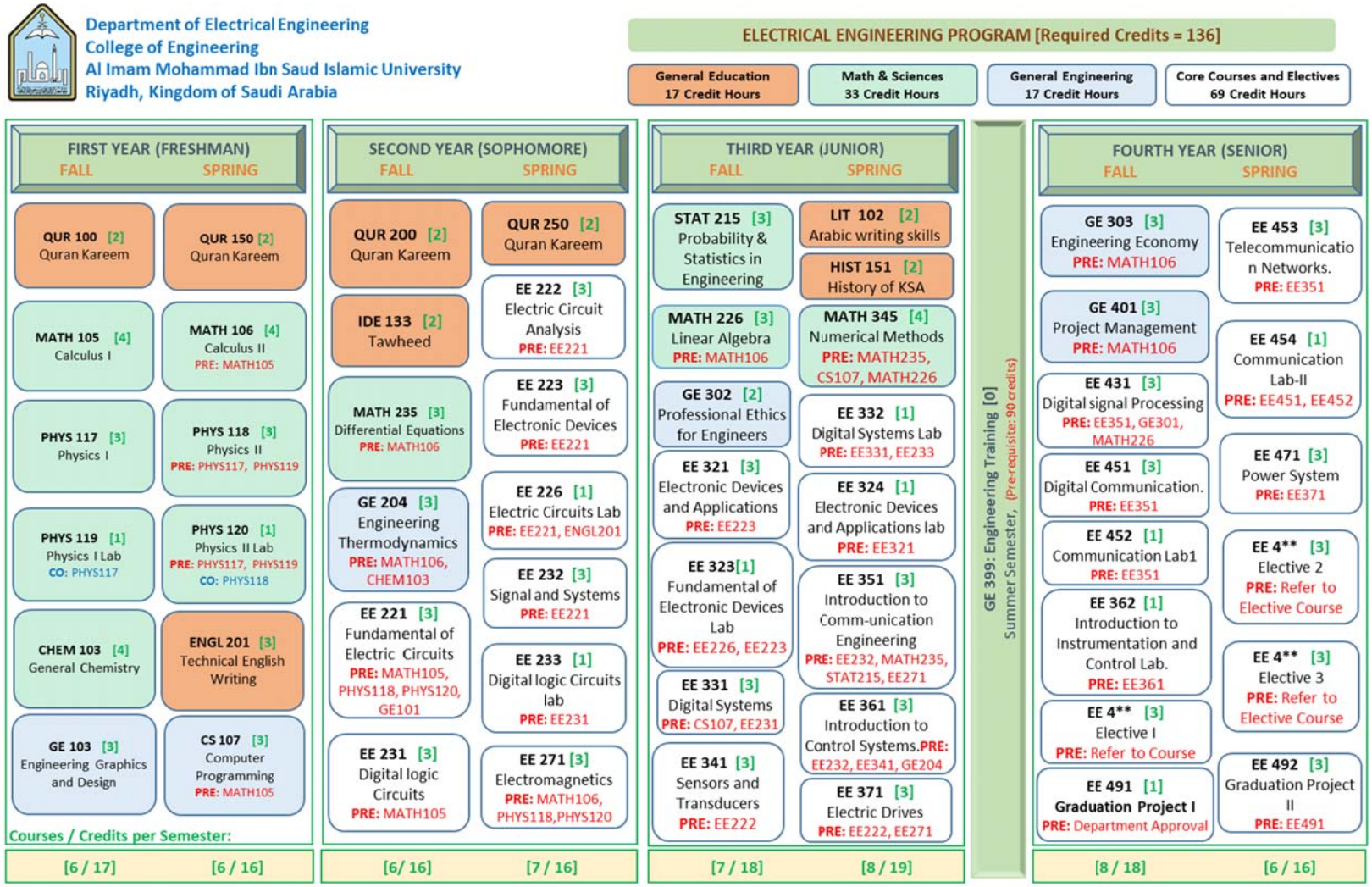
Electrical Engineering department has two areas of specialization. A student will take at least three courses from one of the following two options:

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, EE352
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 341, 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 determine by the Instructor

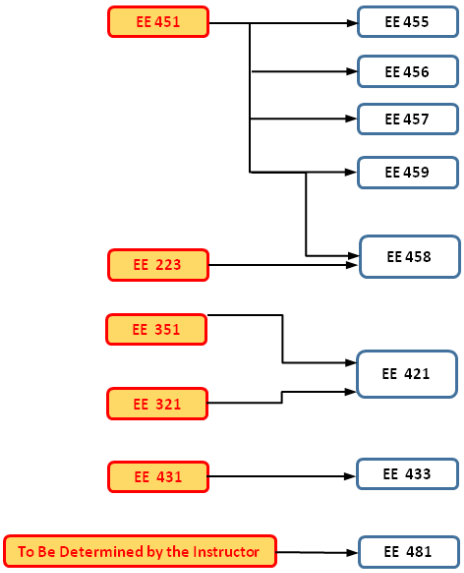


Electrical Engineering.

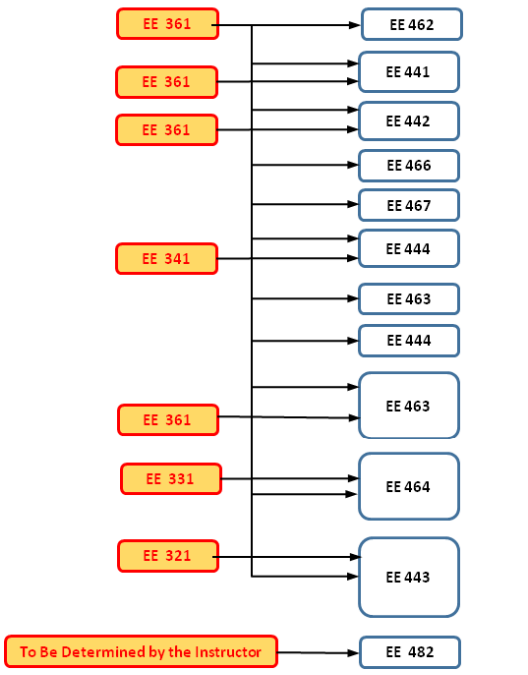
Department of Electrical Engineering, College of Engineering,
Al Imam Mohammad Ibn Saud Islamic University, Riyadh, Kingdom of Saudi Arabia

Electrical Engineering Program - Elective Courses

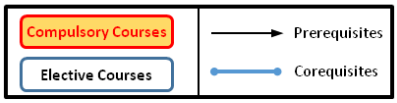
Electrical Engineering



EE 455: Mobile Wireless Communications
EE 456: Information and Theory Coding
EE 457: Mobile and Wireless Networks
EE 433: Digital Image Processing
EE 421: Communication Electronics
EE 458: Fibre Optic Communications
EE 459: Satellite Communication
EE 481: Special Topics in Communication
EE 451: Digital Communication
EE 223: Fundamental of Electronic Devices
EE 321: Electronic Devices and Applications.
EE 351: Introduction to Communication Engineering
EE 431: Digital Signal Processing



EE 462: Applied Control Engineering
EE 441: Advanced Sensors and Actuators
EE 442: Advanced Instrumentation
EE 466: Control Systems Design
EE 467: Intelligent Controllers
EE 444: Applied Instrumentation
EE 463: Digital Control System
EE 464: Programmable Logic Controllers
EE 443: Industrial Electronics
EE 482: Special Topics in Instrumentation and Control
EE 361: Introduction to Control Systems.
EE 341: Sensors and Transducers
EE 331: Digital Systems
EE 321: Electronic Devices and Applications



