KING SAUD UNIVERSITY
COLLEGE OF ENGINEERING
CHEMICAL ENGINEERING DEPARTMENT

BACHELOR OF SCIENCE IN CHEMICAL ENGINEERING

ACADEMIC PLAN

1439 H
2018 G

KING SAUD UNIVERSITY
COLLEGE OF ENGINEERING
CHEMICAL ENGINEERING DEPARTMENT

1. INTRODUCTION

Chemical Engineers play a vital role in industrial development and economic prosperity in the Kingdom of Saudi Arabia due to the vast contribution of the chemical and petrochemical industries in the overall Saudi economy. The recent expansions in materials and processed minerals of non-petroleum origin (e.g. phosphates, uranium, iron ...etc.) provide new working grounds for chemical engineers. Other major working areas for chemical engineers are in water desalination (the Kingdom has the largest productivity of desalinated water worldwide), industrial waste treatment, military industries, extractive-metallurgy (iron, gold, aluminum), building materials, fertilizers and industrial cleaners. Also, Chemical Engineering encompasses biochemical engineering, which involves the pharmaceutical and food industries and biotechnology. The work of chemical engineers extends from the design and planning of new industrial projects to the operation, control and development of existing industries.

The Chemical Engineering Department was established in 1394 H (1974 G) in the College of Engineering at King Saud University. Currently, the department has 24 faculty members (11 Full Professors, 7 Associate Professors and 6 Assistant Professors) and two Lecturers. Also, there are eight Teaching and Research Assistants, and three Technicians. The department has very well equipped laboratories. Some of these laboratories enable the students to visualize the various chemical processes and how they are interrelated. Besides the student's laboratories, the department contains faculty laboratories in which they conduct their own research. Also, the department has advanced computation facilities either through direct contact with university and college computers or the departmental personal computers facilities. The departmental computation laboratories are equipped with a number of design, simulation, and control packages that are used by the students to enhance the understanding of the various chemical processes.

To attain academic excellence and continuous improvement, the department is Accreditation Board for Engineering and Technology (ABET) accredited since 2009 and the ABET accreditation is renewed in 2016 for 6 years. Also the department accredited by the National Commission for Academic Accreditation and Assessment (NCAAA) accredited since 2015. Due to changes by KSU of the preparatory year to the Common First Year that included courses in Chemistry and Statistics, the department modified its programs. Reflection of this modification is manifested in the program plans.

2. BACHELOR OF SCIENCE in CHE PROGRAM

The B.S. program aims at preparing the students to satisfy the needs of the industrial and public sectors and also to contribute to the national industrial development in the Kingdom.

Therefore, the department is keen to include in its program, besides the basic chemical engineering subjects, courses that cover the most important industries (such as petrochemical industries and water desalination) in the Kingdom. The B.S. program is a five year program (10 semesters)**.**

2.1 Course Requirements (165 credit hours)

To complete the graduation requirements for a B. S. in Chemical Engineering, the students are required to successfully pass a total of 165 credit hours (32 credit hours from the Common First Year, CFY and 132 credit hours and 1 (no-grade) credit hour of practical training as shown in Table 1) with a minimum GPA of 2.75 out of 5.0. The program is divided into:

- 32 credit hours of Common First Year Requirements. The breakdown is shown in Table 2.
- 8 credit hours of University requirements (Table 3) of which:
    - 2 credit hours are compulsory (Table 3A)
    - 6 credit hours are elective to be taken from IC courses (Table 3B)..
- 48 credit hours of College requirements (Table 4) of which:
    - 40 credit hours are compulsory courses for all departments (Table 4A)
    - 6 credit hours of additional courses from a list of optional courses offered by the College of Engineering (Table 4B)
    - 2 credit hours of free courses to be taken by the student from any college but not from his department (Table 4C)
- 77 credit hours of departmental requirements (Table 5) of which:
    - 49 credit hours are core courses (Table 5A),
    - 4 credit hours of graduation project (Table 5B),
    - 11 of foundation chemistry courses (Table 5C)
    - 12 credit hours of elective courses (Table 5D) to be selected from the list of electives offered by the department (Table 5E).
    - 1 credit hour (NP, no-grade pass or fail) of practical training (Table 5F).
    - The department provides its students with a chance to register a zero credit hour, no-grade course in research project (Table 5G); this course is NOT required for graduation.

2.2 Senior Graduation Project Requirements (4 credit hours)

The graduation project is divided into two parts (2 credit hours each). The student is eligible to register for Senior Graduation Project-1 if he completes successfully at least 129 credit hours including the CFY (or 97 credit hours excluding the CFY) and successfully passing ALL courses at level 7 and below (levels 1-7). The Senior Graduation Projects (1 and 2) can only be taken during the first and second semesters (not during summer semester).

2.3 Practical Training Requirements (1 no-grade credit hour)

Students in the department are required to complete a 10 weeks practical training requirement in an area related to Chemical Engineering. Prior to undertaking the practical training program, the student must obtain the approval of the department and he must have completed, successfully, at least 110 credit hours including the CFY (or 78 credit hours excluding the CFY). Students enrolling in the practical training program are not allowed to take simultaneously any course or the graduation project.

A typical plan of study for a B. S. in Chemical Engineering is presented in Table 6.

Table 1 SUMMARY OF B.S. DEGREE REQUIREMENTS IN CHEMICAL ENGINEERING

Requirements	Cr. Hr.	Description
Common First Year	**32**	General Chemistry (4) Differential Calculus (3) Statistics (3) English (12) Writing Skills (2) University Skills (3) IT Skills (3) Entrepreneurship (1) Health and Fitness (1)
University	**8**	**Islamic Studies**: Compulsory (2) Electives (6)
College	**48**	Common (40) Additional (6) free course (2)
Department	**77**	Core (49) Projects (4) CHE Electives (12) Foundation Chemistry (11) Practical training (1, NP) Research Project (0, NP)
Total	**165**	

Table 2: Common First Year (32 credit hours)

Level 1			
Course Code	**Course Title**	**Cr. Hr. (X,Y,L)**	**Pre-requisite**
ENGS 100	English language	6(6,9,0)	
MATH 101	Differential Calculus	3(3,1,0)	
ENT 101	Entrepreneurship	1(1,0,0)	
CHEM 101	General Chemistry	4(3,0,2)	
ARAB 100	Writing Skills	2(2,0,0)	
Total		**16**	

Level 2			
Course Code	**Course Title**	**Cr. Hr. (X,Y,L)**	**Pre-requisite**
ENGS 110	English	6(6,9,0)	
CUR 101	University Skills	3(3,0,0)	
CT 101	IT skills	3(0,0,6)	
STAT 101	Introduction to Statistics	3(2,2,0)	
EPH 101	Health Education & Fitness	1(1,1,0)	
Total		**16**	

(X,Y,L) X = Lectures; Y = Tutorials; L = Lab.

