B.Sc. in Chemical Engineering

Chemical Engineering Program

Program Specification

According to Regulation 2019

Administrative Information

Program title	Chemical Engineering, **CHE**
Program type	Single
Award/Degree	B.Sc. Degree
Dept. (s) responsible	Chemical Engineering
Coordinator	Head of Chemical Engineering department Associate prof. Dr. Ghada kadry
Assistant Co-ordinator:	Dr. Mostafa Hassanein Hussein
External evaluator	Prof. Dr. Mai Mohammed Kamal Fouad
Date of the most recent approval of program specification	Department Council on Academic Council on

Content

Chemical Engineering
Program Specification
(New curriculum of academic year 2024/2025)

A. Basic Information

1. **Program Title:** Bachelor's degree of Chemical Engineering.
2. **Program Type:** Single

Department responsibility: Chemical Engineering Department.

Date of program regulation approval: 2019

Date of program specification approval: 2024/2025

Staff Members

Chemical Engineering Program is taught by 24 highly qualified staff members. (Appendix 4).

No. of staff members	Full- time	Part-time
Engineering Courses	**6**	**1**
Basic Sciences Courses	**17**	**-**

B. Professional Information

Preamble

Chemical Engineering is one of the most challenging and rewarding careers one can choose. One of the hallmarks of a chemical engineering education is flexibility. Students study chemical processes at the molecular level and the chemical plant level and gain an education deeply grounded in mathematics, chemistry, physics, biology, and materials science . . . not to mention engineering itself.

Technical knowledge alone is not enough, and chemical engineers must also understand engineering economics, project management, and global business practices.

The chemical industry is one of the major driving forces of our nation's economy. From innovations and continual improvements made by chemical engineers flow every new medicine, electronic device and high-performance material, plus new technologies for cleaning the environment and feeding and clothing the world's population.

An education in chemical engineering can serve as the foundation for a wide variety of careers. Many, but not most, chemical engineering jobs can be found in the chemical process industry, including oil and chemical companies, but other large employers of chemical engineers include organizations involved with food and consumer products, semiconductors, energy and environmental engineering, pharmaceuticals, and cosmetics.

Chemical engineers typically work to design new processes, improve existing processes, reduce manufacturing costs, research, and develop new processes and products, and manage corporate assets.

1. The Program Aims

The mission of the Chemical Engineering program is to harness the capabilities and efforts to build, train and qualify chemical engineer professionally to conduct research and provide advisory services specialized in Chemical Engineering and science applications.

The Chemical Engineering programmer aims are providing future engineers with appropriate theoretical knowledge and technical skills to respond to the professional market demands in the field of Chemical Engineering. The program is identified to satisfy graduates' and stakeholders' needs and to fulfil the program mission.

The graduates of Chemical Engineering program should be able to:

1.1 Apply knowledge and advanced technical skills in chemical engineering.
1.2 Utilize and manage resources creatively through effective analysis and interpretation skill.
1.3 Recognize the potential and applicability of computer-based methods in chemical engineering design.
1.4 Address the issues of process dynamics and control in plant operation.
1.5 Plan and execute research work, evaluate outcomes and draw conclusions.
1.6 Identify and control the impact that chemical engineering has on society from an environmental, economic, social and cultural point of view.

2. The Attributes of Chemical Engineer

The Chemical Engineering Program adopted the NARS attributes for Engineering and Chemical Engineering. The graduates of Chemical Engineering should have the ability to:

2.1 Master a wide spectrum of engineering knowledge and specialized skills and can apply acquired knowledge using theories and abstract thinking in real life situations.
2.2 Apply analytic critical and systemic thinking to identify, diagnose and solve engineering problems with a wide range of complexity and variation.
2.3 Behave professionally and adhere to engineering ethics and standards.
2.4 Work in and lead a heterogeneous team of professionals from different engineering specialties and assume responsibility for own and team performance.
2.5 Recognize his/her role in promoting the engineering field and contribute in the development of the profession and the community.
2.6 Value the importance of the environment, both physical and natural, and work to promote sustainability principles.
2.7 Use techniques, skills and modern engineering tools necessary for engineering practice.
2.8 Assume full responsibility for own learning and self-development, engage in lifelong learning and demonstrate the capacity to engage in post- graduate and research studies.
2.9 Communicate effectively using different modes, tools and languages with various audiences; to deal with academic/professional challenges in a critical and creative manner.
2.10 Demonstrate leadership qualities, business administration and entrepreneurial skills

3. Learning Outcomes (LOs) of Chemical Engineering Program:.

Learning Outcomes (LO's) Chemical Engineering

Upon successful completion of program, the graduate should be able to:

A1.1 Identify and formulate, engineering fundamentals, basic science, and mathematics in the field of Chemical Engineering.
A1.2 Follow methodologies and techniques and explain the data collection and interpretation principle in solving engineering problem.
A1.3 Apply engineering fundamentals, basic science, and mathematics to solve engineering problems
A2.1 Develop and conduct appropriate experimentation and/or simulation
A2.2 Analyze and interpret data, assess, and evaluate findings, draw simplified equipment flow sheets, charts, and curves, and interpret data derived from laboratory observation
A2.3 Use statistical analyses and objective engineering judgment to draw conclusions
A3.1 Discuss topics related to humanitarian interests and moral issues.

A3.2 Analyze the environmental impacts of different industries, to minimize the waste and treat the industrial facilities.
A3.3 Apply engineering design processes to produce cost effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.
A3.4 Use Chemical Engineering IT tools and programming in design
A4.1 Explain the business and the management principles relevant to chemical engineering
A4.2 Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues, and risk management principles.
A5.1 Practice research techniques and methods of investigation as an inherent part of learning
A6.1 Plan, supervise and monitor implementation of engineering projects, taking into consideration other trades requirements.
A7.1 Function efficiently as an individual and as a member of multi-disciplinary and multicultural teams
A8.1 Write technical language and technical report
A8.2 Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools.
A9.1 Use creative, innovative, and flexible thinking in problem solving and design.
A9.2 Acquire entrepreneurial and leadership skills to anticipate and respond to new situations.
A10.1 Acquire and apply new knowledge in deal with the fundamental problems and troubleshooting in chemical engineering plants.
A10.2 Practice self, lifelong and other learning strategies.
B1.1 Explain the essential facts, concepts, theories and the characteristics attributes of organic and inorganic reactions and its applications in the chemical process industries
B1.2 Use The conventional procedures of chemical analysis and characterization common engineering materials and component.
B1.3 Demonstrate the chemical engineering principles and design principles techniques in chemical engineering
B1.4 Identify methods for petroleum and natural gas processing.
B1.5 Design a practical chemical engineering system, component or process utilizing a full range of chemical engineering principles and techniques including Mass and Energy Balance, Thermodynamics, Mass Transfer, Heat Transfer, Momentum Transfer, Kinetics of Chemical Reactions, Reactor Design, Instrumentation and Control of Chemical Processes, and Process and Plant Design.
B2.1 Engage in the recent technological changes and emerging fields relevant to chemical engineering.
B2.2 Act as a professional chemical engineer and respond to the challenging role and responsibilities.
B3.1 Explains basic information and methods of evaluation, good analysis, modelling and simulation of industrial processes
B3.2 Apply numerical modelling methods and/or computational techniques appropriate to chemical engineering.
B4.1 Discuss the principle of quality assurance required for system, codes and standards, the health, safety requirements and environmental issues in the Chemical Engineering field.
B4.2 Adopt suitable national and international standards and codes to design, operate, inspect and maintain chemical engineering systems.

C_1 Acquire insight in the development of raw material, methods of conversion into a useful product, improve the ability to select proper material of construction of equipment in industrial process
C_2 Design and operate different processing systems in the chemical process industries including petroleum refining and gas processing and assess the balance of cost, quality and effects on the environment in production operations
C_3 Apply the concepts of project economics and resources evaluation methods for design and decision making under conditions of risk and uncertainty.

4. Academic Standards

The program adopts the National Academic Reference Standards (NARS 2018) for Engineering in the General (level A) and Chemical Engineering (level B) in Specialized Competencies and ARS (level C) in highly specialized competencies as explained in tables in Appendix1. It was approved by the department council in 12/7/2021 academic council 16/8/2021. The matrices and tables of the program are shown in Appendix1 which include the following Matrices:

- The extent to which the Institute Mission matches the program Mission.
- The extent to which the program Mission matches the program Aims
- The extent to which the program Mission matches the Graduate Attributes
- The extent to which the program Aims matches the Graduate Attributes
- The extent to which the program Aims matches the program competencies
- The extent to which the Graduates Attributes matches the program competencies
- National Academic Reference Standards (NARS) with targeted learning outcomes for the LOS program
- The curriculum mapping matrix of the individual courses to the program competencies targeted for the program. This appendix was developed by the program coordinator, assistant coordinators and professional staff members, the mapping matrix shows that the program courses present balanced to the program LO's
- Analyzing the program's competencies into knowledge and skills outcomes, and they were approved by the Department Council No. (4) on 12/7/2023 and the Academic Council after being reviewed by the external auditor.

5. Benchmark Reference

- A brain storming was made in a meeting dated 24/3/2021 in the Chemical Engineering Department to define the program competencies (Highly specialized)
- The engineering sector and Supreme Council of Higher Education 2020
- The Egyptian NARS 2018, 2nd edition
- Preparation of matrices that demonstrate the adoption of the NARS 2018 academic reference standards:

- The reference mark C1 has been identified from the NARS 2018 standards document (Metallurgical Engineering).
- The reference mark C2 has been identified from the NARS 2018 standards document (Textile Engineering).
- The reference mark C3 has been identified from the NARS 2018 standards document (Petroleum Engineering).
- The reference marks C2 and C3 have been confirmed by the following universities:"

1. Stanford university

Undergraduate Program | Chemical Engineering (stanford.edu)

2. University of California, Berkeley

Chemical Engineering/Nuclear Engineering Joint Major < University of California, Berkeley

6. Program Structure and Contents

A. Program duration Five years including a preparatory year

B. Program Structure:

The main structure of the chemical engineering program is performed according to the Engineering, Technological, Industrial Studies Sector Committee and Standards of National Authority for Quality Assurance and Accreditation**.**

The chemical engineering program includes 65 courses of total 250 contact hours; these courses are classified according to the relevant sector NARS requirements to the following subject areas:

1. Humanities and Social Sciences
2. Mathematics and Basic Sciences
3. Basic Engineering Sciences
4. Applied Engineering and design
5. Computer Application and ICT
6. Projects and Practice
7. Selective Subjects

