

وزارة التعليم العالي والبحث العلمي
جهاز الإشراف والتقويم العلمي
دائرة ضمان الجودة والاعتماد الأكاديمي

استمارة وصف البرنامج الأكاديمي للكليات والمعاهد

الجامعة : ديالى

الكلية/المعهد: الهندسة

القسم العلمي : الهندسة الكيمياوية

تاريخ ملء الملف : 2023



التوقيع :

اسم معاون العلمي : أ.م.د. حمار قاسم حمار

التاريخ : ١٨ / ٩ / ٢٢٠٢



التوقيع :

اسم رئيس القسم : د. احمد دحام وهيب

التاريخ : ١٨ / ٩ / ٢٢٠٢

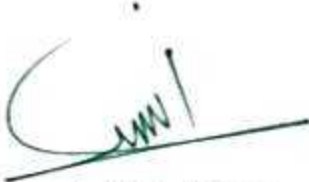
دقق الملف من قبل

شعبة ضمان الجودة والأداء الجامعي

اسم مدير شعبة ضمان الجودة والأداء الجامعي

التاريخ : ١٢ / ٩ / ٢٢٠٢

التوقيع :



مصادقة السيد العميد

أ.د. أ. م. د. عبد الله طاهر

*Republic of Iraq
Ministry of Higher Education & Scientific
Research Supervision and Scientific
Evaluation Directorate Quality Assurance
and Academic Accreditation International
Accreditation Dept.*

Academic Program Specification Form For The Academic

University: Diyala

College :Engineering

Number Of Departments In The College: Chemical Engineering

Date Of Form Completion :20/9/2023

Dean 's Name

Date : / /

Signature

Dean 's Assistant

*For Scientific
Affairs*

Date : / /

Signature

*The College Quality
Assurance And University
Performance Manager*

Date : / /

Signature

Quality Assurance And University Performance

Manager Date : / /

Signature

TEMPLATE FOR PROGRAMME SPECIFICATION

HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW

PROGRAMME SPECIFICATION

This Program Specification provides a concise summary of the main features of the program and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It is supported by a specification for each course that contributes to the program.

1. Teaching Institution	University of Diyala
2. University Department/Centre	Chemical Engineering
3. Program Title	
4. Title of Final Award	Bachelor Degree in Chemical engineering
5. Modes of Attendance offered	semester
6. Accreditation	
7. Other external influences	
8. Date of production/revision of this specification	20/9/2023
9. Aims of the Program	
<ul style="list-style-type: none">(1) Achieving the university's goals within the field of chemical engineering.(2) Gives a sound education in the basics of chemical engineering.(3) develop the skills and confidence necessary to solve, based on engineering and scientific principles, problems in the biochemical, chemical and other industries.(4) Continuing to find graduates with high ability.(5) Providing education compatible with the needs of the labor market linked to the Syndicate of Chemical Engineers	
The program provides opportunities for students to develop and display knowledge, understanding, qualities, skills and other characteristics in the following areas:	
1- Knowledge and understanding: <ul style="list-style-type: none">a . The necessary facts, concepts, principles and theories of chemical engineering,	

and an understanding of the constraints facing the engineer in making the right decision.

b - Basic Mathematics, Science and Techniques.

c - Ideas and Concepts of Management.

2- Awareness and understanding:

a- Ethics and professionalism of the profession.

b- The impact of engineering activities on society and civilization.

c- compatibility with future issues.

3- Cultural capabilities:

a -Solve industrial problems that may be specific to known or unknown circumstances.

b- Analyzing and discussing the available data or conducting specific experiments to obtain more data.

c - Design units and processes and make the necessary improvements.

d- The ability to apply new technologies.

e- Possess a holistic view of industrial engineering problems, taking into account the cost, safety, quality and environmental impacts, and the ability to assess and manage risks.

4. Practical skills:

a . The use of multiple technologies and devices with software related to specialization.

b - Using laboratory equipment to find data.

c- Develop and provide a safe work environment.

5. Transferable skills:

a- Applying mathematical skills to practical problems.

b - Oral and written communication skills.

c - Use information and communicate effectively.

d - control of time and resources.

e- Work within one team.

f- To be creative, especially in designs.

g- work in problem analysis

h- Extracting information from published sources.

10. Learning Outcomes, Teaching, Learning and Assessment Methods

- A1- Necessary facts, concepts, principles and theories of chemical engineering.
- A2- Understand the constraints facing the engineer in making the right decision.
- A3- Basic mathematics and science.
- A4- Techniques used.
- A5- Management ideas and concepts

B. The skills goals special to the program :

- B1- Ethics and professionalism of the profession.
- B2- The impact of engineering activities on society and civilization.
- B3- Compatibility with future issues.

Teaching and Learning Methods

Assessment methods

C. Affective and value goals:

- C1- Solve industrial problems that may be specific to known or unknown circumstances.
- C2- Analyzing and discussing the available data or conducting specific experiments to obtain more data.
- C3- Design units and processes and make the necessary improvements.
- C4- The ability to apply new technologies and possess a holistic view of industrial engineering problems, taking into account cost, safety, quality and environmental impacts, and the ability to assess and manage risks.
- C3.
- C4.

Teaching and Learning Methods

Assessment methods				
D. General and Transferable Skills (other skills relevant to employability and personal development):				
D1- Applying mathematical skills in practical problems.				
D2- Skills in verbal and written communication and effective use of information and communication.				
D3- Control of time and resources and working within one team.				
D4- The ability to design and work in analyzing problems and extracting information from published sources.				
Teaching and Learning Methods				
Assessment Methods				
11. Program Structure				12. Awards and Credits
Level/Year	Course or Module Code	Course or Module Title	Credit rating	
1st		Static science	45 hr.	Bachelor Degree Requires (x) credits

13. Personal Development Planning

14. Admission criteria .

15. Key sources of information about the program

TEMPLATE FOR COURSE SPECIFICATION

HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW

COURSE SPECIFICATION

This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification.

1. Teaching Institution	University of diyala
2. University Department/Centre	Chemical Engineering
3. Course title/code	Static Science
4. Modes of Attendance offered	
5. Semester/Year	Semester
6. Number of hours tuition (total)	45
7. Date of production/revision of this specification	20/9/2023
8. Aims of the Course	<p>The science of static represents the basis in the calculations of structural, mechanical and structural designs for any structure, so by teaching the student the science of statics and resistance of materials, he will be able to make the necessary calculations in the design process</p>

9. Learning Outcomes, Teaching ,Learning and Assessment Method

A- Cognitive goals:

A1- Understand the basics of statics.

A2- Understand forces and analyze them and know their effects on parts, structures or mechanical systems.

A3- The extent to which the material of the parts used is affected by forces imposed on them.

B. The skills goals special to the course.

B1- Learn how to use the basics of statics and materials resistance in designing parts that are subjected to force Within the safety and security specifications without failure.

Teaching and Learning Methods

1- Lectures.

2- Presentation of power point slides.

3- Discussions

Assessment methods

1- Unannounced sudden exams.

2- Home and class duties.

3- Monthly exams.

4- Final exam

C. Affective and value goals :

C1- The ability to make calculations of force and stress.

C2- Using them in the design of parts

Teaching and Learning Methods

1- Lectures.

2- Presentation of power point slides.

3- Discussions

Assessment methods

1- Unannounced sudden exams.

2- Home and class duties.

3- Monthly exams.

4- Final exam

D. General and rehabilitative transferred skills(other skills relevant to employability and personal development)

- D1.
- D2.
- D3.
- D4.

10. Course Structure

Week	Hours	ILOs	Topic Title	Teaching Method	Assessment Method
1-2	6	<ol style="list-style-type: none"> 1. What is the science of statics 2. Newton's laws 3. Units 4. 4- Vectors 5. Unit vector. 6. vector sum. 	Introduction to statics, force vectors	lectures and presentation slides	Unannounced exams and self-assessment during the lecture
3-4	6	<ol style="list-style-type: none"> 1. Define force 2. Forces in two dimensions 3- Analysis of force 	Forces	lectures and presentation slides	Unannounced exams and self-assessment during the lecture
5-6	6	<ol style="list-style-type: none"> 1- Analyzes of forces in three dimensions 2- Moments 3- Force and Moments 	forces in three dimensions, moments	lectures and presentation slides	Unannounced exams and self-assessment during the lecture
7-8	6	<ol style="list-style-type: none"> 1. Equilibrium Calculations 	Equilibrium	lectures and presentation slides	Unannounced exams and self-assessment during the lecture
9-10	6	<ol style="list-style-type: none"> 1- Laws of Friction 2- 2- Static Friction 3- 3- Friction on Inclined Surfaces 	Friction	lectures and presentation slides	Unannounced exams and self-assessment during the lecture
11-12	6	<ol style="list-style-type: none"> 1- Center of Gravity of Objects 2- Center of Areas 	Center of Gravity, Moment of inertia	lectures and presentation slides	Unannounced exams and self-assessment during the lecture
13-15	9	<ol style="list-style-type: none"> 1-Area Moment of inertia 	Moment of inertia	lectures and presentation slides	Unannounced exams and self-assessment during the lecture

11. Infrastructure

1. Books Required reading:	
2. Main references (sources)	<p>1- SI Version, J. L. Merriam, L.G. Krieg, Engineering Mechanics, Volume 1, John Wiley and Sons Inc. 2008</p> <p>2- Ferdinand L. Singer, Andrew Pytel, Strength of Materials, HRPER & ROW Publisher, New York, 1980</p>
A- Recommended books and references (scientific journals, reports...).	<p>1- Applied Statics and Strength of Materials (Available at the library of the Engineering College)</p> <p>Third Edition</p> <p>Authors: Leonard Spiegel George F. Limeburner</p>
B-Electronic references, Internet sites...	<p>http://www.kutub.info/library</p>

12. The development of the curriculum plan

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*Republic of Iraq
Ministry of Higher Education & Scientific
Research Supervision and Scientific
Evaluation Directorate Quality Assurance
and Academic Accreditation International
Accreditation Dept.*

Academic Program Specification Form For The Academic

University: Diyala

College :Engineering

Number Of Departments In The College: Chemical Engineering

Date Of Form Completion :20/9/2023

Dean 's Name

Date : / /

Signature

Dean 's Assistant

*For Scientific
Affairs*

Date : / /

Signature

*The College Quality
Assurance And University
Performance Manager*

Date : / /

Signature

Quality Assurance And University Performance

Manager Date : / /

Signature

TEMPLATE FOR PROGRAMME SPECIFICATION

HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW

PROGRAMME SPECIFICATION

This Program Specification provides a concise summary of the main features of the program and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It is supported by a specification for each course that contributes to the program.

1. Teaching Institution	University of Diyala
2. University Department/Centre	Chemical Engineering
3. Program Title	
4. Title of Final Award	Bachelor Degree in Chemical engineering
5. Modes of Attendance offered	semester
6. Accreditation	
7. Other external influences	
8. Date of production/revision of this specification	20/9/2023
9. Aims of the Program	
<ul style="list-style-type: none">(1) Achieving the university's goals within the field of chemical engineering.(2) Gives a sound education in the basics of chemical engineering.(3) develop the skills and confidence necessary to solve, based on engineering and scientific principles, problems in the biochemical, chemical and other industries.(4) Continuing to find graduates with high ability.(5) Providing education compatible with the needs of the labor market linked to the Syndicate of Chemical Engineers	
The program provides opportunities for students to develop and display knowledge, understanding, qualities, skills and other characteristics in the following areas:	
1- Knowledge and understanding: <ul style="list-style-type: none">a . The necessary facts, concepts, principles and theories of chemical engineering,	

and an understanding of the constraints facing the engineer in making the right decision.

b - Basic Mathematics, Science and Techniques.

c - Ideas and Concepts of Management.

2- Awareness and understanding:

a- Ethics and professionalism of the profession.

b- The impact of engineering activities on society and civilization.

c- compatibility with future issues.

3- Cultural capabilities:

a -Solve industrial problems that may be specific to known or unknown circumstances.

b- Analyzing and discussing the available data or conducting specific experiments to obtain more data.

c - Design units and processes and make the necessary improvements.

d- The ability to apply new technologies.

e- Possess a holistic view of industrial engineering problems, taking into account the cost, safety, quality and environmental impacts, and the ability to assess and manage risks.

4. Practical skills:

a . The use of multiple technologies and devices with software related to specialization.

b - Using laboratory equipment to find data.

c- Develop and provide a safe work environment.

5. Transferable skills:

a- Applying mathematical skills to practical problems.

b - Oral and written communication skills.

c - Use information and communicate effectively.

d - control of time and resources.

e- Work within one team.

f- To be creative, especially in designs.

g- work in problem analysis

h- Extracting information from published sources.

10. Learning Outcomes, Teaching, Learning and Assessment Methods

- A1- Necessary facts, concepts, principles and theories of chemical engineering.
- A2- Understand the constraints facing the engineer in making the right decision.
- A3- Basic mathematics and science.
- A4- Techniques used.
- A5- Management ideas and concepts

B. The skills goals special to the program :

- B1- Ethics and professionalism of the profession.
- B2- The impact of engineering activities on society and civilization.
- B3- Compatibility with future issues.

Teaching and Learning Methods

Assessment methods

C. Affective and value goals:

- C1- Solve industrial problems that may be specific to known or unknown circumstances.
- C2- Analyzing and discussing the available data or conducting specific experiments to obtain more data.
- C3- Design units and processes and make the necessary improvements.
- C4- The ability to apply new technologies and possess a holistic view of industrial engineering problems, taking into account cost, safety, quality and environmental impacts, and the ability to assess and manage risks.
- C3.
- C4.

Teaching and Learning Methods

Assessment methods				
D. General and Transferable Skills (other skills relevant to employability and personal development):				
D1- Applying mathematical skills in practical problems.				
D2- Skills in verbal and written communication and effective use of information and communication.				
D3- Control of time and resources and working within one team.				
D4- The ability to design and work in analyzing problems and extracting information from published sources.				
Teaching and Learning Methods				
Assessment Methods				
11. Program Structure				12. Awards and Credits
Level/Year	Course or Module Code	Course or Module Title	Credit rating	
1st		Strength of materials	45 hr.	Bachelor Degree Requires (x) credits

13. Personal Development Planning

14. Admission criteria .

15. Key sources of information about the program

TEMPLATE FOR COURSE SPECIFICATION

HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW

COURSE SPECIFICATION

This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification.

1. Teaching Institution	University of diyala
2. University Department/Centre	Chemical Engineering
3. Course title/code	Strength of materias
4. Modes of Attendance offered	
5. Semester/Year	Semester
6. Number of hours tuition (total)	45
7. Date of production/revision of this specification	20/9/2023
8. Aims of the Course	
<p>The strength of materials represents the basis in the calculations of structural, mechanical and structural designs for any structure, so by teaching the student the science of statics and resistance of materials, he will be able to make the necessary calculations in the design process.</p>	

9. Learning Outcomes, Teaching ,Learning and Assessment Method

A- Cognitive goals:

A1- Understand the basics of strength of materials .

A2- Understand forces and analyze them and know their effects on parts, structures or mechanical systems.

A3- The extent to which the material of the parts used is affected by forces imposed on them.

B. The skills goals special to the course.

B1- Learn how to use the basics of statics and materials resistance in designing parts that are subjected to force Within the safety and security specifications without failure.

Teaching and Learning Methods

1- Lectures.

2- Presentation of power point slides.

3- Discussions

Assessment methods

1- Unannounced sudden exams.

2- Home and class duties.

3- Monthly exams.

4- Final exam

C. Affective and value goals :

C1- The ability to make calculations of force and stress.

C2- Using them in the design of parts

Teaching and Learning Methods

1- Lectures.

2- Presentation of power point slides.

3- Discussions

Assessment methods

1- Unannounced sudden exams.

2- Home and class duties.

3- Monthly exams.

4- Final exam

D. General and rehabilitative transferred skills(other skills relevant to employability and personal development)

- D1.
- D2.
- D3.
- D4.

10. Course Structure

Week	Hours	ILOs	Topic Title	Teaching Method	Assessment Method
1-2	6	1. Definition strength of material 2. Simple stresses.	Introduction to strength of material	lectures and presentation slides	Unannounced exams and self-assessment during the lecture
3-4	6	1. Single shear 2. Double shear	Shear stresses	lectures and presentation slides	Unannounced exams and self-assessment during the lecture
5-6	6	1- Stresses in thin cylinders 2- Vertical stress calculations 3- Horizontal stress calculations	Stresses in thin cylinders	lectures and presentation slides	Unannounced exams and self-assessment during the lecture
7-8	6	1. Calculation of strain in solid columns 2. Calculations of strain in hollow columns 3- Calculations of stresses in composite materials	Strain, stresses in composite materials	lectures and presentation slides	Unannounced exams and self-assessment during the lecture
9-10	6	1- Definition of beams 2- Types of beams 3- Calculations of forces and reactions in beams	Beams	lectures and presentation slides	Unannounced exams and self-assessment during the lecture
11-12	6	1- Schemes and calculations of shear force and bending moment in beams	Schemes of shear force and bending moment in beams	lectures and presentation slides	Unannounced exams and self-assessment during the lecture
13-14	6	1-Bending stress in beams 2-Shear stress in beams	stresses in beams	lectures and presentation slides	Unannounced exams and self-assessment during the lecture
15	3	Calculations of deformation in beams of all kinds	deformation in beams	lectures and presentation slides	Unannounced exams and self-assessment during the lecture

11. Infrastructure

1. Books Required reading:	
2. Main references (sources)	<p>1- SI Version, J. L. Merriam, L.G. Krieg, Engineering Mechanics, Volume 1, John Wiley and Sons Inc. 2008</p> <p>2- Ferdinand L. Singer, Andrew Pytel, Strength of Materials, HRPER & ROW Publisher, New York, 1980</p>
A- Recommended books and references (scientific journals, reports...).	<p>1- Applied Statics and Strength of Materials (Available at the library of the Engineering College)</p> <p>Third Edition</p> <p>Authors: Leonard Spiegel George F. Limeburner</p>
B-Electronic references, Internet sites...	<p>http://www.kutub.info/library</p>
12. The development of the curriculum plan	



HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW

COURSE SPECIFICATION

This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification.

1. Teaching Institution	University of Diyala - College of Engineering
2. University Department/Centre	Chemical Engineering Department
3. Course title/code	Principles of chemical engineering I – Ch. E.104
4. Modes of Attendance offered	Compulsory
5. Semester/Year	1 st Semester/Academic Year 2022 – 20223
6. Number of hours tuition (total)	45 hrs (3 hrs per week)
7. Date of production/revision of this specification	1/9/2022
8. Aims of the Course	Learn the basics of material balance in the development of industrial and material formulas and their conversions in with and without chemical reaction.