***Approved by*:** Chairman: …… Dean: ……

Table 3 UNIVERSITY REQUIREMENTS (TOTAL 8 CREDIT HOURS)

TABLE 3A: COMPULSORY COURSES (2 CREDIT HOURS)

Course Code	Course Title	Cr. Hr.	Nature
IC 107	Ethics of the Profession	2(2, 0, 0)	Compulsory
Total		**2**	

TABLE 3B: OPTIONAL COURSES (The student must choose 3 courses (6 hours) from the list below)

Course Code	Course Title	Cr. Hr.	Nature
IC 100	Studies in Prophet Biography	2(2, 0, 0)	Elective
IC 101	Origins of Islamic Culture	2(2, 0, 0)	Elective
IC 102	Family in Islam	2(2, 0, 0)	Elective
IC 103	The Economic System in Islam	2(2, 0, 0)	Elective
IC 104	The Political System in Islam	2(2, 0, 0)	Elective
IC 105	Human Rights	2(2, 0, 0)	Elective
IC 106	Medical Jurisprudence	2(2, 0, 0)	Elective
IC 108	Contemporary Issues	2(2, 0, 0)	Elective
IC 109	Role of Women in Development	2(2, 0, 0)	Elective
	Total	**6**	

Table 4 COLLEGE REQUIREMENTS (48 CREDIT HOURS)

Table 4A COLLEGE COMPULSORY COURSES (40 CREDIT HOURS)

Course Code	Course Title	Cr. hr. (X,Y,L)	Pre-requisites
MATH 106	Integral Calculus	3 (3,2,0)	MATH 101
MATH 107	Vectors and Matrices	3 (3,2,0)	MATH 101
MATH 203	Differential & Integral Calculus	3 (3,2,0)	MATH 106; MATH 107
MATH 204	Differential Equations	3 (3,2,0)	MATH 203
PHYS 103	General Physics (1)	4 (3,0,2)	
PHYS 104	General Physics (2)	4 (3,0,2)	PHYS 103
ENGL 109	Language & Communication	2 (2,1,0)	
ENGL 110	Technical Writing	2 (2,1,0)	ENGL 109
GE 201	Statics	3 (3,1,0)	MATH 106; MATH 107
GE 104	Basics of Engineering Drawing	3 (2,0,2)	
GE 106	Introduction to Engineering Design	3 (2,1,2)	GE 104
GE 203	Engineering and Environment	2 (2,0,0)	CHEM 101; MATH 101
GE 402	Engineering Projects Management	3 (3,1,0)	
GE 403	Engineering Economy	2 (2,1,0)	
	Total	**40**	

(X,Y,L) X = Lectures; Y = Tutorials; L = Lab.

***Approved by*:** Chairman: …… Dean: ……

Table 4B COLLEGE ADDITIONAL COURSES FOR CHE PROGRAM (6 CREDIT HOURS)

Course Code	Course Title	Cr. hr. (X,Y,L)	Pre-requisites
GE 209	Computer Programming	3 (2,0,2)	
MATH 254	Numerical Methods	3 (3,2,0)	MATH 107
	Total	**6**	

Table 4C COLLEGE FREE COURSE FOR CHE PROGRAM (2 CREDIT HOURS)

Course Code	Course Title	Cr. Hr. (X,Y,L)	Pre-requisites
xxxxxx	Free elective	2	
	Total	**2**	

Table 5 CHEMICAL ENGINEERING REQUIREMENTS

Table 5A CORE COURSES (49 CREDIT HOURS)

Course Code	Course Title	Cr. Hr. (X,Y,L)	Pre-requisites
CHE 201	Chemical Engineering Principles (1)	3 (3,1,0)	CHEM 101
CHE 202	Chemical Engineering Principles (2)	2 (2,1,0)	CHE 201
CHE 205	Chemical Engineering Thermodynamics (1)	2 (2,1,0)	CHEM 101
CHE 206	Chemical Engineering Thermodynamics (2)	2 (2,1,0)	CHE 205
CHE 219	Fundamentals of Materials Engineering	3 (3,1,0)	CHEM 101
CHE 234	Momentum Transport	3 (3,1,0)	CHE 201
CHE 320	Chemical Reaction engineering	3 (3,1,0)	CHE 206
CHE 333	Unit Operations	2 (2,1,0)	CHE 201
CHE 334	Heat Transfer	3 (3,1,0)	CHE 202
CHE 335	Mass Transfer	3 (3,1,0)	CHE 234
CHE 336	Process Safety	1 (1,1,0)	CHE 320
CHE 366	Chemical Engineering Laboratory (1)	2 (0,0,4)	CHE 335
CHE 406	Computational Techniques	2 (1,1,2)	MATH 254; CHE 201
CHE 409	Separation Processes	3 (3,1,0)	CHE 335
CHE 412	Computer Aided Chemical Process Design	3 (2,1,2)	CHE 334
CHE 415	Process Control	3 (3,1,0)	CHE 406
CHE 420	Economics of Chemical Processes	2 (1,1,2)	GE 403
CHE 423	Selected Topics in Chemical Engineering (2)	2 (2,1,0)	Successful Completion of 120 credit hours
CHE 426	Heterogeneous Reactor Engineering	3 (3,1,0)	CHE 320
CHE 466	Chemical Engineering Laboratory (2)	2 (0,0,4)	CHE 426
	Total	**49**	

NP= No grade (Pass or Fail)

Table 5B SENIOR GRADUATION PROJECTS (4 CREDIT HOURS)

Course Code	Course Title	Cr. Hr. (X,Y,L)	Pre-requisites
CHE 496	Graduation Project (1)	2(2,0,0)	Complete successfully 129 credits hours and passing all courses in levels 1-7.
CHE 497	Graduation Project (2)	2(2,0,0)	CHE 496
	Total	**4**	

(X,Y,L) X = Lectures; Y = Tutorials; L = Lab.

***Approved by*:** Chairman: …… Dean: ……

Table 5C FOUNDATION CHEMISTRY COURSES (11 CREDIT HOURS)

Course Code	Course Title	Cr. Hr. (X,Y,L)	Pre-requisites
CHEM 230	Principles of Physical Chemistry	3(3,0,0)	CHEM 101
CHEM 244	Principles of Organic Chemistry (1)	2(2,0,0)	
CHEM 245	Principles of Organic Chemistry (2)	2(2,0,0)	CHEM 244
CHEM 350	Instrumental Analysis for non-major	4(2,0,4)	CHE 201
	Total	**11**	

Table 5D ELECTIVE COURSES (12 CREDIT HOURS)

(Each student is required to take 12 cr. hr. from the list of ChE elective courses in Table 5E)

Course Code	Course Title	Cr. Hr. (X,Y,L)	Pre-requisites
CHE 4**	Elective (1)	3(3,1,0)	Successful completion of 120 Cr. hrs.
CHE 4**	Elective (2)	3(3,1,0)	Successful completion of 120 Cr. hrs.
CHE 4**	Elective (3)	3(3,1,0)	Successful completion of 120 Cr. hrs.
CHE 4**	Elective (4)	3(3,1,0)	Successful completion of 120 Cr. hrs.
	Total	**12**	

Table 5E LIST OF CHE ELECTIVE COURSES

(Each student is required to take 12 cr. hr. from the following list of ChE elective courses)