The following are the subjects taught during this program

prep 1st Semester

Code	Course Name	First semester								Topic Area							Total marks
		Teaching Hours				Marking			Exam Time (hr)	Hum. & Soc. Sc.	Math. & B. Sc.	B. Eng. Sc.	App. Eng. & Des.	Comp. App. & ICT	Proj. & Practice	Selective course	
		Lectures	Tutorial hour	Practical hour	Total hour	Written Exam	Year work	Practical/ oral Exam									
PHM 011	Mathematics (1)	2	2	-	4	90	60	-	2		4						150
PHM 013	Physics(1)	2	1	2	5	90	30	30	2		5						150
PHM 015	Mechanics (1)	2	2	-	4	90	60	-	2		4						150
ARC 011	Engineering Drawing& Projection (1)	1	2	-	3	60	40	-	2			3					100
CHE 011	Chemistry	2	1	1	4	60	20	20	2		4						100
HUM 013	ICDL	1	-	2	3	30	10	10	2					3			50
HUM 011	Technical English Language (1)	1	-	1	2	30	10	10	1	2							50
		11	8	6						2	17	3		3			750
Total hour of first semester		25				Total marks											

prep 2nd Semester

Code	Course Name	Second semester								Subject Area							Total marks
		Teaching Hours				Marking			Exam Time (hr)	Hum. & Soc. Sc.	Math. & B. Sc.	B. Eng. Sc.	App. Eng. & Des.	Comp. App. & ICT	Proj. & Practice	Selective course	
		Lectures	Tutorial hour	Practical hour	Total hour	Written Exam	Year work	Practical/oral Exam									
PHM 012	Mathematics (2)	2	2	-	4	90	60	-	2		4						150
PHM 014	Physics(2)	2	1	2	5	90	30	30	2		5						150
PHM 016	Mechanics (2)	2	2	-	4	90	60	-	2		4						150
ARC 012	Engineering Drawing& Projection (2)	1	2	2	5	60	20	20	2					5			100
PHM 017	Production Technology	1	-	2	3	45	15	15	2			3					75
HUM 014	History of engineering and technology	2	-	-	2	50	25	-	2	2							75
HUM 012	Technical English Language (2)	1	-	1	2	30	10	10	1	2							50
		11	7	7						4	13	3		5			750
Total hour of second semester		25				Total marks											

*mathematics (1)&(2), Physics(1)&(2), Mechanics(1)& (2) Engineering Drawing& Projection(1)& (2)are continuous subject

First Year / 1st Semester

Code	Course Name	First semester								Subject Area							Total marks
		Teaching Hours				Marking			Exam Time (hr)	Hum. & Soc. Sc.	Math. & B. Sc.	B. Eng. Sc.	App. Eng. & Des.	Comp. App. & ICT	Proj. & Practice	Selective course	
		Lectures	Tutorial hours	Practical hours	Total hours	Written Exam	Year work	Practical/ oral Exam									
CHE 121	Inorganic Chemistry	2	-	2	4	75	30	20	2			4					125
CHE 131	Introduction to Chemical Engineering and Petroleum Processing	2	2	-	4	90	35	-	2			4					125
PHM 171	Mathematics (3)	2	2	-	4	90	35	-	2		4						125
PHM 173	Physics(3)	2	1	1	4	75	30	20	2		4						125
CHE 151	Machine Design	2	1	-	3	70	30	-	2				3				100
HUM 171	Selective course Humanities (1)	2	1	-	3	50	25	-	1	3							75
HUM 172	Technical reports	2	-	-	2	50	25	-	1	2							75
		14	7	3						5	8	8	3				750
Total hour of first semester		24				Total marks											

First Year / 2nd Semester

Code	Course Name	Second semester								Subject Area							Total marks
		Teaching Hours				Marking			Exam Time (hr)	Hum. & Soc. Sc.	Math. & B. Sc.	B. Eng. Sc.	App. Eng. & Des.	Comp. App. & ICT	Proj. & Practice	Selective course	
		Lectures	Tutorial hours	Practical hours	Total hours	Written Exam	Year work	Practical/oral Exam									
CHE 122	Organic Chemistry (1)	2	-	2	4	75	30	20	2			4					125
CHE 123	Inorganic and Analytical Chemistry	2	-	2	4	75	30	20	2			4					125
PHM 172	Mathematics (4)	2	2	-	4	90	35	-	2		4						125
PHM 174	Mechanics (3)	2	2	-	4	70	30	-	2		4						100
CVE 112	Principles of Construction Engineering	2	1	-	3	70	30	-	2		3						100
EPM 116	Electrical and Electronic Engineering	2	1	-	3	70	30	-	2		3						100
HUM 173	Selective Courses Humanities (2)	2	1	-	3	50	25	-	1	3							75
		14	7	4						3	14	8					750
Total hour of second semester		25				Total marks											

* Inorganic Chemistry& Inorganic and Analytical Chemistry are continuous subjects
* Mathematics (3) &(4) are continuous subjects

Second Year / 1st Semester

Code	Course Name	First semester								Subject Area							Total marks
		Teaching Hours				Marking			Exam Time (hr)	Hum. & Soc. Sc.	Math. & B. Sc.	B. Eng. Sc.	App. Eng. & Des.	Comp. App. & ICT	Proj. & Practice	Selective course	
		Lectures	Tutorial hours	Practical hours	Total hours	Written Exam	Year work	Practical/ oral Exam									
CHE 221	Organic Chemistry (2)	2	-	2	4	75	30	20	2			4					125
CHE 231	Momentum Transfer	3	3	-	6	110	65	-	2			6					175
CHE 222	Physical Chemistry and Thermodynamics	2	1	2	5	90	40	20	2			5					150
CHE 232	Fundamentals of Mass and Energy Balance	2	3	-	5	100	50	-	2			4		1			150
HUM 271	Humanities (3)	2	1	-	3	50	25	-	1	3							75
HUM 272	Research and Analysis Skills	2	1	-	3	50	25	-	1	3							75
		13	9	4						8		19		1			750
Total hour of first semester		26				Total marks											

Second Year / 2nd Semester

Code	Course Name	Second semester								Subject Area							Total marks
		Teaching Hours				Marking			Exam Time (hr)	Hum. & Soc. Sc.	Math. & B. Sc.	B. Eng. Sc.	App. Eng. & Des.	Comp. App. & ICT	Proj. & Practice	Selective course	
		Lectures	Tutorial hours	Practical hours	Total hours	Written Exam	Year work	Practical/ oral Exam									
CHE 223	Physical Chemistry and Phase Equilibrium	2	1	2	5	90	40	20	2			5					150
CHE 224	Organic and Biochemistry	2	-	2	4	75	30	20	2			4					125
PHM 271	Probability and Statistics	1	1	-	2	70	30	-	2		2						100
CHE 233	Principles of Mechanical Engineering	2	1	-	3	70	30	-	2		3						100
CHE 2XX1	Selective Courses (1)	2	2	-	4	90	35	-	2							4	125
HUM 273	Humanities (4)	2	1	-	3	50	25	-	1	3							75
HUM 274	Environmental Evaluation Impacts	2	1	-	3	50	25	-	1	3							75
		13	7	4						6	5	9				4	750
Total hour of second semester		24				Total marks											

Third Year / 1st Semester

Code	Course Name	First semester								Subject Area							Total marks
		Teaching Hours				Marking			Exam Time (hr)	Hum. & Soc. Sc.	Math. & B. Sc.	B. Eng. Sc.	App. Eng. & Des.	Comp. App. &	Proj. & Practice	Selective course	
		Lectures	Tutorial hours	Practical hours	Total hours	Written Exam	Year work	Practical/ oral Exam									
CHE 371	Mechanical Unit Operations	2	3	-	5	90	35	-	2				5				125
CHE 361	Organic Chemical Industries	2	-	2	4	75	30	20	2				2		2		125
CHE 362	Inorganic Chemical Industries	2	-	2	4	90	40	20	2				2		2		150
CHE 331	Heat Transfer and its Applications	2	3	-	5	100	50	-	2				5				150
CHE 341	Applied Electrochemistry and Corrosion Engineering	2	2	-	4	90	35	-	2				2			2	125
HUM 371	Project Management	2	1	-	3	50	25	-	2					3			75
		12	9	4									16	3	4	2	750
Total hour of first semester		25				Total marks											

Third Year / 2nd Semester

Code	Course Name	Second semester								Subject Area							Total marks
		Teaching Hours				Marking			Exam Time (hr)	Hum. & Soc. Sc.	Math. & B. Sc.	B. Eng. Sc.	App. Eng. &	Comp. App. & ICT	Proj. & Practice	Selective course	
		Lectures	Tutorial hours	Practical hours	Total hours	Written Exam	Year work	Practical/ oral Exam									
CHE 342	Material Science and New Materials	2	2	-	4	90	35	-	2			4					125
CHE 363	Polymer Engineering	2	-	2	4	75	30	20	2				2			2	125
CHE 364	High Temperature Industries	3	-	2	5	90	40	20	2				3		2		150
CHE 351	Modeling and Simulation in Chemical Engineering	2	3	-	5	100	50	-	2					5			150
CHE 3XX2	Selective Course(2)	2	2	-	4	90	35	-	2							4	125
CHE 3YY	Field Training (1)	-	-	3	3	-	75	-							3		75
		11	7	7								4	5	5	5	6	750
Total hour of second semester		25				Total marks											

Fourth Year / 1st Semester

Code	Course Name	First semester								Subject Area							Total marks
		Teaching Hours				Marking			Exam Time (hr)	Hum. & Soc. Sc.	Math. & B. Sc.	B. Eng. Sc.	App. Eng. & Des.	Comp. App. & ICT	Proj. & Practice	Selective course	
		Lectures	Tutorial hours	Practical hours	Total hours	Written Exam	Year work	Practical/ oral Exam									
CHE 431	Mass Transfer and Multi-stage Separations (1)	2	2	-	4	80	30	15	2				4				125
CHE 491	Petroleum Refining Engineering	2	2	1	5	75	30	20	2				4		1		125
CHE 451	Chemical Reactors and Vessel Design	3	3	-	6	100	50	-	2				3	3			150
CHE 452	Process and Plant Design	2	2	-	4	80	30	15	2				4				125
CHE 453	Chemical Engineering Lab	1	-	3	4	60	20	20	2				1		3		100
CHE 4ZZ	Graduation Project	1	-	-	1	-	-	-	-						1		-
CHE 4YY	Field Training (2)	-	-	3	3	-	75	-	-						3		75
		11	9	7									16	3	8		700
Total hour of first semester		27				Total marks											

Fourth Year / 2nd Semester

Code	Course Name	Second semester								Subject Area							Total marks
		Teaching Hours				Marking			Exam Time (hr)	Hum. & Soc. Sc.	Math. & B. Sc.	B. Eng. Sc.	App. Eng. & Des.	Comp. App. & ICT	Proj. & Practice	Selective course	
		Lectures	Tutorial hours	Practical hours	Total hours	Written Exam	Year work	Practical/oral Exam									
CHE 432	Mass Transfer and Multi-stage Separations (2)	2	2	-	4	80	30	15	2				4				125
CHE 454	Process Control	2	2	-	4	100	50	-	2				2	2			150
CHE 455	Economics of Chemical Plants	2	2	-	4	70	30	-	2				4				100
CHE 481	Environmental Engineering	2	1	1	4	60	20	20	2				3		1		100
CHE 4XX$_3$	Selective Course (3)	2	2	-	4	90	35	-	2							4	125
CHE 4ZZ	Graduation Project	1	-	3	4	-	75	125	-						4		200
		11	9	4									13	2	5	4	
Total hour of second semester		24				Total marks											800