9. Learning Outcomes, Teaching ,Learning and Assessment Method

A- Knowledge and Understanding

1. Definition the dimensions, units and their conversions.
2. Dimensional Consistency (Homogeneity).
3. Express of concentrations, mole and density.
4. Temperature and pressure.
5. General strategy for solving material balance problems.
6. Material Balances for Batch and Semi-Batch Processes.
7. Solving material balance problems for single units without reaction.

B- Subject-specific skills

1. Material balances for operation units.
2. How to deal with units and problems that relates with the material balance.

C- Thinking Skills

1. Learning the basic calculation and principles in chemical engineering.
2. Using mathematical methods for solving material balances.
3. Solving steady-state single unit problems.

D- General and Transferable Skills (other skills relevant to employability and personal development)

1. Activity with society.
2. The work with a team.
3. How engineering is benefit for society and environment.

Teaching and Learning Methods

1. Lectures
2. Presenting Power point (PPT) slides
3. Problems discussion (Tutorial)

Assessment methods

1. Daily exams
2. Monthly exams
3. Home work
4. Final exams

10. Course Structure					
Week	Hours	ILOs	Unit/Module or Topic Title	Teaching Method	Assessment Method
1	3	Introduction	Definition of dimensions and units and their conversions.	1.Lectures (PPT) 2. Tutorial	Oral exam
2	3	Definitions of material	Dimensional consistency (Homogeneity).	1.Lectures (PPT) 2. Tutorial	Oral exam
3	3	Representation of materials	The mole	1.Lectures (PPT) 2. Tutorial	Oral exam Quiz
4	3		The density	1.Lectures (PPT) 2. Tutorial	Oral exam Monthly exam
5	3		The concentration of material	1.Lectures (PPT) 2. Tutorial	Oral exam
6	3		Choosing a basis	1.Lectures (PPT) 2. Tutorial	Oral exam Quiz
7	3		The temperature	1.Lectures (PPT) 2. Tutorial	Oral exam
8	3	Humidity	The pressure	1.Lectures (PPT) 2. Tutorial	Oral exam Quiz
9	3	Heat capacity	Introduction to material balance	1.Lectures (PPT) 2. Tutorial	Oral exam Monthly exam
10	3	Enthalpy	General strategy for solving material balance problems	1.Lectures (PPT) 2. Tutorial	Oral exam
11	3	Degree of freedom	Material Balances for Batch and Semi-Batch Processes	1.Lectures (PPT) 2. Tutorial	Oral exam Quiz
12	3	Material and energy balance	Degree of Freedom Analysis	1.Lectures (PPT) 2. Tutorial	Oral exam
13	3	Material and energy balance	Solving material balance problems for single units without reaction	1.Lectures (PPT) 2. Tutorial	Oral exam Quiz
14	3	Unsteady State energy balance	Solving material balance problems for single units without reaction	1.Lectures (PPT) 2. Tutorial	Oral exam
15	3	Unsteady State energy balance	Solving material balance problems for single units	1.Lectures (PPT)	Oral exam Monthly exam

		without reaction	2. Tutorial	
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12. The development of the curriculum plan

11. Infrastructure

Required reading:

1. Himmelblau David M. "Basic Principles and Calculations in Chemical Engineering". 7th Ed. 2003. Prentice Hall PTR.
2. Felder Richard M., Rousseau Ronald W. "Elementary Principles of Chemical Processes" 3rd Ed. 2001. John Willey & Sons.
3. Reklaitis G.V., Schneider Daniel R. "Introduction to Material and Energy Balances" 1983. John Wiley & Sons.
4. Hougen Olaf A., Watson Kenneth M. "Chemical Processes Principles". 2004, John Wiley and Sons & CBS Publishers.

Others

Lecture notes

Students answers for problems

Special requirements (include for example workshops, periodicals, IT software, websites)

Internet knowledge for chemical engineering

Community-based facilities (include for example, guest Lectures , internship , field studies)

Internship, field studies

HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW

COURSE SPECIFICATION

This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification.

1. Teaching Institution	University of Diyala - College of Engineering
2. University Department/Centre	Chemical Engineering Department
3. Course title/code	Principles of chemical engineering II – Ch. E.105
4. Modes of Attendance offered	Compulsory
5. Semester/Year	2 nd Semester/Academic Year 2022 – 20223
6. Number of hours tuition (total)	45 hrs (3 hrs per week)
7. Date of production/revision of this specification	1/9/2022
8. Aims of the Course	Learn the basics of material balance in the development of industrial and material formulas and their conversions in with and without chemical reaction.

9. Learning Outcomes, Teaching ,Learning and Assessment Method

A- Knowledge and Understanding

1. Definition the dimensions, units and their conversions.
2. Dimensional Consistency (Homogeneity).
3. Express of concentrations, mole and density.
4. Temperature and pressure.
5. General strategy for solving material balance problems.
6. Material Balances for Batch and Semi-Batch Processes.
7. Solving material balance problems for single units without reaction.

B- Subject-specific skills

1. Material balances for operation units.
2. How to deal with units and problems that relates with the material balance.

C- Thinking Skills

1. Learning the basic calculation and principles in chemical engineering.
2. Using mathematical methods for solving material balances.
3. Solving steady-state single unit problems.

D- General and Transferable Skills (other skills relevant to employability and personal development)

1. Activity with society.
2. The work with a team.
3. How engineering is benefit for society and environment.

Teaching and Learning Methods

1. Lectures
2. Presenting Power point (PPT) slides
3. Problems discussion (Tutorial)

Assessment methods

1. Daily exams
2. Monthly exams
3. Home work
4. Final exams

10. Course Structure					
Week	Hours	ILOs	Unit/Module or Topic Title	Teaching Method	Assessment Method
1	3	Introduction	The Chemical Reaction Equation and Stoichiometry	1.Lectures (PPT) 2. Tutorial	Oral exam
2	3	Definitions of material	The Chemical Reaction Equation and Stoichiometry	1.Lectures (PPT) 2. Tutorial	Oral exam
3	3	Representation of materials	Limiting and Excess Reactants, Conversion, Selectivity and Yield	1.Lectures (PPT) 2. Tutorial	Oral exam Quiz
4	3		Conversion, Selectivity and Yield	1.Lectures (PPT) 2. Tutorial	Oral exam Monthly exam
5	3		Material Balances for Processes Involving Chemical Reaction	1.Lectures (PPT) 2. Tutorial	Oral exam
6	3		Material Balances for Processes Involving Chemical Reaction	1.Lectures (PPT) 2. Tutorial	Oral exam Quiz
7	3		Processes Involving Multiple Reactions	1.Lectures (PPT) 2. Tutorial	Oral exam
8	3	Humidity	Element Material Balances	1.Lectures (PPT) 2. Tutorial	Oral exam Quiz
9	3	Heat capacity	Element Material Balances	1.Lectures (PPT) 2. Tutorial	Oral exam Monthly exam
10	3	Enthalpy	Material Balances Involving Combustion	1.Lectures (PPT) 2. Tutorial	Oral exam
11	3	Degree of freedom	Material Balances Involving Combustion	1.Lectures (PPT) 2. Tutorial	Oral exam Quiz
12	3	Material and energy balance	Material Balance Problems Involving Multiple Unit	1.Lectures (PPT) 2. Tutorial	Oral exam
13	3	Material and energy balance	Material Balance Problems Involving Multiple Unit	1.Lectures (PPT) 2. Tutorial	Oral exam Quiz
14	3	Unsteady State energy balance	Recycle with and without Chemical Reaction	1.Lectures (PPT) 2. Tutorial	Oral exam
15	3	Unsteady State energy balance	Bypass, Purge, and the Industrial Application of	1.Lectures (PPT)	Oral exam Monthly exam

		Material Balances without reaction	2. Tutorial	
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12. The development of the curriculum plan

11. Infrastructure

Required reading:

1. Himmelblau David M. "Basic Principles and Calculations in Chemical Engineering". 7th Ed. 2003. Prentice Hall PTR.
2. Felder Richard M., Rousseau Ronald W. "Elementary Principles of Chemical Processes" 3rd Ed. 2001. John Willey & Sons.
3. Reklaitis G.V., Schneider Daniel R. "Introduction to Material and Energy Balances" 1983. John Wiley & Sons.
4. Hougen Olaf A., Watson Kenneth M. "Chemical Processes Principles". 2004, John Wiley and Sons & CBS Publishers.

Others

Lecture notes

Students answers for problems

Special requirements (include for example workshops, periodicals, IT software, websites)

Internet knowledge for chemical engineering

Community-based facilities (include for example, guest Lectures , internship , field studies)

Internship, field studies

Republic of Iraq
The Ministry Of Higher Education
& Scientific Research



University: Diyala
College: Engineering
Department: Chemical Engineering
Stage: First
Lecturer name: Nabaa B. Ali
Qualification: Msc Science
Chemistry

Flow up of implementation celli pass play

Course Instructor	Nabaa Burhan Ali				
E-mail	nabaa_burhan_eng@uodiyala.edu.iq				
Title	Analytical Chemistry				
Course Coordinator	Semester				
Course Objective	<ol style="list-style-type: none"> 1. During the semester, the student learns an idea about analytical chemistry and the main principles of analysis methods. 2. Learn and understand the methods of instrumental analysis 3. Learn and understand ways to express the concentrations of solutions. 4. Learn and understand the methods of leaching in analytical chemistry theoretically and practically. 5. Identify the types of solutions and solve the required issues. 6. Learn and understand gravimetric methods of analysis. 7. Learn about complex acid-base systems. 8. Learn and understand the Nernst equation and the measurement of concentration by cell potential 				
Course Description	<p>This course provides students an idea of analytical chemistry and its methods, perform the required analytical operations on samples, determining the appropriate methods for each sample, as well as identifying ways to express the concentrations of solutions and units used, solving the required problems, Equilibrium problems for complex systems are solved, Nernst equation and measurement of concentrations by potentials of cells, applying the necessary experiments in the analytical chemistry laboratory, Preparing primary and secondary standard solutions by applying theoretical calculations and then preparing solutions practically and learning about titration methods in chemistry.</p>				
Textbook	<ol style="list-style-type: none"> 1. Skoog, D.A., West, D.M., Holler, F.J. and Crouch, S.R., 2013. <i>Fundamentals of analytical chemistry. Cengage learning</i> 2. David H., 2000. <i>Modern Analytical Chemistry. 1st ed.</i> 				
Course Assessments	Term Tests	Laboratory	Quizzes	Assignments	Final Exam
	As (20%)	As (10%)	As (10%)	As(10%)	As (50%)
General Notes	Type here general notes regarding the course				

Republic of Iraq
The Ministry Of Higher Education
& Scientific Research



University: Diyala
College: Engineering
Department: Chemical Engineering
Stage: First
Lecturer name: Nabaa B. Ali
Qualification: Msc in Science
Chemistry

Course Weekly Outline

Week	Date	Topes Covered	Lab. Experiment Assignments	Notes
1		The Nature of Analytical Chemistry	Lab 1: Preparation of primary standard solution (preparation of pure sodium carbonate solution)	
2		Calculations Used in Chemistry Analytical	Lab 2: Preparation of secondary standard solution of hydrochloric acid	
3		Sampling, Standardization, and calibration	Lab 3: Titrate a dilute hydrochloric acid solution and find the normality of sodium hydroxide	
4		Solutions and Aqueous Chemical Equilibria	Lab 4: Quantitative determination of the components of a solution composed of a mixture of sodium carbonate and sodium hydroxide	

5		Effect of Electrolytes on Chemical Equilibria	Lab 5: Titrations curves	
6		Solving Equilibrium Problems Systems for Complex	Lab 6: Refracting titrant	
7		Mid-term Exam - Gravimetric Methods of Analysis	Lab 7: Quantitative determination of chlorine ions in drinking water	
8		Titrations in Analytical Chemistry	Lab 8: Titration of potassium permanganate solution and finding the normality of ferrous sulfate solution	
9		Principles of Neutralization Titrations, Solutions and Indicators for Acid/Base titrations	Lab 9: Water hardness measurement	
10		Titration Curves for Weak Acids , Determining Dissociation Constants of Weak Acids and Bases.	Lab 10: The acidity of vinegar	
11		Complex Acid/Base Systems	Lab 11: Purification of table salt	
12		Calculation of the pH of Solutions of NaHA , Titration Curves for Polyfunctional Acids	Lab 12: Determination of the amount of ammonia in ammonium salts	
13		Principles of Neutralization Titrations	Lab 13: Paper chromatography	
14		Nernst equation and measurement of concentration	Lab 14: detection of ions	

		by potential of the cell		
15		Selected Inorganic materials and reactions	Lab 15: Detection of elements by organic compounds	
16		Final Exam	Lab 1: Preparation of primary standard solution (preparation of pure sodium carbonate solution)	
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INSTRUCTOR Signature:

Dean Signature:

Ministry of Higher Education and Scientific Research

Scientific Supervision and Evaluation Authority

Department of Quality Assurance and Academic Accreditation



Academic program description for colleges and institutes

University: Diyala

College/Institute: College of Engineering

Scientific Department: Chemical Engineering

File filling date: 2020

Department Head Name: Prof. Ahmed Daham Wiheeb

Signature:

Date:

Scientific Associate Name:

Signature:

Date:

The file has already been checked from Quality Assurance and University Performance Division.

Name of the Director of the Quality Assurance and University Performance Division:

Signature:

Date:

Dean's endorsement

Signature

Date:

Academic Program Description

This academic program description provides a brief summary of the most important characteristics of the program and the learning outcomes expected of the student to achieve, proving whether he has made the most of the available opportunities. It is accompanied by a description of each course within the program.

- 1. The educational institution:** University of Diyala
- 2. Scientific Department:** Chemical Engineering
- 3. The name of the academic or professional program**
- 4. The name of the final certificate:** Bachelor of Chemical Engineering
- 5. Academic system:(Annual / courses / other):** Courses
- 6. Accredited Accreditation Program:**
- 7. Other external influences:**
- 8. Description preparation date:** 2020

9. Academic Program Objectives

- (1) Accomplishing the university's goals within the field of chemical engineering;
- (2) gives a sound education in the basics of chemical engineering;
- (3) develop the skills and confidence necessary to solve, based on engineering and scientific principles, problems in the biochemical, chemical and other industries;
- (4) continue to find graduates of high caliber;
- (5) Providing education compatible with the needs of the labor market linked to the Syndicate of Chemical Engineers.

The program provides opportunities for students to develop and display knowledge, understanding, qualities, skills and other characteristics in the following areas: -

1- Knowledge and understanding:

a- The necessary facts, concepts, principles and theories of chemical engineering, and an understanding of the constraints facing the engineer in making the right decision.

B- Basic mathematics, science and technology

C - ideas and concepts of management.

2- Awareness and understanding: -

A- Ethics and professionalism of the profession.

B - The impact of engineering activities on society and civilization.

c- Compatibility with future issues.

3- Cultural capabilities: -

A- Solve industrial problems that may be limited by known or unknown circumstances.

b- Analyzing and discussing the available data or conducting specific experiments to obtain more data.

c- Design units and processes and make the necessary improvements.

The ability to apply new technologies.

C - Possessing a holistic view of industrial engineering problems, taking into consideration cost, safety, quality, environmental impacts, and the ability to assess and manage risks.

4- Practical skills: -

A - Using multiple technologies and devices with software related to the specialty.

B - Using laboratory equipment to find data.

C - Developing and providing a safe work environment.

5- Transferable skills: -

A- Applying mathematical skills to practical problems.

b- Oral and written communication skills.

c- Use information and communicate effectively.

D - control over time and resources.

C - Work in one team.

H - To be creative, especially in designs.

G- Practical in problem analysis

D - Extracting information from published sources.

10. Required program outcomes and methods of teaching, learning and assessment

A- Cognitive goals

1- Necessary facts, concepts, principles and theories of chemical engineering

2- Understand the constraints facing the engineer in making the right decision

3 - Basic Mathematics and Science

4- Techniques used

5- Ideas and concepts of management

B - Skills objectives of the program

1 - Ethics and professionalism of the profession.

2 - the impact of engineering activities on society and civilization.

3 - Compatibility with future issues

Teaching and learning methods

Traditional methods of education and modern and electronic methods

Evaluation methods

Daily and monthly exams, reports, homework, and commitment to lecture time

C- Emotional and value goals.

1- Solve industrial problems that may be limited by known or unknown circumstances.

2 - Analyzing and discussing the available data or conducting specific experiments to obtain more data.

3 - Design units and processes and make the necessary improvements.

4 - The ability to apply new technologies and possess a holistic view of industrial engineering problems and take

Considering cost, safety, quality, environmental impacts, and the ability to assess and manage risks.

D- Transferred general and rehabilitative skills (other skills related to employability and personal development).

1- Applying mathematical skills to practical problems

2 - Oral and written communication skills, effective use of information and communication.

3- Controlling time and resources and working within one team

4- The ability to design and be practical in analyzing problems and extracting information from sources published.

Course description form

Course description

This course description provides a brief summary of the most important characteristics of the course and the learning outcomes expected of the student to achieve, demonstrating whether he has made the most of the available learning opportunities. It must be linked to the description of the program.

1. Educational Institution	University of Diyala
2. Scientific Department / Center	Department of chemical engineering
3. Course name/code	E108 computer programming
4. Forms of attendance available	weekly lectures
5. Semester/year	Semester (second course)
6. Number of hours of study (total)	15 theoretical + 30 practical
7. Date of preparation of this description	2020

8. Course objectives

The main objective of the programming subject is to introduce the student to the foundations of building different programs using the (Quick Basic) language to build different applications used in various programming disciplines, explaining how the computer and programmer deal with the (Quick Basic) language and how to deal with commands and programming instructions such as input, output and control commands. In addition, the possibility of developing students' skills to deal with these instructions through the application of different programs in all fields and clarifying the importance of computer science for students at present and in the future and keeping pace with the development of this science in various disciplines.

9. Course outcomes and methods of teaching, learning and assessment

A- Cognitive goals

A1- Learn about the components of the Quick Basic language.

A2- Identifying the types of constants and variables in the language of (Quick Basic).

A3- Recognize the input and output instructions in the language of (Quick Basic).

A4- Recognize the commands of control in the language of (Quick Basic).

A 5- Learn about Quick Basic language applications using different programs.

B - Skills objectives for the course

B1 - The possibility of writing all kinds of programs using the (Quick Basic) language.

B2 - The possibility of finding the appropriate way to write a specific program by applying the concepts of (Quick Basic) language.