Course Code	Course Title	Cr. Hr. (X,Y,L)	Pre-requisites
CHE 413	Desalination and Water Treatment	3(3,1,0)	Successful completion of 120 Cr. hrs.
CHE 422	Selected Topics in Chemical Engineering (1)	3(3,1,0)	Successful completion of 120 Cr. hrs.
CHE 425	Selected Topics in Chemical Engineering (3)	3(3,1,0)	Successful completion of 120 Cr. hrs.
CHE 427	Pollution Prevention in Chemical Industries	3(3,1,0)	Successful completion of 120 Cr. hrs.
CHE 428	Production of Building and Cementing Materials	3(3,1,0)	Successful completion of 120 Cr. hrs.
CHE 429	Energy and Chemical Industries	3(3,1,0)	Successful completion of 120 Cr. hrs.
CHE 430	Corrosion Engineering	3(3,1,0)	Successful completion of 120 Cr. hrs.
CHE 433	Electrochemical Engineering	3(3,1,0)	Successful completion of 120 Cr. hrs.
CHE 434	Extractive metallurgy & metals recycling	3(3,1,0)	Successful completion of 120 Cr. hrs.
CHE 437	Waste Treatment Processes	3(3,1,0)	Successful completion of 120 Cr. hrs.
CHE 438	Water Chemistry & Chemical Analysis	3(3,1,0)	Successful completion of 120 Cr. hrs.
CHE 440	Introduction to Biochemical Engineering	3(3,1,0)	Successful completion of 120 Cr. hrs.
CHE 441	Petroleum Refining Engineering	3(3,1,0)	Successful completion of 120 Cr. hrs.
CHE 442	Petrochemical Industries	3(3,1,0)	Successful completion of 120 Cr. hrs.
CHE 443	Natural Gas Processing	3(3,1,0)	Successful completion of 120 Cr. hrs.
CHE 445	Biological Wastewater Treatment	3(3,1,0)	Successful completion of 120 Cr. hrs.
CHE 446	Environmental Biotechnology	3(3,1,0)	Successful completion of 120 Cr. hrs.
CHE 447	Fundamentals of Polymer Sciences and Engineering	3(3,1,0)	Successful completion of 120 Cr. hrs.
CHE 448	Fundamentals of Mineral Processing	3(3,1,0)	Successful completion of 120 Cr. hrs.
CHE 449	Membrane Separations	3(3,1,0)	Successful completion of 120 Cr. hrs.
CHE 450	Renewable Energy	3(3,1,0)	Successful completion of 120 Cr. hrs.
CHE 451	Risk Assessment and Hazard Control	3(3,1,0)	Successful completion of 120 Cr. hrs.
CHE 452	Food Processing Technologies	3(3,1,0)	Successful completion of 120 Cr. hrs.
CHE 453	Composite Science & Engineering	3(3,1,0)	Successful completion of 120 Cr. hrs.
CHE 454	Process Energy Optimization	3(3,1,0)	Successful completion of 120 Cr. hrs.
CHE 467	Process Integration	3(3,1,0)	Successful completion of 120 Cr. hrs.

(X,Y,L) X = Lectures; Y = Tutorials; L = Lab; NP=No grade (Pass or Fail)

***Approved by*:** Chairman: …… Dean: ……

Table 5F CHE PRACTICAL TRAINING REQUIREMENT (COMPULSORY; 1 NP)

Course Code	Course Title	Cr. Hr. (X,Y,L)	Pre-requisites
CHE 999	Practical Training	1 (NP)	Successful Completion of 110 credit hours
	Total	**1**	

NP= No grade (Pass or Fail)

Table 5G CHE ELECTIVE COURSE WITHOUT CREDIT HOURS (0 NP)

(This is an optional elective course with no credit hours; no required for the B.S. degree in CHE)

Course Code	Course Title	Cr. Hr. (X,Y,L)	Pre-requisites
CHE 998	Research Project	0 (NP)	Successful completion of 129 cr. hr.

Table 6 RECOMMENDED SEMESTER SCHEDULE - CHEMICAL ENGINEERING PROGRAM

Level 1			
Course Code	**Course Title**	**Cr. Hr. (X,Y,L)**	**Pre-requisite**
ENGS 100	English language	6(6,9,0)	
MATH 101	Differential Calculus	3(3,1,0)	
ENT 101	Entrepreneurship	1(1,0,0)	
CHEM 101	General Chemistry	4(3,0,2)	
ARAB 100	Writing Skills	2(2,0,0)	
Total		**16**	

Level 2			
Course Code	**Course Title**	**Cr. Hr. (X,Y,L)**	**Pre-requisite**
ENGS 110	English	6(6,9,0)	
CUR 101	University Skills	3(3,0,0)	
CT 101	IT skills	3(0,0,6)	
STAT 101	Introduction to Statistics	3(2,2,0)	
EPH 101	Health Education & Fitness	1(1,1,0)	
Total		**16**	

Level 3			
Course Code	**Course Title**	**Cr. Hr. (X,Y,L)**	**Pre-requisite**
IC 1xx	Optional IC course	2(2,0,0)	
PHYS 103	General Physics (1)	4(3,0,2)	
MATH 106	Integral Calculus	3(3,2,0)	MATH 101
MATH 107	Vectors & Matrices	3(3,2,0)	MATH 101
ENGL 109	Language & Communication	2(2,1,0)	
GE 104	Basics of Engineering Drawing	3(2,0,2)	
Total		**17**	

Level 4			
Course Code	**Course Title**	**Cr. Hr. (X,Y,L)**	**Pre-requisite**
PHYS 104	General Physics (2)	4(3,0,2)	PHYS 103
ENGL 110	Technical Writing	2(2,1,0)	ENGL 109
MATH 203	Differential and Integral Calculus	3(3,2,0)	MATH 106 MATH 107
GE 106	Introduction to Engineering Design	3(2,1,2)	GE 104
GE 201	Statics	3(3,1,0)	MATH 106 MATH 107
GE 203	Engineering and Environment	2(2,0,0)	CHEM 101 MATH 101
Total		**17**	

***Approved by*:** Chairman: …… Dean: ……

Level 5			
Course Code	**Course Title**	**Cr. Hr. (X,Y,L)**	**Pre-requisite**
MATH 204	Differential Equations	3(3,2,0)	MATH 203
CHEM 244	Principles of Organic Chemistry (1)	2(2,0,0)	
CHEM 230	Principles of Physical Chemistry	3(3,0,0)	CHEM 101
CHE 201	Chemical Engineering Principles (1)	3(3,1,0)	CHEM 101
CHE 205	Chemical Engineering Thermodynamics (1)	2(2,1,0)	CHEM 101
CHE 219	Fundamentals of Materials Engineering	3(3,1,0)	CHEM 101
Total		**16**	

Level 6			
Course Code	**Course Title**	**Cr. Hr. (X,Y,L)**	**Pre-requisite**
IC 107	Ethics of the Profession	2(2,0,0)	
CHEM 245	Principles of Organic Chemistry (2)	2(2,0,0)	CHEM 244
GE 209	Computer Programming	3(2,0,2)	
CHE 202	Chemical Engineering Principles (2)	2(2,1,0)	CHE 201
CHE 206	Chemical Engineering Thermodynamics (2)	2(2,1,0)	CHE 205
CHE 234	Momentum Transport	3(3,1,0)	CHE 201
xxx	Free Elective	2	
Total		**16**	

Level 7			
Course Code	**Course Title**	**Cr. Hr. (X,Y,L)**	**Pre-requisite**
IC 1xx	Optional IC course	2(2,0,0)	
MATH 254	Numerical Methods	3(3,2,0)	MATH 107
CHE 333	Unit operations	2(2,1,0)	CHE 201
CHE 334	Heat Transfer	3(3,1,0)	CHE 202
CHE 335	Mass Transfer	3(3,1,0)	CHE 234
CHE 320	Chemical Reaction Engineering	3(3,1,0)	CHE 206
Total		**16**	

Level 8			
Course Code	**Course Title**	**Cr. Hr. (X,Y,L)**	**Pre-requisite**
CHEM 350	Instrumental Analysis for non-major	4 (2,0,4)	CHE 201
GE 403	Engineering Economy	2 (2,1,0)	
CHE 366	Chemical Engineering Laboratory (1)	2 (0,0,4)	CHE **335**
CHE 406	Computational Techniques	2 (1,1,2)	MATH 254 CHE 201
CHE 409	Separation Processes	3 (3,1,0)	CHE 335
CHE 426	Heterogeneous Reactor Engineering	3 (3,1,0)	CHE 320
CHE 336	Process Safety	1 (1,1,0)	CHE 320
Total		**17**	