*Mass transfer & separation operation (1),(2) are continuous subjects

Total teaching hours and subject distribution over the subject areas chemical engineering

	Course teaching hours credit hour	Humanities & Social Sciences	Math & Basic Sciences	Basic Eng	Applied Eng & Design	Computer Appl & ICT*	Projects* & Practice	Selective course
Total prep year 1st Semester	25	2	17	3		3		
Total prep year 2nd Semester	25	4	13	3		5		
Total 1st year 1st Semester	24	5	8	8	3			
Total 1st year 2nd Semester	25	3	14	8				
Total 2nd year 1st Semester	26	6		19		1		
Total 2nd year 2nd Semester	24	6	5	9				4
Total 3rd year 1st Semester	25				16	3	4	2
Total 3rd year2nd Semester	24			4	5	5	5	6
Total 4th year 1st Semester	27				16	3	8	
Total4th year 2nd Semester	24				13	2	5	4
Total of Five Years	250	26	57	54	53	22	22	16
% of Five Years	100%	**10.4%**	**22.8%**	**21.6%**	**21.2%**	**8.8%**	**8.8%**	**6.4%**
NARS %	**100%**	**9-12%**	**20-26%**	**20-23%**	**20-22%**	**9-11%**	**8-10%**	**6-8%**

Courses in the Chemical Engineering Program according to Engineering Studies Sector Committee Requirements as follows

Topic	Topic Area							Total Contact hours	Total credit hours
	Humanities and Social Sciences	Business Management	Engineering Culture	Mathematics and Basic Sciences	Basic Engineering Sciences	Applied Engineering and design	Projects and Practice		
Humanities and Social Sciences								21	14
Business Management								7	5
Engineering Culture								12	8
Mathematics and Basic Sciences								52	37
Basic Engineering Sciences								72	48
Applied Engineering and design								73	51
Projects and Practice								13	7
Total Credit hours	14	5	8	37	48	51	7		170
Total Contact hours	21	7	12	52	72	73	13	250	
% Credit hours	8.24%	2.94 %	4.71%	21.76%	28.23%	30%	4.12%		100%
%Contact hours	8.4%	2.8%	4.8%	20.8%	28.8%	29.2%	5.2%	100%	
The Engineering Studies Sector Committee Requirements	8-12%	2- 4%	4-6%	18-22%	25-30%	25-30%	4-6%		

Topic	Topic Area				Total Contact hours	Total credit hours
	University Requirements	College Requirements	General Specialization Requirements	Specialization requirements		
University Requirements					24	16
College Requirements					75	49
General Specialization Requirements					86	59
Specialization requirements					65	46
Total Credit hours	16	49	59	46		170
Total Contact hours	24	75	86	65	250	
% Credit hours	9.41%	28.82%	34.71%	27.06%		100%
% Contact hours	9.6%	30%	34.4%	26%	100%	
Graduation Requirements	Min. 8%	Min. 20 %	Min. 35%	Max. 30%		

The above tables show the contact hours distribution and the requirements of

- The engineering sector and Supreme Council of Higher Education 2020
- The Egyptian NARS 2018, 2nd edition

It is the evident that the current program fulfills the NARS, The engineering sector requirements and Graduation requirement.

7. Courses contributing to the program

Courses Code:
Title course: See Appendix 2 Course Description
Content:

8. Program Admission Requirements

- Secondary Egyptian Schools Graduates.
- Secondary School Certificate Graduates of other countries are eligible to join this program if they meet the minimum grades set by Admission Office of the Ministry of Higher Education.
- The study begins with a preparatory year for all students before specialization in Chemical Engineering. Students departmental allocation is in accordance with the institute Council regulations.

9. Regulations for Progression and Program Completion

- The student is considered successful if he passes the examinations in all courses of his class.
- The student is promoted to the next higher level if he fails in not more than two subjects of his class or from lower classes.
- In addition to the two subjects mentioned in the previous item, the student who fails in two subjects in humanities and social sciences, whether from his class or from lower classes, is admitted to the transfer to the consecutive higher level. Passing successfully in all courses before attaining the B.Sc. degree is a prerequisite.
- The referred student has to sit the examination in the courses in which he has failed together with the students studying the same courses. The student gets a pass grade when he passes the examination successfully. In case the student was considered absent with acceptable excuse in a course, he gets the actual grade,
- The grades of the successful student in a course and in the general grade are evaluated as follows:

- Distinction: from 85% of the total mark and upwards.
- Very good: from 75% to less than 85% of the total mark.
- Good from: 65% to less than 75% of the total mark
- Pass: from: 50% to less than 65% of the total mark
- The grades of a failing student in a course are either one of the following grades:

Weak: from 30% to less than 50% of the total mark

Very weak: less than 30% of the total mark.

- The B.Sc. general grade for students is based on the cumulative marks obtained during all the years of study. The students are then arranged serially according to their cumulative sum.
- The student is awarded an honor degree if his cumulative sum is either distinction or very good provided that he gets a grade not less than very good in any class of study other than the preparatory year. Moreover, he should have not failed in any examination he sat in any class other than the preparatory year.

10. Methods and rules for student assessment

10.1 Teaching and learning methods.

teaching and learning methods	LOs of Chemical Engineering Program																																				
	Level A General Competencies																						Level B Specialized Competencies												Level C Highly Specialized Competencies		
	A1.1	A1.2	A1.3	A2.1	A2.2	A2.3	A3.1	A3.2	A3.3	A3.4	A4.1	A4.2	A5.1	A6.1	A7.1	A8.1	A8.2	A9.1	A9.2	A10.1	A10.2	B1.1	B1.2	B1.3	B1.4	B1.5	B2.1	B2.2	B3.1	B3.2	B4.1	B4.2	C1	C2	C3
Lectures / online lecture	■	■	■								■	■				■	■	■	■			■	■	■	■	■			■	■			■	■	■
Presentations and Movies													■		■	■	■	■	■																
Discussions															■	■	■	■	■																
Tutorials				■	■	■	■	■	■	■	■	■						■	■			■	■	■	■	■			■	■			■	■	■
Practical and Laboratory experiments				■	■	■									■	■	■	■	■										■	■			■		
Problem solving	■	■	■											■		■	■	■	■								■	■			■	■			■
Projects							■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■
Self-learning													■							■	■														■
Site visits /simulation &modeling				■	■	■									■												■	■	■	■			■		■
Researches and Reports							■	■	■	■	■	■	■		■					■	■	■	■	■	■	■	■	■					■		■
Cooperative work															■	■	■	■	■										■	■	■	■	■		

10.2 Assessment Methods

Assesssement methods	LOs of Chemical Engineering Program																																	
	Level A General Competencies																					Level B Specialized Competencies										Level C Highly Specialized Competencies		
	A1.1	A1.2	A1.3	A2.1	A2.2	A2.3	A3.1	A3.2	A3.3	A3.4	A4.1	A4.2	A5.1	A6.1	A7.1	A8.1	A8.2	A9.1	A9.2	A10.1	A10.2	B1.1	B1.2	B1.3	B1.4	B1.5	B2.1	B2.2	B3.1	B3.2	B4.1	B4.2	C 1	C 2	C 3
Written exam	■	■	■	■	■	■	■	■	■	■	■	■								■	■	■	■	■	■	■			■	■	■	■	■	■	■
Oral Exam											■	■		■		■	■	■	■	■	■						■	■			■	■	■		■
Mid Term Exam(face to face/online)	■	■	■	■	■	■	■	■	■	■	■	■								■	■	■	■	■	■	■			■	■	■	■	■	■	■
Attendance	■	■	■										■		■	■	■	■	■			■	■	■	■	■			■	■	■	■	■	■	■
Project							■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■
sheet	■	■	■	■	■	■																■	■	■	■	■			■	■				■	■
Report							■	■	■	■	■	■	■		■					■	■	■	■	■	■	■	■	■					■		
Laboratory Exam				■	■	■									■	■	■	■	■										■	■					
Quiz	■	■	■	■	■	■																■	■	■	■	■									
Online Quiz	■	■	■	■	■	■																■	■	■	■	■			■	■					

11. Program Evaluation

Evaluator	Tool
1- Senior students	**Questionnaire**
2- Alumni	**Questionnaire**
3- Stakeholders	**Questionnaire**
4- External Evaluator(s) (External Examiner (s))	**Report**
5- Other societal parties	**Questionnaire**

Program Coordinator: Head of Chemical Engineering Department
Associate prof. Dr. Ghada kadry

Signature:
Date:

In The Department Council 2-9-2024
In The Academic Council 18-9-2024

Appendix 1

Matrices

Table (1) Analysis of Program mission

Chemical Engineering Program

Program Mission Harness the capabilities and efforts to build, train and qualify chemical engineer professionally to conduct research and provide advisory services specialized in Chemical Engineering and science applications	Learning Mission	Post Graduate and Research Mission	Society and Environmental Affairs Mission	Ethics Mission
Harness the capabilities and efforts to build, train and qualify chemical engineer professionally,	√		√	√
conduct research	√	√		√
Provide advisory services specialized in Chemical Engineering and science applications		√	√	√

Table (2) Matrix of Program mission and Institute mission

Program Mission	Institute Mission: رسالة المعهد إعداد مهندسين قادرين على الإبداع من خلال البرامج الأكاديمية المختلفة تخريج مهندسين متميزين في تخصصات مختلفة تلبى احتياجات ومتطلبات سوق العمل تطوير البحث العلمي ليتكامل مع متطلبات الصناعة والمجتمع المحلى الرسالة باللغة الانجليزية Preparation of creative engineers through various academic programs. Graduate distinguished engineers in different disciplines to meet the needs of the labor market. The development of scientific research to integrate with the industry and the local community requirements
Harness the capabilities and efforts to build, train and qualify chemical engineer professionally,	Preparation of creative engineers through various academic programs.
conduct research	The development of scientific research
Provide advisory services specialized in Chemical Engineering and science applications	Graduate distinguished engineers in different disciplines meet the needs of the labor market

Table (3) Matrix of Program mission and Program aims

Program Mission Harness the capabilities and efforts to build, train and qualify chemical engineer professionally to conduct research and provide advisory services specialized in Chemical Engineering and science applications	Program aims
Harness the capabilities and efforts to build, train and qualify chemical engineer professionally,	1. Apply knowledge and advanced technical skills in chemical engineering. 2. Utilize and manage resources creatively through effective analysis and interpretation skill. 3. Recognize the potential and applicability of computer-based methods in chemical engineering design. 4. Address the issues of process dynamics and control in plant operation .
conduct research	2. Utilize and manage resources creatively through effective analysis and interpretation skill. 5.Plan and execute research work, evaluate outcomes, and draw conclusions .
Provide advisory services specialized in Chemical Engineering and science applications	2. Utilize and manage resources creatively through effective analysis and interpretation skill. 4. Address the issues of process dynamics and control in plant operation . 6. Identify and control the impact that chemical engineering has on society from an environmental, economic, social and cultural point of view.