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 103	Engineering Graphics and Design	3	2	2	
Semester Total Credit Hours			**17**	**13**	**6**	**1**
Cumulated Total Credit 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		
Semester Total Credit Hours			**16**	**13**	**4**	**1**
Cumulated Total Credit Hours			**33**	**26**	**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	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
Semester Total Credit Hours			**16**	**16**		**4**
Cumulated Total Credit Hours			**49**	**42**	**10**	**6**

Fourth Level

No.	Course Code	Course Name	Hours Credit	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
Semester Total Credit Hours			**16**	**14**	**4**	**4**
Cumulated Total Credit Hours			**65**	**56**	**14**	**10**

Third Year (Junior)

Fifth Level

No.	Course Code	Course Name	Hours Credit	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
Semester Total Credit Hours			**18**	**17**	**2**	**4**
Cumulated Total Credit Hours			**83**	**73**	**16**	**14**

Sixth Level

No.	Course Code	Course Name	Hours Credit	Theory	Lab	Tut
1	LIT 102	Arabic Writing Skills	2	2		
2	HIST 102	History of Saudi Arabia	2	2		
3	MATH 345	Numerical Methods	4	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
9	GE 399	Summer Training	0	0	0	0
Semester Total Credit Hours			**19**	**17**	**2**	**4**

Cumulated Total Credit Hours	**84**	**73**	**16**	**14**

Fourth Year (Senior)

Seventh Level

No.	Course Code	Course Name	Hours Credit	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	
Semester Total Credit Hours			**18**	**15**	**6**	**3**
Cumulated Total Credit Hours			**120**	**104**	**26**	**21**

Eighth Level

No.	Course Code	Course Name	Hours Credit	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	
Semester Total Credit Hours			**16**	**12**	**8**	**1**
Cumulated Total Credit Hours			**136**	**116**	**34**	**22**

Course Description

6. General Education

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

7. Mathematics and Science

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.

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

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

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

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.

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

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

MATH 345 Numerical Methods 4 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.

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

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.

8. **General Engineering**

GE 103	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 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.

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 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 co-workers. 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 learning experience during training in addition to fulfilling any other requirements as determined 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

9. Core Courses and Technical Electives

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, AC Power Analysis.

EE 222 Electrical Circuits Analysis 3 Credit Hours

Polyphase circuits, Complex frequency, Frequency response, magnetically coupled circuits, General two-port networks, Solving circuit problems using Laplace transform, Tuned circuits, Transient analysis of Second-Order 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

In this lab course the student will get hands-on experience to design, construct and analyze different Electrical circuits. Student will learn Ohm's law, Kirchoff current & voltage laws, Resistors in Series & Parallel, Star to Delta circuit analysis, Thevenins & Nortons, theorem Superposition theorem & Maximum power transfer theorem verification RC circuit transient analysis & AC sinusoidal analysis. During this course the student will learn hand on experience on simulation software "Pspice", Bread board, oscilloscope & Functional generators.

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 discrete Fourier 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	Electronic 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

Introduction to Basic Electronics, Electronic Devices, Semiconductor Diodes, VI-characteristics of PN-junction diode, Wave shaping Circuits using Diode, Half wave and Full wave rectifiers with and without Filter circuits, Clipping Circuits, Clamping Circuits , Zener Diode Characteristics, Input &output Characteristics of Bipolar Junction Transistors(BJT), and Special types of semiconductor devices.

EE 324 Electronics Devices and Applications Lab 1 Credit Hour

Bipolar Junction Transistor (BJT) and Operational Amplifier characteristics, Frequency Response of Single and Double stage BJT amplifier, Different Configurations of op-amps, Applications of Op-amps such as inverting & non-inverting Comparators, Characteristics and Frequency response of inverting & non-inverting amplifiers, integrators , differentiators, Active Low Pass Filters and their Frequency Responses, Active High Pass Filters and their Frequency Responses, Schmitt Triggers, Oscillators.

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.

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 sensor: physical variable Measurement; Transducer classification and type, general input-output configuration, Static and Dynamic characteristics of Sensors, Variable resistance transducers: Potentiometers, Thermistors, RTDs, metal and semiconductor strain gauges and their signal conditioning circuits, Bridge Measurements, strain gauge applications, Accelerometer, Mercury Thermometer, Inductive Transducers; Linear Variable Differential Transducers; Capacitive Transducers, Thermoelectric Transducers; Thermocouples, Piezoelectric Transducers.

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, and PWM.

EE 361 Introduction to Control Systems 3 Credit Hours

Review of complex-variable concept, Laplace transform, Transfer function, Polar plots, Bode Plots, Block Diagrams, Signal-flow graphs, State-variable analysis of linear dynamic systems, stability of linear control systems, Steady State Error, 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.

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.

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

In this lab course the student will get hands-on experience to design, construct and analyze different Communication circuits. Student will learn, Analog Communications, AM, DSB, SSB and FM modulators and demodulators. Digital Communications, PAM. During this course the student will learn hand on experience on simulation software, Power Meter, Oscilloscope, frequency Counter, Functional Generators & Spectrum Analyzer.

EE 453 Telecommunication Networks 3 Credit Hours

ISO/OSI & Internet protocol stack TCP/IP and the relevant protocols used in computer networks. Concept of application layer protocols, HTTP, SMTP, POP3, FTP, DNS. Transport layer protocols, TCP and UDP. Network layer Internet Protocol (IP), subnet, IP fragmentation and packet routing protocols RIP, OSPF. link layer protocols error detection, correction EDC, CRC, ALOHA, CSMA/CD, ARP, Ethernet. Physical Layer include Data and Signals.

EE 454 Communications Lab II 1 Credit Hour

Digital representation of analog signal; line encoding and decoding, ASK, FSK and PSK Generation and Detection. Waveform coding techniques- PCM; Fiber optic communication system measurements, laser Diodes and Measurements of Optical power.

EE 461 Introduction to Instrumentation and Control Lab 1 Credit Hour

This lab provides an introduction to LabVIEW, tutorials and programing aspect from control systems view point. Student will learn Block Diagram Reduction, performance characteristics of first and second order systems, effect of feedback, building a VI and modifying signals 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. Underground cables design and safety, Series impedance of transmission lines, Capacitance of transmission lines, Current and voltage relations of transmission lines, Capacitance and resistance of underground cables, Insulation of transmission lines and underground cables.

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.

10. Technical Elective Courses

EE 421 Communication Electronics **3 Credit Hours**

Passive Circuits and attenuators, Large-signal analysis, RF power amplifiers, Tuned amplifiers, RF oscillators and Mixers; Design of S/H circuits, Transmitter Circuits, Receiver 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**

Fundamental Concepts, Measurement and Error, Analog Sensors and Transducers, Digital Transducers, Smart Sensors, Sensing Electronic Circuits, Mechanical Actuation, Rotational Actuators, Variable Speed Drives, Linear Actuators and Integrated Micro Sensors.

EE 442 Advanced Instrumentation **3 Credit Hours**

Variable conversion elements, Measurement signal transmission, Intelligent Drives, Micro-machined sensors, Fiber optical sensors, Gas chromatography, Gas detectors, Environment monitoring systems, and soft-sensing techniques, Ultrasonic transducers intelligent temperature measuring instruments, Intelligent pressure transducers and Flow measurements.

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 transducers, 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, Trunked radio system, 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, and FSK).

E 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 and EE 361 which include: Discrete time systems - Sampling process, Z-transform techniques; Difference equations and state space representation, Simulation of discrete systems; Solution via Z-transform; Stability, Steady State Error, controllability of discrete systems, Root locus design for discrete systems.

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, pole placement, and robust control.