B3 - The possibility of choosing the appropriate constants, variables and office functions when writing the program using Quick Basic language.

B4 - The possibility of analyzing a specific issue and programming it using the (Quick Basic) language.

Teaching and learning methods

1. Lectures.

2- Presenting power point slides.

3- Collecting data and preparing reports.

4- Discussions.

Evaluation methods

1. Sudden exams.

2- Monthly exams.

3- Final exam.

C- Emotional and moral goals

C1- The ability to use appropriate input and output instructions when writing the program.

C2 - The ability to use appropriate commands and commands when writing the program.

C3- The ability to differentiate between directives and programming commands in the Quick Basic language.

C4- The ability to write all kinds of programs using the (Quick Basic) language.

Teaching and learning methods

1. Lectures.

2- Presenting power point slides.

3- Collecting data and preparing reports.

4- Discussions

5-Individual and group reports, as well as preparing presentations

Evaluation methods

1. Unannounced exams.
- 2- Monthly exams.
- 3- Final exam.

D - Transferred general and qualifying skills (other skills related to employability and personal development).

D1 - Using different sources of information.

D 2- Working in one team to achieve a specific design

D 3- The ability to design and be practical in analyzing problems and extracting information from sources.

10. Course Structure

Week	Hours	Required learning outcomes	Unit name and/or topic	education method	Evaluation method
1-2	6	<ol style="list-style-type: none"> 1. Constants in QBASIC. 2. Variables in QBASIC. 3. Arithmetic Expressions. 4. Library Functions. Various Applications. 	Introduction to Q-basic	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
3-4	6	<ol style="list-style-type: none"> 1. Flow Charts. Various applications. 	Flow Charts in Q-basic	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
5-7	9	<ol style="list-style-type: none"> 1. Print statement 2. Let statement. 3. Input statement. 4. Read / Data statement. Various Applications. 	Input and output instructions in Q-basic	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
8	3	semester exam	-	-	-
9-11	9	<ol style="list-style-type: none"> 1. Go To statement. 2. If Then statement. 3. If Go To statement. 4. Various Applications 	Control instructions in Q-basic	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
12-13	6	<ol style="list-style-type: none"> 1. Compound IF...then. 2. Compound IF...Else. 3. For and Next Statements. 4. Various Applications 	Compound instructions in Q-basic.	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
14	3	<ol style="list-style-type: none"> 1. Command Window, Command History and Workspace. 2. Functions and Variables. 3. Generating Arrays and Matrices (rows and columns). 4. Various Applications. 	Introduction to Matlab.	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
15	3	semester exam	-	-	-

11. Infrastructure	
1- Required prescribed books	Joseph H. Noggle, Quick BASIC Programming for Scientists and Engineers, CRC-Press; 1st edition (January 18, 1993).
2- Main references (sources)	Mitchell Waite, Waite Group's Microsoft QuickBASIC Bible, 1990.
3- Recommended books and references (scientific journals, reports ...)	Salah Rasoul Hamza, Basic Language, 1998.
4- Electronic references, websites, etc.	https://programmingbasic.com/qbasic-programming-examples-exercises/

12. Course Development Plan
Adding vocabulary to programming to keep pace with the development of modern programming languages to acquire new and diverse skills.

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The Ministry Of Higher Education
& Scientific Research



بسم الله الرحمن الرحيم

University: Diyala
College: Engineering
Department: Chemical Engineering
Stage: first
Lecturer name: Mohanad
Ali Sultan
Qualification: master.

Course Instructor	: Mohanad Ali Sultan				
E-mail	Maalazzawi85@uodiyala.edu.iq				
Title	Organic Chemistry				
Course Coordinator					
Course Objective	The aim of the module is to introduce you to organic chemistry and develop the ground-work needed for further study. This includes the structures of organic molecules, bonding and an introduction to chemical reactions				
Course Description	This course provides a systematic study of organic chemistry. Topics include nomenclature, structure, properties, reactions, and mechanisms of hydrocarbons, alkyl halides, alcohols, and ethers; further topics include isomerization,. Upon completion, students should be able to demonstrate an understanding of the fundamental concepts of covered organic topics as needed for many chemical industries. The laboratory component provides a vital practical training with a strong focus on developing skills to control chemical reactivity, synthesise and isolate molecular targets, and then to report and apply this knowledge to disciplinary and challenges.				
Textbook	Organic Chemistry 8th edition by Francis A. Carey University of Virginia and Robert M. Giuliano Villanova University Organic Chemistry (fifth edition) by Francis A. Carey Tata Mc Graw Hill publishing company Limited, New Delhi.				
Course Assessments	Term Tests	Laboratory	Quizzes	Project	Final Exam
	As (40%)	As (0%)	As (10%)	----	As (50%)
General Notes	Type here general notes regarding the course				

Republic of Iraq
The Ministry Of Higher Education
& Scientific Research



University: Diyala
College: Engineering
Department: Chemical Engineering
Stage: Third
Lecturer name: Salah N. Farhan
Qualification: pH-D chemical Eng.
Place of work: Chemical Eng. Dept.

Course Weekly Outline

Week	Date	Topics Covered	Lab. Experiment Assignments	Notes
1		<p>) Introduction</p>		
2		<p>Atoms, molecules, bonding, polar and nonpolar molecules, intermolecular forces, solubilities, Lewis structures, acids and bases. Writing Organic Structures, Bond strength, Intro. to electrophiles & nucleophiles</p>		
3		<p>) Alkanes and Cycloalkanes: Introduction to Hydrocarbons Molecular Formulas, structural isomerism and nomenclature, alkyl group, Rings (cycloalkanes, polycyclic compounds)</p> <p>) Alkyl halides IUPAC Nomenclature of Alkyl Halides substitution reactions of alkyl halides. Elimination reactions Physical Properties of Alcohols and Alkyl Halides: Intermolecular Forces</p>		
4		<p>) Alkenes and Cycloalkenes structure and bonding, nomenclature, Physical Properties of Alkenes, E-Z notation, hydrogenation, Preparation of Alkenes: Dehydration of Alcohols, Dehydrohalogenation of Alkyl Halides, Addition Reactions of Alkenes</p>		

		Hydrogenation of Alkenes Addition of Hydrogen Halides to Alkenes		
5) Addition Reactions of Alkenes Addition of Sulfuric Acid to Alkenes Acid-Catalyzed Hydration of Alkenes Hydroboration–Oxidation of Alkenes Addition of Halogens to Alkenes Epoxidation of Alkenes Ozonolysis of Alkenes Reactions of Alkenes with Alkenes: Polymerization		
6) Alkynes Sources of Alkynes Nomenclature Physical Properties of Alkynes Structure and Bonding in Alkynes: sp Hybridization Acidity of Acetylene and Terminal Alkynes Preparation of Alkynes by Alkylation of Acetylene and Terminal Alkynes Preparation of Alkynes by Elimination Reactions		
7) Alkynes Reactions of Alkynes Hydrogenation of Alkynes Metal–Ammonia Reduction of Alkynes Addition of Hydrogen Halides to Alkynes		

		<p>Hydration of Alkynes</p> <p>Addition of Halogens to Alkynes</p>		
8		<p>) Arenes and Aromaticity</p> <p>Benzene</p> <p>The Structure of Benzene 430</p> <p>The Stability of Benzene 432</p> <p>Substituted Derivatives of Benzene and Their Nomenclature</p> <p>Polycyclic Aromatic Hydrocarbons</p> <p>Physical Properties of Arenes</p>		
9		<p>Reactions of Arenes:</p> <p>The Birch Reduction</p> <p>Free-Radical Halogenation of Alkylbenzenes</p> <p>Oxidation of Alkylbenzenes</p> <p>Reactions of Benzylic Halides</p> <p>Reactions of Benzylic Halides</p> <p>Preparation of Alkenylbenzenes</p> <p>Addition Reactions of Alkenylbenzenes</p> <p>Cyclobutadiene and Cyclooctatetraene</p> <p>Hückel's Rule</p>		
10		<p>) Alcohols</p> <p>Sources of Alcohols</p> <p>Preparation of Alcohols by Reduction of Aldehydes and Ketones</p> <p>Preparation of Alcohols by Reduction of Carboxylic Acids</p> <p>Preparation of Alcohols from Epoxides</p> <p>Preparation of Diols</p> <p>Reactions of Alcohols: A Review</p>		

		<p>and a Preview</p> <p>Conversion of Alcohols to Ethers</p> <p>Esterification</p> <p>Oxidation of Alcohols</p>		
11		<p>Heat balance calculations in processes with chemical reaction, Heat of reaction, standard heats of formation.</p>		
12		<p>J Aldehydes and Ketones</p> <p>Nomenclature</p> <p>Structure and Bonding: The Carbonyl Group</p> <p>Physical Properties</p> <p>Sources of Aldehydes and Ketones</p> <p>Reactions of Aldehydes and Ketones: A Review and a Preview</p> <p>Principles of Nucleophilic Addition: Hydration of Aldehydes and Ketones</p> <p>Cyanohydrin Formation</p> <p>Acetal Formation</p>		
13		<p>J Carboxylic Acids</p> <p>Carboxylic Acid Nomenclature</p> <p>Structure and Bonding</p> <p>Physical Properties</p> <p>Acidity of Carboxylic Acids</p>		
14		<p>Substituents and Acid Strength</p> <p>Salts of Carboxylic Acids</p> <p>Sources of Carboxylic Acids</p> <p>Synthesis of Carboxylic Acids by the Carboxylation of Grignard Reagents</p> <p>Synthesis of Carboxylic Acids by</p>		

		<p>the Preparation and Hydrolysis of Nitriles</p> <p>Reactions of Carboxylic Acids</p>		
15		<p>Amine</p> <p>Amine Nomenclature</p> <p>Structure and Bonding</p> <p>Physical Properties 935</p> <p>Basicity of Amines 936</p> <p>amines as Natural Products</p> <p>Tetraalkylammonium Salts as Phase-Transfer Catalysts</p> <p>Reactions That Lead to Amines: A Review and a Preview</p> <p>Preparation of Amines by Alkylation of Ammonia</p> <p>The Gabriel Synthesis of Primary Alkylamines</p> <p>Preparation of Amines by Reduction</p> <p>Reductive Amination</p> <p>Reactions of Amines: A Review and a Preview</p> <p>Reaction of Amines with Alkyl Halides</p> <p>The Hofmann Elimination</p> <p>Electrophilic Aromatic Substitution in Arylamines</p> <p>Nitrosation of Alkylamines</p> <p>Nitrosation of Arylamines</p> <p>Synthetic Transformations of Aryl Diazonium Salts</p>		
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INSTRUCTOR Signature:

Dean Signature:

Ministry of Higher Education and Scientific Research

Scientific Supervision and Evaluation Authority

Department of Quality Assurance and Academic Accreditation



Academic program description for colleges and institutes

University: Diyala

College/Institute: College of Engineering

Scientific Department: Chemical Engineering

File filling date: 2023

Department Head Name: Prof. Ahmed Daham Wiheeb

Signature:

Date:

Scientific Associate Name:

Signature:

Date:

The file has already been checked from Quality Assurance and University Performance Division.

Name of the Director of the Quality Assurance and University Performance Division:

Signature:

Date:

Dean's endorsement

Signature

Date:

Academic Program Description

This academic program description provides a brief summary of the most important characteristics of the program and the learning outcomes expected of the student to achieve, proving whether he has made the most of the available opportunities. It is accompanied by a description of each course within the program.

- 1. The educational institution:** University of Diyala
- 2. Scientific Department:** Chemical Engineering
- 3. The name of the academic or professional program**
- 4. The name of the final certificate:** Bachelor of Chemical Engineering
- 5. Academic system:(Annual / courses / other):** Courses
- 6. Accredited Accreditation Program:**
- 7. Other external influences:**
- 8. Description preparation date:** 2023

9. Academic Program Objectives

- (1) Accomplishing the university's goals within the field of chemical engineering;
- (2) gives a sound education in the basics of chemical engineering;
- (3) develop the skills and confidence necessary to solve, based on engineering and scientific principles, problems in the biochemical, chemical and other industries;
- (4) continue to find graduates of high caliber;
- (5) Providing education compatible with the needs of the labor market linked to the Syndicate of Chemical Engineers.

The program provides opportunities for students to develop and display knowledge, understanding, qualities, skills and other characteristics in the following areas: -

1- Knowledge and understanding:

a- The necessary facts, concepts, principles and theories of chemical engineering, and an understanding of the constraints facing the engineer in making the right decision.

B- Basic mathematics, science and technology

C - ideas and concepts of management.

2- Awareness and understanding: -

A- Ethics and professionalism of the profession.

B - The impact of engineering activities on society and civilization.

c- Compatibility with future issues.

3- Cultural capabilities: -

A- Solve industrial problems that may be limited by known or unknown circumstances.

b- Analyzing and discussing the available data or conducting specific experiments to obtain more data.

c- Design units and processes and make the necessary improvements.

The ability to apply new technologies.

C - Possessing a holistic view of industrial engineering problems, taking into consideration cost, safety, quality, environmental impacts, and the ability to assess and manage risks.

4- Practical skills: -

A - Using multiple technologies and devices with software related to the specialty.

B - Using laboratory equipment to find data.

C - Developing and providing a safe work environment.

5- Transferable skills: -

A- Applying mathematical skills to practical problems.

b- Oral and written communication skills.

c- Use information and communicate effectively.

D - control over time and resources.

C - Work in one team.

H - To be creative, especially in designs.

G- Practical in problem analysis

D - Extracting information from published sources.

10. Required program outcomes and methods of teaching, learning and assessment

A- Cognitive goals

1- Necessary facts, concepts, principles and theories of chemical engineering

2- Understand the constraints facing the engineer in making the right decision

3 - Basic Mathematics and Science

4- Techniques used

5- Ideas and concepts of management

B - Skills objectives of the program

1 - Ethics and professionalism of the profession.

2 - the impact of engineering activities on society and civilization.

3 - Compatibility with future issues

Teaching and learning methods

Traditional methods of education and modern and electronic methods

Evaluation methods

Daily and monthly exams, reports, homework, and commitment to lecture time

C- Emotional and value goals.

1- Solve industrial problems that may be limited by known or unknown circumstances.

2 - Analyzing and discussing the available data or conducting specific experiments to obtain more data.

3 - Design units and processes and make the necessary improvements.

4 - The ability to apply new technologies and possess a holistic view of industrial engineering problems and take

Considering cost, safety, quality, environmental impacts, and the ability to assess and manage risks.

D- Transferred general and rehabilitative skills (other skills related to employability and personal development).

1- Applying mathematical skills to practical problems

2 - Oral and written communication skills, effective use of information and communication.

3- Controlling time and resources and working within one team

4- The ability to design and be practical in analyzing problems and extracting information from sources published.

Ministry of Higher Education and Scientific Research

Scientific Supervision and Evaluation Authority

Department of Quality Assurance and Academic Accreditation



Academic program description for colleges and institutes

University: Diyala

College/Institute: College of Engineering

Scientific Department: Chemical Engineering

File filling date: 2023

Department Head Name: Prof. Ahmed Daham Wiheeb

Signature:

Date:

Scientific Associate Name:

Signature:

Date:

The file has already been checked from Quality Assurance and University Performance Division.

Name of the Director of the Quality Assurance and University Performance Division:

Signature:

Date:

Dean's endorsement

Signature

Date:

Academic Program Description

This academic program description provides a brief summary of the most important characteristics of the program and the learning outcomes expected of the student to achieve, proving whether he has made the most of the available opportunities. It is accompanied by a description of each course within the program.

- 1. The educational institution:** University of Diyala
- 2. Scientific Department:** Chemical Engineering
- 3. The name of the academic or professional program**
- 4. The name of the final certificate:** Bachelor of Chemical Engineering
- 5. Academic system:(Annual / courses / other):** Courses
- 6. Accredited Accreditation Program:**
- 7. Other external influences:**
- 8. Description preparation date:** 2023

9. Academic Program Objectives

- (1) Accomplishing the university's goals within the field of chemical engineering;
- (2) gives a sound education in the basics of chemical engineering;
- (3) develop the skills and confidence necessary to solve, based on engineering and scientific principles, problems in the biochemical, chemical and other industries;
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The program provides opportunities for students to develop and display knowledge, understanding, qualities, skills and other characteristics in the following areas: -

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b- Analyzing and discussing the available data or conducting specific experiments to obtain more data.

c- Design units and processes and make the necessary improvements.

The ability to apply new technologies.

C - Possessing a holistic view of industrial engineering problems, taking into consideration cost, safety, quality, environmental impacts, and the ability to assess and manage risks.

4- Practical skills: -

A - Using multiple technologies and devices with software related to the specialty.

B - Using laboratory equipment to find data.

C - Developing and providing a safe work environment.

5- Transferable skills: -

A- Applying mathematical skills to practical problems.

b- Oral and written communication skills.

c- Use information and communicate effectively.

D - control over time and resources.

C - Work in one team.

H - To be creative, especially in designs.

G- Practical in problem analysis

D - Extracting information from published sources.

10. Required program outcomes and methods of teaching, learning and assessment

A- Cognitive goals

1- Necessary facts, concepts, principles and theories of chemical engineering

2- Understand the constraints facing the engineer in making the right decision

3 - Basic Mathematics and Science

4- Techniques used

5- Ideas and concepts of management

B - Skills objectives of the program

1 - Ethics and professionalism of the profession.

2 - the impact of engineering activities on society and civilization.

3 - Compatibility with future issues

Teaching and learning methods

Traditional methods of education and modern and electronic methods

Evaluation methods

Daily and monthly exams, reports, homework, and commitment to lecture time

C- Emotional and value goals.

1- Solve industrial problems that may be limited by known or unknown circumstances.

2 - Analyzing and discussing the available data or conducting specific experiments to obtain more data.

3 - Design units and processes and make the necessary improvements.

4 - The ability to apply new technologies and possess a holistic view of industrial engineering problems and take

Considering cost, safety, quality, environmental impacts, and the ability to assess and manage risks.

D- Transferred general and rehabilitative skills (other skills related to employability and personal development).

1- Applying mathematical skills to practical problems

2 - Oral and written communication skills, effective use of information and communication.

3- Controlling time and resources and working within one team

4- The ability to design and be practical in analyzing problems and extracting information from sources published.

HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW

COURSE SPECIFICATION

This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification.

1. Teaching Institution	University of Diyala - College of Engineering
2. University Department/Centre	Chemical Engineering Department
3. Course title/code	Principles of chemical engineering III – Ch. E.206
4. Modes of Attendance offered	Online studying (Electronic Teaching)
5. Semester/Year	1 st Semester/Academic Year 2020 – 2021
6. Number of hours tuition (total)	45 hrs (3 hrs per week)
7. Date of production/revision of this specification	12/6/2021
8. Aims of the Course	Learn the basics of energy balance in the development of industrial and energy formulas and their transformations in with and without chemical reaction.