***Approved by*:** Chairman: …… Dean: ……

Level 9			
Course Code	**Course Title**	**Cr. Hr. (X,Y,L)**	**Pre-requisite**
IC 1xx	Optional IC course	2(2,0,0)	
CHE 412	Computer Aided Chemical Process Design	3(2,1,2)	CHE **334**
CHE 415	Process Control	3(3,1,0)	CHE 406
CHE 423	Selected Topics in Chemical Engineering (2)	2(2,1,0)	Complete successfully 120 credits hours
CHE 420	Economics of Chemical Processes	2(1,1,2)	GE 403
CHE 4xx	Elective (1)	3(3,1,0)	Complete successfully 120 credits hours
CHE 496	Graduation Project (1)	2(2,0,0)	Complete successfully 129 credits hours and passing all courses in levels 1-7.
Total		**17**	

Level 10			
Course Code	**Course Title**	**Cr. Hr. (X,Y,L)**	**Pre-requisite**
GE 402	Engineering Projects Management	3(3,1,0)	
CHE 4xx	Elective (2)	3(3,1,0)	Complete successfully 120 credits hours
CHE 4xx	Elective (3)	3(3,1,0)	Complete successfully 120 credits hours
CHE 4xx	Elective (4)	3(3,1,0)	Complete successfully 120 credits hours
CHE 466	Chemical Engineering Laboratory (2)	2(0,0,4)	CHE 426
CHE 497	Graduation Project (2)	2(2,0,0)	CHE 496
CHE 999	Practical Training	1 (NP)	Complete successfully 110 credits hours
CHE 998	Research Project	0 (NP)	Complete successfully 129 credits hours
Total		**17**	

NP: No grade (Pass or Fail)
(X,Y,L) X = Lectures; Y = Tutorials; L = Lab.

***Approved by*:** Chairman: …… Dean: ……

3- COURSE DESCRIPTION

3.1 Common First Year

ENGS 100: English language ***6(6,9,0)***

This initial stage of the course is designed to give the students a strong foundation in the language, improving their command of English as well as improving their vocabulary, reading, writing and communication skills. In the process of improving these skills, students will also develop their confidence in the language and also their presentation skills. These all contribute to the life skills of the student and help to prepare them for their future studies and careers beyond KSU. As the course progresses and students reach a higher level of English, the focus will switch to the academic side of the language. This will involve preparing students for the style of language they will need for their future studies.
Pre-requisites: None.

MATH 101: Differential Calculus ***3(3,1,0)***

Limits and Continuity: The Concept of Limit, Computation of Limits, Continuity and its Consequences, Limits Involving Infinity, Formal Definition of the Limit. Differentiation: The Concept of Derivative, Computation of Derivatives (The Power Rule, Higher Order Derivatives, and Acceleration), the Product and Quotient Rules, The Chain Rule, Derivatives of Exponential and Logarithmic Functions, Implicit Differentiation and Inverse Trigonometric Functions, the Mean Value Theorem. Applications of Differentiation: Indeterminate Forms and L'Hopital's rule, Maximum and Minimum Values, Increasing and Decreasing Functions, Concavity and the Second Derivative Test, Optimization, Related Rates.

Textbook: Robert T. Smith, and Roland R. Minton, "Calculus, early Transcendental functions", Third Edition, 2007.
Pre-requisite: None

ENT 101 Entrepreneurship ***1(1,0,0)***

Pre-requisites: None.

CHEM 101: General Chemistry ***4(3,0,2)***

Stoichiometry: SI Units, chemical formulas, the mole, methods of expressing concentration, Calculations based on chemical equations. Gases: laws, kinetic theory, deviation and van der Waals equation. Thermochemistry: Types of enthalpy changes, Hess Law and its applications,, first law of thermodynamics. Solutions: Type of solutions and laws related , colligative properties. Chemical kinetics: Law of reaction rate, reaction order, factors affecting the rates. Chemical Equilibrium : Relation between Kc & Kp, Le Chatelier's principle and factor affecting equilibrium. Ionic equilibrium: Acid and base concepts, pH calculations of acid, base and buffer solutions. Atomic Structure: emission spectrum, Bohr's theory de Broglre's hypothesis, quantum numbers, electronic configuration of elements, consequences of the periodic table.
Pre-requisites: None.

ARAB 100: Writing Skills ***2(2,0,0)***

ENGS 110: English ***6(6,9,0)***

The final assessment for the course is the highly regarded International English Language Testing System (IELTS), which is used as a qualifying test for students wishing to attend university in many countries including the UK and Australia. Specialist material will be used to prepare students for this test with the aim of reaching an IELTS score of 5.0 by the end of the year.

Pre-requisites: None.

CUR 101: University skills ***3(3,0,0)***

Learning skills**:** Self management for learning, Learning tools, Reading strategies, Second language learning skills, Test administration.

Thinking skills: Theory Of Inventive Problem Solving (TRIZ), Rounding Thinking, Expanding perception, Creative thinking. Research skills: Problem determining, Search for information strategies, Sites of sources, access this information, Using thin formation, Information construction, Information evaluation.

Pre-requisites: None.

CT 101: IT skills ***3(0,0,6)***

Basic Concepts of Information Technology, Using a computer and Managing Files, Word Processing, Spreadsheets, Databases, Presentation.

Pre-requisites: None.

STAT 101: Introduction to Statistics ***3(2,2,0)***

Descriptive statistics; Probability; Random variables and probability distribution functions; Statistical inference; Correlation and simple linear regression.

Pre-requisites: None.

EPH 101: Health Education and Fitness ***1(1-1-0)***

Subjects about general health and body and brain fitness.

Pre-requisites: None.

3.2 University Requirements

IC 100 - Studies in Prophet Biography 2(2,0,0)

IC 101 - Origins of Islamic Culture 2(2,0,0)

IC 102 - Family in Islam 2(2,0,0)

IC 103 - The Economic System in Islam 2(2,0,0)

IC 104 - The Political System in Islam 2(2,0,0)

IC 105 - Human Rights 2(2,0,0)

IC 106 - Medical Jurisprudence 2(2,0,0)

***Approved by*:** Chairman: …… Dean: ……

IC 107 - Ethics of the Profession 2(2,0,0)

IC 108 - Contemporary Issues 2(2,0,0)

IC 109 - Role of Women in Development 2(2,0,0)

3.3 College Requirements

A- Compulsory courses

MATH 106: Integral Calculus ***3(3,2,0)***

The definite integral, fundamental theorem of calculus, the indefinite integral, change of variable, numerical integration. Area, volume of revolution, work, arc length. Differentiation and integration of inverse trigonometric functions. The logarithmic, exponential, hyperbolic and inverse hyperbolic functions. Techniques of integration: substitution, by parts, trigonometric substitutions, partial fractions, miscellaneous substitutions. Indeterminate forms, improper integrals. Polar coordinates.

Textbooks: 1- Robert T. Smith, and Roland R. Minton, "Calculus, early Transcendental functions", 3rd Edition.
2- Earl W. Swokowski, Michael Olinick, Dennis Pence, and Jeffery A. Cole "Calculus", 6th Edition.

Pre-requisite: MATH 101

MATH 107: Vectors and Matrices ***3(3,2,0)***

Vectors in two and three dimensions, scalar and vector products, equations of lines and planes in space, surfaces, cylindrical and spherical coordinates. Vector valued functions, their limits, continuity, derivatives and integrals. Motion of a particle in space, tangential and normal components of acceleration. Functions in two or three variables, their limits, continuity, partial derivatives, differentials, chain rule, directional derivatives, tangent planes and normal lines to surfaces. Extrema of functions of several variables, Lagrange multipliers. Systems of linear equations, matrices, determinants, inverse of a matrix, Cramer's rule.

Textbook: Edward and Penny, "Calculus", international edition.