EE 467 Intelligent Controllers **3 Credit Hours**

Foundations of fuzzy set theory, system modeling using fuzzy rules, structure of fuzzy controllers and PID fuzzy controller design. Also included are neural network foundations, single layered/multi-layered perceptions, learning rules, basics of adaptive controls and adaptive neural control.

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.

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 study in mechanical and materials engineering. The undergraduate mechanical engineering program recognizes that students have a variety of career paths to choose from within the wide variety of industrial environments available to mechanical engineers. For this reason, 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

Mechanical Engineering Department is to be nationally and internationally recognized as a leader in both research and education in mechanical engineering

Mission

To produce high quality mechanical engineers who can undertake challenging assignments, excel in higher education and research, and provide effective solutions of real life engineering problems by considering ethical, social, and environmental standards

Program Educational Objectives

In accordance with University and College of Engineering missions, graduates of Mechanical Engineering Department are expected to:

- Embark on a career as mechanical engineers in industry or enterprise, and serve with continued excellence to reach leadership positions.
- Pursue advanced education, research and development, and other creative and innovative efforts in science, engineering, and other professional careers.
- Exercise self-learning and strive for continuous personal and professional improvement
- Conform to ethical and social responsibilities while serving the community at large.

Program Outcomes

We expect our graduates to have:

(1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

(2) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

(3) An ability to communicate effectively with a range of audiences

(4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

(5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

(6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

(7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Job Opportunities in the Labor Market

Fields of work of Mechanical Engineer:

1. Work in the field of design and supervision of the mechanical services of the facilities including air conditioning, heating, cooling systems, drainage, firefighting, security and industrial safety.

2. Maintenance and operation of machines, whether in the civil or military sector.

3. Participation in the operation and maintenance of power plants.

4. Operating and monitoring production lines in the industrial field.

5. Design machines and production lines and supervise their installation.

6. Exploitation of renewable energy for heating, cooling and desalination and for other industrial and household uses.

7. Procurement and marketing materials and equipment for engineering projects and final consumer through engineering trading companies.

8. Control and develop the quality of industrial products.

9. Implementation of engineering research and university education related to mechanics and manufacturing.

10. Design, operation and maintenance of heat exchangers, pumps and turbines.

11. Design and maintenance of engines and heavy equipment and supervise the operation and maintenance.

12. Engineering management of government, industrial and commercial establishments.

Academic Programs

The Department of Mechanical Engineering at Al Imam Mohammad Ibn Saud Islamic University allows students to obtain a Bachelor's degree of Mechanical Engineering by completing the study plan agreed upon by the department. After graduation they are qualified to enter the labor market and employ all the skills and abilities they have acquired during their years of study in various professional fields

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.

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 Number	Specialization
0	General Engineering
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's degree of Mechanical Engineering requires **136 credits** and is organized as follows:

General Education	**17** Credit Hours
Mathematics and Science	**33** Credit Hours
General Engineering	**20** Credit Hours
Core Courses and Technical Electives	**66** Credit Hours
Total Credit Hours:	**136**

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 Core Courses

The following 57 credit hours must be taken by all students in the Mechanical Engineering Program:

Course Code	Course Name	Credits	Prerequisite	Co-requisite
CS 107	Computer Programming	3	MATH 105	
ME 211	Materials Science and Engineering	3	CHEM 103 MATH 105	
ME 213	Mechanics of Materials Lab	1	ME 216	
ME 216	Mechanics of Materials	3	GE 103 GE 201 ME 211	ME 213
ME 221	Thermodynamics - I	3	CHEM 103 MATH 106	
ME 222	Fluid Mechanics	3	ME 221 GE 201 MATH 235	
ME 322	Thermo-fluids Lab	1	ME 222	
ME 323	Thermodynamics - II	3	ME 221	
ME 324	Heat Transfer	3	ME 222	ME 325
ME 325	Heat Transfer Lab	1	ME 324	
ME 331	Mechanics of Machines	3	MATH 226 GE 202	
ME 333	Mechanical Vibrations	3	GE 202	
ME 334	Automatic Control	3	ME 333	
ME 361	Industrial Safety	1	None	
ME 363	Manufacturing Technology	3	GE 103 ME 211	ME 364
ME 364	Manufacturing Technology Lab	1	ME 363	
ME 365	Machine Design - I	3	ME 216	
ME 436	System Dynamics and Modeling	3	ME 333 ME334	
ME 441	Internal Combustion Engines	3	ME 323	
ME 465	Machine Design - II	3	ME 331 ME 365	
ME 451	HVAC Systems	3	ME 324	
ME 491	Graduation Project - I	1	Completion of 100 Cr. H. + Department Approval	
ME 492	Graduation Project - II	3	ME 491	

Total	57		

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	Credits	Prerequisite
ME 411	Mechanical Behavior of Materials	3	ME 216
ME 412	Nanomaterials	3	ME 216 ME 363
ME 413	Corrosion Engineering	3	ME 211
ME 414	Processing of Polymer Materials	3	ME 216 ME 363
ME 415	Tribology	3	ME 324 ME 365
ME 419	Special Topics	3	ME 216 ME 363

2. Control Theory and System Dynamics

Course Code	Course Name	Credits	Prerequisite
ME 433	Mechatronics	3	CS 107 GE 202 GE 205
ME 434	Introduction to Robotics	3	ME 334 ME 436
ME 435	Automotive Control	3	ME 334
ME 439	Special Topics	3	ME 334

3. Thermal Sciences, Power Generation and Energy Conversion

Course Code	Course Name	Credits	Prerequisite
ME 421	Design and Analysis of Thermal Systems	3	ME 323
ME 442	Power and Desalination Plants	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 324
ME 446	Gas Dynamics	3	ME 222, ME 323

ME 449	Special Topics	3	ME 323, ME 324

4. Manufacturing Engineering and Safety

Course Code	Course Name	Credits	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 216 ME 365
ME 464	Risk Assessment and Safety Management	3	ME 361 GE 303
ME 469	Special Topics	3	ME 361 ME 363

5. Computational Methods in Mechanical Engineering

Course Code	Course Name	Credits	Prerequisite
ME 471	Introduction to Finite Element Methods	3	MATH 226 MATH 345
ME 472	Engineering Optimization	3	MATH 345
ME 473	Computational Fluid Dynamics	3	MATH 345 ME 324
ME 479	Special Topics	3	MATH 345

Mechanical Engineering Undergraduate Curriculum

First Year (Freshman)

Level - 1

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 103	Engineering Graphics and Design	3	2	2	
Total Semester Hours			**17**	**14**	**6**	**1**

Level - 2

No.	Course Code	Course Name	Hours			
			Credit	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 Hours			**35**	**30**	**10**	**2**

Second Year (Sophomore)

Level - 3

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 Hours			**52**	**47**	**10**	**7**

Level - 4

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 205	Fundamentals of Electrical Engineering	3	3		1
5	ME 216	Mechanics of Materials	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 Hours			**70**	**64**	**12**	**12**

Third Year (Junior)

Level - 5

No.	Course Code	Course Name	Hours			
			Credit	Theory	Lab	Tut
1	IDE 133	Tawheed	2	2		
2	MATH 345	Numerical Methods	4	4		1
3	ME 322	Thermo-fluids Lab	1		2	
4	ME 324	Heat Transfer	3	3		1
5	ME 331	Mechanics of Machines	3	3		1
6	ME 333	Mechanical Vibrations	3	3		1
7	ME 361	Industrial Safety	1	1		
Total Semester Hours			**17**	**16**	**2**	**4**
Cumulative Hours			**87**	**80**	**14**	**16**