Table (4) Matrix of Program mission and the attributes of chemical engineer

Program Mission Harness the capabilities and efforts to build, train and qualify chemical engineer professionally to conduct research and provide advisory services specialized in Chemical Engineering and science applications	The attributes of chemical engineer
Harness the capabilities and efforts to build, train and qualify chemical engineer professionally,	1. Master a wide spectrum of engineering knowledge and specialized skills and can apply acquired knowledge using theories and abstract thinking in real life situations. 2. Apply analytic critical and systemic thinking to identify, diagnose and solve engineering problems with a wide range of complexity and variation. 3. Behave professionally and adhere to engineering ethics and standards. 4. Work in and lead a heterogeneous team of professionals from different engineering specialties and assume responsibility for own and team performance. 7. Use techniques, skills and modern engineering tools necessary for engineering practice. 9. Communicate effectively using different modes, tools and languages with various audiences; to deal with academic/professional challenges in a critical and creative manner.
conduct research	7. Use techniques, skills, and modern engineering tools necessary for engineering practice.

	8. Assume full responsibility for own learning and self-development, engage in lifelong learning and demonstrate the capacity to engage in post- graduate and research studies.
Provide advisory services specialized in Chemical Engineering and science applications	2. Apply analytic critical and systemic thinking to identify, diagnose and solve engineering problems with a wide range of complexity and variation 3. Behave professionally and adhere to engineering ethics and standards 5. Recognize his/her role in promoting the engineering field and contribute in the development of the profession and the community 6. Value the importance of the environment, both physical and natural, and work to promote sustainability principles 10. Demonstrate leadership qualities, business administration and entrepreneurial skills

Table (5) Matrix of Program Aims and The attributes of chemical engineer

The attributes of chemical engineer	Program Aims
1. Master a wide spectrum of engineering knowledge and specialized skills and can apply acquired knowledge using theories and abstract thinking in real life situations 2. Apply analytic critical and systemic thinking to identify, diagnose and solve engineering problems with a wide range of complexity and variation 7. Use techniques, skills, and modern engineering tools necessary for engineering practice 8. Assume full responsibility for own learning and self-development, engage in lifelong learning and demonstrate the capacity to engage in post-graduate and research studies.	1. Apply knowledge and Advanced technical skills in chemical engineering
2. Apply analytic critical and systemic thinking to identify, diagnose and solve engineering problems with a wide range of complexity and variation 3. Behave professionally and adhere to engineering ethics and standards 7. Use techniques, skills and modern engineering tools necessary for engineering practice	2. Utilize and manage resources creatively through effective analysis and interpretation skill.
2. Apply analytic critical and systemic thinking to identify, diagnose and solve engineering problems with a wide range of complexity and variation 7. Use techniques, skills and modern engineering tools necessary for engineering practice 9. Communicate effectively using different modes, tools and languages with various audiences; to deal with academic/professional challenges in a critical and creative manner	3. Recognize the potential and applicability of computer-based methods in chemical engineering design.
3. Behave professionally and adhere to engineering ethics and standards 4. Work in and lead a heterogeneous team of professionals from different engineering specialties and assume responsibility for own and team performance 5. Recognize his/her role in promoting the engineering field and contribute in the development of the profession and the community 8. Assume full responsibility for own learning and self-development, engage in lifelong learning and demonstrate the capacity to engage in post-graduate and research studies 9. Communicate effectively using different modes, tools and languages with various audiences; to deal with academic/professional challenges in a critical and creative manner 10. Demonstrate leadership qualities, business administration and entrepreneurial skills	4. Address the issues of process dynamics and control in plant operation .
1. Master a wide spectrum of engineering knowledge and specialized skills and can apply acquired knowledge using theories and abstract thinking in real life situations	5. Plan and execute research work, evaluate outcomes and draw conclusions .

The attributes of chemical engineer	Program Aims
2. Apply analytic critical and systemic thinking to identify, diagnose and solve engineering problems with a wide range of complexity and variation 6. Value the importance of the environment, both physical and natural, and work to promote sustainability principles 8. Assume full responsibility for own learning and self-development, engage in lifelong learning and demonstrate the capacity to engage in post-graduate and research studies	
2. Apply analytic critical and systemic thinking to identify, diagnose and solve engineering problems with a wide range of complexity and variation 3. Behave professionally and adhere to engineering ethics and standards 4. Work in and lead a heterogeneous team of professionals from different engineering specialties and assume responsibility for own and team performance 5. Recognize his/her role in promoting the engineering field and contribute in the development of the profession and the community 6. Value the importance of the environment, both physical and natural, and work to promote sustainability principles	6. Identify and control the impact that chemical engineering has on society from an environmental, economic, social, and cultural point of view.

Table (6a) Matrix of (LOs) for Chemical Engineering program and Program mission

(LOs) for Chemical Engineering program	Program mission
A1.1 Identify and formulate, engineering fundamentals, basic science, and mathematics in the field of Chemical Engineering. **A1.2** Follow methodologies and techniques and explain the data collection and interpretation principle in solving engineering problem. **A1.3** Apply engineering fundamentals, basic science, and mathematics to solve engineering problems **A2.1** Develop and conduct appropriate experimentation and/or simulation **A2.2** Analyze and interpret data, assess, and evaluate findings, draw simplified equipment flow sheets, charts, and curves, and interpret data derived from laboratory observation **A2.3** Use statistical analyses and objective engineering judgment to draw conclusions. **A9.1** Use creative, innovative, and flexible thinking in problem solving and design. **A9.2** Acquire entrepreneurial and leadership skills to anticipate and respond to new situations. **A10.1** Acquire and apply new knowledge in deal with the fundamental problems and troubleshooting in chemical engineering plants. **A10.2** Practice self, lifelong and other learning strategies. **B1.1** Explain the essential facts, concepts, theories and the characteristics attributes of organic and inorganic reactions and its applications in the chemical process industries **B1.2** Use The conventional procedures of chemical analysis and characterization common engineering materials and component. **B1.3** Demonstrate the chemical engineering principles and design principles techniqu in chemical engineering **B1.4** Identify methods for petroleum and natural gas processing. **B1.5** Design a practical chemical engineering system, component or process utilizing a full range of chemical engineering principles and techniques including Mass and Energy Balance, Thermodynamics, Mass Transfer, Heat Transfer, Momentum Transfer, Kinetics of Chemical Reactions, Reactor Design, Instrumentation and Control of Chemical Processes, and Process and Plant Design. **B2.1** Engage in the recent technological changes and emerging fields relevant to chemical engineering. **B2.2** Act as a professional chemical engineer and respond to the challenging role and responsibilities. **B3.1** Explains basic information and methods of evaluation, good analysis, modelling and simulation of industrial processes **B3.2** Apply numerical modelling methods and/or computational techniques appropriate to chemical engineering.	Harness the capabilities and efforts to build, train and qualify chemical engineer professionally

(LOs) for Chemical Engineering program	Program mission
C1 Acquire insight into the development of raw materials, and methods of conversion into a useful product, and improve the ability to select proper material of the construction of equipment in the industrial process. **C2** Design and operate different processing systems in the chemical process industries including petroleum refining and gas processing and assess the balance of cost, quality, and effects on the environment in production operations. **C3** Apply the concepts of project economics and resources evaluation methods for design and decision-making under conditions of risk and uncertainty.	
A2.1 Develop and conduct appropriate experimentation and/or simulation **A2.2** Analyze and interpret data, assess, and evaluate findings, draw simplified equipment flow sheets, charts, and curves, and interpret data derived from laboratory observation **A2.3** Use statistical analyses and objective engineering judgment to draw conclusions **A5.1** Practice research techniques and methods of investigation as an inherent part of learning **A9.1** Use creative, innovative, and flexible thinking in problem solving and design. **A9.2** Acquire entrepreneurial and leadership skills to anticipate and respond to new situations. **A10.1** Acquire and apply new knowledge in deal with the fundamental problems and troubleshooting in chemical engineering plants. **A10.2** Practice self, lifelong and other learning strategies. **B3.1** Explains basic information and methods of evaluation, good analysis, modelling and simulation of industrial processes **B3.2** Apply numerical modelling methods and/or computational techniques appropriate to chemical engineering. **B4.1** Discuss the principle of quality assurance required for systems, codes, and standards, the health, safety requirements, and environmental issues in the Chemical Engineering field. **B4.2** Adopt suitable national and international standards and codes to design, operate, inspect and maintain chemical engineering systems. **C1** Acquire insight into the development of raw materials, and methods of conversion into a useful product, and improve the ability to select proper material of the construction of equipment in the industrial process. **C3** Apply the concepts of project economics and resources evaluation methods for design and decision-making under conditions of risk and uncertainty.	To conduct research
A3.1 Discuss topics related to humanitarian interests and moral issues. **A3.2** Analyze the environmental impacts of different industries, to minimize the waste and treat the industrial facilities. **A3.3** Apply engineering design processes to produce cost effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.	Provide advisory services specialized in Chemical Engineering and science applications.

(LOs) for Chemical Engineering program	Program mission
A3.4 Use Chemical Engineering IT tools and programming in design **A4.1** Explain the business and the management principles relevant to chemical engineering **A4.2** Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues, and risk management principles. **A6.1** Plan, supervise and monitor implementation of engineering projects, taking into consideration other trades requirements. **A7.1** Function efficiently as an individual and as a member of multi-disciplinary and multicultural teams **A8.1** Write technical language and technical report **A8.2** Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools. **A9.1** Use creative, innovative, and flexible thinking in problem solving and design. **A9.2** Acquire entrepreneurial and leadership skills to anticipate and respond to new situations. **B2.1** Engage in the recent technological changes and emerging fields relevant to chemical engineering. **B2.2** Act as a professional chemical engineer and respond to the challenging role and responsibilities. **B3.1** Explains basic information and methods of evaluation, good analysis, modelling and simulation of industrial processes **B3.2** Apply numerical modelling methods and/or computational techniques appropriate to chemical engineering. **B4.1** Discuss the principle of quality assurance required for systems, codes, and standards, the health, safety requirements, and environmental issues in the Chemical Engineering field. **B4.2** Adopt suitable national and international standards and codes to design, operate, inspect and maintain chemical engineering systems. **C2** Design and operate different processing systems in the chemical process industries including petroleum refining and gas processing and assess the balance of cost, quality, and effects on the environment in production operations. **C3** Apply the concepts of project economics and resources evaluation methods for design and decision-making under conditions of risk and uncertainty.	