Pre-requisite: MATH 101

MATH 203: Differential & Integral Calculus ***3(3,2,0)***

Infinite series, convergence and divergence of infinite series, integral test, ratio test, root test and comparison test. Conditional convergence and absolute convergence, alternating series test. Power series, Taylor and Maclaurin series. Double integral and its applications to area, volume, moments and centre of mass. Double integrals in polar coordinates. Triple integral in rectangular, cylindrical and spherical coordinates and applications to volume moment and centre of mass. Vector fields, line integrals, surface integrals, Green's theorem, the divergence theorem, Stoke' theorem.

Textbook: 1- Robert T. Smith, and Roland R. Minton, "Calculus, early Transcendental functions", 3rd Edition.
2- Earl W. Swokowski, Michael Olinick, Dennis Pence, and Jeffery A. Cole "Calculus", 6th Edition.

Pre-requisite: MATH 106 and MATH 107

MATH 204: Differential Equations ***3(3,2,0)***

Various types of first order equations and their applications. Linear equations of higher order. Systems of linear equations with constant coefficients, reduction of order. Power series methods for solving second order equations with polynomial coefficients. Fourier series, Fourier series for even and odd functions. Complex Fourier series. The Fourier integral.

Textbook: Dennis G. Zill and Michael R Cullen, "Differential equations with boundary value problems", 6th edition

Pre-requisite: MATH 203

PHYS 103: General Physics (1) ***4(3,0,2)***

Introduction (Vectors), Motion in one dimension with constant acceleration, Motion in two dimensions with application to projectile motion and circular motion, Newton's Laws of Motion, Work and Energy, Potential Energy and law of conservation of Energy, Linear Momentum and Collisions, Rotation of rigid object about a fixed axis.

Pre-requisites: None.

PHYS 104: General Physics (2) ***4(3,0,2)***

Electricity and Magnetism: Coulomb's law, electric fields, Gauss' Law, electric potential, potential energy, capacitance and dielectric, currents and resistance, electrical energy and power, direct current circuits, Kirchhoffs rules, magnetic fields, motion of charged particle in a magnetic field, sources of the magnetic field, Ampere's law, Faraday's law of induction, self inductance, energy in a magnetic field, mutual inductance, alternating current circuits, the RLC series circuit, power in an A.C. circuit, resonance in RLC services circuit.

Pre-requisites: PHYS 103.

ENGL 109 – Language and Communication **2*(2,1,0)***

ENGL 109 includes *English for Specific Purpose* (ESP) units that cover terminology and expressions, in various engineering disciplines. The course is designed to improve the communication and reading skills of engineering students. It equips the student with essential linguistic expertise for his engineering study and prospective professional career.

Textbook: Eric H. Glendinning & Norman Glendinning, "Oxford English for Electrical and mechanical Engineering", Oxford University Press (2000).

Pre-requisites: None.

ENGL 110 – Technical Writing **2*(2,1,0)***

English 110 is intended to enhance technical writing skills. It equips students with writing basics and techniques required for constructing clear and persuasive presentation of their ideas, on various forms including reports, presentations, worksheets, CVs' and memos. The course highlights effective writing features including: focus, organization, support & elaboration, style, and conventions. It emphasizes on observing ethical norms in writing.

Textbook: Daphne Mackey, "Send me a Message: *A step-by-step approach to business and professional writing*", McGraw Hill (2006)

Pre-requisites: ENGL 109.

GE 104: Basics of Engineering Drawing **3*(2,0,2)***

***Approved by*:** Chairman: …… Dean: ……

The course includes the drawing of Orthographic and isometric projections. Other topics include scaling, sectioning, dimensioning and blue print reading. The course is taught using free hand, AutoCAD and AutoDesk Invetor

Textbook: Fundamentals of Graphics Communication, Bertoline, G.R., And Weibe, E.N., Mc Grew-Hill Inc., New York, 5th edition, 2007

References: A Manual of Engineering Drawing Practice, C.H. Simons and D.E. Maguire, Hodder & Stoughton.
Engineering Drawing and Graphic Technology, French T. E., Charles J. V. and Foster R.J., 14th Edition, McGraw-Hill,1993.

Pre-requisites: None.

GE 106: Introduction to Engineering Design ***3(2,1,2)***

Engineering profession, jobs, and disciplines; Elements of engineering analysis; Introduction to engineering design and team formation; Engineering problem definition; Engineering system Architecture and physical function decomposition; human factor, environment, and safety issues in design; Generation of alternative concepts; Evaluation of alternatives and selection of a concept, Design defense, performance evaluation, and reporting; Engineering ethics.

Textbook: Philip Kosky, Robert T. Balmer, William D. Keat, George Wise, Exploring Engineering: An Introduction to Engineering and design, 4th ed.

Pre-requisite: GE 104

GE 201: Statics ***3(3,1,0)***

Force systems; vector analysis, moments and couples in 2D and 3D. Equilibrium of force systems. Analysis of structures; plane trusses and frames. Distributed force system; centroid of simple and composite bodies. Area moments of inertia. Analysis of beams. Friction.

Textbook: Meriam, J. L. and Kraige, L. G. "Engineering Mechanics, Volume 1, Statics", SI units Version

Pre-requisite: MATH 106 & MATH 107

GE 203: Engineering and Environment ***2(2,0,0)***

This course introduces the impact of engineering and industrial activities on the environment. The lectures cover basics of ecosystems, environmental balance, types of pollution, and types, sources, and limits of pollutants; in addition to fundamentals of Environmental Impact Assessment (EIA). Pollution control technologies and examples of pollution from various engineering and industrial sectors are also covered.

Textbook: G. Tyler Miller, Scott Spoolman. Living in the Environment, 17th edition. Cengage Learning (2014)
Jerry A. Nathanson, Richard A. Schneider. Basic Environmental Technology: Water Supply, Waste Management, and Pollution Control, 6th edition. Pearson Education, Limited (2014)

Pre-requisite: CHEM 101, MATH 101

GE 402: Engineering Projects Management ***3(3,1,0)***

This course introduces techniques that provide rational solutions to a range of project management decisions encountered in engineering projects. Students are expected to gain a

detailed understanding of some of the techniques, tools and processes available and their application in starting, planning, managing and finishing engineering projects; The course covers project management fundamentals including projects life cycle, project planning and scheduling techniques, cash flow forecasting, performance evaluations, estimating and cost control; project organizations; Introduction to risk management.

Textbook: Meredith, J. R., Mantel Jr, S. J., & Shafer, S. M. (2013). Project management in practice. Wiley Global Education

Prerequisite: None

GE 403: Engineering Economy ***2(2,1,0)***

This course is being offered to the students who enroll in the College of Engineering to give them fundamental knowledge and understandings on Cost concepts, Time value of money operations, Measuring the worth of investments, Comparison of alternatives, Depreciation, and Economic analysis of public projects

Textbook: John A. White, Kenneth E. Case and David B. Pratt, "Principles of engineering economic analyses", 5th edition.

Pre-requisites: None

B- Additional courses

GE 209: Computer Programming ***3(2,0,2)***

To introduce computer programming for solving engineering problems in MATLAB environment

Textbook: MATLAB for Engineers by Holly Moore, Pearson; 5th edition (2017).16

Pre-requisites: None.

MATH 254: Numerical Methods ***3(3,2,0)***

Various numerical methods for solving nonlinear equations. Direct and iterative methods for solving systems of linear equations along with error estimate. Polynomial interpolation with error formula. Numerical differentiation and integration with error terms. An introduction to numerical solution of ordinary differential equations.