Level - 6

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 325	Heat Transfer Lab	1		2	
4	ME 334	Automatic Control	3	2	2	1
5	ME 363	Manufacturing Technology	3	3		1
6	ME 364	Manufacturing Technology Lab	1		2	
7	ME 365	Machine Design - I	3	3		1
Total Semester Hours			**17**	**14**	**6**	**5**
Cumulative Hours			**104**	**94**	**20**	**21**

Summer after Level-6

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 Hours			**104**	**94**	**20**	**21**

Fourth Year (Senior)

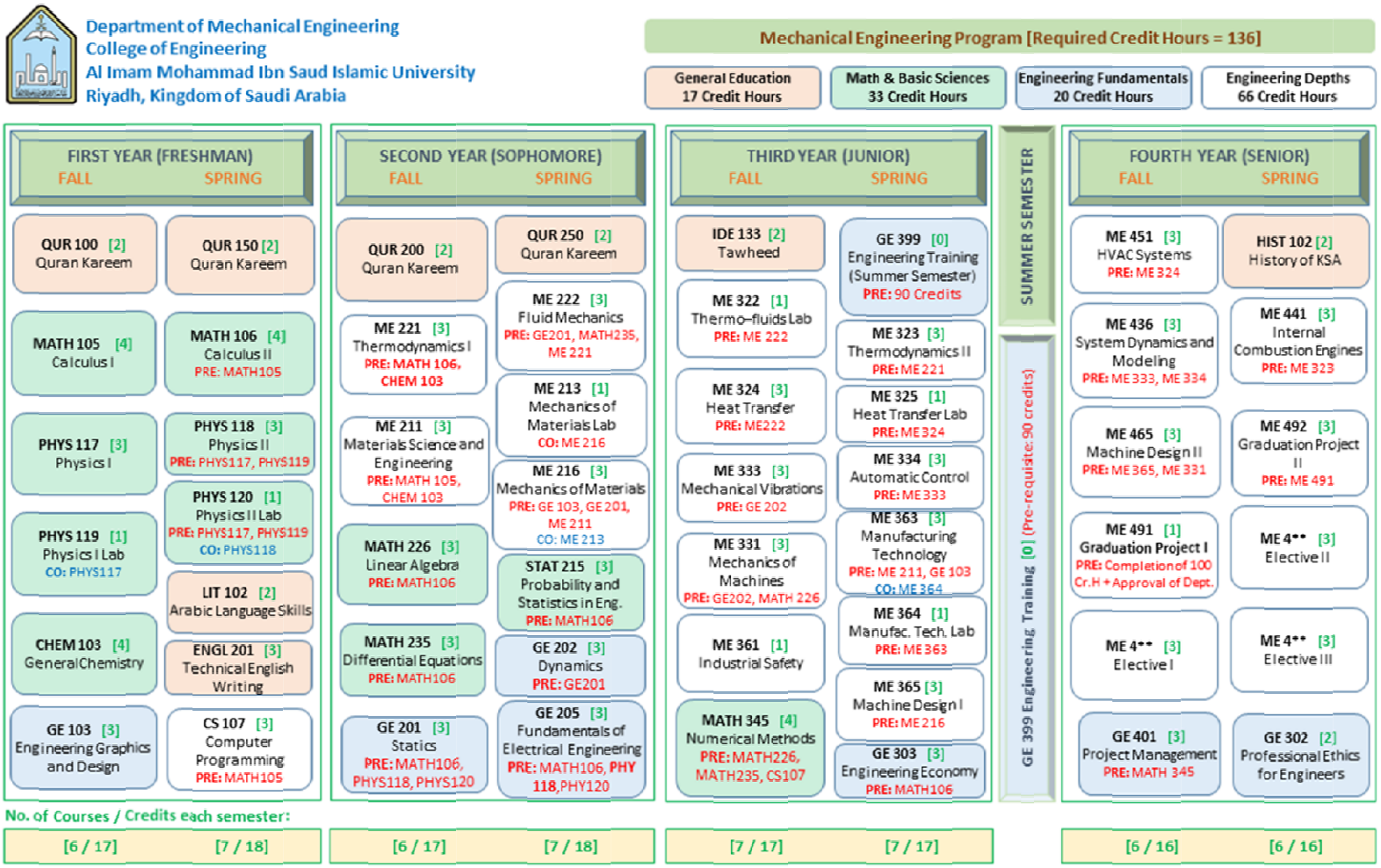
Level - 7

No.	Course Code	Course Name	Hours			
			Credit	Theory	Lab	Tut
1	GE 401	Project Management	3	3		
2	ME 436	System Dynamics and Modeling	3	3		1
4	ME 451	HVAC Systems	3	2	2	1
3	ME 465	Machine Design - II	3	3		1
5	ME 4**	Elective - I	3	3		
6	ME 491	Graduation Project - I	1		2	
Total Semester Hours			**16**	**14**	**8**	**3**
Cumulative Hours			**120**	**108**	**24**	**24**

Level - 8

No.	Course Code	Course Name	Hours			
			Credit	Theory	Lab	Tut
1	HIST 102	History of Saudi Arabia	2	2		
2	GE 302	Professional Ethics in Engineering	2	2		
3	ME 441	Internal Combustion Engines	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 Hours			**136**	**120**	**32**	**25**

Mechanical Engineering

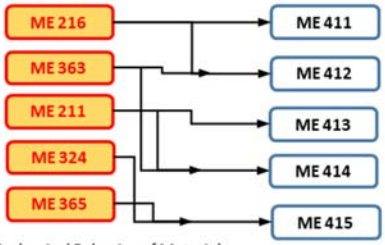


Department of Civil Engineering, College of Engineering,
Al Imam Mohammad Ibn Saud Islamic University, Riyadh, Kingdom of Saudi Arabia

Mechanical Engineering Program - Elective Courses

THIRD YEAR Fall Spring | FINAL YEAR Fall Spring

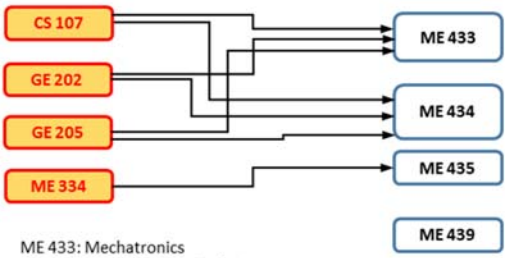
Material Engineering and Processing



ME 411: Mechanical Behavior of Materials
ME 412: Nano Materials
ME 413: Corrosion Engineering
ME 414: Processing of Polymer materials
ME 415: Tribology
ME 419: Special Topics

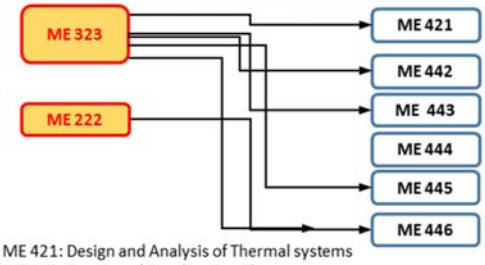
THIRD YEAR Fall Spring | FINAL YEAR Fall Spring

Control Theory and System Dynamics



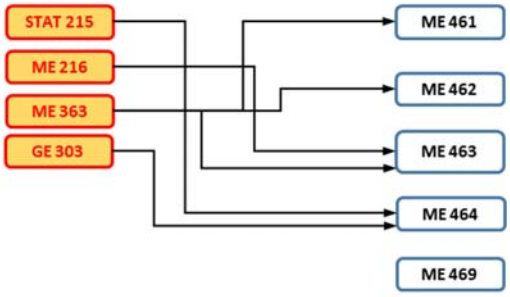
ME 433: Mechatronics
ME 434: Introduction to Robotics
ME 435: Automotive control
ME 449: Special Topics