9. Learning Outcomes, Teaching ,Learning and Assessment Method

A- Knowledge and Understanding

1. Definition the basics of energy and their transformation.
2. Types of Energy.
3. Energy balance.
4. Enthalpy-concentration charts and their uses.
5. Knowing how to balance unsteady material and energy systems.
6. Using Humidity charts.

B- Subject-specific skills

1. Solve problems for real gas and their mixture.
2. Using diagrams and chart for calculation Humidity and heat of solution.
3. Used unsteady state balances for solving systems.

C- Thinking Skills

1. Learning the basic calculation and principles in chemical engineering.
2. Using mathematical methods for solving material and energy balances.
3. Solving unsteady state models.

D- General and Transferable Skills (other skills relevant to employability and personal development)

1. Activity with society.
2. The work with a team.
3. How engineering is benefit for society and environment.

Teaching and Learning Methods

1. Lectures
2. Presenting Power point (PPT) slides
3. Problems discussion (Tutorial)

Assessment methods

1. Daily exams
2. Monthly exams
3. Home work
4. Final exams

10. Course Structure					
Week	Hours	ILOs	Unit/Module or Topic Title	Teaching Method	Assessment Method
1	3	Introduction	1. Energy definition. 2. Energy forms.	1.Lectures (PPT) 2. Tutorial	Oral exam
2	3	Enthalpy	1. Latent heat of vaporization. 2. Enthalpy of reaction.	1.Lectures (PPT) 2. Tutorial	Oral exam
3	3	First law of thermodynamic	Energy balance without chemical reaction.	1.Lectures (PPT) 2. Tutorial	Oral exam Quiz
4	3	First law of thermodynamic	Energy balance with chemical reaction.	1.Lectures (PPT) 2. Tutorial	Oral exam Monthly exam
5	3	Energy balance	Application of energy balance in the industry.	1.Lectures (PPT) 2. Tutorial	Oral exam
6	3	Energy balance	Mechanical energy balance.	1.Lectures (PPT) 2. Tutorial	Oral exam Quiz
7	3	Heat of solution	Heat of solution	1.Lectures (PPT) 2. Tutorial	Oral exam
8	3	Humidity	1. Definitions of different kinds of humidity. 2. Humidity charts and their uses.	1.Lectures (PPT) 2. Tutorial	Oral exam Quiz
9	3	Heat capacity	Heat capacity	1.Lectures (PPT) 2. Tutorial	Oral exam Monthly exam
10	3	Enthalpy	Enthalpy-concentration charts and their uses	1.Lectures (PPT) 2. Tutorial	Oral exam
11	3	Degree of freedom	Degree of freedom of systems	1.Lectures (PPT) 2. Tutorial	Oral exam Quiz
12	3	Material and energy balance	Material and energy balance for complete projects.	1.Lectures (PPT) 2. Tutorial	Oral exam

13	3	Material and energy balance	Material and energy balance for complete projects.	1.Lectures (PPT) 2. Tutorial	Oral exam Quiz
14	3	Unsteady State energy balance	Unsteady state material balance	1.Lectures (PPT) 2. Tutorial	Oral exam
15	3	Unsteady State energy balance	Unsteady State energy balance	1.Lectures (PPT) 2. Tutorial	Oral exam Monthly exam

11. Infrastructure

Required reading:

1. Himmelblau David M. "Basic Principles and Calculations in Chemical Engineering". 7th Ed. 2003. Prentice Hall PTR.
2. Felder Richard M., Rousseau Ronald W. "Elementary Principles of Chemical Processes" 3rd Ed. 2001. John Willey & Sons.
3. Reklaitis G.V., Schneider Daniel R. "Introduction to Material and Energy Balances" 1983. John Wiley & Sons.
4. Hougen Olaf A., Watson Kenneth M. "Chemical Processes Principles". 2004, John Wiley and Sons & CBS Publishers.

Others

Lecture notes

Students answers for problems

Special requirements (include for example workshops, periodicals, IT software, websites)

Internet knowledge for chemical engineering

Community-based facilities (include for example, guest Lectures , internship , field studies)

Internship, field studies

12. The development of the curriculum plan

Flow up of implementation academic program

Course Instructor	Yaser I. Jasem				
E-mail	Yaser.ij13@gmail				
Title	Food Engineering				
Course Coordinator	Courses				
Course Objective	<p>a) Introducing pollutants in general, whether they are air, water, or solid pollutants, especially those resulting from various industries.</p> <p>b) Introducing the harms resulting from these pollutants and their negative impact on human life and the surrounding soil, air, water, and all living organisms.</p> <p>c) Thus, finding the best appropriate methods (taking into account Cost factor) to reduce these pollutants or reduce their impact through designing the necessary equipment to reduce these pollutants or through the correct management of various wastes in a way that ensures the best environment with the least amount of pollutants possible to preserve life.</p> <p>d) Introducing food fortification technology and fortification requirements.</p>				
Course Description	<p>Identifying global environmental phenomena, their effects, and ways to reduce them and reduce their effects. Air pollution, air pollution classification, Gravitational settling chambers, Cyclone separators, Baghouses, Electrostatic precipitator, Wet scrubber and their calculations. Water and wastewater treatment, Primary and Secondary treatment. Tertiary treatment. Solid Waste Management.</p>				
Textbook	<p>1- C.S.Rao , “Environmental Pollution Control Engineering”, 2nd eddition , New Age International(P) Limited, Published, 2006, Reprint 2007.</p> <p>2- R. K. Sinnott, Chemical Engineering Design, Vol. 6. 4th edition, Chemical Engineering Design, 2005, pp. 450-457.</p> <p>3- Noel de Never, “Air Pollution Control Engineering”, McGraw-Hill, Inc 1987.</p> <p>M. Grawford, “Air Pollution Control Theory”, McGraw-Hill, New York, 1976.</p> <p>4- M. M. Gilbert, “Introduction To Environmental Engineering And Science ”, 2nd edition, Hall, Inc, New Jersey, 1998.</p>				
Course Assessments	Term Tests	Laboratory	Quizzes	Project	Final Exam
	As (40%)	As (0%)		----	As (60%)
General Notes	Type here general notes regarding the course				

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Republic of Iraq
The Ministry Of Higher Education
& Scientific Research



University: Diyala
College: Engineering
Department: Chemical Engineering
Stage: Third
Lecturer name: Salah N. Farhan
Qualification: pH-D chemical Eng.
Place of work: Chemical Eng. Dept.

Course Weekly Outline

Week	Date	Topes Covered	Lab. Experiment Assignments	Notes
1				
2				
3				
4				
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31				

INSTRUCTOR Signature:

Dean Signature:

Ministry of Higher Education and Scientific Research

Scientific Supervision and Evaluation Authority

Department of Quality Assurance and Academic Accreditation



Academic program description for colleges and institutes

University: Diyala

College/Institute: College of Engineering

Scientific Department: Chemical Engineering

File filling date: 2020

Department Head Name: Prof. Ahmed Daham Wiheeb

Signature:

Date:

Scientific Associate Name:

Signature:

Date:

The file has already been checked from Quality Assurance and University Performance Division.

Name of the Director of the Quality Assurance and University Performance Division:

Signature:

Date:

Dean's endorsement

Signature

Date:

Academic Program Description

This academic program description provides a brief summary of the most important characteristics of the program and the learning outcomes expected of the student to achieve, proving whether he has made the most of the available opportunities. It is accompanied by a description of each course within the program.

- 1. The educational institution:** University of Diyala
- 2. Scientific Department:** Chemical Engineering
- 3. The name of the academic or professional program**
- 4. The name of the final certificate:** Bachelor of Chemical Engineering
- 5. Academic system:(Annual / courses / other):** Courses
- 6. Accredited Accreditation Program:**
- 7. Other external influences:**
- 8. Description preparation date:** 2020

9. Academic Program Objectives

- (1) Accomplishing the university's goals within the field of chemical engineering;
- (2) gives a sound education in the basics of chemical engineering;
- (3) develop the skills and confidence necessary to solve, based on engineering and scientific principles, problems in the biochemical, chemical and other industries;
- (4) continue to find graduates of high caliber;
- (5) Providing education compatible with the needs of the labor market linked to the Syndicate of Chemical Engineers.

The program provides opportunities for students to develop and display knowledge, understanding, qualities, skills and other characteristics in the following areas: -

1- Knowledge and understanding:

a- The necessary facts, concepts, principles and theories of chemical engineering, and an understanding of the constraints facing the engineer in making the right decision.

B- Basic mathematics, science and technology

C - ideas and concepts of management.

2- Awareness and understanding: -

A- Ethics and professionalism of the profession.

B - The impact of engineering activities on society and civilization.

c- Compatibility with future issues.

3- Cultural capabilities: -

A- Solve industrial problems that may be limited by known or unknown circumstances.

b- Analyzing and discussing the available data or conducting specific experiments to obtain more data.

c- Design units and processes and make the necessary improvements.

The ability to apply new technologies.

C - Possessing a holistic view of industrial engineering problems, taking into consideration cost, safety, quality, environmental impacts, and the ability to assess and manage risks.

4- Practical skills: -

A - Using multiple technologies and devices with software related to the specialty.

B - Using laboratory equipment to find data.

C - Developing and providing a safe work environment.

5- Transferable skills: -

A- Applying mathematical skills to practical problems.

b- Oral and written communication skills.

c- Use information and communicate effectively.

D - control over time and resources.

C - Work in one team.

H - To be creative, especially in designs.

G- Practical in problem analysis

D - Extracting information from published sources.

10. Required program outcomes and methods of teaching, learning and assessment

A- Cognitive goals

1- Necessary facts, concepts, principles and theories of chemical engineering

2- Understand the constraints facing the engineer in making the right decision

3 - Basic Mathematics and Science

4- Techniques used

5- Ideas and concepts of management

B - Skills objectives of the program

1 - Ethics and professionalism of the profession.

2 - the impact of engineering activities on society and civilization.

3 - Compatibility with future issues

Teaching and learning methods

Traditional methods of education and modern and electronic methods

Evaluation methods

Daily and monthly exams, reports, homework, and commitment to lecture time

C- Emotional and value goals.

1- Solve industrial problems that may be limited by known or unknown circumstances.

2 - Analyzing and discussing the available data or conducting specific experiments to obtain more data.

3 - Design units and processes and make the necessary improvements.

4 - The ability to apply new technologies and possess a holistic view of industrial engineering problems and take

Considering cost, safety, quality, environmental impacts, and the ability to assess and manage risks.

D- Transferred general and rehabilitative skills (other skills related to employability and personal development).

1- Applying mathematical skills to practical problems

2 - Oral and written communication skills, effective use of information and communication.

3- Controlling time and resources and working within one team

4- The ability to design and be practical in analyzing problems and extracting information from sources published.

Course description form

Course description

This course description provides a brief summary of the most important characteristics of the course and the learning outcomes expected of the student to achieve, demonstrating whether he has made the most of the available learning opportunities. It must be linked to the description of the program.

1. Educational Institution	University of Diyala
2. Scientific Department / Center	Department of chemical engineering
3. Course name/code	Ch.E208 statistical and probability
4. Forms of attendance available	weekly lectures
5. Semester/year	Semester (first course)
6. Number of hours of study (total)	30
7. Date of preparation of this description	2020
8. Course objectives	Giving the student an overview of the principles and concepts of statistics and probability, and making the student able to represent data in the form of tables and graphics. Differentiate between quantitative and qualitative data and how they are represented. Knowing the types of descriptive measures such as arithmetic mean, frequency, range, amount of change and standard deviation. Knowledge of the principles of probability and its types and the laws of multiplication, addition and continuity in addition to the use of the laws of permutations and combinations in finding probability. Make the student able to know the types of distribution such as the normal distribution and use it to represent the types of probability.

9. Course outcomes and methods of teaching, learning and assessment

A- Cognitive goals

A1- Identify the types of quantitative and qualitative data.

A2- Identify ways to represent quantitative and qualitative data.

A3- Identifying the types of descriptive measures such as arithmetic mean, frequency, range, amount of change and standard deviation.

A4- Understand the principles and types of probability and the laws of multiplication, addition and continuity.

A 5- Know the laws of permutations and combinations in finding probability.

A6- Identify the types of distribution and use them in representing the types of probability.

B - Skills objectives for the course

B1 - The ability to differentiate between quantitative and qualitative data.

B2 - The possibility of differentiating between the methods of representing quantitative and qualitative data, whether in the form of tables or graphics.

B3 - The possibility of finding types of descriptive metrics.

B4 - The possibility of finding the probability for each variable.

B5- The possibility of finding the types of distribution for the discrete and continuous random variables.

Teaching and learning methods

1. Lectures.

2- Presenting power point slides.

3- Collecting data and preparing reports.

4- Discussions.

Evaluation methods

1. Sudden exams.

2- Monthly exams.

3- Final exam.

C- Emotional and moral goals

C1- The ability to identify and represent data types.

C2 - the ability to determine the values of descriptive measures.

C3 - The ability to use appropriate techniques to find the probability of each variable.

C4- The ability to determine the appropriate method to find the different types of distribution to be used in representing random data.

Teaching and learning methods

1. Lectures.

2- Presenting power point slides.

3- Collecting data and preparing reports.

4- Discussions

5- Individual and group reports, as well as preparing presentations

Evaluation methods

1. Unannounced exams.

2- Monthly exams.

3- Final exam.

D - Transferred general and qualifying skills (other skills related to employability and personal development).

D1 - Using different sources of information.

D 2- Working in one team to achieve a specific design

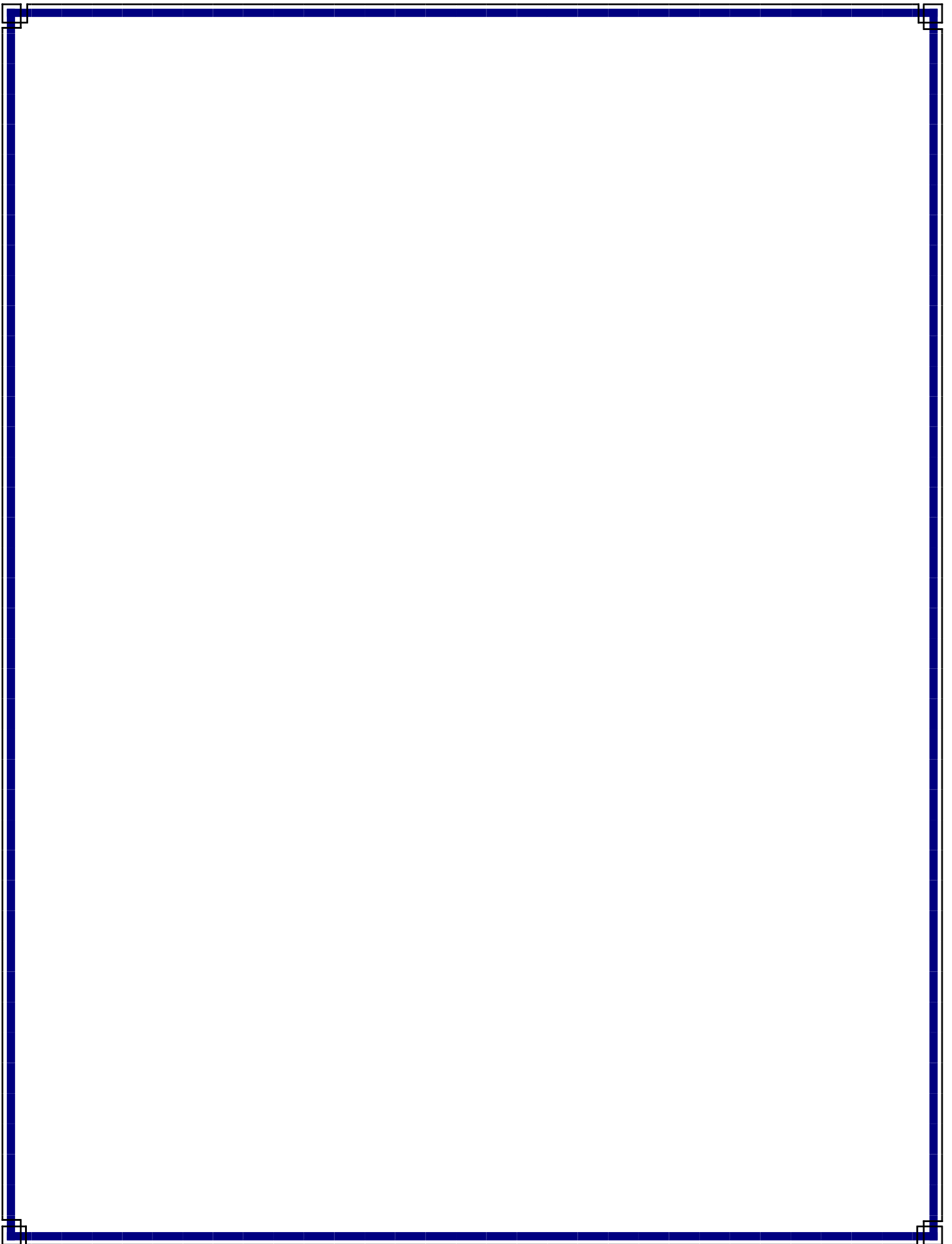
D 3- The ability to design and be practical in analyzing problems and extracting information from sources.

10. Course Structure

Week	Hours	Required learning outcomes	Unit name and/or topic	education method	Evaluation method
1	2	Introduction to statistics	Principles of Statistics	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
2-3	4	Types of quantitative and qualitative data and the way to represent them numerically and graphically	Quantitative and qualitative data	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
4-5	4	Descriptive measures such as mean, frequency, mean value, amount of change, standard deviation, and range	descriptive metrics	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
6-7	4	Introduction to probability and its types and the laws of multiplication and addition using art forms	probability	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
8	2	semester exam	-	-	-
9-10	4	Use permutations and combinations theorems to find probability values	Permutations and combinations	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
11-12	4	Introduction to the types of probability distribution such as normal distribution, Poisson distribution, Binomial distribution, Standard distribution	Types of probability distribution	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
13	2	central limit theorem	central limit theorem	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
14	2	curve fitting methods	curve fitting	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
15	2	semester exam	-	-	-

11. Infrastructure	
1- Required prescribed books	Douglas C. Montgomery, G. C. Runger, Applied Statistics and Probability for Engineers, John Wiley and Sons, 2003.
2- Main references (sources)	A. M. Mood and F. A. Graybill, an Introduction to the Theory of Statistics, Prentice Hall of India, 1963.
3- Recommended books and references (scientific journals, reports ...)	P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Statistical Theory, Houghton Mifflin, 1971.
4- Electronic references, websites, etc.	http://www.pitt.edu/~super1/ResearchMethods/Arabic/statstic albookinarabict.pdf .