Table (6b) Matrix of (LOs) for Chemical Engineering program and Program Aims

(LOs) for Chemical Engineering program	Program Aims
A1.1 Identify and formulate, engineering fundamentals, basic science, and mathematics in the field of Chemical Engineering. **A1.2** Follow methodologies and techniques and explain the data collection and interpretation principle in solving engineering problem. **A1.3** Apply engineering fundamentals, basic science, and mathematics to solve engineering problems **A2.1** Develop and conduct appropriate experimentation and/or simulation **A2.2** Analyze and interpret data, assess, and evaluate findings, draw simplified equipment flow sheets, charts, and curves, and interpret data derived from laboratory observation **A2.3** Use statistical analyses and objective engineering judgment to draw conclusions **A3.1** Discuss topics related to humanitarian interests and moral issues. **A3.2** Analyze the environmental impacts of different industries, to minimize the waste and treat the industrial facilities. **A3.3** Apply engineering design processes to produce cost effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development. **A3.4** Use Chemical Engineering IT tools and programming in design **A4.1** Explain the business and the management principles relevant to chemical engineering **A4.2** Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues, and risk management principles. **A5.1** Practice research techniques and methods of investigation as an inherent part of learning **A10.1** Acquire and apply new knowledge in deal with the fundamental problems and troubleshooting in chemical engineering plants. **A10.2** Practice self, lifelong and other learning strategies. **B1.1** Explain the essential facts, concepts, theories and the characteristics attributes of organic and inorganic reactions and its applications in the chemical process industries **B1.2** Use The conventional procedures of chemical analysis and characterization common engineering materials and component. **B1.3** Demonstrate the chemical engineering principles and design principles techniques in chemical engineering **B1.4** Identify methods for petroleum and natural gas processing. **B1.5** Design a practical chemical engineering system, component or process utilizing a full range of chemical engineering principles and techniques	1. Apply knowledge and Advanced technical skills in chemical engineering

(LOs) for Chemical Engineering program	Program Aims
including Mass and Energy Balance, Thermodynamics, Mass Transfer, Heat Transfer, Momentum Transfer, Kinetics of Chemical Reactions, Reactor Design, Instrumentation and Control of Chemical Processes, and Process and Plant Design. **B2.1** Engage in the recent technological changes and emerging fields relevant to chemical engineering. **B2.2** Act as a professional chemical engineer and respond to the challenging role and responsibilities. **C3** Apply the concepts of project economics and resources evaluation methods for design and decision-making under conditions of risk and uncertainty.	
A2.1 Develop and conduct appropriate experimentation and/or simulation **A2.2** Analyze and interpret data, assess, and evaluate findings, draw simplified equipment flow sheets, charts, and curves, and interpret data derived from laboratory observation **A2.3** Use statistical analyses and objective engineering judgment to draw conclusions **A9.1** Use creative, innovative, and flexible thinking in problem solving and design. **A9.2** Acquire entrepreneurial and leadership skills to anticipate and respond to new situations. **C1** Acquire insight into the development of raw materials, and methods of conversion into a useful product, and improve the ability to select proper material of the construction of equipment in the industrial process. **C3** Apply the concepts of project economics and resources evaluation methods for design and decision-making under conditions of risk and uncertainty.	2. Utilize and manage resources creatively through effective analysis and interpretation skill.
A2.1 Develop and conduct appropriate experimentation and/or simulation **A2.2** Analyze and interpret data, assess, and evaluate findings, draw simplified equipment flow sheets, charts, and curves, and interpret data derived from laboratory observation **A2.3** Use statistical analyses and objective engineering judgment to draw conclusions **A3.1** Discuss topics related to humanitarian interests and moral issues. **A3.2** Analyze the environmental impacts of different industries, to minimize the waste and treat the industrial facilities. **A3.3** Apply engineering design processes to produce cost effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development. **A3.4** Use Chemical Engineering IT tools and programming in design	3. Recognize the potential and applicability of computer based methods in chemical engineering design.

(LOs) for Chemical Engineering program	Program Aims
B1.1 Explain the essential facts, concepts, theories and the characteristics attributes of organic and inorganic reactions and its applications in the chemical process industries **B1.2** Use The conventional procedures of chemical analysis and characterization common engineering materials and component. **B1.3** Demonstrate the chemical engineering principles and design principles techniques in chemical engineering **B1.4** Identify methods for petroleum and natural gas processing. **B1.5** Design a practical chemical engineering system, component or process utilizing a full range of chemical engineering principles and techniques including Mass and Energy Balance, Thermodynamics, Mass Transfer, Heat Transfer, Momentum Transfer, Kinetics of Chemical Reactions, Reactor Design, Instrumentation and Control of Chemical Processes, and Process and Plant Design. **B2.1** Engage in the recent technological changes and emerging fields relevant to chemical engineering. **B2.2** Act as a professional chemical engineer and respond to the challenging role and responsibilities. **B3.1** Explains basic information and methods of evaluation, good analysis, modelling and simulation of industrial processes **B3.2** Apply numerical modelling methods and/or computational techniques appropriate to chemical engineering. **B4.1** Discuss the principle of quality assurance required for systems, codes, and standards, the health, safety requirements, and environmental issues in the Chemical Engineering field. **B4.2** Adopt suitable national and international standards and codes to design, operate, inspect and maintain chemical engineering systems. **C2** Design and operate different processing systems in the chemical process industries including petroleum refining and gas processing and assess the balance of cost, quality, and effects on the environment in production operations. **C3** Apply the concepts of project economics and resources evaluation methods for design and decision-making under conditions of risk and uncertainty.	
A3.1 Discuss topics related to humanitarian interests and moral issues. **A3.2** Analyze the environmental impacts of different industries, to minimize the waste and treat the industrial facilities. **A3.3** Apply engineering design processes to produce cost effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development. **A3.4** Use Chemical Engineering IT tools and programming in design	4. Address the issues of process dynamics and control in plant operation .

(LOs) for Chemical Engineering program	Program Aims
A6.1 Plan, supervise and monitor implementation of engineering projects, taking into consideration other trades requirements. **A9.1** Use creative, innovative, and flexible thinking in problem solving and design. **A9.2** Acquire entrepreneurial and leadership skills to anticipate and respond to new situations. **B1.1** Explain the essential facts, concepts, theories and the characteristics attributes of organic and inorganic reactions and its applications in the chemical process industries **B1.2** Use The conventional procedures of chemical analysis and characterization common engineering materials and component. **B1.3** Demonstrate the chemical engineering principles and design principles techniques in chemical engineering **B1.4** Identify methods for petroleum and natural gas processing. **B1.5** Design a practical chemical engineering system, component or process utilizing a full range of chemical engineering principles and techniques including Mass and Energy Balance, Thermodynamics, Mass Transfer, Heat Transfer, Momentum Transfer, Kinetics of Chemical Reactions, Reactor Design, Instrumentation and Control of Chemical Processes, and Process and Plant Design. **B2.1** Engage in the recent technological changes and emerging fields relevant to chemical engineering. **B2.2** Act as a professional chemical engineer and respond to the challenging role and responsibilities. **B4.1** Discuss the principle of quality assurance required for systems, codes, and standards, the health, safety requirements, and environmental issues in the Chemical Engineering field. **B4.2** Adopt suitable national and international standards and codes to design, operate, inspect and maintain chemical engineering systems.	
A2.1 Develop and conduct appropriate experimentation and/or simulation **A2.2** Analyze and interpret data, assess, and evaluate findings, draw simplified equipment flow sheets, charts, and curves, and interpret data derived from laboratory observation **A2.3** Use statistical analyses and objective engineering judgment to draw conclusions **A5.1** Practice research techniques and methods of investigation as an inherent part of learning **A6.1** Plan, supervise and monitor implementation of engineering projects, taking into consideration other trades requirements. **A10.1** Acquire and apply new knowledge in deal with the fundamental problems and troubleshooting in chemical engineering plants. **A10.2** Practice self, lifelong and other learning strategies.	5. Plan and execute research work, evaluate outcomes, and draw conclusions .

(LOs) for Chemical Engineering program	Program Aims
B1.1 Explain the essential facts, concepts, theories and the characteristics attributes of organic and inorganic reactions and its applications in the chemical process industries **B1.2** Use The conventional procedures of chemical analysis and characterization common engineering materials and component. **B1.3** Demonstrate the chemical engineering principles and design principles techniques in chemical engineering **B1.4** Identify methods for petroleum and natural gas processing. **B1.5** Design a practical chemical engineering system, component or process utilizing a full range of chemical engineering principles and techniques including Mass and Energy Balance, Thermodynamics, Mass Transfer, Heat Transfer, Momentum Transfer, Kinetics of Chemical Reactions, Reactor Design, Instrumentation and Control of Chemical Processes, and Process and Plant Design. **B2.1** Engage in the recent technological changes and emerging fields relevant to chemical engineering. **B2.2** Act as a professional chemical engineer and respond to the challenging role and responsibilities. **C1** Acquire insight into the development of raw materials, and methods of conversion into a useful product, and improve the ability to select proper material of the construction of equipment in the industrial process.	
A3.1 Discuss topics related to humanitarian interests and moral issues. **A3.2** Analyze the environmental impacts of different industries, to minimize the waste and treat the industrial facilities. **A3.3** Apply engineering design processes to produce cost effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development. **A3.4** Use Chemical Engineering IT tools and programming in design **A4.1** Explain the business and the management principles relevant to chemical engineering **A4.2** Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues, and risk management principles. **A7.1** Function efficiently as an individual and as a member of multi-disciplinary and multicultural teams **A8.1** Write technical language and technical report **A8.2** Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools. **B2.1** Engage in the recent technological changes and emerging fields relevant to chemical engineering.	6. Identify and control the impact that chemical engineering has on society from an environmental, economic, social and cultural point of view.

(LOs) for Chemical Engineering program	Program Aims
B2.2 Act as a professional chemical engineer and respond to the challenging role and responsibilities **B4.1** Discuss the principle of quality assurance required for systems, codes, and standards, the health, safety requirements, and environmental issues in the Chemical Engineering field. **B4.2** Adopt suitable national and international standards and codes to design, operate, inspect and maintain chemical engineering systems. **C2** Design and operate different processing systems in the chemical process industries including petroleum refining and gas processing and assess the balance of cost, quality, and effects on the environment in production operations. **C3** Apply the concepts of project economics and resources evaluation methods for design and decision-making under conditions of risk and uncertainty.	