Thermal Sciences, Power Generation and Energy Conversion



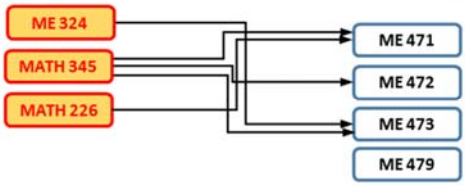
ME 421: Design and Analysis of Thermal systems
ME 442: Power and Desalination Plants
ME 443: Turbomachinery
ME 444: Gas Turbine Engines
ME 445: Introduction to Nuclear Energy
ME 446: Gas Dynamics

Manufacturing Engineering and Safety

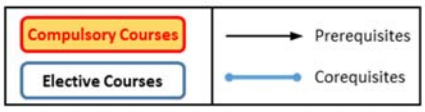


ME 461: Computer Aided Design and Computer Aided Manufacturing
ME 462: Advanced Manufacturing Technology
ME 463: Metal Forming
ME 464 Risk Assessment and Safety Management
ME 469: Special Topics

Computational Methods in Mechanical Engineering



ME 471: Introduction to Finite Element Methods
ME 472: Engineering Optimization
ME 473: Computational Fluid Dynamics (CFD)
ME 479: Special Topics



Course Description

1. General Education

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.		

2. Mathematics and Science

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.		
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.		
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**
This lab course will contain experiments based on theory covered in PHYS 117.		
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.		
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**
This lab course will contain experiments based on theory covered in PHYS 118.		
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.		
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 345	Numerical Methods	4 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.		

3. **General Engineering**

GE 103	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 202	**Dynamics**	**3 Credit Hours**
Kinematics and kinetics of particles including force and acceleration, Newton's second law, energy-work principles, impulse-momentum methods. Planar kinematics and planar kinetics of rigid bodies: translation, rotation about a fixed axis, general plane motion. Introduction to three-dimensional dynamics of rigid bodies.		
GE 205	**Fundamentals 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 on a design and construction project.		
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 co-workers. 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 learning experience during training in addition to fulfilling any other requirements as determined 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.		

4. Mechanical Engineering Core Courses

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

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.		

ME 211	Materials Science and Engineering	3 Credit Hours
Introduction to Materials Science, Atomic Structure and Interatomic Bonding, Structures of Metals and Ceramics, Polymer Structures, Polymers properties & processing, Mechanical Properties and Testing, Solidification of Metals and Alloys, Imperfections in Metals and Alloys, Phase Diagrams, Materials Strengthening Mechanisms, Classification of Metal Alloys, Basics of Corrosion and corrosion prevention.		
ME 213	**Mechanics of Materials Lab**	**1 Credit Hour**
Material testing in tension, compression, impact etc., comparison of springs' extension through Hooke's Law, measurements of deflection through strain gage three-point bending. Hardness, torsion, creep and fatigue tests.		
ME 216	**Mechanics of Materials**	**3 Credit Hours**
Normal and shear stress, normal and shear strain, stress-strain relations for ductile and brittle materials, yield and ultimate stress, elasticity and plasticity, Hooke's law, Poisson's ratio. Axial loading, stress on inclined planes. Torque and torsion, deformation of circular bars under torsion, polar moment of inertia. Pure shear and pure bending, Euler's beam theory, curvature and bending moment, second moment of inertia, normal and shear stress in beams of various cross-sections. Plain stress and strain, Principal and maximum shear stress and strain, Mohr's circle, general 3-dstress-strain relationship in elasticity, buckling of columns.		
ME 221	**Thermodynamics I**	**3 Credit Hour**
Thermodynamic properties, system, process, cycle and equilibrium. Control mass and control volume analysis. Properties and behavior of pure substances. First law of Thermodynamics. Steady state and transient processes and their application to thermodynamic systems and devices. Entropy and the Second law of thermodynamics. Ideal gas equation of state and compressibility factor. Simple steam power and vapor compression refrigeration cycles.		
ME 222	**Fluid Mechanics**	**3 Credit Hours**
Fluid statics, conservation of mass, momentum, and energy in fixed and moving control volumes. Steady and unsteady Bernoulli's equation. Differential analysis of fluid flow, dimensional analysis and similitude, laminar and turbulent flow. Boundary layers, lift and drag.		
ME 322	**Thermo Fluid Lab**	**1 Credit Hour**
Introduction to basic fluid mechanics instrumentation, experimental verification and reinforcement of the analytical concepts introduced in ME 221 and ME 222. Pressure drop in pipes, fittings and centrifugal pump performance.		

ME 323	Thermodynamics II	3 Credit Hours
Analysis of gas power, vapor power and advanced refrigeration cycles. Availability (exergy), irreversibility and second law efficiency. Moist air properties and psychrometric analysis. Combustion analysis. Introduction to compressible fluid flow.		
ME 324	**Heat Transfer**	**3 Credit Hours**
One-dimensional axial and radial heat conduction. Steady state and transient heat conduction. Analogy of thermal systems with electrical systems (thermal circuit modeling). Dimensionless numbers. Convection heat transfer in internal and external flows. Conduction-convection systems (lumped capacitance method). Heat exchanger design (the LMTD and NTU methods), Surface radiation properties. Radiation heat transfer from black and gray surfaces.Net radiation exchange in enclosures.		
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 333	**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 334	**Automatic Control**	**3 Credit Hour**
Theory and analysis of linear closed-loop control systems containing electronic, hydraulic, and mechanical components. Differential equations. Laplace transforms. Stability, Nyquist and Bode diagrams.		
ME 361	**Industrial Safety**	**1 Credit Hours**
Basic safety definitions. Accident causes and costs. Hazard and risk assessment. Accident analysis, investigation, and prevention. Safety systems. Accident reports and records. Inspection and accident investigation. Plant layout and arrangement. Hazardous materials and environmental health. Material handling and safety. Noise.		

Workshop safety and machine guarding. Tools. Personal protection equipment. Fire prevention.		
ME 363	**Manufacturing Technology**	**3 Credit Hour**
Relationship between product engineering and manufacturing engineering, Fundamentals of Metal Casting, Metal Casting Process, Shaping Process for Plastics, Powder Metallurgy, Fundamentals of Metal Forming, Bulk Deformation Processes in Metalworking, Sheet Metalworking, Theory of Metal Machining, Machining Operations and Machine Tools, Cutting-Tool Technology, Grinding and Other Abrasive Processes, Fundamentals of Welding, Welding Processes, Heat treatment.		
ME 364	**Manufacturing Technology Lab**	**1 Credit Hour**
Practical demonstration and learning of various production processes such as metal cutting, machining, welding, sheet rolling etc. Study and familiarization with various measuring instruments. Measurement of specified dimensions such as lengths, internal and external diameters, radii, angles and taper dimensions. Estimation of measurement variations and identification of typical errors. Familiarization with various safety measures.		
ME 365	**Machine Design – I**	**1 3 Credit Hour**
General principles of machine design, reliability and statistical considerations, engineering materials and their mechanical properties, factor of safety, fits & tolerances, deflections and stress analysis for different types of elements, buckling, static strength and failure theories, fatigue strength and failure theories.		
ME 436	**System Dynamics and Modelling**	**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 441	**Internal Combustion Engines**	**3 Credit Hour**
Engine types and basic operation, cycles and combustion thermodynamics, two-stroke and four-stroke cycles, engine testing and control, friction and wear of engine parts. Air, fuel, cooling and lubrication systems, engine emissions, fuels and lubricants, engine performance.		
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 465	**Machine Design – II**	**3 Credit Hours**
Basic design principles of some machine elements and their selection (shafts and shaft components, non-permanent joints, springs, bearings; spur, helical and bevel gears; flexible drives and flywheels; clutches and brakes). Ethical and social impacts of mechanical 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.		