12. Course Development Plan
Adding a chapter related to the applications of chemical engineering in the field of statistics.



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The Ministry of Higher Education
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بسم الله الرحمن الرحيم



University: Diyala
College: Engineering
Department: Chemical Engineering
Stage: Third
Lecturer name: Ali Z. Al-hassn
Qualification: Ph.D chemical Eng.
Place of work: Chemical Eng. Dept.

Course Instructor	Ali Z. Al-hassn				
E-mail	alialhassn.uod@uodiyala.edu.iq				
Title	Thermodynamics I				
Course Coordinator					
Course Objective	<ul style="list-style-type: none"> The course provides an introductory treatment of thermodynamics from a chemical-engineering viewpoint. This course provides the students with a fundamental understanding of the basics of energy conversion and prepare the student to evaluate the relative qualities of different thermodynamic systems. The course should provide students with good skills and ability to solve the thermodynamic problems related to chemical engineering units. The course also provides a better understanding of the thermodynamic fundamentals themselves. 				
Course Description	The course at the beginning present basic definitions and a development of the first law as it applies to nonflow and simple steady-flow processes. Then, it will treat the pressure-volume-temperature behavior of fluids and certain heat effects. After that, the second law and some of its applications are considered followed by a treatment of the thermodynamic properties of pure fluids and applications of the first and second laws to flow processes in general.				
Textbook	<ol style="list-style-type: none"> Introduction to Chemical Engineering Thermodynamics: Smith, J.M., Van ness H.C. and Abbot, M.M., 7th Edn. MGH., 2005 A text Book of Chemical Engineering Thermodynamics, Narayanan, PHI Chemical Engineering Thermodynamics: Y.V.C. Rao. 				
Course Assessments	Term Tests	Laboratory	Quizzes	Project	Final Exam
	As (30%)	As (0%)	As (10%)	----	As (60%)
General Notes	Type here general notes regarding the course				

Republic of Iraq
The Ministry Of Higher Education
& Scientific Research



University: Diyala
College: Engineering
Department: Chemical Engineering
Stage: Third
Lecturer name: Ali Z. Al-hassn
Qualification: Ph.D chemical Eng.
Place of work: Chemical Eng. Dept.

Course Weekly Outline

Week	Date	Topes Covered	Lab. Experiment Assignments	Notes
1		Introduction <ul style="list-style-type: none"> Basic definitions Fundamental physical quantities Heat and work	N/A	Lecture (1)
2		1st law of thermodynamics <ul style="list-style-type: none"> Joule's Experiments Internal Energy Formulation of the First Law of Thermodynamics	N/A	Lecture (2)
3		<ul style="list-style-type: none"> The Thermodynamic State and State Functions Enthalpy Heat capacity, Reversible process The Phase Rule	N/A	Lecture (3)
4		Volumetric Properties of Pure Fluids <ul style="list-style-type: none"> The PVT Behavior of Pure Substances The Virial Equation	N/A	Lecture (4)
5		Volumetric Properties of Pure Fluids <ul style="list-style-type: none"> The Ideal Gas (isochoric, isothermal, & adiabatic) Cubic Equations of State Generalized Correlations for Gases and liquids	N/A	Lecture (5)
6		Heat Effects <ul style="list-style-type: none"> Sensible Heat Effects Heat Effects Accompanying Phase Changes of Pure Substances	N/A	Lecture (6)
7		Heat Effects <ul style="list-style-type: none"> The Standard Heat of Reaction The Standard Heat of Formation The Standard Heat of Combustion	N/A	Lecture (7)

8		Heat Effects <ul style="list-style-type: none"> • Effect of Temperature on the Standard Heat of Reaction Heat Effects of Industrial Reactions	N/A	Lecture (8)
9		Midterm examination	N/A	Lecture (9)
10		2nd law of thermodynamics <ul style="list-style-type: none"> • The Heat Engine Carnot Cycle for an Ideal Gas	N/A	Lecture (10)
11		2nd law of thermodynamics <ul style="list-style-type: none"> • Entropy • Entropy Changes of an Ideal Gas Mathematical Statement of the Second Law	N/A	Lecture (11)
12		Thermodynamic Properties of Fluids <ul style="list-style-type: none"> • Relations for a homogenous phase of constant composition Maxwell's equations	N/A	Lecture (12)
13		Thermodynamic Properties of Fluids Residual Properties	N/A	Lecture (13)
14		Thermodynamic Properties of Fluids <ul style="list-style-type: none"> • Two-Phase Systems Quality of vapor	N/A	Lecture (14)
15		Thermodynamics of Flow Processes Throttling process	N/A	Lecture (15)

INSTRUCTOR Signature:

Dean Signature:

Course Instructor	Ali Z. Al-hassn				
E-mail	alialhassn.uod@uodiyala.edu.iq				
Title	Thermodynamics II				
Course Coordinator					
Course Objective	<ul style="list-style-type: none"> The course provides an introductory treatment of thermodynamics from a chemical-engineering viewpoint. This course provides the students with a fundamental understanding of the basics of energy conversion and prepare the student to evaluate the relative qualities of different thermodynamic systems. The course should provide students with good skills and ability to solve the thermodynamic problems related to chemical engineering units. The course also provides a better understanding of the thermodynamic fundamentals themselves. 				
Course Description	<p>This course covers major thermodynamics principles that are useful to engineering applications. The student will learn how the power cycle can convert heat into work and how the power produced in steam power plant and solving related problems. The refrigeration and the liquefaction processes will be dealt with, too. After that, the course will tackle the problems of fluid mixtures with application to vapor/liquid equilibrium. The application of equations of state in thermodynamic calculations, particularly in vapor/liquid equilibrium, is discussed later. Finally, thermodynamics of the chemical reaction equilibrium will be covered.</p>				
Textbook	<ol style="list-style-type: none"> Introduction to Chemical Engineering Thermodynamics: Smith, J.M., Van ness H.C. and Abbot, M.M., 7th Edn. MGH., 2005 A text Book of Chemical Engineering Thermodynamics, Narayanan, PHI Chemical Engineering Thermodynamics: Y.V.C. Rao. 				
Course Assessments	Term Tests	Laboratory	Quizzes	Project	Final Exam
	As (30%)	As (0%)	As (10%)	----	As (60%)
General Notes	Type here general notes regarding the course				

Republic of Iraq
The Ministry Of Higher Education
& Scientific Research



University: Diyala
College: Engineering
Department: Chemical Engineering
Stage: Third
Lecturer name: Ali Z. Al-hassn
Qualification: Ph.D chemical Eng.
Place of work: Chemical Eng. Dept.

Course Weekly Outline

Week	Date	Topes Covered	Lab. Experiment Assignments	Notes
1		Conversion of Heat into Work by Power Cycles Basic definitions <ul style="list-style-type: none"> The Steam Power Plant Carnot cycle	N/A	Lecture (1)
2		Conversion of Heat into Work by Power Cycles Basic definitions <ul style="list-style-type: none"> Rankine cycle Practical power plant cycle Jet engines; rocket engines	N/A	Lecture (2)
3		Refrigeration and Liquefaction <ul style="list-style-type: none"> The Camot Refrigerator The Vapor-Compression Cycle	N/A	Lecture (3)
4		Refrigeration and Liquefaction <ul style="list-style-type: none"> The Choice of Refrigerant The Heat Pump	N/A	Lecture (4)
5		Liquefaction Processes	N/A	Lecture (5)
6		Phase equilibrium <ul style="list-style-type: none"> Nature of equilibrium Raoult's law	N/A	Lecture (6)
7		Phase equilibrium Flash calculation	N/A	Lecture (7)
8		<ul style="list-style-type: none"> Fugacity Fugacity coefficient	N/A	Lecture (8)
9		Midterm examination	N/A	Lecture (9)
10		Vapor-Liquid Equilibrium VLE <ul style="list-style-type: none"> Duhem's Theorem Dew-Point and Bubble-Point	N/A	Lecture (10)

		Calculations		
11		Chemical-Reaction Equilibria <ul style="list-style-type: none"> The Reaction Coordinate The Standard Gibbs Energy Change and the Equilibrium Constant	N/A	Lecture (11)
12		Chemical-Reaction Equilibria <ul style="list-style-type: none"> the chemical potential and phase equilibrium Effect of Temperature on the Equilibrium Constant	N/A	Lecture (12)
13		Evaluation of equilibrium constant	N/A	Lecture (13)
14		Relations between Equilibrium Constants and Composition	N/A	Lecture (14)
15		Calculation of Equilibrium Conversions for Single Reactions	N/A	Lecture (15)

INSTRUCTOR Signature:

Dean Signature:

Ministry of Higher Education and Scientific Research

Scientific Supervision and Evaluation Authority

Department of Quality Assurance and Academic Accreditation



Academic program description for colleges and institutes

University: Diyala

College/Institute: College of Engineering

Scientific Department: Chemical Engineering

File filling date: 20/9/2023

Department Head Name: Prof. Ahmed Daham Wiheeb

Signature:

Date:

Scientific Associate Name:

Signature:

Date:

The file has already been checked from Quality Assurance and University Performance Division.

Name of the Director of the Quality Assurance and University Performance Division:

Signature:

Date:

Dean's endorsement

Signature

Date:

Academic Program Description

This academic program description provides a brief summary of the most important characteristics of the program and the learning outcomes expected of the student to achieve, proving whether he has made the most of the available opportunities. It is accompanied by a description of each course within the program.

- 1. The educational institution:** University of Diyala
- 2. Scientific Department:** Chemical Engineering
- 3. The name of the academic or professional program**
- 4. The name of the final certificate:** Bachelor of Chemical Engineering
- 5. Academic system:(Annual / courses / other):** Courses
- 6. Accredited Accreditation Program:**
- 7. Other external influences:**
- 8. Description preparation date:** 2023

9. Academic Program Objectives

- (1) Accomplishing the university's goals within the field of chemical engineering;
- (2) gives a sound education in the basics of chemical engineering;
- (3) develop the skills and confidence necessary to solve, based on engineering and scientific principles, problems in the biochemical, chemical and other industries;
- (4) continue to find graduates of high caliber;
- (5) Providing education compatible with the needs of the labor market linked to the Syndicate of Chemical Engineers.

The program provides opportunities for students to develop and display knowledge, understanding, qualities, skills and other characteristics in the following areas: -

1- Knowledge and understanding:

a- The necessary facts, concepts, principles and theories of chemical engineering, and an understanding of the constraints facing the engineer in making the right decision.

B- Basic mathematics, science and technology

C - ideas and concepts of management.

2- Awareness and understanding: -

A- Ethics and professionalism of the profession.

B - The impact of engineering activities on society and civilization.

c- Compatibility with future issues.

3- Cultural capabilities: -

A- Solve industrial problems that may be limited by known or unknown circumstances.

b- Analyzing and discussing the available data or conducting specific experiments to obtain more data.

c- Design units and processes and make the necessary improvements.

The ability to apply new technologies.

C - Possessing a holistic view of industrial engineering problems, taking into consideration cost, safety, quality, environmental impacts, and the ability to assess and manage risks.

4- Practical skills: -

A - Using multiple technologies and devices with software related to the specialty.

B - Using laboratory equipment to find data.

C - Developing and providing a safe work environment.

5- Transferable skills: -

A- Applying mathematical skills to practical problems.

b- Oral and written communication skills.

c- Use information and communicate effectively.

D - control over time and resources.

C - Work in one team.

H - To be creative, especially in designs.

G- Practical in problem analysis

D - Extracting information from published sources.

10. Required program outcomes and methods of teaching, learning and assessment

A- Cognitive goals

1- Necessary facts, concepts, principles and theories of chemical engineering

2- Understand the constraints facing the engineer in making the right decision

3 - Basic Mathematics and Science

4- Techniques used

5- Ideas and concepts of management

B - Skills objectives of the program

1 - Ethics and professionalism of the profession.

2 - the impact of engineering activities on society and civilization.

3 - Compatibility with future issues

Teaching and learning methods

Traditional methods of education and modern and electronic methods

Evaluation methods

Daily and monthly exams, reports, homework, and commitment to lecture time

C- Emotional and value goals.

1- Solve industrial problems that may be limited by known or unknown circumstances.

2 - Analyzing and discussing the available data or conducting specific experiments to obtain more data.

3 - Design units and processes and make the necessary improvements.

4 - The ability to apply new technologies and possess a holistic view of industrial engineering problems and take

Considering cost, safety, quality, environmental impacts, and the ability to assess and manage risks.

D- Transferred general and rehabilitative skills (other skills related to employability and personal development).

1- Applying mathematical skills to practical problems

2 - Oral and written communication skills, effective use of information and communication.

3- Controlling time and resources and working within one team

4- The ability to design and be practical in analyzing problems and extracting information from sources published.

Ministry of Higher Education and Scientific Research

Scientific Supervision and Evaluation Authority

Department of Quality Assurance and Academic Accreditation



Academic program description for colleges and institutes

University: Diyala

College/Institute: College of Engineering

Scientific Department: Chemical Engineering

File filling date: 20/9/2023

Department Head Name: Prof. Ahmed Daham Wiheeb

Signature:

Date:

Scientific Associate Name:

Signature:

Date:

The file has already been checked from Quality Assurance and University Performance Division.

Name of the Director of the Quality Assurance and University Performance Division:

Signature:

Date:

Dean's endorsement

Signature

Date:

Academic Program Description

This academic program description provides a brief summary of the most important characteristics of the program and the learning outcomes expected of the student to achieve, proving whether he has made the most of the available opportunities. It is accompanied by a description of each course within the program.

- 1. The educational institution:** University of Diyala
- 2. Scientific Department:** Chemical Engineering
- 3. The name of the academic or professional program**
- 4. The name of the final certificate:** Bachelor of Chemical Engineering
- 5. Academic system:(Annual / courses / other):** Courses
- 6. Accredited Accreditation Program:**
- 7. Other external influences:**
- 8. Description preparation date:** 2023

9. Academic Program Objectives

- (1) Accomplishing the university's goals within the field of chemical engineering;
- (2) gives a sound education in the basics of chemical engineering;
- (3) develop the skills and confidence necessary to solve, based on engineering and scientific principles, problems in the biochemical, chemical and other industries;
- (4) continue to find graduates of high caliber;
- (5) Providing education compatible with the needs of the labor market linked to the Syndicate of Chemical Engineers.

The program provides opportunities for students to develop and display knowledge, understanding, qualities, skills and other characteristics in the following areas: -

1- Knowledge and understanding:

a- The necessary facts, concepts, principles and theories of chemical engineering, and an understanding of the constraints facing the engineer in making the right decision.

B- Basic mathematics, science and technology

C - ideas and concepts of management.

2- Awareness and understanding: -

A- Ethics and professionalism of the profession.

B - The impact of engineering activities on society and civilization.

c- Compatibility with future issues.

3- Cultural capabilities: -

A- Solve industrial problems that may be limited by known or unknown circumstances.

b- Analyzing and discussing the available data or conducting specific experiments to obtain more data.

c- Design units and processes and make the necessary improvements.

The ability to apply new technologies.

C - Possessing a holistic view of industrial engineering problems, taking into consideration cost, safety, quality, environmental impacts, and the ability to assess and manage risks.

4- Practical skills: -

A - Using multiple technologies and devices with software related to the specialty.

B - Using laboratory equipment to find data.

C - Developing and providing a safe work environment.

5- Transferable skills: -

A- Applying mathematical skills to practical problems.

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D - control over time and resources.

C - Work in one team.

H - To be creative, especially in designs.

G- Practical in problem analysis

D - Extracting information from published sources.

10. Required program outcomes and methods of teaching, learning and assessment

A- Cognitive goals

1- Necessary facts, concepts, principles and theories of chemical engineering

2- Understand the constraints facing the engineer in making the right decision

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4- Techniques used

5- Ideas and concepts of management

B - Skills objectives of the program

1 - Ethics and professionalism of the profession.

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Teaching and learning methods

Traditional methods of education and modern and electronic methods

Evaluation methods

Daily and monthly exams, reports, homework, and commitment to lecture time

C- Emotional and value goals.

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2 - Analyzing and discussing the available data or conducting specific experiments to obtain more data.

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Considering cost, safety, quality, environmental impacts, and the ability to assess and manage risks.

D- Transferred general and rehabilitative skills (other skills related to employability and personal development).

1- Applying mathematical skills to practical problems

2 - Oral and written communication skills, effective use of information and communication.

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4- The ability to design and be practical in analyzing problems and extracting information from sources published.

Ministry of Higher Education and Scientific Research

Scientific Supervision and Evaluation Authority

Department of Quality Assurance and Academic Accreditation



Academic program description for colleges and institutes

University: Diyala

College/Institute: College of Engineering

Scientific Department: Chemical Engineering

File filling date: 2020

Department Head Name: Prof. Ahmed Daham Wiheeb

Signature:

Date:

Scientific Associate Name:

Signature:

Date:

The file has already been checked from Quality Assurance and University Performance Division.

Name of the Director of the Quality Assurance and University Performance Division:

Signature:

Date:

Dean's endorsement

Signature

Date:

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This academic program description provides a brief summary of the most important characteristics of the program and the learning outcomes expected of the student to achieve, proving whether he has made the most of the available opportunities. It is accompanied by a description of each course within the program.

- 1. The educational institution:** University of Diyala
- 2. Scientific Department:** Chemical Engineering
- 3. The name of the academic or professional program**
- 4. The name of the final certificate:** Bachelor of Chemical Engineering
- 5. Academic system:(Annual / courses / other):** Courses
- 6. Accredited Accreditation Program:**
- 7. Other external influences:**
- 8. Description preparation date:** 2020

9. Academic Program Objectives

- (1) Accomplishing the university's goals within the field of chemical engineering;
- (2) gives a sound education in the basics of chemical engineering;
- (3) develop the skills and confidence necessary to solve, based on engineering and scientific principles, problems in the biochemical, chemical and other industries;
- (4) continue to find graduates of high caliber;
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c- Compatibility with future issues.

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A- Solve industrial problems that may be limited by known or unknown circumstances.

b- Analyzing and discussing the available data or conducting specific experiments to obtain more data.

c- Design units and processes and make the necessary improvements.

The ability to apply new technologies.

C - Possessing a holistic view of industrial engineering problems, taking into consideration cost, safety, quality, environmental impacts, and the ability to assess and manage risks.