Table (7) Matrix of (LOs) for Chemical Engineering program and attributes of chemical engineering

(LOs) for Chemical Engineering program	The attributes of chemical engineer
A1.1 Identify and formulate, engineering fundamentals, basic science, and mathematics in the field of Chemical Engineering. **A1.2** Follow methodologies and techniques and explain the data collection and interpretation principle in solving engineering problem. **A1.3** Apply engineering fundamentals, basic science, and mathematics to solve engineering problems **A10.1** Acquire and apply new knowledge in deal with the fundamental problems and troubleshooting in chemical engineering plants. **A10.2** Practice self, lifelong and other learning strategies. **B1.1** Explain the essential facts, concepts, theories and the characteristics attributes of organic and inorganic reactions and its applications in the chemical process industries **B1.2** Use The conventional procedures of chemical analysis and characterization common engineering materials and component. **B1.3** Demonstrate the chemical engineering principles and design principles techniques in chemical engineering **B1.4** Identify methods for petroleum and natural gas processing. **B1.5** Design a practical chemical engineering system, component or process utilizing a full range of chemical engineering principles and techniques including Mass and Energy Balance, Thermodynamics, Mass Transfer, Heat Transfer, Momentum Transfer, Kinetics of Chemical Reactions, Reactor Design, Instrumentation and Control of Chemical Processes, and Process and Plant Design.	1. Master a wide spectrum of engineering knowledge and specialized skills and can apply acquired knowledge using theories and abstract thinking in real life situations

(LOs) for Chemical Engineering program	The attributes of chemical engineer
B4.1 Discuss the principle of quality assurance required for systems, codes, and standards, the health, safety requirements, and environmental issues in the Chemical Engineering field. **B4.2** Adopt suitable national and international standards and codes to design, operate, inspect and maintain chemical engineering systems. **C3** Apply the concepts of project economics and resources evaluation methods for design and decision-making under conditions of risk and uncertainty.	
A2.1 Develop and conduct appropriate experimentation and/or simulation **A2.2** Analyze and interpret data, assess, and evaluate findings, draw simplified equipment flow sheets, charts, and curves, and interpret data derived from laboratory observation **A2.3** Use statistical analyses and objective engineering judgment to draw conclusions **A9.1** Use creative, innovative, and flexible thinking in problem solving and design. **A9.2** Acquire entrepreneurial and leadership skills to anticipate and respond to new situations. **B1.1** Explain the essential facts, concepts, theories and the characteristics attributes of organic and inorganic reactions and its applications in the chemical process industries **B1.2** Use The conventional procedures of chemical analysis and characterization common engineering materials and component. **B1.3** Demonstrate the chemical engineering principles and design principles techniques in chemical engineering **B1.4** Identify methods for petroleum and natural gas processing. **B1.5** Design a practical chemical engineering system, component or process utilizing a full range of chemical engineering principles and techniques including Mass and Energy Balance, Thermodynamics, Mass Transfer, Heat Transfer, Momentum Transfer, Kinetics of Chemical Reactions, Reactor Design, Instrumentation and Control of Chemical Processes, and Process and Plant Design. **C1** Acquire insight into the development of raw materials, and methods of conversion into a useful product, and improve the ability to select proper material of the construction of equipment in the industrial process. **C2** Design and operate different processing systems in the chemical process industries including petroleum refining and gas processing and assess the balance of cost, quality, and effects on the environment in production operations. **C3** Apply the concepts of project economics and resources evaluation methods for design and decision-making under conditions of risk and uncertainty.	2. Apply analytic critical and systemic thinking to identify, diagnose and solve engineering problems with a wide range of complexity and variation

(LOs) for Chemical Engineering program	The attributes of chemical engineer
A3.1 Discuss topics related to humanitarian interests and moral issues. **A3.2** Analyze the environmental impacts of different industries, to minimize the waste and treat the industrial facilities. **A3.3** Apply engineering design processes to produce cost effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development. **A3.4** Use Chemical Engineering IT tools and programming in design **A4.1** Explain the business and the management principles relevant to chemical engineering **A4.2** Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues, and risk management principles. **A6.1** Plan, supervise and monitor implementation of engineering projects, taking into consideration other trades requirements. **B2.1** Engage in the recent technological changes and emerging fields relevant to chemical engineering. **B2.2** Act as a professional chemical engineer and respond to the challenging role and responsibilities. **B4.1** Discuss the principle of quality assurance required for systems, codes, and standards, the health, safety requirements, and environmental issues in the Chemical Engineering field. **B4.2** Adopt suitable national and international standards and codes to design, operate, inspect and maintain chemical engineering systems. **C1** Acquire insight into the development of raw materials, and methods of conversion into a useful product, and improve the ability to select proper material of the construction of equipment in the industrial process. **C3** Apply the concepts of project economics and resources evaluation methods for design and decision-making under conditions of risk and uncertainty.	3. Behave professionally and adhere to engineering ethics and standards
A6.1 Plan, supervise and monitor implementation of engineering projects, taking into consideration other trades requirements. **A7.1** Function efficiently as an individual and as a member of multi-disciplinary and multicultural teams **A8.1** Write technical language and technical report **A8.2** Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools.	4. Work in and lead a heterogeneous team of professionals from different engineering specialties and assume responsibility for own and team performance

(LOs) for Chemical Engineering program	The attributes of chemical engineer
A3.1 Discuss topics related to humanitarian interests and moral issues. **A3.2** Analyze the environmental impacts of different industries, to minimize the waste and treat the industrial facilities. **A3.3** Apply engineering design processes to produce cost effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development. **A3.4** Use Chemical Engineering IT tools and programming in design **B1.1** Explain the essential facts, concepts, theories and the characteristics attributes of organic and inorganic reactions and its applications in the chemical process industries **B1.2** Use The conventional procedures of chemical analysis and characterization common engineering materials and component. **B1.3** Demonstrate the chemical engineering principles and design principles techniques in chemical engineering **B1.4** Identify methods for petroleum and natural gas processing. **B1.5** Design a practical chemical engineering system, component or process utilizing a full range of chemical engineering principles and techniques including Mass and Energy Balance, Thermodynamics, Mass Transfer, Heat Transfer, Momentum Transfer, Kinetics of Chemical Reactions, Reactor Design, Instrumentation and Control of Chemical Processes, and Process and Plant Design. **B2.1** Engage in the recent technological changes and emerging fields relevant to chemical engineering. **B2.2** Act as a professional chemical engineer and respond to the challenging role and responsibilities. **B4.1** Discuss the principle of quality assurance required for systems, codes, and standards, the health, safety requirements, and environmental issues in the Chemical Engineering field. **B4.2** Adopt suitable national and international standards and codes to design, operate, inspect and maintain chemical engineering systems. **C1** Acquire insight into the development of raw materials, and methods of conversion into a useful product, and improve the ability to select proper material of the construction of equipment in the industrial process. **C2** Design and operate different processing systems in the chemical process industries including petroleum refining and gas processing and assess the balance of cost, quality, and effects on the environment in production operations.	5. Recognize his/her role in promoting the engineering field and contribute in the development of the profession and the community

(LOs) for Chemical Engineering program	The attributes of chemical engineer
A4.1 Explain the business and the management principles relevant to chemical engineering **A4.2** Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues, and risk management principles. **B1.1** Explain the essential facts, concepts, theories and the characteristics attributes of organic and inorganic reactions and its applications in the chemical process industries **B1.2** Use The conventional procedures of chemical analysis and characterization common engineering materials and component. **B1.3** Demonstrate the chemical engineering principles and design principles techniques in chemical engineering **B1.4** Identify methods for petroleum and natural gas processing. **B1.5** Design a practical chemical engineering system, component or process utilizing a full range of chemical engineering principles and techniques including Mass and Energy Balance, Thermodynamics, Mass Transfer, Heat Transfer, Momentum Transfer, Kinetics of Chemical Reactions, Reactor Design, Instrumentation and Control of Chemical Processes, and Process and Plant Design. **B2.1** Engage in the recent technological changes and emerging fields relevant to chemical engineering. **B2.2** Act as a professional chemical engineer and respond to the challenging role and responsibilities. **B4.1** Discuss the principle of quality assurance required for systems, codes, and standards, the health, safety requirements, and environmental issues in the Chemical Engineering field. **B4.2** Adopt suitable national and international standards and codes to design, operate, inspect and maintain chemical engineering systems. **C2** Design and operate different processing systems in the chemical process industries including petroleum refining and gas processing and assess the balance of cost, quality, and effects on the environment in production operations. **C3** Apply the concepts of project economics and resources evaluation methods for design and decision-making under conditions of risk and uncertainty.	6. Value the importance of the environment, both physical and natural, and work to promote sustainability principles
A4.1 Explain the business and the management principles relevant to chemical engineering **A4.2** Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues, and risk management principles.	7. Use techniques, skills and modern engineering tools necessary for engineering practice

(LOs) for Chemical Engineering program	The attributes of chemical engineer
B1.1 Explain the essential facts, concepts, theories and the characteristics attributes of organic and inorganic reactions and its applications in the chemical process industries **B1.2** Use The conventional procedures of chemical analysis and characterization common engineering materials and component. **B1.3** Demonstrate the chemical engineering principles and design principles techniques in chemical engineering **B1.4** Identify methods for petroleum and natural gas processing. **B1.5** Design a practical chemical engineering system, component or process utilizing a full range of chemical engineering principles and techniques including Mass and Energy Balance, Thermodynamics, Mass Transfer, Heat Transfer, Momentum Transfer, Kinetics of Chemical Reactions, Reactor Design, Instrumentation and Control of Chemical Processes, and Process and Plant Design. **B3.1** Explains basic information and methods of evaluation, good analysis, modelling and simulation of industrial processes **B3.2** Apply numerical modelling methods and/or computational techniques appropriate to chemical engineering.	
A5.1 Practice research techniques and methods of investigation as an inherent part of learning **A10.1** Acquire and apply new knowledge in deal with the fundamental problems and troubleshooting in chemical engineering plants. **A10.2** Practice self, lifelong and other learning strategies.	8. Assume full responsibility for own learning and self-development, engage in lifelong learning and demonstrate the capacity to engage in post- graduate and research studies
A6.1 Plan, supervise and monitor implementation of engineering projects, taking into consideration other trades requirements. **A7.1** Function efficiently as an individual and as a member of multi-disciplinary and multicultural teams **A8.1** Write technical language and technical report **A8.2** Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools. **A9.1** Use creative, innovative, and flexible thinking in problem solving and design. **A9.2** Acquire entrepreneurial and leadership skills to anticipate and respond to new situations.	9. Communicate effectively using different modes, tools and languages with various audiences; to deal with academic/professional challenges in a critical and creative manner

(LOs) for Chemical Engineering program	The attributes of chemical engineer
B2.1 Engage in the recent technological changes and emerging fields relevant to chemical engineering. **B2.2** Act as a professional chemical engineer and respond to the challenging role and responsibilities. **B3.1** Explains basic information and methods of evaluation, good analysis, modelling and simulation of industrial processes **B3.2** Apply numerical modelling methods and/or computational techniques appropriate to chemical engineering.	
A3.1 Discuss topics related to humanitarian interests and moral issues. **A3.2** Analyze the environmental impacts of different industries, to minimize the waste and treat the industrial facilities. **A3.3** Apply engineering design processes to produce cost effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development. **A3.4** Use Chemical Engineering IT tools and programming in design **A4.1** Explain the business and the management principles relevant to chemical engineering **A4.2** Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues, and risk management principles. **A6.1** Plan, supervise and monitor implementation of engineering projects, taking into consideration other trades requirements. **A7.1** Function efficiently as an individual and as a member of multi-disciplinary and multicultural teams **A8.1** Write technical language and technical report **A8.2** Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools. **A9.1** Use creative, innovative, and flexible thinking in problem solving and design. **A9.2** Acquire entrepreneurial and leadership skills to anticipate and respond to new situations. **C2** Design and operate different processing systems in the chemical process industries including petroleum refining and gas processing and assess the balance of cost, quality, and effects on the environment in production operations. **C3** Apply the concepts of project economics and resources evaluation methods for design and decision-making under conditions of risk and uncertainty.	10. Demonstrate leadership qualities, business administration and entrepreneurial skills

Table (8) Matrix of National Reference Standards (NARS 2018) and (LOs) for Chemical Engineering