Textbook: Rizwan Butt and Yacine Benhadid, "An Introduction to Numerical Analysis"

Pre-requisite: MATH 107

3.4 Department Requirements

A- Core Courses

CHE 201: Chemical Engineering Principles (1) ***3(3,1,0)***

The course gives a brief account of the origin and role of Chemical Engineering. It also provides the students with the tools and the correct methods of performing engineering calculations and units. It also shows the students the basic concepts and procedures to perform material balances on single and multiple units for both non-reactive and reactive processes including combustion reactions.

Textbook: Felder R. M. and Rousseau, R. W. "Elementary Principles of Chemical Processes" John Wiley & Sons.

Pre-requisite: CHEM 101

CHE 202: Chemical Engineering Principles (2) ***2(2,1,0)***

The course teaches the students how to perform energy balances on reactive and nonreactive systems using tabular and equation-based data. The students expand their previous knowledge in formulating and solving problems in energy balances and also problems that require simultaneous solution of material and energy balances. The students also learn how to use psychrometric charts.

Textbook: Felder R. M. and Rousseau, R. W. "Elementary Principles of Chemical Processes" John Wiley & Sons.

Pre-requisite: CHE 201

CHE 205: Chemical Engineering Thermodynamics (1) ***2(2,1,0)***

In this module, the principles of chemical engineering thermodynamics (first and second laws) are presented with their applications for closed and open systems. The volumetric properties of pure fluids and their calculation using different equations of state (Ideal gas, Virial and cubic EoS) and other generalized correlations are also described in details. Moreover, the physical and chemical heat effects are also presented as well as the thermodynamic properties of fluids, the fundamental equations, Maxwell relations, residual properties and steam tables.

Textbook: Smith, J.M.; Van Ness, H.C.; and Abbott, M.M. "Introduction to Chemical Engineering Thermodynamics", 7th ed. McGraw Hill, 2005.

Pre-requisite: CHEM 101

CHE 206: Chemical Engineering Thermodynamics (2) ***2(2,1,0)***

The main topics covered in this course are: Application of thermodynamics for flow processes (Throttling, turbines, expanders, compressors, pumps); Heat engines and refrigerators (Carnot cycle, Rankine cycle, vapor compressor cycle, heat pumps); Introduction to liquid vapor equilibrium (VLE) calculations (Qualitative description, Raoult's law, Henry's law, modified Raoult's law, azeotrope); Theory of solution thermodynamics (Chemical potential, partial molar properties, fugacity, fugacity coefficient); Chemical reaction equilibria (The reaction coordinate, the standard Gibbs energy, evaluation of the equilibrium constant, effect of temperature)

Textbook: Smith, J.M.; Van Ness, H.C.; and Abbott, M.M. "Introduction to Chemical Engineering Thermodynamics", 7th ed. McGraw Hill, 2005.

Pre-requisite: CHE 205

CHE 219: Fundamentals of Materials Engineering ***3(3,1,0)***

Classification of materials, Structure of materials, Properties and processing of materials. Engineering applications of materials.

***Approved by*:** Chairman: …… Dean: ……

Textbook: William D. Callister, "Materials Science and Engineering an introduction", John Wiley & Sons, 7th ed. 2007.

Pre-requisite: CHEM 101

CHE 234: Momentum Transport ***3(3,1,0)***

This course deals with the study of concept of momentum and mechanical energy transport of fluids, by examining fluid statics and dynamics, viscosity, fluid friction, pumping, settling and flow through porous media. The course presents also definitions of Non-Newtonian fluids, and discusses dimensional analysis.

Textbook: Geankoplis, G.J: Transport Processes and Unit Operations, Prentice Hall, 4th edition, 2008.

Pre-requisite: CHE 201

CHE 320: Chemical Reaction Engineering ***3(3,1,0)***

Understanding how chemical reactors work lies at the heart of almost every chemical processing operation. Design of the reactor is no routine matter, and many alternatives can be proposed for a process. Reactor design uses information, knowledge and experience from a variety of areas - thermodynamics, chemical kinetics, fluid mechanics, heat and mass transfer, and economics. CRE is the synthesis of all these factors with the aim of properly designing and understanding the chemical reactor.

Textbook: H. Scott Fogler, "Elements of Chemical Reaction Engineering", Prentice-Hall, 5th ed., 2016.

Pre-requisite: CHE 206

CHE 333: Unit Operations ***2(2,1,0)***

This course deals mainly with the study and concept of the operations involving particulate solids: properties, modification, separation, settling and flow through porous media.

Textbook: W. L. McCabe, J. C. Smith and P. Harriott, Unit Operations of Chemical Engineering, 6th ed., McGraw-Hill, Inc., New York, 2001.

Pre-requisite: CHE 201

CHE 334: Heat Transfer ***3(3,1,0)***

Introduction and mechanisms of heat transfer. Steady state heat transfer by conduction. Individual and overall coefficients of heat transfer. Heat Transfer correlation in convection. Natural and forced convection, and Radiation. Heat transfer with phase change. Design of heat exchangers.

Textbook: F. Kreith, R. Manglik, M. Bohn, "Principles of heat transfer", Cengage Learning, 7th edition, 2011.

Pre-requisite: CHE 202

***Approved by*:** Chairman: …… Dean: ……

CHE 335: Mass Transfer ***3(3,1,0)***

This course teaches the students the basic concepts involving the molecular transport of mass in gases, and liquids and Fickian and non-Fickian mass transport in solids; Prediction of convective mass transport coefficients for various geometries; Interphase mass transfer and importance of mass transport resistances; Design of separation units involving continuous packed bed as well as tray absorption towers.

Textbook: Geankoplis, G.J: Transport Processes and Unit Operations, Prentice Hall, 4th edition, 2008.

Pre-requisite: CHE 234

CHE 336: Process Safety ***1(1,1,0)***

The course provides the students with the fundamentals and applications of chemical process safety, process safety-related standards and regulations, toxicology, toxic release and dispersion model, process hazard identification including HAZOP, and fires and explosions.

Textbook: D. A. Crowl and J. F. Louvar. Chemical Process Safety, Fundamentals with Applications. 3rd. edition, 2011.

Prerequisite: CHE 320

CHE 366: Chemical Engineering Laboratory (1) ***2(0,0,4)***

Carry out experiments of filtration and solid handling; Carry out experiment on double pipe heat exchangers to measure the overall heat transfer coefficient, based on the three modes of heat transfer and the LMTD; Measure the friction factors of fluid flows and the minimum fluidization velocity; Measure experimentally the different parameters related to mass transfer operations: concentration of CO_2 in water, gas diffusion and liquid diffusion.

Pre-requisite: CHE 335

CHE 406: Computational Techniques ***2(1,1,2)***

Apply knowledge in mathematics, applied mathematics and basic chemical engineering principles to numerically solve CHE problems. Familiarize the students with basic concepts and procedures in programming numerical methods to solve and analyze solutions to typical CHE problem.

Textbook: J. B. Riggs, An Introduction to Numerical Methods for Chemical Engineers, 2nd Edition, Texas Tech University Press, 1994.

Pre-requisite: CHE 201 and MATH 254

CHE 409: Separation Processes ***3(3,1,0)***

This course deals with the design of distillation columns involving binary and multi-components; Application of equilibrium stage analysis to solvent extraction; Drying and humidification methods; Cooling towers for air-water system: fundamentals, types, and design.

Textbook: Geankoplis, G.J: Transport Processes and Unit Operations, Prentice Hall, 4th edition, 2008.

Pre-requisite: CHE 335

***Approved by*:** Chairman: …… Dean: ……

CHE 412: Computer Aided Chemical Process Design ***3(2,1,2)***

Introduction to process simulators such as ASPEN PLUS, CHEMCAD, etc. Principles of process synthesis and design. Development of steady-state mass and heat balances and sizing for a chemical process with the aid of process simulators. Optimization of process flowsheet. Computer-aided analyses of large-scale chemical processes.