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A - Using multiple technologies and devices with software related to the specialty.

B - Using laboratory equipment to find data.

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5- Transferable skills: -

A- Applying mathematical skills to practical problems.

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G- Practical in problem analysis

D - Extracting information from published sources.

10. Required program outcomes and methods of teaching, learning and assessment

A- Cognitive goals

1- Necessary facts, concepts, principles and theories of chemical engineering

2- Understand the constraints facing the engineer in making the right decision

3 - Basic Mathematics and Science

4- Techniques used

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B - Skills objectives of the program

1 - Ethics and professionalism of the profession.

2 - the impact of engineering activities on society and civilization.

3 - Compatibility with future issues

Teaching and learning methods

Traditional methods of education and modern and electronic methods

Evaluation methods

Daily and monthly exams, reports, homework, and commitment to lecture time

C- Emotional and value goals.

1- Solve industrial problems that may be limited by known or unknown circumstances.

2 - Analyzing and discussing the available data or conducting specific experiments to obtain more data.

3 - Design units and processes and make the necessary improvements.

4 - The ability to apply new technologies and possess a holistic view of industrial engineering problems and take

Considering cost, safety, quality, environmental impacts, and the ability to assess and manage risks.

D- Transferred general and rehabilitative skills (other skills related to employability and personal development).

1- Applying mathematical skills to practical problems

2 - Oral and written communication skills, effective use of information and communication.

3- Controlling time and resources and working within one team

4- The ability to design and be practical in analyzing problems and extracting information from sources published.

Course description form

Course description

This course description provides a brief summary of the most important characteristics of the course and the learning outcomes expected of the student to achieve, demonstrating whether he has made the most of the available learning opportunities. It must be linked to the description of the program.

1. Educational Institution	University of Diyala
2. Scientific Department / Center	Department of chemical engineering
3. Course name/code	Ch.E301 Applied Mathematics
4. Forms of attendance available	weekly lectures
5. Semester/year	Semester (first course)
6. Number of hours of study (total)	60
7. Date of preparation of this description	2020
8. Course objectives	Providing and qualifying the student with the main information of applied mathematics such as the foundations of solving ordinary linear differential equations and partial equations, knowledge of special functions such as (Error Gamma, Beta, and Bell functions), differentiation between (differential and differences equations), properties (Laplace). transform) and its most important practical applications, methods of solving nonlinear differential equations to benefit from them in the analysis of chemical engineering processes such as the transfer of matter or heat transfer and chemical reactions.

9. Course outcomes and methods of teaching, learning and assessment

A- Cognitive goals

A1- Learn about ordinary and partial differential equations.

A2- Learn about differential equations of the first and second degree and methods of solving them.

A3- Identify the most important transformation for solving differential equations of any order of magnitude, which is the Laplace transform.

A4- The possibility of differentiating between differences and differential equations

A5 - Identify ways to solve linear and nonlinear equations.

A6- Learn about the Z-transform to solve subtractive equations.

B - Skills objectives for the course

B1 - The possibility of solving all differential equations of the first and second degree, ordinary and partial equations.

B2 - The possibility of finding the appropriate and fast way to solve these equations.

B3 - The possibility of finding the roots of linear and nonlinear equations.

B4 - The possibility of solving equations analytically.

B5 - The possibility of linking between mathematical problems and real physical applications.

B6 - The possibility of solving applications in chemical engineering using applied mathematics.

Teaching and learning methods

1. Lectures.

2- Presenting power point slides.

3- Collecting data and preparing reports.

4- Discussions.

Evaluation methods

1. Sudden exams.

2- Monthly exams.

3- Final exam.

C- Emotional and moral goals

C1- The ability to use the appropriate method to solve differential equations.

C2 - The ability to determine the values of dependent and independent variables in differential equations.

C3 - The ability to use appropriate techniques to solve chemical engineering problems.

C4 - The ability to determine the analytical method for solving mathematical

problems.

Teaching and learning methods

1. Lectures.
- 2- Presenting power point slides.
- 3- Collecting data and preparing reports.
- 4- Discussions
- 5-Individual and group reports, as well as preparing presentations

Evaluation methods

1. Unannounced exams.
- 2- Monthly exams.
- 3- Final exam.

D - Transferred general and qualifying skills (other skills related to employability and personal development).

D1 - Using different sources of information.

D 2- Working in one team to achieve a specific design

D 3- The ability to design and be practical in analyzing problems and extracting information from sources.

10. Course Structure

Week	Hours	Required learning outcomes	Unit name and/or topic	education method	Evaluation method
1	4	Non-linear Second order differential equations.	Second order differential equations.	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
2-3	8	Linear Second order differential equations (Frobenius method).	Second order differential equations.	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
4-5	8	Error, Gamma, Beta, and Bell functions.	Functions of Definite Integrals.	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
6-7	8	Partial Differential Equations	Partial differential equations.	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
8	4	semester exam	-	-	-
9-12	16	Laplace transform	Laplace transform	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
13	4	The Mathematical Modeling of the Problem	The Mathematical Modeling of the Problem	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
14-15	8	Z-transform	Z-transform	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture

11. Infrastructure	
1- Required prescribed books	1. Jenson & Jeffreys, "Mathematical Methods in Chemical Engineering", Academic Press, 3rd ed., 1983. 2. Richard G. R. & Duong D. D., "Applied Mathematics and Modeling For Chemical Engineers", Second edition, John Wiley & Sons, Inc. 2012.
2- Main references (sources)	Process Modeling, simulation and Control for Chemical Engineers", W. L. Luyben, 1990.
3- Recommended books and references (scientific journals, reports ...)	Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, ISBN: 0471728977.
4- Electronic references, websites, etc.	1. Stephen Goode, "Differential Equations and Linear Algebra", Prentice Hill, ISBN: 013263757X. 2. "Modelling and Simulation in Chemical Engineering", Roger E. Franks, John Wiley and Sons, 1972. 3. "Mathematical Methods in Chemical Engineering", Seinfeld and Lapidus, Prentice Hall, 1974.

12. Course Development Plan
Adding a chapter related to Fourier Transform applications in chemical engineering.

Republic of Iraq
The Ministry Of Higher Education
& Scientific Research



بسم الله الرحمن الرحيم

University: Diyala
College: Engineering
Department: Chemical Engineering
Stage: Third
Lecturer name: Salah N. Farhan
Qualification: pH-D chemical Eng.
Place of work: Chemical Eng. Dept.

Flow up of implementation celli pass play

Course Instructor	Salah N. Farhan				
E-mail	drsalahchem@uodiyala.edu.iq				
Title	Biochemical Reaction Engineering				
Course Coordinator	Semester				
Course Objective	Introduction of the basics biochemistry, biology and microbiology with applications in biochemical engineering. Explanation of how biochemical engineering is used for the analysis, control, and development of biological, biochemical, and industrial processes. Quantitative, problem-solving methods emphasized.				
Course Description	In this course, students learn the basics of biochemical engineering, and apply the knowledge to answer the following questions. • What are the major components of cells? • How do cells grow? • How do metabolic pathways decide the formation of different compounds? • How can cells be engineered genetically and metabolically? • How can bioprocesses be established and scaled up?				
Textbook	<ol style="list-style-type: none"> 1. Biochemical Engineering Fundamentals by J.E.Bailey & D. F. Ollis, McGraw Hill Book Company, 1986. 2. Biochemical Engineering by H. W.Blanch & D.S. Clark, Marcel Dekker, Inc., 1997. 3. Bioprocess Engineering (Basic Concepts) by M. L.Shuler & F.Kargi,Prentice Hall of India, 2003. 				
Additional Reading	<ol style="list-style-type: none"> 1. "Principle of Fermentation Technology", P.F. Stanbury and A. Whitaker; Pergamon Press. 2. Bioprocess Engineering Basic Concepts. 2nd edition.. Michael L. Shuler and Fikret Kargi, Prentice Hall, Upper Saddle River, NJ. 3. Bioprocess Engineering Principles Pauline Doran, Academic Press, London. 6. T Panda, Bioreactors analysis and design, Tata McGraw Hill, New Delhi, New York, 2011 				
Course Assessments	Term Tests	Laboratory	Quizzes	Project	Final Exam
	As (40%)	As (0%)	As (10%)	----	As (50%)
General Notes	Type here general notes regarding the course				

Republic of Iraq
The Ministry Of Higher Education
& Scientific Research



University: Diyala
College: Engineering
Department: Chemical Engineering
Stage: Third
Lecturer name: Salah N. Farhan
Qualification: pH-D chemical Eng.
Place of work: Chemical Eng. Dept.

Course Weekly Outline

Week	Date	Topes Covered	Lab. Experiment Assignments	Notes
1	Week 1 2021	Basics of Biology, Overview of Biotechnology, Diversity in Microbial Cells, Cell Constituents, Chemicals for Life		
2	Week 2 2021	Kinetics of Enzyme Catalysis 1		
3	Week 3 2021	Kinetics of Enzyme Catalysis 2		
4	Week 4 2021	Immobilized Enzymes: effects of intra and inter-phase mass transfer on enzyme kinetics		
5	Week 5 2021	Major Metabolic Pathways: Bioenergetics, Glucose Metabolism, Biosynthesis.		
5	Week 6 2021	Microbial Growth: Continuum and Stochastic Models		
6	Week 7 2021	Design, Analysis and Stability of Bioreactors		
7	Week 8 2021	Design of bioreactor		

8	Week 9 2021	Bio-product Recovery & Bio-separations, Manufacture of Biochemical Products		Exam
9	Week 10 2021	Bio separation 1		
10	Week 11 2021	Bio separation 2		
11	Week 12 2021	Review and Exam		
12	Week 13 2021	Kinetics of microbial growth and product formation		
13	Week 14 2022	Batch, continuous and fed-batch processes		
14	Week 15 2022	Media and air sterilization. Aseptic operation. Aeration and agitation. Scale-up criteria.		
16	Week 16 2022	Measurement of parameters and control of bioreactors.		
Half – year break				

INSTRUCTOR Signature:

Dean Signature:

Flow up of implementation academic program

Course Instructor	Yaser I. Jasem				
E-mail	Yaser.ij13@gmail				
Title	Food Engineering				
Course Coordinator	Courses				
Course Objective	a) Giving an introduction to the foundations of food engineering. b) Identifying the most important goals of the food industry, in addition to the most important challenges facing food industry operations, and the future outlook for food engineering in facing these challenges. c) Introducing the basic components of food and their most important sources. d) Introducing food fortification technology and fortification requirements. e) Introducing the applications of enzymes in foods, in addition to the safety and security issues used in the food industries. f) Introducing food manufacturing processes in full detail, in addition to the applications of membranes in the food industry. g) Introducing food packaging methods in addition to the materials used in this regard and others.				
Course Description	Engineering challenges in the Food Processing Industry. Basic Food Biochemistry and Microbiology. Food Constituents. Food Fortification. Enzymes and Application in Food Processing. Food Safety. Ambient-Temperature Processing. Membrane Concentration Fermentation				
Textbook	1- Fellows, P., Food Processing Technology: Principles and Practice, 2nd Edition, Woodhead Publishing Ltd., England, 2000. 2- James G. Brennan, Food Processing Handbook: WILEY-VCH Verlag GmbH & Co. KGaA, 2006. 3- Toledo, R, Fundamentals of Food Process Engineering, 3rd Edition, Springer, 2010. 4- Da-Wen Sun, Thermal Food Processing: New Technologies and Quality Issues, Taylor & Francis Group, 2006.				
Course Assessments	Term Tests	Laboratory	Quizzes	Project	Final Exam
	As (40%)	As (0%)	As (10%)	----	As (50%)
General Notes	Type here general notes regarding the course				

Republic of Iraq
The Ministry Of Higher Education
& Scientific Research



University: Diyala
College: Engineering
Department: Chemical Engineering
Stage: Third
Lecturer name: Salah N. Farhan
Qualification: pH-D chemical Eng.
Place of work: Chemical Eng. Dept.

Course Weekly Outline

Week	Date	Topes Covered	Lab. Experiment Assignments	Notes
1				
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INSTRUCTOR Signature:

Dean Signature:



Course Instructor	Ahmed Daham Wiheeb				
E-mail	ahmed_chem76@uodiyala.edu.iq				
Title	Mass Transfer I				
Course Coordinator	Annually				
Course Objective	<ul style="list-style-type: none"> • The course provides an introductory treatment of mass transfer from a chemical-engineering viewpoint. • This course provides the students with a fundamental understanding of the basics of diffusion theory to simple mass transfer problems and prepare the student to analysis of chemical engineering unit operations involving mass transfer. • The course should provide students with good skills and ability to solve the mass transfer problems related to chemical engineering units. • This course provides the students with a fundamental understanding of diffusion, mass transfer coefficient, modes of diffusion. • Absorption process calculations for tray and packed towers. • Liquid –liquid extraction, principles, calculations. 				
Course Description	<p>This course will provide an overview of mass transfer operation at basic to an intermediate level. This course applies the concepts of diffusion and interphase mass transfer to the analysis of different mass transfer operations such as absorption and extraction. The goal is to provide students with the theoretical/analytical background to understand mass transfer operations as well as application and to tackle the sort of complex problems.</p>				
Textbook	<ol style="list-style-type: none"> 1. Coulson J.M. & Richardson J.F., Chemical Engineering, Volume 1, Sixth edition, ELBS, Pergamon Press. 2002. 2. Coulson J.M. & Richardson J.F., Chemical Engineering, Volume 2, Fifth edition, ELBS, Pergamon Press. 2002. 				
Course Assessments	Term Tests	Laboratory	Quizzes	Project	Final Exam
	30%	0	10%	-	60%
General Notes	This subject is very important in understanding the principles and calculations of mass transfer.				

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Republic of Iraq
The Ministry Of Higher Education
& Scientific Research



University:
College:
Department:
Stage:
Lecturer name:
Qualification:
Place of work

Course Weekly Outline

Week	Date	Topes Covered	Lab. Experiment Assignments	Notes
1	18, Sep. 2023	Diffusion, flick's law, modes of diffusion	N/A	Lecture (1)
2	25, Sep. 2023	Multi-components mixture, correction of diffusivity	N/A	Lecture (2)
3	2, Oct. 2023	Diffusion in varying cross section area	N/A	Lecture (3)
4	9, Oct. 2023	Diffusivity coefficient in liquid and gas	N/A	Lecture (4)
5	16, Oct. 2023	Mass transfer theory	N/A	Lecture (5)
6	23, Oct. 2023	Mass transfer coefficient, wetted wall column	N/A	Lecture (6)
7	6, Nov. 2023	Absorption, equilibrium of gas and liquid	N/A	Lecture (7)
8	13, Nov. 2023	Packed tower	N/A	Lecture (8)
9	20, Nov. 2023	Tray tower	N/A	Lecture (9)
10	27, Nov. 2023	Calculation of tower diameter, stripping	N/A	Lecture (10)
11	4, Dec. 2023	Extraction, differential type	N/A	Lecture (11)
12	11, Dec. 2023	Completely immiscible, co-current flow	N/A	Lecture (12)
13	17, Dec. 2023	Completely immiscible, counter-current flow	N/A	Lecture (13)

14	25, Dec. 2023	Party miscible, co-current flow	N/A	Lecture (14)
15	2, Jan. 2024	Party miscible, counter-current flow	N/A	Lecture (15)

INSTRUCTOR Signature:

Prof. Dr. Ahmed Daham Wiheeb

Dean Signature:

15. Sep. 2023



Course Instructor	Ahmed Daham Wiheeb				
E-mail	ahmed_chem76@uodiyala.edu.iq				
Title	Mass Transfer II				
Course Coordinator	Annually				
Course Objective	<ul style="list-style-type: none"> • The course provides an introductory treatment of vapor-liquid equilibrium. • The course should provide students with good skills and ability to solve the mass transfer problems related to leaching and distillation units. • This course provides the students with a fundamental understanding of different types of distillation units and cooling towers. 				
Course Description	<p>The course is designed to develop a student's applied analytical skills and knowledge of the complex mass transport phenomena in selected types of solid/liquid and distillation equipment commonly encountered in chemical process plants. This course applies the concepts of vapor- liquid equilibrium and distillation units. The goal is to provide students with the theoretical/analytical background to understand mass transfer operations as well as application and to tackle the sort of complex problems in leaching and distillation topics.</p>				
Textbook	<ol style="list-style-type: none"> 1. Coulson J.M. & Richardson J.F., Chemical Engineering, Volume 1, Sixth edition, ELBS, Pergamon Press. 2002. 2. Coulson J.M. & Richardson J.F., Chemical Engineering, Volume 2, Fifth edition, ELBS, Pergamon Press. 2002. 				
Course Assessments	Term Tests	Laboratory	Quizzes	Project	Final Exam
	30%	0	10%	-	60%
General Notes	This subject is very important in understanding the principles and calculations of mass transfer.				

Course Weekly Outline

Week	Date	Topes Covered	Lab. Experiment Assignments	Notes
1	29, Jan. 2024	Leaching, batch leaching	N/A	Lecture (1)
2	5, Feb. 2024	Continuous leaching, constant under flow	N/A	Lecture (2)
3	12, Feb. 2024	Continuous leaching, variable under flow	N/A	Lecture (3)
	19, Feb. 2024	Distillation, vapor-liquid equilibrium		
4	26, Feb. 2024	Differential type	N/A	Lecture (4)
5	4, March. 2024	flash distillation	N/A	Lecture (5)
6	11, March. 2024	Continuous distillation (binary system)	N/A	Lecture (6)
7	18, March. 2024	Calculation the number of stages and reflux ratio in continuous distillation	N/A	Lecture (7)
8	25, March. 2024	Multi-feeds and side stream, Lewis-Sorial method	N/A	Lecture (8)
9	1, April. 2024	Ponchon-Savarit method	N/A	Lecture (9)
10	1, April. 2024	Batch distillation with constant reflux ratio	N/A	Lecture (10)
11	8, April. 2024	Batch distillation with constant product composition	N/A	Lecture (11)
12	15, April. 2024	Multi-component distillation	N/A	Lecture (12)
13	22, April. 2024	Humidification, humidity	N/A	Lecture (13)
14	29, April. 2024	Cooling tower calculation	N/A	Lecture (14)
15	6, May. 2024	Height of cooling tower, Carey method	N/A	Lecture (15)

INSTRUCTOR Signature:

Prof. Dr. Ahmed Daham Wiheeb

Dean Signature:

15. Sep. 2023

Ministry of Higher Education and Scientific Research

Scientific Supervision and Evaluation Authority

Department of Quality Assurance and Academic Accreditation



Academic program description for colleges and institutes

University: Diyala

College/Institute: College of Engineering

Scientific Department: Chemical Engineering

File filling date: 2020

Department Head Name: Prof. Ahmed Daham Wiheeb

Signature:

Date:

Scientific Associate Name:

Signature:

Date:

The file has already been checked from Quality Assurance and University Performance Division.