A. Level A Competencies

National Academic Reference Standards (NARS2018) of Chemical Engineering (competencies)	LOS of chemical engineering regulation 2019
A1 Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics	$A_{1.1}$ Identify and formulate, engineering fundamentals, basic science, and mathematics in the field of Chemical Engineering. $A_{1.2}$ Follow methodologies and techniques and explain the data collection and interpretation principle in solving engineering problems. $B_{1.1}$ Explain the essential facts, concepts, theories and the characteristics attributes of organic and inorganic reactions and its applications in the chemical process industries. $B_{1.2}$ Use The conventional procedures of chemical analysis and characterization common engineering materials and component. $B_{1.3}$ Demonstrate the chemical engineering principles and design principles techniques in chemical engineering. $B_{1.4}$ Identify methods for petroleum and natural gas processing. $B_{3.1}$ Explains basic information and methods of evaluation, good analysis, modelling, and simulation of industrial processes. $A_{1.3}$ Apply engineering fundamentals, basic science, and mathematics to solve engineering problems.
A2 Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.	$A_{2.1}$ Develop and conduct appropriate experimentation and/or simulation. $A_{2.2}$ Analyze and interpret data, assess and evaluate findings, draw simplified equipment flow sheets, charts and curves and interpret data derived from laboratory observation. $A_{2.3}$ Use statistical analyses and objective engineering judgment to draw conclusions.
A3 Apply engineering design processes to produce cost effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.	$A_{3.1}$ Discuss topics related to humanitarian interests and moral issues $A_{4.2}$ Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues, and risk management principles. $A_{3.3}$ Apply engineering design processes to produce cost effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development. $A_{3.4}$ Use Chemical Engineering IT tools and programming in design.

National Academic Reference Standards (NARS2018) of Chemical Engineering (competencies)	LOS of chemical engineering regulation 2019
A4 Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues and risk management principles.	$B_{4.1}$ Discuss the principle of quality assurance required for system, codes and standards, the health, safety requirements and environmental issues in the Chemical Engineering field. $A_{4.1}$ Explain the business and the management principles relevant to chemical engineering $A_{4.2}$ Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues and risk management principles.
A5 Practice research techniques and methods of investigation as an inherent part of learning.	$A_{5.1}$ Practice research techniques and methods of investigation as an inherent part of learning
A6 Plan, supervise and monitor implementation of engineering projects, taking into consideration other trades requirements.	$A_{4.1}$ Explain the business and the management principles relevant to chemical engineering $A_{6.1}$ Plan, supervise and monitor implementation of engineering projects, taking into consideration other trades requirements.
A7 Function efficiently as an individual and as a member of multi-disciplinary and multicultural teams.	$A_{7.1}$ Function efficiently as an individual and as a member of multi-disciplinary and multicultural teams
A8 Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools.	$A_{8.1}$ Write technical language and technical report $A_{8.2}$ Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools.
A9 Use creative, innovative and flexible thinking and acquire entrepreneurial and leadership skills to anticipate and respond to new situations.	$A_{9.1}$ Use creative, innovative, and flexible thinking in problem solving and design. $A_{9.2}$ Acquire entrepreneurial and leadership skills to anticipate and respond to new situations.
A10 Acquire and apply new knowledge, and practice self, lifelong and other learning strategies.	$A_{10.1}$ Acquire and apply new knowledge in deal with the fundamental problems and troubleshooting in chemical engineering plants. $A_{10.2}$ practice self, lifelong and other learning strategies.

B. **Specialized Competencies Chemical Engineering** (level B)

National Academic Reference Standards (NARS2018) of Chemical Engineering (chemical engineering)	LOS of chemical engineering regulation 2019
B1 Design a practical chemical engineering system, component or process utilizing a full range of chemical engineering principles and techniques including: Mass and Energy Balance, Thermodynamics, Mass Transfer, Heat Transfer, Momentum Transfer, Kinetics of Chemical Reactions, Reactor Design,	$B_{1.2}$ Use The conventional procedures of chemical analysis and characterization common engineering materials and component $B_{1.3}$ Demonstrate the chemical engineering principles and design principles techniques in chemical engineering $B_{1.5}$ Design a practical chemical engineering system, component or process utilizing a full range of chemical engineering principles and techniques including: Mass

Instrumentation and Control of Chemical Processes, and Process and Plant Design.	and Energy Balance, Thermodynamics, Mass Transfer, Heat Transfer, Momentum Transfer, Kinetics of Chemical Reactions, Reactor Design, Instrumentation and Control of Chemical Processes, and Process and Plant Design.
B2 Engage in the recent technological changes and emerging fields relevant to chemical engineering to respond to the challenging role and responsibilities of a professional chemical engineer.	$A_{6.1}$ Plan, supervise and monitor implementation of engineering projects, taking into consideration other trades requirements. $B_{2.1}$ Engage in the recent technological changes and emerging fields relevant to chemical engineering. $B_{2.2}$ Act as a professional chemical engineer and respond to the challenging role and responsibilities.
B3 Apply numerical modeling methods and/or computational techniques appropriate to chemical engineering.	$B_{3.1}$ Explains basic information and methods of evaluation, good analysis, modelling and simulation of industrial processes $A_{2.1}$ Develop and conduct appropriate experimentation and/or simulation $B_{3.2}$ Apply numerical modeling methods and/or computational techniques appropriate to chemical engineering
B4 Adopt suitable national and international standards and codes to: design, operate, inspect and maintain chemical engineering systems.	$B_{4.1}$ Discuss the principle of quality assurance required for system, codes and standards, the health, safety requirements and environmental issues in the Chemical Engineering field. $A_{3.1}$ Discuss topics related to humanitarian interests and moral issues $A_{4.2}$ Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues, and risk management principles. $B_{4.2}$ Adopt suitable national and international standards and codes to: design, operate, inspect and maintain chemical engineering systems

Level C: Highly specialized competencies of Chemical engineering program	
ARS Competencies	C1Acquire insight in the development of raw material, methods of conversion into a useful product, improve the ability to select proper material of construction of equipment in industrial process
	C2 Design and operate different processing systems in the chemical process industries including petroleum refining and gas processing and assess the balance of cost, quality and effects on the environment in production operations
	C3 Apply the concepts of project economics and resources evaluation methods for design and decision making under conditions of risk and uncertainty.

Matrix 1- Curriculum Mapping Matrix (Appendix 1)

Learning Outcomes (LOs): Level A General Competencies; Level B Specialized Competencies; Level C Highly Specialized

Course code	Course title	Sum of LOs A	B	C	Total
PHM 011	Mathematics (1)	3	0	0	3
PHM 013	Physics(1)	3	0	0	3
PHM 015	Mechanics (1)	5	0	0	5
ARC 011	Engineering Drawing& Projection (1)	8	0	0	8
CHE 011	Chemistry	3	1	0	4
HUM 013	ICDL	4	0	0	4
HUM 011	Technical English Language (1)	5	0	0	5
PHM 012	Mathematics (2)	4	0	0	4
PHM 014	Physics(2)	3	0	0	3
PHM 016	Mechanics (2)	4	0	0	4
ARC 012	Engineering Drawing& Projection (2)	5	0	0	5
PHM 017	Production Technology	4	0	0	4
HUM 014	History of engineering and technology	5	0	0	5
HUM 012	Technical English Language (2)	5	0	0	5
CHE 121	Inorganic Chemistry	4	1	0	5
CHE 131	Introduction to Chemical Engineering and Petroleum Economics	1	3	0	4
PHM 171	Mathematics (3)	5	0	0	5
PHM 173	Physics(3)	5	0	0	5
CHE 151	Machine Design	0	5	0	5
HUM 171	* Industrial psychology	3	0	0	0
	International relations				
HUM 172	technical reports	4	0	0	4
CHE 122	Organic Chemistry (1)	8	0	0	8
CHE 123	Inorganic and Analytical Chemistry	5	1	0	6
PHM 172	Mathematics (4)	5	0	0	5
PHM 174	Mechanics (3)	4	1	0	5
CVE 112	Principles of Construction Engineering	8	1	0	9
EPM 116	electrical and electronic Engineering	3	2	0	5
HUM 173	Industrial safety &risk analysis *	3	1	0	0
	* تشريعات و عقود والكميات والمواصفات				
	البيئة و خدمة المجتمع				
CHE 221	Organic Chemistry (2)	3	4	0	7
CHE 231	momentum transfer	1	2	0	3
CHE 222	Physical Chemistry and Thermodynamics	4	4	0	8
CHE 232	Fundamentals of Mass and Energy Balance	1	4	0	5
HUM 271	History of Nuclear Engineering	2	2	0	4
HUM 272	Research and analysis skills	3	0	0	3
CHE 223	Physical chemistry and phase equilibrium	1	2	0	3
CHE 224	Organic and Biochemistry (3)	6	5	0	11
PHM 271	Probabilities and Statistics	5	0	0	5
CHE 233	Principles of Mechanical Engineering	3	1	0	4
CHE 2XX	Renewable Energy Resources engineering	0	3	0	3
	* solid waste management				
	* water treatment				
HUM 273	Elective humanity course Stratum Planning	4	0	0	4
HUM 274	Evaluation of environmental impacts	7	0	0	7
CHE 371	Mechanical unit operations	2	2	0	4
CHE 361	Organic chemical industries	3	6	2	11
CHE 362	Inorganic chemical industries	1	3	0	4
CHE 331	Heat transfer and it's application	0	4	0	4
CHE 341	Applied Electrochemistry and corrosion engineering	0	5	0	5
HUM371	Project Management	0	1	2	3
CHE 342	Material Science and new materials	0	5	0	5
CHE 363	Polymer Engineering	2	4	0	6
CHE 364	High Temperature Industries	1	7	0	8
CHE 391	Modeling and simulation in Chemical Engineering	2	3	0	5
CHE 3XX	Petrochemical	1	3	0	4
	* Biochemical industry				
CHE 3YY	Practical field training(1)	3	3	0	6
CHE 431	Mass transfer and multi-stage separations (1)	0	3	0	3
CHE 491	Petroleum Refining Engineering	0	1	3	4
CHE 451	Chemical reactor and vessel Design	0	3	0	3
CHE 452	Process and plant design	0	3	1	4
CHE 453	Lab of Chemical Engineering	2	5	0	7
CHE 4ZZ	Graduation project(1)	7	4	0	11
CHE 4ZZ	Graduation project(2)	7	4	3	14
CHE 4YY	Practical field training(2)	0	2	3	5
CHE 432	Mass transfer and multi-stage separations (2)	0	3	0	3
CHE 454	Process control	0	4	0	4
CHE 455	Economics of Chemical Plants	0	0	2	2
CHE 481	Environmental engineering	1	0	2	3
CHE 4XX	Fertilizer technology	0	0	3	3
	Natural gas Engineering	0	1	2	3
	* Advanced Modeling & simulation in chemical Engineering				
	Nuclear and Radiation engineering	0	6	0	6
		191	128	23	335

Column totals (Learning Outcomes):