Textbook: Seider, Seader, Lewin, Widagdo, "Product and Process Design Principles: Synthesis, Analysis and Evaluation, 3rd Edition, 2010.

Pre-requisite: CHE 334

CHE 415: Process Control ***3(3,1,0)***

Introduction and significance of control; Feedback and feed forward control; Dynamics of first and second order systems; Overall transfer function testability; Controllers (P, PI, PID etc.) & final control elements; Introduction to stability of chemical processes; Introduction to frequency response techniques; Routh's criteria, Bode plots, Nyquist method;

Textbook: Stephanopoulos, G., "Chemical Process Control: An Introduction to Theory and Practice", Prentice Hall, 1984.

Pre-requisite: CHE 406

CHE 420: Economics of Chemical Processes ***2(1,1,2)***

The use of chemical engineering and economic principles in the design of a complete chemical plant. General design considerations regarding environmental, health, safety and selection of plant location. Process design development. Sizing, selection and costing of equipment. Capital and operating cost estimation. Profitability indicators: ROI, PBP, NPV, and discounted cash flow return (IRR). Alternative investments and replacements. Introduction to computer-aided design. Optimization solution methodology. Linear programming (Graphical and computer application). Relevant Computer laboratory

Textbook: Turton, R. et al., "Analysis, Synthesis, and design of chemical processes", Prentice Hall, 2012.

Pre-requisite: GE 403.

CHE 423: Selected Topics in Chemical Engineering (2) **2*(2,1,0)***

This course involves a variety of selected topics in chemical engineering. The contents of course depend on community/industry needs and/or instructor specialization and/or students' needs and/or contemporary issues. The course acquaints the students with various Chemical Engineering topics which affect the profession or society or the scientific community at large.
Prerequisite: Successful completion of 120 credit hrs.

CHE 426: Heterogeneous Reactor Engineering ***3(3,1,0)***

This course focuses on various aspects of catalysis including preparation, promoters, inhibitors, and determination of properties. It also discusses transport processes involved in catalysis and catalyst deactivation. Diffusional (internal and external) effects are also presented. Heterogeneous reactors involving solid-gas systems are designed in this course.

***Approved by*:** Chairman: …… Dean: ……

Textbook: H. Scott Fogler, "Elements of Chemical Reaction Engineering", Prentice-Hall, 5th ed., 2016.
Pre-requisite: CHE 320

CHE 466: Chemical Engineering Laboratory (2) ***2(0,0,4)***
Experiments will focus on: Separation processes: distillation and L-L extraction: Reaction Engineering: Batch, CSTR and PFR: Control: stability tests and control
Pre-requisite: CHE 426

B- Seniors' Graduation Project Requirements

CHE 496: Graduation Project (1) ***2(2,0,0)***
This course is aimed at providing the students with the opportunity to unify all their previous course's knowledge or utilize it into one project by designing a chemical process and/or perform experimental work and presenting it a formal report. The topics of the course vary with requirements.
Pre-requisite: Successful completion of 129 cr. Hr and finishing all level 7 and below requirements

CHE 497: Graduation Project (2) ***2(2,0,0)***
This course is the second part of final year project and it is a continuation of the first project (CHE 496)
Pre-requisite: CHE 496

C- Foundation Chemistry Courses

CHEM 230: Principles of Physical Chemistry ***3(3,0,0)***
Molecular kinetic theory of gases, first law of thermodynamics, thermo chemistry, second and third laws of thermodynamics, free energies, adsorption and heterogeneous catalysis.
Pre-requisite: CHEM 101

CHEM 244: Principles of Organic Chemistry (1) ***2(2,0,0)***
Aliphatic Hydrocarbons: Structure, nomenclature, stereochemistry (confirmation of alkane, stereochemistry of cycloalkanes and alkenes (Z, E), synthesis and reactions. Aromatic Hydrocarbons: Benzene, aromaticity, nomenclature, reactions (activation and orientation), polynuclear urenes. Alkyl halides, nomenclature, synthesis and reactions, optical isomerism (SN1, SN2 reactions)
Pre-requisite: None

CHEM 245: Principles of Organic Chemistry (2) ***2(2,0,0)***
Classification, nomenclature, physical properties, synthesis and reactions of the following organic classes: Alcohols, ethers, phenols, aldehydes, ketones, carboxylic (and their derivatives) and amines.

Pre-requisite: CHEM 244

***Approved by*:** Chairman: …… Dean: ……

CHEM 350: Instrumental Analysis for non-major ***4(2,0,4)***
Principles and applications of spectrophotometric and Electro-analytical methods in the determinations of Organic and Inorganic samples
Pre-requisite: CHE 201

D- Elective Courses

Each student is required to select four courses (12 hrs) from the list of elective courses:

CHE 413: Desalination and Water Treatment ***3(3,1,0)***
Study of the scientific, technical as well as economical aspects of desalination of seawater and brackish water with special reference to local conditions. Recovery of minerals as by-products. Solar energy utilization
Prerequisite: Successful completion of 120 credit hours

CHE 422: Selected Topics in Chemical Engineering (1) **3*(3,1,0)***

This course involves a variety of selected topics in chemical engineering. The contents of course depend on community/industry needs and/or instructor specialization and/or students' needs and/or contemporary issues. The course acquaints the students with various Chemical Engineering topics which affect the profession or society or the scientific community at large.

Prerequisite: Successful completion of 120 credit hrs.

CHE 425: Selected Topics in Chemical Engineering (3) **3*(3,1,0)***

This course involves a variety of selected topics in chemical engineering. The contents of course depend on community/industry needs and/or instructor specialization and/or students' needs and/or contemporary issues. The course acquaints the students with various Chemical Engineering topics which affect the profession or society or the scientific community at large.

Prerequisite: Successful completion of 120 credit hrs.

CHE 427: Pollution Prevention in Chemical Industries ***3(3,1,0)***
Introduce students to the environmental laws and regulations for solid waste, water, and air pollutions, hazardous waste management, and life cycle assessment concept with case studies. The course presents available remediation techniques for pollution prevention and waste minimization.
Prerequisite: Successful completion of 120 credit hours

CHE 428: Production of Building and Cementing Materials ***3(3,1,0)***
To teach the students about building material used in various sectors of civilization as well as their production processes and properties and merits.
Prerequisite: Successful completion of 120 credit hours

CHE 429: Energy and Chemical Industries ***3(3,1,0)***
The course covers the following: - energy Analysis of Energy Utilization in The Process Industry. Types and sources of fuels. Optimization of energy consumption in chemical industries. Classifications and manufacturing of fuels. Renewable energy sources potentials and utilizations, Energy and the environmental .Case study. Field trip. Energy-related economics and environmental issues will be discussed.