Name of the Director of the Quality Assurance and University Performance Division:

Signature:

Date:

Dean's endorsement

Signature

Date:

Academic Program Description

This academic program description provides a brief summary of the most important characteristics of the program and the learning outcomes expected of the student to achieve, proving whether he has made the most of the available opportunities. It is accompanied by a description of each course within the program.

- 1. The educational institution:** University of Diyala
- 2. Scientific Department:** Chemical Engineering
- 3. The name of the academic or professional program**
- 4. The name of the final certificate:** Bachelor of Chemical Engineering
- 5. Academic system:(Annual / courses / other):** Courses
- 6. Accredited Accreditation Program:**
- 7. Other external influences:**
- 8. Description preparation date:** 2020

9. Academic Program Objectives

- (1) Accomplishing the university's goals within the field of chemical engineering;
- (2) gives a sound education in the basics of chemical engineering;
- (3) develop the skills and confidence necessary to solve, based on engineering and scientific principles, problems in the biochemical, chemical and other industries;
- (4) continue to find graduates of high caliber;
- (5) Providing education compatible with the needs of the labor market linked to the Syndicate of Chemical Engineers.

The program provides opportunities for students to develop and display knowledge, understanding, qualities, skills and other characteristics in the following areas: -

1- Knowledge and understanding:

a- The necessary facts, concepts, principles and theories of chemical engineering, and an understanding of the constraints facing the engineer in making the right decision.

B- Basic mathematics, science and technology

C - ideas and concepts of management.

2- Awareness and understanding: -

A- Ethics and professionalism of the profession.

B - The impact of engineering activities on society and civilization.

c- Compatibility with future issues.

3- Cultural capabilities: -

A- Solve industrial problems that may be limited by known or unknown circumstances.

b- Analyzing and discussing the available data or conducting specific experiments to obtain more data.

c- Design units and processes and make the necessary improvements.

The ability to apply new technologies.

C - Possessing a holistic view of industrial engineering problems, taking into consideration cost, safety, quality, environmental impacts, and the ability to assess and manage risks.

4- Practical skills: -

A - Using multiple technologies and devices with software related to the specialty.

B - Using laboratory equipment to find data.

C - Developing and providing a safe work environment.

5- Transferable skills: -

A- Applying mathematical skills to practical problems.

b- Oral and written communication skills.

c- Use information and communicate effectively.

D - control over time and resources.

C - Work in one team.

H - To be creative, especially in designs.

G- Practical in problem analysis

D - Extracting information from published sources.

10. Required program outcomes and methods of teaching, learning and assessment

A- Cognitive goals

1- Necessary facts, concepts, principles and theories of chemical engineering

2- Understand the constraints facing the engineer in making the right decision

3 - Basic Mathematics and Science

4- Techniques used

5- Ideas and concepts of management

B - Skills objectives of the program

1 - Ethics and professionalism of the profession.

2 - the impact of engineering activities on society and civilization.

3 - Compatibility with future issues

Teaching and learning methods

Traditional methods of education and modern and electronic methods

Evaluation methods

Daily and monthly exams, reports, homework, and commitment to lecture time

C- Emotional and value goals.

1- Solve industrial problems that may be limited by known or unknown circumstances.

2 - Analyzing and discussing the available data or conducting specific experiments to obtain more data.

3 - Design units and processes and make the necessary improvements.

4 - The ability to apply new technologies and possess a holistic view of industrial engineering problems and take

Considering cost, safety, quality, environmental impacts, and the ability to assess and manage risks.

D- Transferred general and rehabilitative skills (other skills related to employability and personal development).

1- Applying mathematical skills to practical problems

2 - Oral and written communication skills, effective use of information and communication.

3- Controlling time and resources and working within one team

4- The ability to design and be practical in analyzing problems and extracting information from sources published.

Course description form

Course description

This course description provides a brief summary of the most important characteristics of the course and the learning outcomes expected of the student to achieve, demonstrating whether he has made the most of the available learning opportunities. It must be linked to the description of the program.

1. Educational Institution	University of Diyala
2. Scientific Department / Center	Department of chemical engineering
3. Course name/code	Ch.E309 numerical and optimization methods
4. Forms of attendance available	weekly lectures
5. Semester/year	Semester (second course)
6. Number of hours of study (total)	45 theoretical + 30 practical
7. Date of preparation of this description	2020

8. Course objectives

Providing the student and qualifying him with the main information for numerical analysis, such as solving linear finite difference equations, methods for finding the roots of non-linear equations, finding the values of variables in linear and non-linear equations, and methods for solving differential and integral equations that are difficult to solve or require a long time in solving using numerical analyzes and thus can save effort And time, especially in equations that need great repetition in order to reach the result or solution. In addition, giving the student the ability to judge the validity and reasonableness of the solution and enabling him to implement engineering constructions and build mathematical models using numerical analysis in practical life.

9. Course outcomes and methods of teaching, learning and assessment

A- Cognitive goals

A1- Identifying linear finite difference equations.

A2- Identify nonlinear equations and ways to solve them.

A3- Identify the types of linear equations and how to find the values of the variables in them.

A4- Know the methods of solving differential equations numerically.

A5 - Identify the methods of solving integrals numerically.

B - Skills objectives for the course

B1-The possibility of solving all kinds of linear and non-linear equations, the difference between them, and the properties of each one.

B2 - The possibility of finding the appropriate method for solving equations by applying the concepts of numerical methods.

B3 - Realizing the importance of applying the concepts of different numerical methods in practical life.

B4 - The possibility of developing these concepts for the student, as well as access to new numerical concepts.

Teaching and learning methods

1. Lectures.

2- Presenting power point slides.

3- Collecting data and preparing reports.

4- Discussions.

Evaluation methods

1. Sudden exams.

2- Monthly exams.

3- Final exam.

C- Emotional and moral goals

C1- The ability to use the appropriate numerical method to solve linear and non-linear equations.

C2- The ability to determine the numerical method for solving complex mathematical equations.

C3 - The ability to differentiate between linear and non-linear equations.

C4 - The ability to solve mathematical problems related to calculus using different numerical methods.

Teaching and learning methods

1. Lectures.

2- Presenting power point slides.

3- Collecting data and preparing reports.

4- Discussions

5- Individual and group reports, as well as preparing presentations

Evaluation methods

1. Unannounced exams.

2- Monthly exams.

3- Final exam.

D - Transferred general and qualifying skills (other skills related to employability and personal development).

D1 - Using different sources of information.

D 2- Working in one team to achieve a specific design

D 3- The ability to design and be practical in analyzing problems and extracting information from sources.

10. Course Structure

Week	Hours	Required learning outcomes	Unit name and/or topic	education method	Evaluation method
1-3	9	1. Finite Differences 2. Linear Finite Difference Equations	Finite Differences	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
4-6	9	1. Error Definitions 2. Finding the Roots of a Single Nonlinear Equation	Finding the Roots of a Single Nonlinear Equation	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
7-9	9	1. Matrix Inverse Method 2. Cramer's Rule 3. Gauss Elimination Method 4. Gauss-Seidel Method	Methods of Solving System of Linear Equations	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
10	3	semester exam	-	-	-
11	3	1. Simple Iteration Method 2. Newton-Raphson Method	Solving System of Non-linear Equations	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
12-13	6	1. Euler Method 2. Improved Euler Method 3. Runge – Kutta Method	Solving Ordinary Differential Equations	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
14	3	1. Trapezoidal Rule 2. Simpson's Rule	Numerical Integration	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
15	3	semester exam	-	-	-

11. Infrastructure	
1- Required prescribed books	1. Michael B. Cutlip, Mordechai Shacham, Problem Solving in Chemical Engineering with Numerical Methods, Prentice Hall PTR Upper Saddle River, NJ, USA1998. 2. Sergiy Butenko, Panos M. Pardalos, Numerical Methods and Optimization: An Introduction, Tylor and France Group, 2014.
2- Main references (sources)	1. Suman Dutta, Optimization in Chemical Engineering, Cambridge University Press, 2016. 2. Edgar, T.F., Himmelblau, D.M., and L.S. Lasdon, Optimization of Chemical Processes, McGraw Hill, 2001.
3- Recommended books and references (scientific journals, reports ...)	Sergiy Butenko, Panos M. Pardalos, Numerical Methods and Optimization An Introduction, Chapman and Hall/CRC, 2014.
4- Electronic references, websites, etc.	https://www.sciencedirect.com/topics/engineering/numerical-optimization

12. Course Development Plan
The possibility of linking the numerical analysis methods found in the theoretical lectures to the actual reality that exists in practical life for all fields, specializations and applications of chemical engineering.

Ministry of Higher Education and Scientific Research

Scientific Supervision and Evaluation Authority

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Academic program description for colleges and institutes

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Scientific Department: Chemical Engineering

File filling date: 2023

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B - Skills objectives of the program

- 1 - Ethics and professionalism of the profession.
- 2 - the impact of engineering activities on society and civilization.
- 3 - Compatibility with future issues

Teaching and learning methods:

Traditional methods of education and modern and electronic methods

Evaluation methods:

Daily and monthly exams, reports, homework, and commitment to lecture time

C- Emotional and value goals.

- 1) Solve industrial problems that may be limited by known or unknown circumstances.
- 2) Analyzing and discussing the available data or conducting specific experiments to obtain more data.
- 3) Design units and processes and make the necessary improvements.
- 4) The ability to apply new technologies and possess a holistic view of industrial engineering problems and take

Considering cost, safety, quality, environmental impacts, and the ability to assess and manage risks.

D- Transferred general and rehabilitative skills (other skills related to employability and personal development).

1. Applying mathematical skills to practical problems
2. Oral and written communication skills, effective use of information and communication.
3. Controlling time and resources and working within one team
4. The ability to design and be practical in analyzing problems and extracting information from sources published.

Study stage: fourth year

Course: Unit operation (II) / Course code: Ch.E409

Course: 4 Credit with 60 hours

1. Personal development planning

Providing students with self-learning skills that enable them to update their scientific knowledge in specialization.

2. Admission criterion (setting regulations related to joining the college or institute)

Central acceptance from the Ministry of Higher Education and Scientific Research, according to the faculties' absorptive capacities.

The average for graduates of the preparatory school, the scientific branch.

3. The most important sources of information about the program.

Curriculum Skills Outline

Please check the boxes corresponding to the individual learning outcomes from the program being evaluated

Stage	course name	Basic Or optional	Learning outcomes required from the program															
			Cognitive				Program specific objectives				Emotional and value				Transferred general and qualification skills (other skills related to employability and personal development)			
			A				B				C				D			
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Fourth	Unit Operation (I)	Basic	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓

Week	Hours	The output requirements	subject	Teaching method	Evaluation method
1-4	16	1. Type of Filters, Filtration theory 2. Plate and frame filter press, leaf filter. 3. Basic principles of units operation. 4. filtration at Constant ΔP 5. Filtration at Constant rate 6. Washing Time.	Filtration	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
5-6	8	1. Membrane Separation Process. 2. Molecular diffusion, Eddy motions.	Mechanical Separation	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
7-10	16	1. Introduction and general Principle in drying. 2. Rate of drying, the mechanism of moisture movement. 3. Calculation of rate of drying, moisture transport in Solids at Constant in Continuous dryers. 4. Types of Dryers and falling rate Period 5. Capillary movement	Drying	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
11-13	10	1. Temperature humidity Chart for air – water system 2. Enthalpy – humidity – temperature chart 3. Addition of Vapor or liquid Stream to a gas stream.	Humidification	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
13-15	10	1. Evaluation of heat and Mass transfer Coefficient 2. Cooling tower, height of Packing in Cooling towers 3. . Minimum gas Condition	Mechanism of dehumidification	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture

Curriculum Development Plan

Adding topics related to separation processes for products using nano-membrane techniques, as well as crystallization processes and types of crystallizers.

Infrastructure

1- Required prescribed books	<ol style="list-style-type: none">1. Martin R., Introduction to Particle Technology, Second edition, John Wiley & Sons, Ltd. 2008.2. McCabe W.L., Smith J.C. & Harriott P., Unit Operations of Chemical Engineering, Fifth edition, McGraw Hill. 1993.
2 - main references (sources)	<ol style="list-style-type: none">1. Coulson J.M. & Richardson J.F., Chemical Engineering, Volume 1, six edition, ELBS, Pergamum Press. 2002.2. Coulson J.M. & Richardson J.F., Chemical Engineering, Volume 2, Fifth edition, ELBS, Pergamon Press. 2002.
Recommended books and references (scientific journals, reports,)	
-...Electronic references, websites	

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Ministry of Higher Education and Scientific Research

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Academic program description for colleges and institutes

University: Diyala

College/Institute: College of Engineering

Scientific Department: Chemical Engineering

File filling date: 2023

Department Head Name: Prof. Ahmed Daham Wiheeb

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- 1. The educational institution:** University of Diyala
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9. Academic Program Objectives

- (1) Accomplishing the university's goals within the field of chemical engineering;
- (2) gives a sound education in the basics of chemical engineering;
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1- Knowledge and understanding:

a- The necessary facts, concepts, principles and theories of chemical engineering, and an understanding of the constraints facing the engineer in making the right decision.

B- Basic mathematics, science and technology

C - ideas and concepts of management.

2- Awareness and understanding: -

A- Ethics and professionalism of the profession.

B - The impact of engineering activities on society and civilization.

c- Compatibility with future issues.

3- Cultural capabilities: -

A- Solve industrial problems that may be limited by known or unknown circumstances.

b- Analyzing and discussing the available data or conducting specific experiments to obtain more data.

c- Design units and processes and make the necessary improvements.

The ability to apply new technologies.

C - Possessing a holistic view of industrial engineering problems, taking into consideration cost, safety, quality, environmental impacts, and the ability to assess and manage risks.

4- Practical skills: -

A - Using multiple technologies and devices with software related to the specialty.

B - Using laboratory equipment to find data.

C - Developing and providing a safe work environment.

5- Transferable skills: -

- a. Applying mathematical skills to practical problems.
- b. Oral and written communication skills.
- c. Use information and communicate effectively.
- d. Control over time and resources.
- e. Work in one team.
- f. To be creative, especially in designs.
- g. Practical in problem analysis
- h. Extracting information from published sources.

10. Required program outcomes and methods of teaching, learning and assessment

A- Cognitive goals

- 1- Necessary facts, concepts, principles and theories of chemical engineering
- 2- Understand the constraints facing the engineer in making the right decision
- 3 - Basic Mathematics and Science
- 4- Techniques used
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B - Skills objectives of the program

- 1 - Ethics and professionalism of the profession.
- 2 - the impact of engineering activities on society and civilization.
- 3 - Compatibility with future issues

Teaching and learning methods:

Traditional methods of education and modern and electronic methods

Evaluation methods:

Daily and monthly exams, reports, homework, and commitment to lecture time

C- Emotional and value goals.

- 1) Solve industrial problems that may be limited by known or unknown circumstances.
- 2) Analyzing and discussing the available data or conducting specific experiments to obtain more data.
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- 4) The ability to apply new technologies and possess a holistic view of industrial engineering problems and take

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D- Transferred general and rehabilitative skills (other skills related to employability and personal development).

1. Applying mathematical skills to practical problems
2. Oral and written communication skills, effective use of information and communication.
3. Controlling time and resources and working within one team
4. The ability to design and be practical in analyzing problems and extracting information from sources published.

Study stage: fourth year

Course: Unit operation (I) / Course code: Ch.E402

Course: 4 Credit with 90 hours: Theory (60 hr.) + lab. (30 hr.)

1. Personal development planning

Providing students with self-learning skills that enable them to update their scientific knowledge in specialization.

2. Admission criterion (setting regulations related to joining the college or institute)

Central acceptance from the Ministry of Higher Education and Scientific Research, according to the faculties' absorptive capacities.

The average for graduates of the preparatory school, the scientific branch.

3. The most important sources of information about the program.

Curriculum Skills Outline

Please check the boxes corresponding to the individual learning outcomes from the program being evaluated

Stage	course name	Basic Or optional	Learning outcomes required from the program															
			Cognitive				Program specific objectives				Emotional and value				Transferred general and qualification skills (other skills related to employability and personal development)			
			A				B				C				D			
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Fourth	Unit Operation (I)	Basic	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓

Week	Hours	The output requirements	subject	Teaching method	Evaluation method
1	4	1. Units Operation (physical). 2. Units Operation (chemical). 3. Raw materials, processes and products. 4. Basic principles of units operation. 5. The type of operations, the forces responsible for them, and the resistance for each type.	Introduction to the unit operation	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
2-4	8	1. Types of fluid flow 2. Molecular diffusion, Eddy motions.	Momentum, mass and heat transfer	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
5-6	8	1- Reynolds' theory momentum, and heat transfer 2- Reynolds' developed theory of heat and mass.	Reynolds Analogy	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
7-9	12	1. How the boundary layer develops. 2. The boundary layer in the stratigraphic and turbulent flow. 3. Coefficient of friction in turbulent flow. 4. Application of the boundary layer theory in tube flow 5. The boundary layer in heat transfer.	Boundary layer	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
10-11	8	1. Free and aggregated sedimentation 2. The theory of the motion of molecules in a fluid 3. Equations of falling velocity 4. Sedimentation devices	Solid particles movement through fluids	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
12-13	8	1. Darcy's equation and transmittance 2. Kozeny–Carman equation and its hypotheses. 3. Retained fluid	The flow through the backed bed	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
14-15	8	1. Using Fluidization advantages and disadvantages 2. Types of Fluidization 3. Calculate the initial liquefaction speed 4. Arkin equation	Fluidization	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture

Curriculum Development Plan

Adding topics related to separation processes for products using nano-membrane techniques, as well as crystallization processes and types of crystallizers.

Infrastructure

1- Required prescribed books	<ol style="list-style-type: none">1. Martin R., Introduction to Particle Technology, Second edition, John Wiley & Sons, Ltd. 2008.2. McCabe W.L., Smith J.C. & Harriott P., Unit Operations of Chemical Engineering, Fifth edition, McGraw Hill. 1993.
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3 - Design units and processes and make the necessary improvements.

4 - The ability to apply new technologies and possess a holistic view of industrial engineering problems and take

Considering cost, safety, quality, environmental impacts, and the ability to assess and manage risks.

D- Transferred general and rehabilitative skills (other skills related to employability and personal development).