A1.1	A1.2	A1.3	A2.1	A2.2	A2.3	A3.1	A3.2	A3.3	A3.4	A4.1	A4.2	A5.1	A6.1	A7.1	A8.1	A8.2	A9.1	A9.2	A10.1	A10.2
26	12	17	9	22	8	3	3	7	8	3	7	8	2	10	12	7	8	3	6	10

B1.1	B1.2	B1.3	B1.4	B1.5	B2.1	B2.2	B3.1	B3.2	B4.1	B4.2	C1	C2	C3
11	16	26	3	15	11	5	12	8	12	9	5	9	9

Matrix 2 Mapping of NARS to the program LOs (Matrix)

National academic reference (NARS)		LOs of Chemical Engineering Program																																	
		Level A General Competencies																					Level B Specialized Competencies											Level C Highly Specialized Competencies (ARS)		
		A1.1	A1.2	A1.3	A2.1	A2.2	A2.3	A3.1	A3.2	A3.3	A3.4	A4.1	A4.2	A5.1	A6.1	A7.1	A8.1	A8.2	A9.1	A9.2	A10.1	A10.2	B1.1	B1.2	B1.3	B1.4	B1.5	B2.1	B2.2	B3.1	B3.2	B4.1	B4.2	C 1	C 2	C 3
Level A General Competencies	A1	■	■	■																			■	■	■	■				■						
	A2				■	■	■																														
	A3							■	■	■	■																										
	A4											■	■																				■				
	A5													■																							
	A6											■			■																						
	A7															■																					
	A8																■	■																			
	A9																		■	■																	
	A10																				■	■															
Level B Specialize	B1																							■	■		■										
	B2														■														■	■							
	B3				■																										■	■					
	B4							■					■																				■	■			

Matrix 3 Mapping of Program mission and Program aims (Matrix)

The chemical engineering program mission		Chemical Engineering Program Aims					
		1	2	3	4	5	6
Program Mission	harness the capabilities and efforts to build, train and qualify chemical engineer professionally,						
	conduct research						
	provides advisory services specialized in Chemical Engineering and science applications						

Matrix 4 Mapping of Program mission and the program LOs (matrix)

The chemical engineering program mission	Competencies of Chemical Engineering Program																																
	Level A General Competencies																				Level B Specialized Competencies										Level C Highly Specialized Competencies		
	A1.1	A1.2	A1.3	A2.1	A2.2	A2.3	A3.1	A3.2	A3.3	A3.4	A4.1	A4.2	A5.1	A6.1	A7.1	A8.1	A8.2	A9.1	A9.2	A10.1	A10.2	B1.1	B1.2	B1.3	B1.4	B1.5	B2.1	B2.2	B3.1	B3.2	B4.1	B4.2	C1	C2	C3
harness the capabilities and efforts to build, train and qualify chemical engineer professionally	■	■	■	■	■	■												■	■	■	■	■	■	■	■	■	■	■	■	■			■	■	■
To conduct research				■	■	■							■					■	■	■	■							■	■	■	■	■	■		■
Provide advisory services specialized in Chemical Engineering and science applications.							■	■	■	■	■	■		■	■	■	■	■	■								■	■	■	■	■	■		■	■

Matrix 5 Mapping of Program mission and Attributes of Chemical Engineer (matrix)

The chemical engineering program's Mission		Chemical Engineer Attributes of Chemical Engineer									
		1	2	3	4	5	6	7	8	9	10
Program's Mission	harness the capabilities and efforts to build, train and qualify chemical engineer professionally,										
	conduct research										
	provides advisory services specialized in Chemical Engineering and science applications										

Matrix 6 Mapping of Program Aims and Attributes of Chemical Engineer (matrix)

The chemical engineering Program Aims		Chemical Engineering									
		Attributes of Chemical Engineering									
		1	2	3	4	5	6	7	8	9	10
Program Aims	1. Apply knowledge and Advanced technical skills in chemical engineering										
	2. Utilize and manage resources creatively through effective analysis and interpretation skill.										
	3. Recognize the potential and applicability of computer-based methods in chemical engineering design.										
	4. Address the issues of process dynamics and control in plant operation.										
	5. Plan and execute research work, evaluate outcomes and draw conclusions.										
	6. Identify and control the impact that chemical engineering has on society from an environmental, economic, social, and cultural point of view.										

Matrix 7 Mapping of Program Aims and Chemical Engineering program LOs (matrix)

The chemical engineering program Aims		Competencies of Chemical Engineering Program																																	
		Level A General Competencies																					Level B Specialized Competencies											Level C Highly Specialized Competencies		
		A1.1	A1.2	A1.3	A2.1	A2.2	A2.3	A3.1	A3.2	A3.3	A3.4	A4.1	A4.2	A5.1	A6.1	A7.1	A8.1	A8.2	A9.1	A9.2	A10.1	A10.2	B1.1	B1.2	B1.3	B1.4	B1.5	B2.1	B2.2	B3.1	B3.2	B4.1	B4.2	C 1	C 2	C 3
Program Aims	1. Apply knowledge and Advanced technical skills in chemical engineering	■	■	■	■	■	■	■	■	■	■	■	■	■							■	■	■	■	■	■	■	■							
	2. Utilize and manage resources creatively through effective analysis and interpretation skill.				■	■	■												■	■														■		■
	3. Recognize the potential and applicability of computer-based methods in chemical engineering design.				■	■	■	■	■	■	■												■	■	■	■	■	■	■	■	■	■		■	■
	4. Address the issues of process dynamics and control in plant operation.							■	■	■	■				■				■	■			■	■	■	■	■	■	■			■	■			
	5. Plan and execute research work, evaluate outcomes and draw conclusions.				■	■	■							■	■						■	■	■	■	■	■	■	■	■					■		
	6. Identify and control the impact that chemical engineering has on society from an environmental, economic, social, and cultural point of view.							■	■	■	■	■	■			■	■	■										■	■			■	■		■	■

Matrix 8 Mapping of Attributes of Chemical Engineer and the program LOs (matrix)

The attributes of chemical engineer	LOs of Chemical Engineering Program																																
	Level A General Competencies																					Level B Specialized Competencies										Level C Highly Specialized Competencies (ARS)		
	A1.1	A1.2	A1.3	A2.1	A2.2	A2.3	A3.1	A3.2	A3.3	A3.4	A4.1	A4.2	A5.1	A6.1	A7.1	A8.1	A8.2	A9.1	A9.2	A10.1	A10.2	B1.1	B1.2	B1.3	B1.4	B1.5	B2.1	B2.2	B3.1	B3.2	B4.1	B4.2	C 1	C 2	C 3
1. Master a wide spectrum of engineering knowledge and specialized skills and can apply acquired knowledge using theories and abstract thinking in real life situations	■	■	■																	■	■	■	■	■	■					■	■			■
2. Apply analytic critical and systemic thinking to identify, diagnose and solve engineering problems with a wide range of complexity and variation				■	■	■												■	■			■	■	■	■	■							■	■	■
3. Behave professionally and adhere to engineering ethics and standards							■	■	■	■	■	■		■													■	■			■	■	■		■
4. Work in and lead a heterogeneous team of professionals from different engineering specialties and assume responsibility for own and team performance														■	■	■	■																		
5. Recognize his/her role in promoting the engineering field and contribute in the development of the profession and the community							■	■	■	■												■	■	■	■	■	■	■			■	■	■	■	
6. Value the importance of the environment, both physical and natural, and work to promote sustainability principles											■	■										■	■	■	■	■	■	■			■	■		■	■
7. Use techniques, skills and modern engineering tools necessary for engineering practice											■	■										■	■	■	■	■			■	■					
8. Assume full responsibility for own learning and self-development, engage in lifelong learning and demonstrate the capacity to engage in post- graduate and research studies													■							■	■													
9. Communicate effectively using different modes, tools and languages with various audiences; to deal with academic/professional challenges in a critical and creative manner														■	■	■	■	■	■								■	■	■	■					
10. Demonstrate leadership qualities, business administration and entrepreneurial skills							■	■	■	■	■	■		■	■	■	■	■	■															■	■

Matrix 9 Mapping of Teaching and learning methods and the program LOs (matrix)

teaching and learning methods	LOs of Chemical Engineering Program																																		
	Level A General Competencies																					Level B Specialized Competencies											Level C Highly Specialized Competencies		
	A1.1	A1.2	A1.3	A2.1	A2.2	A2.3	A3.1	A3.2	A3.3	A3.4	A4.1	A4.2	A5.1	A6.1	A7.1	A8.1	A8.2	A9.1	A9.2	A10.1	A10.2	B1.1	B1.2	B1.3	B1.4	B1.5	B2.1	B2.2	B3.1	B3.2	B4.1	B4.2	C 1	C 2	C 3
Lectures / online lecture	■	■	■								■	■				■	■	■	■			■	■	■	■	■			■	■			■	■	■
Presentations and Movies													■		■	■	■	■	■																
Discussions															■	■	■	■	■																
Tutorials				■	■	■	■	■	■	■	■	■						■	■			■	■	■	■	■			■	■			■	■	■
Practical and Laboratory experiments				■	■	■									■	■	■	■	■										■	■			■		
Problem solving	■	■	■											■		■	■	■	■								■	■			■	■	■		■
Projects							■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■
Self-learning													■							■	■														■
Site visits /simulation &modeling				■	■	■									■												■	■	■	■			■		■
Researches and Reports							■	■	■	■	■	■	■		■					■	■	■	■	■	■	■	■						■		■
Cooperative work															■	■	■	■	■										■	■	■	■	■		

Matrix 10 Mapping of Assessment methods and the program LOs (matrix)

Assesssement methods	LOs of Chemical Engineering Program																																		
	Level A General Competencies																					Level B Specialized Competencies											Level C Highly Specialized Competencies		
	A1.1	A1.2	A1.3	A2.1	A2.2	A2.3	A3.1	A3.2	A3.3	A3.4	A4.1	A4.2	A5.1	A6.1	A7.1	A8.1	A8.2	A9.1	A9.2	A10.1	A10.2	B1.1	B1.2	B1.3	B1.4	B1.5	B2.1	B2.2	B3.1	B3.2	B4.1	B4.2	C 1	C 2	C 3
Written exam	■	■	■	■	■	■	■	■	■	■	■	■								■	■	■	■	■	■			■	■	■	■	■	■	■
Oral Exam											■	■		■		■	■	■	■	■	■						■	■			■	■	■		■
Mid Term Exam(face to face/online)	■	■	■	■	■	■	■	■	■	■	■	■								■	■	■	■	■	■	■			■	■	■	■	■	■	■
Attendance	■	■	■										■		■	■	■	■	■			■	■	■	■	■			■	■	■	■	■	■	■
Project							■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■
sheet	■	■	■	■	■	■																■	■	■	■	■			■	■				■	■
Report							■	■	■	■	■	■	■		■					■	■	■	■	■	■	■	■	■					■		
Laboratory Exam				■	■	■									■	■	■	■	■										■	■					
Quiz	■	■	■	■	■	■																■	■	■	■	■									
Online Quiz	■	■	■	■	■	■																■	■	■	■	■			■	■					