***Approved by*:** Chairman: …… Dean: ……

Prerequisite: Successful completion of 120 credit hours

CHE 430: Corrosion Engineering ***3(3,1,0)***
The course covers: Corrosion engineering definition & importance, Classification & Nature of corrosion processes, Corrosion in selected environments, Corrosion testing and monitoring, Corrosion prevention and control.
Prerequisite: Successful completion of 120 credit hours

CHE 433: Electrochemical Engineering ***3(3,1,0)***
The course covers the fundamentals of electrochemical engineering, electrochemical cells, thermodynamics and kinetics of electrochemical systems, selected applications of electrochemical engineering.
Prerequisite: Successful completion of 120 credit hours

CHE 434: Extractive Metallurgy and Metals Recycling ***3(3,1,0)***
Perform engineering calculations, which include material & energy balances applied in extractive metallurgical processes. Familiarize the students with basic concepts and procedures that it is applied in minerals processing: calcination, pyrometallurgy, hydrometallurgy, electrometallurgy, and the basic processes for metals recycling.
Prerequisite: Successful completion of 120 credit hours

CHE 437: Waste Treatment Processes ***3(3,1,0)***
Acquire a general information about the waste management and disposal; Sources and classification of wastes; Effects of waste on the health, safety and environmental. Be aware of Local and international laws, regulations and standards related to waste treatment and management. Study different waste treatment processes.
Prerequisite: Successful completion of 120 credit hours

CHE 438: Water Chemistry & Chemical Analysis ***3(3,1,0)***
The students are exposed to the basic concepts of water properties and chemistry needed for water and desalination processes. Basic Principles, Major aquatic chemical processes, Analytical data required for desalination applications, Principles of disinfection, Oxidation – reduction reactions in water.
Prerequisite: Successful completion of 120 credit hours

CHE 440: Introduction to Biochemical Engineering ***3(3,1,0)***
Application of Chemical Engineering principles and approaches to biologically-based systems and processes. Elements of applied microbiology: Enzyme & Fermentation kinetics, Bioreactor design, scale-up and scale-down, Down-stream processing.
Prerequisite: Successful completion of 120 credit hours

CHE 441: Petroleum Refining Engineering ***3(3,1,0)***
Characterization and evaluation of crude petroleum. Application of chemical engineering to the oil industry. Refining techniques, physical separation, chemical conversion and treating processes. Design and costing of refinery equipment. Product testing and specifications. Environmental issues
Prerequisite: Successful completion of 120 credit hours

CHE 442: Petrochemical Industries ***3(3,1,0)***

The course provides the students with the techniques and economics of the production of basic and intermediate petrochemicals as well as some products with special reference to conditions prevailing in Saudi Arabia.
Prerequisite: Successful completion of 120 credit hours

CHE 443: Natural Gas Processing ***3(3,1,0)***
This course deals mainly with the study of concept of gas processing, the principal types of natural gas, and its applications both as feedstock in petrochemicals industries and as an energy sources. The course also discusses the main low temperatures process such as liquefaction cycles, and separations process related to natural gas. It also introduces recent advanced technology related to LNG, storage and transport equipment
Prerequisite: Successful completion of 120 credit hours

CHE 445: Biological Wastewater Treatment ***3(3,1,0)***
Introduce the students to the fundamentals of biochemical operations in waste water treatment, stoichiometry and kinetics of biochemical operations, applications to analysis and design of suspended growth reactors and attached growth reactors.
Prerequisite: Successful completion of 120 credit hours

CHE 446: Environmental Biotechnology ***3(3,1,0)***
Provide the students with the fundamental background knowledge in the area of Environmental Biotechnology. Students should be able to understand the role of microorganisms in processes such as biofilm formation, bio-corrosion, mineral leaching, composting, bioremediation and production of a fine chemical from a renewable resource and to understand how to manipulate environmental conditions to enhance or retard a given process.
Prerequisite: Successful completion of 120 credit hours

CHE 447: Fundamentals of Polymer Sciences and Engineering ***3(3,1,0)***
This course familiarizes the students with the polymer classifications and properties. To familiarize the students with basic concepts and procedures to perform polymer processing. Understanding the concepts of viscoelasticity, solubility and rubber elasticity. Establishing polymerization reaction mechanism, kinetics, reaction rates and polymer reactors.
Prerequisite: Successful completion of 120 credit hours

CHE 448: Fundamentals of Minerals Processing ***3(3,1,0)***
Provide the student with a basic understanding of mineral processing industry. The mining component of the course will introduce the mineral processing methods and the economic evaluation of mineral properties. The mineral processing component will introduce mineral separation processes including gravity, electrostatic and flotation separation
Prerequisite: Successful completion of 120 credit hours

CHE 449: Membrane Separations ***3(3,1,0)***
Overview of separation processes based on the application of membranes; Definition and explanation of terms related to membrane separation ; Mass transport in membranes and their modelling; Membrane materials, membrane modules, membrane flow patterns, membrane cascades; External mass-transfer resistances; Dialysis and electro-dialysis, Reverse osmosis, Gas permeation, Ultra-filtration, Microfiltration, Pervaporation.
Prerequisite: Successful completion of 120 credit hours

***Approved by*:** Chairman: …… Dean: ……

CHE 450: Renewable Energy ***3(3,1,0)***

To familiarize the students with concept and different sources of renewable energy, their need and benefit and application. Estimation of the energy produced from each source of Energy renewable and classical

Prerequisite: Successful completion of 120 credit hours

CHE 451: Risk Assessment and Hazard Control ***3(3,1,0)***

The course covers various topics regarding risk assessment in chemical industries. Introduction to the concepts of hazard, risk, and risk assessment.Risk Assessment Methodologies. Hazard Identification and Control. Hazard and Operability Method (HAZOP). Implementing Process Hazard Analysis (PHAs) in design. Lessons Learned from Accidents

Prerequisite: Successful completion of 120 credit hours

CHE 452: Food Processing Technologies ***3(3,1,0)***

Food processing, an integral part of chemical engineering, is a vital industrial sector which includes a variety of chemical engineering unit operations. Indeed, from raw materials to the final products and byproducts food systems may be subjected to many operations such as cutting, washing, fluidization, mass transfer extractive operations, thermal/cold treatment, pressing, drying, etc. Understanding the relationship ‘‘food material-technology’’ is central for a successful implementation of any food processing operation. To do so from processing engineering perspectives, knowledge of food properties and the influence of food constituents on these properties should be insured.

Textbook: P. Fellows. Food Processing Technology: Principles and Practice, 2nd Edition

Prerequisite: Successful completion of 120 credit hours

CHE 453: Composite Science & Engineering ***3(3,1,0)***

Production/fabrication processes of composite materials; The Concept of Reinforcement; Definition and importance of Matrix

Textbook: Composite Materials: Science and Engineering (Materials Research and Engineering) 2012 by Krishan K. Chawla

Prerequisite: Successful completion of 120 credit hours

CHE 454: Process Energy Optimization ***3(3,1,0)***

Principles of process heat integration. Fundamentals of pinch analysis. Introduction to Aspen Energy Analyzer. Energy optimization of chemical process. Preliminary Heat exchanger network. Optimum heat exchanger network.

Prerequisite: Successful completion of 120 credit hours

CHE 467: Process Integration ***3(3,1,0)***

The course presents systematic and state-of-the-art techniques for understanding the global insights of mass and energy flows within a chemical process (plant) and how these integrated insights can be used to optimize process performance. A variety of mathematical and visualization tools are presented. The course investigates the recent advances in chemical process integration and synthesis. In particular, emphasis is given to fundamental integration and synthesis methodologies along with their applications to the process industries.

Prerequisite: Successful completion of 120 credit hours

CHE 998: Research Project *1 (NP)*

The course is designed to serve the research needs of the students. The course is not required for graduation; so students may opt to register it or otherwise. The consent of the faculty member with whom the student might work is essential.

Prerequisite: Successful completion of 129 credit hours.

CHE 999: Practical Training *0 (NP)*

Students in the department are required to complete a 10 weeks summer training requirement in an area related to Chemical Engineering. Prior to undertaking the summer training program, the student must obtain the approval of the department and he must have completed, successfully, at least 110 credit hours including the CFY (or 78 credit hours excluding the CFY). Students enrolling in the summer training program are not allowed to take simultaneously any course or projects.

Prerequisite: Successful completion of 110 credit hours