5. Technical Elective Courses

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 Hour
Introduction to basic principles of corrosion, mixed potential theory, types of corrosion, cell potentials, and corrosion prevention.		
ME 414	**Processing of Polymer Materials**	**3 Credit Hours**
Chemistry and classification of polymers, crystal structure and morphology of polymers, physical and chemical characterization of polymers, manufacturing processes of plastics/composites, and properties of polymer composites.		
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 in Materials Processing to strengthen student's knowledge in this field. Any course from other engineering departments or University must be approved by the ME Department Council.		
ME 433	**Mechatronics**	**3 Credit Hours**
Focus on the fundamentals of design-oriented mechanical, electrical and computer systems integration. Specifically, analogue 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 in Control Theory and System Dynamics to strengthen student's knowledge in these fields. Any course from other engineering departments or University must be approved by the ME Department Council.		
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 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 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, cycle analysis and performance characteristics of gas turbines for aircraft propulsion and electric power generation. Turbojet, turbofan, turboprop type aircraft engines. Flow analysis through centrifugal compressors, axial flow compressors, axial flow turbines, compressor inlets, nozzles, diffusers and regenerators.		
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	**Gas Dynamics**	**3 Credit Hours**
Sonic wave propagation and Mach number, flow in converging and converging-diverging nozzles, normal and oblique shocks, Prantdl-Meyer, Fanno and Rayleigh flows, semi-perfect and real gas behavior, air-breathing and rocket propulsion systems, supersonic diffusers.		
ME 449	**Special Topics in Thermal Sciences, Power and Energy Conversion**	**3 Credit Hours**
Topics relevant to specialization in Thermal Science, Power, and Energy Conversions to strengthen student's knowledge in these fields. Any course from other engineering departments or University must be approved by the ME Department Council.		

ME 461	Computer Aided Design and Computer Aided Manufacturing (CAD/CAM)	3 Credit Hours
Principles of 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-conventional machining: Principles, Ultrasonic machining, Electromechanical Machining, Electro-discharge Machining, Plasma Arc Machining, Laser Beam Machining, Electron Beam Machining. 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.		
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 die.		
ME 464	**Risk Assessment and Safety Management**	**3 Credit Hours**
Basic concepts of risk, reliability and hazard. Potential elements of risk assessment, statistical methods, control charts, appraisal of advanced techniques, fault tree analysis, failure mode and effect analysis. Quantitative structure to activity relationship, analysis of fuzzy model for risk assessment. Analysis of safety program organization through current industry leadership, supervision and management.		
ME 469	**Special Topics in Manufacturing Engineering and Safety**	**3 Credit Hours**
Topics relevant to specialization in Manufacturing Engineering and Safety to strengthen student's knowledge in these fields. Any course from other engineering departments or University must be approved by the ME Department Council.		

ME 471	Introduction to Finite Element Methods	3 Credit Hours
Virtual formulation. Finite element analysis: shape formation, equilibrium conditions, element classification, and 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**
Application of optimization techniques in solving engineering problems. Linear programming, non-linear programming, dynamic programming, integer programming, stochastic programming, genetic algorithms, heuristic methods, queuing theory, and 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 in Computational Methods to strengthen students' knowledge in this field. Any course from other engineering departments or University must be approved by the ME Department Council.		

Chemical Engineering Program

Chemical Engineering Program

Introduction

Chemical Engineering is a branch of engineering that deals with the basic 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 chemicals, fertilizers, energy, petrochemicals 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, a 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 be well known for chemical engineering education and research integrated with Islamic values.

Mission

The mission of Chemical Engineering department is to produce competent chemical engineers, to advance scientific knowledge through research, and to provide valuable services to chemical engineering profession and society.

Goals

1. Provide high quality education that prepares our graduates for chemical engineering practice.
2. Develop necessary skills in our graduates that allows them to be professional leaders and vibrant contributors to the society.
3. Maintain a program of study that is consistent with the current and future needs of chemical engineering profession.
4. Perform valuable innovative research to serve the industrial and societal needs.

Program Objectives

Graduates of the Chemical Engineering program at Al Imam Mohammad Ibn Saud Islamic University are expected to:

1. Successfully commence their career as practicing chemical engineers and/or pursue graduate studies in related fields,
2. Analyze, design and implement sustainable engineering solutions to real world problems considering realistic constraints and societal needs,
3. Demonstrate commitment to lifelong learning and professional development to stay current in modern engineering practice and contemporary issues, and
4. Advance to increasing levels of responsibility and leadership in their professional roles.

Program Outcomes

We expect our graduates to have:

1. An ability to identify, formulate and solve complex engineering problems by applying principles of engineering, science and mathematics
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. An ability to communicate effectively with a range of audiences

4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data and use engineering judgment to draw conclusion
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

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	General Engineering 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's degree of Chemical Engineering requires **136 credits** and is organized as follows:

General Education	17 Credit Hours
Mathematics and Science	41 Credit Hours
General Engineering	14 Credit Hours
Core Courses and Technical Electives	64 Credit Hours
Total Credit Hours	136

General Education

These courses are specifically required for all engineering students to meet particular requirements of the University.

Course Code	Course Title	Credits
QUR 100	Quran Kareem	2
QUR 150	Quran Kareem	2
QUR 200	Quran Kareem	2
QUR 250	Quran Kareem	2
IDE 133	Tawheed	2
LIT 102	Arabic Language Skills	2
HIST 102	History of Saudi Arabia	2
ENGL 201	Technical English Writing	3
	Total Credit Hours:	**17**

Mathematics and Basic Science

To achieve proficiency in Mathematics and Basic Science, students are required to take the following courses.

Course Code	Course Title	Credits	Pre-requisite	Corequisite
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	3	MATH 106	
CHEM 103	General Chemistry	4	None	
CHEM 222	Physical Chemistry	3	CHEM 103	
CHEM 202	Organic Chemistry	3	CHEM 103	
CHEM 203	Organic Chemistry Lab	1		CHEM 202
PHYS 117	Physics I	3	None	
PHYS 119	Physics I Lab	1		PHYS 117
PHYS 118	Physics II	3	PHYS 117 PHYS 119	
PHYS 120	Physics II Lab	1	PHYS 117 PHYS 119	PHYS 118
MATH 345	Numerical Methods	4	MATH 226 MATH 235 CS 107	
	Total Credit Hours:	**41**		

General Engineering

The following courses are required as *General Engineering* courses in the undergraduate curriculum of Chemical Engineering program.

Course Code	Course Title	Credits	Pre-requisite	Corequisite
GE 103	Engineering Graphics and Design	3	None	
CS 107	Computer Programming	3	MATH 105	
GE 205	Fundamentals of Electrical Engineering	3	MATH 106 PHYS 118 PHYS 120	
GE 302	Professional Ethics for Engineers	2	None	
GE 303	Engineering Economy	3	MATH 106	
GE 399	Engineering Training	0	Completion of 90 Credits	
	Total Credit Hours:	**14**		

Chemical Engineering Department Requirements

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

A. Chemical Engineering Core Courses

Course Code	Course Name	Credit	Prerequisite	Corequisite
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
CHE 211	Principles of Chemical Engineering I	3	CHEM 103 MATH 105	
CHE 213	Principles of Chemical Engineering II	2	CHE 211 MATH 106	
CHE 221	Chemical Engineering Thermodynamics I	3	CHE 211	
CHE 222	Chemical Engineering Thermodynamics II	3	CHE 221 CHEM 222 CHEM 223	
CHE 223	Fluid Mechanics	3	CHE 221 GE 103	
CHE 311	Chemical Reactions Engineering	3	CHE 222 MATH 345	
CHE 321	Heat Transfer	3	CHE 213 CHE 223 GE 205	
CHE 320	Fluid Mechanics Lab	1	CHE 223	
CHE 323	Heat Transfer Lab	1	CHE 320 CHE 321 ENGL 201	
CHE 325	Unit Operations	3	CHE 321	
CHE 326	Mass Transfer	3	CHE 321	
CHE 341	Materials Science and Engineering	3	CHEM 103	
CHE 342	Polymer Science and Engineering	3	CHE 213 CHEM 202 CHEM 203	

Course Code	Course Name	Credit	Prerequisite	Course Code
CHE 421	Separation Processes	3	CHE 326	
CHE 422	Unit Operations Lab	1	CHE 325 CHE 421 CHE 433	
CHE 431	Process Control	3	CHE 326 MATH 235	
CHE 432	Process Control Lab	1	CHE 431	
CHE 433	Reaction Engineering Lab	1	CHE 311 CHE 323	
CHE 461	Chemical Processes and Plant Design	3	CHE 325 CHE 341 GE 303	
CHE 462	Process Synthesis and Modeling	3	CHE 311 MATH 345 STAT 215	
CHE 481	Biochemical Engineering	2	CHE 311	
CHE 4**	Elective I	3	CHE 325 CHE 326	
CHE 4**	Elective II	3	CHE 325 CHE 326	
CHE 4**	Elective III	3	CHE 325 CHE 326	
CHE 491	Graduation Project-I	1		CHE 461
CHE 492	Graduation Project-II	3	CHE 491	
Total		**72**		

B. Chemical Engineering Technical Elective Courses

Students must take nine credits of elective courses which are listed below.

1. Energy and Air Pollution Control

Course Code	Course Name	Credit	Prerequisite
CHE 412	Energy Conversion and Management	3	CHE 325, CHE 326
CHE 413	Renewable Energy	3	CHE 325, CHE 326
CHE 414	Solar Energy	3	CHE 325, CHE 326
CHE 415	Fuel Cells	3	CHE 325, CHE 326
CHE 416	Air Pollution Control	3	CHE 325, CHE 326
CHE 471	Special Topics	3	CHE 325, CHE 326

2. Materials Engineering

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

3. Petroleum and Petrochemical Industries

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

4. Desalination

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

5. Bioengineering

Course Code	Course Name	Credit	Prerequisite
CHE 482	Bioprocess Engineering	3	CHE 325, CHE 326
CHE 483	Bioseparations Engineering	3	CHE 325, CHE 326
CHE 484	Applications in Biological Engineering	3	CHE 325, CHE 326
CHE 471	Special Topics	3	CHE 325, CHE 326

Chemical Engineering

Department of Chemical Engineering, College of Engineering
Al Imam Mohammad Ibn Saud Islamic University
Riyadh, Kingdom of Saudi Arabia

CHEMICAL ENGINEERING PROGRAM [Required Credits = 136]

General Education 17 Credits	Mathematics and Science 41 Credits	General Engineering 14 Credits	Core Courses & Technical Electives 64 Credits

FIRST YEAR FALL	FIRST YEAR SPRING	SECOND YEAR FALL	SECOND YEAR SPRING	THIRD YEAR FALL	THIRD YEAR SPRING	FOURTH YEAR FALL	FOURTH YEAR SPRING
QUR 100 [2] Quran Kareem	QUR 150 [2] Quran Kareem	QUR 200 [2] Quran Kareem	QUR 250 [2] Quran Kareem	ENGL 201 [3] Technical English Writing	IDE 133 [2] Tawheed	HIST 102 [2] History of KSA	CHE 422 [1] Unit Operations Lab Pre: CHE325, CHE421, CHE433
MATH 105 [4] Calculus I	MATH 106 [4] Calculus II PRE: MATH105	MATH 226 [3] Linear Algebra PRE: MATH106	LIT 102 [2] Arabic Language Skills	MATH 345 [4] Numerical Methods PRE: MATH226, MATH235, CS107	GE 303 [3] Engineering Economy PRE: MATH106	CHE 421 [3] Separation Processes Pre: CHE326	CHE 432 [1] Process Control Lab Pre: CHE431
PHYS 117 [3] Physics I	PHYS 118 [3] Physics II PRE: PHYS117, PHYS119	CHEM 222 [3] Physical Chemistry Pre: CHEM103	MATH 235 [3] Differential Equations PRE: MATH106	GE 302 [2] Professional Ethics for Engineers	STAT 215 [3] Probability & Statistics in Engineering PRE: MATH106	CHE 431 [3] Process Control Pre: CHE326, MATH235	CHE 462 [3] Processes Synthesis and Modeling Pre: CHE311, STAT215, MATH345
PHYS 119 [1] Physics I Lab CO: PHYS117	PHYS 120 [1] Physics II Lab PRE: PHYS119 CO: PHYS118	GE 205 [3] Fund. of Elect. Eng. PRE: MATH106, PHYS118, PHYS120	CHEM 202 [3] Organic Chemistry Pre: CHEM103	CHE 320 [1] Fluid Mechanics Lab Pre: CHE223	CHE 311 [3] Chemical Reaction Eng. Pre: CHE222, MATH345	CHE 433 [1] Reaction Engineering Lab Pre: CHE311, CHE323	CHE 481 [2] Biochemical Eng. Pre: CHE311
CHEM 103 [4] General Chemistry	CS 107 [3] Computer Programming PRE: MATH105	CHEM 223 [1] Physical Chemistry Lab CO: CHEM222	CHEM 203 [1] Organic Chemistry Lab CO: CHEM202	CHE 321 [3] Heat Transfer Pre: CHE213, CHE223, GE205	CHE 323 [1] Heat Transfer Lab Pre: CHE320, CHE321, ENGL201	CHE 461 [3] Chemical Processes and Plant Design Pre: CHE325, CHE341, GE303	CHE 492 [3] Graduation Project II PRE: CHE491
GE 103 [3] Engineering Graphics and Design	CHE 211 [3] Principles of Chem. Eng. I Pre: CHEM103	CHE 213 [2] Principles of Chem. Eng. II Pre: CHE211, MATH106	CHE 222 [3] Chem. Eng. Thermodynamics II Pre: CHE221, CHEM222, CHEM223	CHE 341 [3] Material Sci. and Eng. Pre: CHEM103	CHE 325 [3] Unit Operations Pre: CHE321	CHE 491 [1] Graduation Project I CO: CHE461	CHE 4** [3] Elective II Pre: CHE325, CHE326
		CHE 221 [3] Chem. Eng. Thermodynamics I Pre: CHE211	CHE 223 [3] Fluid Mechanics Pre: CHE221, GE103	CHE 342 [3] Polymer Sci. and Eng. Pre: CHE213, CHEM202, CHEM203	CHE 326 [3] Mass Transfer Pre: CHE321	CHE 4** [3] Elective I Pre: CHE325, CHE326	CHE 4** [3] Elective III Pre: CHE325, CHE326
						GE 399 [0] Engineering Training (Summer Semester) PRE: 90 Credits	
CREDITS: [17]	[16]	CREDITS: [17]	[17]	CREDITS: [19]	[18]	CREDITS: [16]	[16]

Chemical Engineering Undergraduate Curriculum

First Year (Freshman)

First Level

No.	Course Code	Course Name	Hours			
			Credit	Theory	Lab	Tut
1	QUR 100	The Holy Quran	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 103	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	The Holy Quran	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	The Holy Quran	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 205	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	The Holy Quran	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 Writing	3	3		
2	GE 302	Professional Ethics in Engineering	2	2		
3	MATH 345	Numerical Methods	4	4		1
4	CHE 320	Fluid Mechanics Lab	1		2	
5	CHE 321	Heat Transfer	3	3		1
6	CHE 341	Materials Science and Engineering	3	3		1
7	CHE 342	Polymer Science and Engineering	3	3		1
Total Semester Hours			**19**	**18**	**2**	**4**
Cumulative Credit Hours			**86**	**78**	**16**	**16**

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 325	Unit Operations	3	3		1
7	CHE 326	Mass Transfer	3	3		1
Total Semester Hours			**18**	**17**	**2**	**5**
Cumulative Credit Hours			**104**	**95**	**18**	**21**

Summer after Level-6

No.	Course Code	Course Name	Hours			
			Credit	Theory	Lab	Tut
1	GE 399	Engineering Training	0	0	0	0

Fourth Year (Senior)

Seventh Level

No.	Course Code	Course Name	Hours			
			Credit	Theory	Lab	Tut
1	HIST 151	History of Kingdom of Saudi Arabia	2	2		
2	CHE 421	Separation Processes	3	3		1
3	CHE 431	Process Control	3	3		1
4	CHE 433	Reaction Engineering Lab	1		2	
5	CHE 461	Chemical Processes and Plant Design	3	3		1
6	CHE 4**	Elective I	3	3		1
7	CHE 491	Graduation Project I	1	1		
Total Semester Hours			**16**	**15**	**2**	**4**
Cumulative Credit Hours			**120**	**110**	**20**	**25**

Eighth Level

No.	Course Code	Course Name	Hours			
			Credit	Theory	Lab	Tut
1	CHE 422	Unit Operations Lab	1		2	
2	CHE 432	Process Control Lab	1		2	
3	CHE462	Process Synthesis and Modeling	3	3		1
4	CHE 481	Biochemical Engineering	2	2		1
5	CHE 4**	Elective II	3	3		1
6	CHE 4**	Elective III	3	3		1
7	CHE 492	Graduation Project II	3	3		
Total Semester Hours			**16**	**14**	**4**	**4**
Cumulative Credit Hours			**136**	**124**	**24**	**29**

Course Description

COURSE DESCRIPTIONS

1. General Education

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

2. Mathematics and Science

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.

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

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

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

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.

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

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

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

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 345 Numerical Methods **4 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

CHEM 202 Organic Chemistry **3 Credit Hours**

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, and sulphur-containing compounds and organic compounds

CHEM 203 Organic Chemistry Lab **1 Credit Hours**

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. The practical application of the automated chemical analysis.

CHEM 222 Physical Chemistry **3 Credit Hours**

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 Hours

pH measurements. Activation energy for different reactions. Evaluation of thermodynamics properties and EMF cells. 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. 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.

3. General Engineering

GE 103	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.

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 205	Fundamentals 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 on a design and construction project.

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 learning experience during training in addition to fulfilling any other requirements as determined by the department.

4. Chemical Engineering Core Courses

CHE 211	Principles of Chemical Engineering I	3 Credit Hours

Introduction to chemical engineering and the role of the chemical engineer. The emphasis 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

The energy balance for chemical processes using first law of thermodynamics. Energy and energy balances, steady state energy balances on reactive and nonreactive processes, computer-aided balance calculations.

CHE 221	Chemical Engineering Thermodynamics I	3 Credit Hours

Fundamental concepts of thermodynamic systems, heat and work, properties of pure substances, first and second laws, entropy and exergy analysis.

CHE 222	Chemical Engineering Thermodynamics II	3 Credit Hours

Multicomponent systems, phase equilibria, prediction of thermodynamic properties and reaction equilibria.

CHE 223	Fluid Mechanics	3 Credit Hours

Physical concepts of fluid mechanics and using governing equations to solve the related problems. Main topics are: Basic concepts, dimensional analysis and scale up, fluid properties, fluid static, conservation principles, pipe flow and Bernoulli's equation, internal flow applications.

CHE 311	Chemical Reaction Engineering	3 Credit Hours

Reaction kinetics: batch reactor system, CSTR reactor, tubular reactor, CSTR in series, reaction conversion and rate, adiabatic reaction, isothermal and non-isothermal reaction, catalytic reaction

CHE 320	Fluid Mechanics Lab	1 Credit Hour

Introduction / lay out of the Fluid laboratory/ Safety regulations, Flow Measurements, Laminar and turbulent Flow, Flowing Fluids and Pressure Variation, Flow in Conduits, Cavitation.

CHE 321	Heat Transfer	3 Credit Hours

Fundamentals of heat transfer. Theory of heat transfer and solution methods for heat transfer problems. 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 323	Heat Transfer Lab	1 Credit Hours

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

Drag force and drag coefficients. Flow through beds of solids, mechanics of particle motion, pressure drop, settling, sedimentation, fluidization applications. Characterization of solid particles, storage and transportation of solid particles, size reduction, screening, filtration, gravity sedimentation processes, mechanical separation by centrifuges, separation by cyclones, and evaporation.

CHE 326 Mass Transfer 3 Credit Hours

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

Properties and behavior of engineering materials, atomic structures, interatomic forces. Mechanical properties and characterization of engineering materials.

CHE 342 Polymer Science and Engineering 3 Credit Hours

Polymer various usage and applications, sources of raw materials. Physical and thermodynamic properties of polymeric materials, such as enthalpy, entropy, Gips free energy, degree of polymerization, poly-dispersity. Fundamentals of polymer synthesis, chain growth and step growth. Mechanisms and kinetics derivation for polymerization reactions. Polymerization techniques; bulk, solution, suspension and emulsion. Fabrication processes, e.g., injection molding, blown film extrusion, extrusion blow molding, pipe extrusion, sheet extrusion, thermoforming. Polymer recycling and heat recovery.

CHE 421 Separation Processes 3 Credit Hours

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 Operations Lab 1 Credit Hours

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

Closed loop control, Laplace transform, Response of first order systems, Response of higher order systems, Controllers and final control elements, Controller stability, Frequency Response and body stability.

CHE 432	Process Control Lab	1 Credit Hours

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 Hours

CSTR Reactor, PFR Reactor, and Batch Reactor, CSTRs in series and Catalytic Reactor.

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 equipment.

CHE 462	Process Synthesis and Modelling	3 Credit Hours

Conceptualization of chemical processes, engineering economic analyss, computer-aided design of chemical processes with emphasis on process economics, profitability analysis, and optimum operating conditions

CHE 481	Biochemical Engineering	2 Credit Hours

Introduction / application of chemical engineering / biological systems, Flow Measurements, food and medicine applications.

CHE 491	Graduation Project I	1 Credit Hours

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.

5. Chemical Engineering Technical Electives

CHE 412	Energy Conversion and Management	3 Credit Hours

The 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 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

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

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

Formalize students 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

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

Principles and theories relevant at the nanoscale dimension, properties and characterization of nonmaterial, current and future nanotechnology applications in engineering materials, electronics, energy and desalination.

CHE 443 Polymer Chemistry and Engineering 3 Credit Hours

The 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

The origin and composition of petroleum. Crude oil analysis and evaluation. Petroleum products and their uses. Refinery structure. The main units operation in the different 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

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

Fundamentals of desalination 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

Introduction of detailed descriptions of the fundamentals and applications of the membrane separation processes. Membrane module designs is presented besides 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 1 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

Emphasis the 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

Identify the role of equilibrium and biochemical separation to demonstrate how they are used in the analysis and design of different bioseparators.

CHE 484 Application in Biological Engineering 3 Credit Hours

Overview of the research and applications of Biological Engineering such as bio processing, biotechnology, transport processes, biosensors, bioremediation, biological materials, and biomedicine.