1- Applying mathematical skills to practical problems

2 - Oral and written communication skills, effective use of information and communication.

3- Controlling time and resources and working within one team

4- The ability to design and be practical in analyzing problems and extracting information from sources published.

Ministry of Higher Education and Scientific Research

Scientific Supervision and Evaluation Authority

Department of Quality Assurance and Academic Accreditation



Academic program description for colleges and institutes

University: Diyala

College/Institute: College of Engineering

Scientific Department: Chemical Engineering

File filling date: 20/9/2023

Department Head Name: Prof. Ahmed Daham Wiheeb

Signature:

Date:

Scientific Associate Name:

Signature:

Date:

The file has already been checked from Quality Assurance and University Performance Division.

Name of the Director of the Quality Assurance and University Performance Division:

Signature:

Date:

Dean's endorsement

Signature

Date:

Academic Program Description

This academic program description provides a brief summary of the most important characteristics of the program and the learning outcomes expected of the student to achieve, proving whether he has made the most of the available opportunities. It is accompanied by a description of each course within the program.

- 1. The educational institution:** University of Diyala
- 2. Scientific Department:** Chemical Engineering
- 3. The name of the academic or professional program**
- 4. The name of the final certificate:** Bachelor of Chemical Engineering
- 5. Academic system:(Annual / courses / other):** Courses
- 6. Accredited Accreditation Program:**
- 7. Other external influences:**
- 8. Description preparation date:** 2023

9. Academic Program Objectives

- (1) Accomplishing the university's goals within the field of chemical engineering;
- (2) gives a sound education in the basics of chemical engineering;
- (3) develop the skills and confidence necessary to solve, based on engineering and scientific principles, problems in the biochemical, chemical and other industries;
- (4) continue to find graduates of high caliber;
- (5) Providing education compatible with the needs of the labor market linked to the Syndicate of Chemical Engineers.

The program provides opportunities for students to develop and display knowledge, understanding, qualities, skills and other characteristics in the following areas: -

1- Knowledge and understanding:

a- The necessary facts, concepts, principles and theories of chemical engineering, and an understanding of the constraints facing the engineer in making the right decision.

B- Basic mathematics, science and technology

C - ideas and concepts of management.

2- Awareness and understanding: -

A- Ethics and professionalism of the profession.

B - The impact of engineering activities on society and civilization.

c- Compatibility with future issues.

3- Cultural capabilities: -

A- Solve industrial problems that may be limited by known or unknown circumstances.

b- Analyzing and discussing the available data or conducting specific experiments to obtain more data.

c- Design units and processes and make the necessary improvements.

The ability to apply new technologies.

C - Possessing a holistic view of industrial engineering problems, taking into consideration cost, safety, quality, environmental impacts, and the ability to assess and manage risks.

4- Practical skills: -

A - Using multiple technologies and devices with software related to the specialty.

B - Using laboratory equipment to find data.

C - Developing and providing a safe work environment.

5- Transferable skills: -

A- Applying mathematical skills to practical problems.

b- Oral and written communication skills.

c- Use information and communicate effectively.

D - control over time and resources.

C - Work in one team.

H - To be creative, especially in designs.

G- Practical in problem analysis

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10. Required program outcomes and methods of teaching, learning and assessment

A- Cognitive goals

1- Necessary facts, concepts, principles and theories of chemical engineering

2- Understand the constraints facing the engineer in making the right decision

3 - Basic Mathematics and Science

4- Techniques used

5- Ideas and concepts of management

B - Skills objectives of the program

1 - Ethics and professionalism of the profession.

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3 - Compatibility with future issues

Teaching and learning methods

Traditional methods of education and modern and electronic methods

Evaluation methods

Daily and monthly exams, reports, homework, and commitment to lecture time

C- Emotional and value goals.

1- Solve industrial problems that may be limited by known or unknown circumstances.

2 - Analyzing and discussing the available data or conducting specific experiments to obtain more data.

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HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW

COURSE SPECIFICATION

This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification.

1. Teaching Institution	University of Diyala - College of Engineering
2. University Department/Centre	Chemical Engineering Department
3. Course title/code	Natural Gas Processing / Ch. E.413
4. Modes of Attendance offered	Yearly system with full study
5. Semester/Year	2 nd Semester/Academic Year 2020 – 2021
6. Number of hours tuition (total)	30 hrs (2 hrs per week)
7. Date of production/revision of this specification	12/6/2021
8. Aims of the Course	Learn the basics of natural gas, processing methods, purification and increasing its efficiency.

9. Learning Outcomes, Teaching ,Learning and Assessment Method

A- Knowledge and Understanding

1. Definition the basics of natural gas.
2. Classification of natural gas.
3. Natural gas utilization.
4. Natural gas reservoirs.
5. Natural gas processing.
6. Liquefying and compressing the natural gas.
7. Heating value of natural gas.

B- Subject-specific skills

1. Calculating the heating value for the natural gas.
2. Separation units used in the natural gas processing.

C- Thinking Skills

1. The ability of characterization the natural gas type.
2. The ability to know the importance of the natural gas processing.

D- General and Transferable Skills (other skills relevant to employability and personal development)

1. Activity with society.
2. The work with a team.
3. How engineering is benefit for society and environment.
4. Calculating the heating value for the natural gas from the experimental data.

Teaching and Learning Methods

1. Lectures
2. Presenting Power point (PPT) slides
3. Problems discussion (Tutorial)

Assessment methods

1. Daily exams
2. Monthly exams
3. Home work
4. Final exams

Week	Hours	Unit/Module or Topic Title	ILOs	Teaching Method	Assessment Method
1	2	1. Natural gas definition. 2. Chemical composition of natural gas.	Introduction	1.Lectures (PPT) 2. Tutorial	Oral exam
2	2	1. Classification of natural gas. 2. Natural gas utilization.	Classification of natural gas	1.Lectures (PPT) 2. Tutorial	Oral exam
3	2	1. Natural gas reservoirs. 2. Natural gas properties.	Gas Reservoirs	1.Lectures (PPT) 2. Tutorial	Quiz
4	2	1. Impurities in the natural gas. 2. Impurities effects.	Impurities	1.Lectures (PPT) 2. Tutorial	Monthly exam
5	2	1. World picture of natural gas. 2. Importance of the natural gas processing	Importance of natural gas	1.Lectures (PPT) 2. Tutorial	Oral exam
6	2	1. Condensate and Water Removal.	Natural gas processing	1.Lectures (PPT) 2. Tutorial	Oral exam
7	2	1. Acid Gas Removal.	Natural gas processing	1.Lectures (PPT) 2. Tutorial	Oral exam
8	2	1. Sulfur Recovery Unit	Natural gas processing	1.Lectures (PPT) 2. Tutorial	Oral exam
9	2	1. Dehydration	Natural gas processing	1.Lectures (PPT) 2. Tutorial	Monthly exam
10	2	1. Mercury Removal from Natural Gas.	Natural gas processing	1.Lectures (PPT) 2. Tutorial	Oral exam
11	2	1. Nitrogen Rejection.	Natural gas processing	1.Lectures (PPT) 2. Tutorial	Oral exam
12	2	1. NGL Recovery.	Natural gas processing	1.Lectures (PPT) 2. Tutorial	Oral exam
13	2	1. Natural Gas Liquids Fractionation	Natural gas processing	1.Lectures (PPT) 2. Tutorial	Quiz
14	2	1. Liquefied Natural Gas. 2. Compressed Natural Gas.	Trnsportation of natural gas	1.Lectures (PPT) 2. Tutorial	Oral exam
15	2	1. Heating Value of Fuel.	Fuel evaluating	1.Lectures (PPT) 2. Tutorial	Monthly exam

11. Infrastructure	
<p>Required reading:</p> <ol style="list-style-type: none"> 1. Himmelblau David M. "Basic Principles and Calculations in Chemical Engineering". 7th Ed. 2003. Prentice Hall PTR. 2. Felder Richard M., Rousseau Ronald W. "Elementary Principles of Chemical Processes" 3rd Ed. 2001. John Wiley & Sons. 3. Reklaitis G.V., Schneider Daniel R. "Introduction to Material and Energy Balances" 1983. John Wiley & Sons. 4. Hougén Olaf A., Watson Kenneth M. "Chemical Processes Principles". 2004, John Wiley and Sons & CBS Publishers. <p>Others Lecture notes Students answers for problems</p>	
Special requirements (include for example workshops, periodicals, IT software, websites)	Internet knowledge for chemical engineering
Community-based facilities (include for example, guest Lectures , internship , field studies)	Internship, field studies

12. The development of the curriculum plan

Ministry of Higher Education and Scientific Research
Scientific Supervision and Evaluation Authority
Department of Quality Assurance and Academic Accreditation



Academic program description for colleges and institutes

University: Diyala

College/Institute: College of Engineering

Scientific Department: Chemical Engineering

File filling date: 2023

signature:

Department Head Name: Prof. Ahmed Daham Wahib Al-Azzawi

Scientific Associate Name:

signature:

date:

The file has already been checked

Quality Assurance and University Performance Division

Name of the Director of the Quality Assurance and University Performance
Division:

Dean's endorsement

Signature

Date

Academic Program Description

This academic program description provides a brief summary of the most important characteristics of the program and the learning outcomes expected of the student to achieve, proving whether he has made the most of the available opportunities. It is accompanied by a description of each course within the program.

- 1. The educational institution, University of Diyala**
- 2. Scientific Department / Chemical Engineering**
- 3. The name of the academic or professional program**
- 4. The name of the final certificate: Bachelor of Chemical Engineering**
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- 8. Description preparation date: 2023**
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C - ideas and concepts of management.

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A- Ethics and professionalism of the profession.

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3- Cultural capabilities: -

A- Solve industrial problems that may be limited by known or unknown circumstances.

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c- Design units and processes and make the necessary improvements.

The ability to apply new technologies.

C - Possessing a holistic view of industrial engineering problems, taking into consideration cost, safety, quality, environmental impacts, and the ability to assess and manage risks.

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A - Using multiple technologies and devices with software related to the specialty.

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10. Required program outcomes and methods of teaching, learning and assessment

A- Cognitive goals

1- Necessary facts, concepts, principles and theories of chemical engineering

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Study stage: fourth stage

Course: petroleum refinery

course: 4 Credit 64 hours

1. Personal development planning

Providing students with self-learning skills that enable them to update their scientific knowledge in specialization.

2. Admission criterion (setting regulations related to joining the college or institute)

Central acceptance from the Ministry of Higher Education and Scientific Research, according to the faculties' absorptive capacities.

The average for graduates of the preparatory school, the scientific branch.

3. The most important sources of information about the program.

Curriculum Skills Outline

Please check the boxes corresponding to the individual learning outcomes from the program being evaluated

Stage	course name	Basic Or optional	Learning outcomes required from the program													
			Cognitive				Program specific objectives				Emotional and value			Transferred general and qualification skills (other skills related to employability and personal development)		
Fourth	Petroleum refinery	Basic	A 1	A 2	A 3	A 4	B 1	B 2	B 3	B 4	C 1	C 2	C 3	D 1	D 2	D3

بسم الله الرحمن الرحيم

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Course Instructor	Salah N. Farhan
E-mail	drsalahchem@uodiyala.edu.iq
Title	Reactor Design
Course Coordinator	Frist Course
Course Objective	<ul style="list-style-type: none"> • Define the rate of chemical reactions • Apply the mole balance equations to batch reactors, CSTRs, PFRs, and PBRs • Define the rate of chemical reactions • Apply the mole balance equations to batch reactors, CSTRs, PFRs, and PBRs • Calculate the equilibrium conversion for both gas and liquid phase reactions • Write the combined mole balance and rate law in measures other than conversion • Set up a stoichiometric table for reactions with phase change • Apply CRE algorithm to gas phase • Account for the effects of pressure drop conversion in packed bed tubular reactors and in packed bed spherical reactors • Answer what if... questions • Write balance equations in measure other than conversion and apply these balance evaluations to membrane reactors and semibatch reactors • Determine the reaction order and specific reaction rate from experimental data obtained for either batch or flow reactors • Describe how to use equal-area differentiation, polynomial fitting, numerical difference formulas and regression to analyze experimental data to determine the rate law
Course Description	Stoichiometric Coefficients and Reaction, progress variables Thermodynamics of chemical reactions, basic concepts in chemical Kinetics determination of the reaction rate expression, basic concepts in molecular Interpretations of kinetic phenomena , chemical systems involving multiple reactions, elements of Heterogeneous catalysis, liquid phase reactions.

Republic of Iraq
The Ministry Of Higher Education
& Scientific Research



University: Diyala
College: Engineering
Department: Chemical Engineering
Stage: 4th
Lecturer name: Salah N. Farhan
Qualification: pH-D chemical Eng.
Place of work: Chemical Eng. Dept.

Textbook	1- Fogler, H.S. , “Element of chemical Reaction Engineering” Prentic Hall (2000). 2- Levespiel,O., “Chemical Reaction Engineering” Wiley&Sons (1999). 3- Smith,J.M.,” Chemical Engineering Kinetics” 3rd ed., McGraw Hill (1981).				
Course Assessments	Term Tests	Laboratory	Quizzes	Project	Final Exam
	As (40%)	As (0%)	As (10%)	----	As (50%)
General Notes	Type here general notes regarding the course				

Course Weekly Outline

Week	Date	Topes Covered	Lab. Experiment Assignments	Notes
1	Week 1 2023	Overview of Chemical Reaction Engineering. Homogeneous Reactions in Ideal Reactors		
2	Week 2 2023	Basic Concepts- Representation of Chemical Reactions		
3	Week 3 2023	Thermodynamics of Chemical Reactions-Part-I		
4	Week 4 2023	Thermodynamics of Chemical Reactions-Part II		
5	Week 5 2023	Chemical Reaction Kinetics - Overview		
6	Week 6 2023	Chemical Reaction Kinetics and Reactor Design		
7	Week 7 2023	Chemical Reactor Design		
8	Week 8 2023	Problem solving- Thermodynamics & kinetics		Exam

Republic of Iraq
The Ministry Of Higher Education
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9	Week 9 2023	Complex Reactions Introduction		
10	Week 10 2023	Complex Reactions Yield & Selectivity		
11	Week 11 2023	Complex Reactions - Quasi Steady State and Quasi Equilibrium Approximations		
12	Week 12 2023	Complex Reactions - Kinetics of chain Reactions & Polymerization		
13	Week 13 2024	Catalytic reactions - Introduction		
14	Week 14 2024	Catalytic reactions - Adsorption & Desorption		
15	Week 15 2024	Catalytic reactions- Kinetics		
16	Week 16 2024	Monomolecular Reaction Network and Lumping Analysis		
Exam 1st Semester				

INSTRUCTOR Signature:

Dean Signature:

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بسم الله الرحمن الرحيم

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Department: Chemical Engineering
Stage: 4th
Lecturer name: Salah N. Farhan
Qualification: pH-D chemical Eng.
Place of work: Chemical Eng. Dept.

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Course Instructor	Salah N. Farhan
E-mail	drsalahchem@uodiyala.edu.iq
Title	Reactor Design
Course Coordinator	Second Course
Course Objective	<ul style="list-style-type: none"> • Define different types of selectivity and yield • Choose a reaction system that would maximize the selectivity of the desired product given the rate laws for all reactions occurring in the system. • Write net rates of reaction for each species present • Write the combined mole balance, rate law and stoichiometry for multiple reactions • Discuss each term in the energy balance • Describe the algorithm for CSTRs that are not operated isothermally • Size adiabatic and nonadiabatic CSTRs • Discuss reactor staging for adiabatic reaction • Discuss optimum impact temperatures • Describe the algorithm for PFRs and PBRs with heat exchange • Size adiabatic and nonadiabatic PFRs and PBRs • Carry out an analysis to determine the Multiple Steady States (MSS) in a CSTR along with the ignition and extinction temperatures • Analyze multiple reactions carried out in CSTRs, PFRs and PBRs which are not operated isothermally in order to determine the concentrations and temperature as a function of position (PFR/PBR) and operating variables. • Analyze batch reactors and semibatch not operated isothermally • Analyze the startup of nonisothermal CSTRs • Analyze multiple reactions in batch and semibatch reactors not operated isothermally • Define a catalyst, a catalytic mechanism and a rate limiting step • Describe the steps in a catalytic mechanism and how one goes about deriving a rate law and a mechanism and rate limiting step consistent with the experimental data

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Stage: 4th
Lecturer name: Salah N. Farhan
Qualification: pH-D chemical Eng.
Place of work: Chemical Eng. Dept.

Course Description	Basic Concepts in Reactor Design and Ideal Reactor Models, Selectivity and Optimization Considerations in the Design of Isothermal Reactors, Temperature and Energy Effects in Chemical Reactors, Deviations from Ideal Flow Conditions, Reactor Design for Heterogeneous Catalytic Reactions, Illustrative Problems in Reactor Design.				
Textbook	1- Fogler, H.S. , “Element of chemical Reaction Engineering” Prentic Hall (2000). 2- Levespiel,O., “Chemical Reaction Engineering” Wiley&Sons (1999). 3- Smith,J.M.,” Chemical Engineering Kinetics” 3rd ed., McGraw Hill (1981).				
Course Assessments	Term Tests	Laboratory	Quizzes	Project	Final Exam
	As (40%)	As (0%)	As (10%)	----	As (50%)
General Notes	Type here general notes regarding the course				

Republic of Iraq
The Ministry Of Higher Education
& Scientific Research



University: Diyala
College: Engineering
Department: Chemical Engineering
Stage: 4th
Lecturer name: Salah N. Farhan
Qualification: pH-D chemical Eng.
Place of work: Chemical Eng. Dept.

Week	Date	Topes Covered	Lab. Experiment Assignments	Notes
1	Week 1 2024	Problem solving-Complex reactions		
2	Week 2 2024	Gas-solid Catalytic Reactions - External diffusion		
3	Week 3 2024	Gas-solid Catalytic Reactions Transport in Catalyst Pellet		
4	Week 4 2024	Gas-solid Catalytic Reactions - Diffusion & Reaction I		
5	Week 5 2024	Gas - Solid Catalytic Reactions - Diffusion & Reaction II		
6	Week 6 2024	Gas - solid Catalytic Reactions- Diffusion & Reaction III		
7	Week 7 2024	Gas - solid Catalytic Reactions – Non isothermal effects		
8	Week 8 2024	Chemical Reactor Design- Mass & Energy Balances		Exam
9	Week 9 2024	Chemical Reactor Design- Mass and Energy Balances for		

		Heterogeneous Reactions		
10	Week 10 2024	Case Study - Ethane dehydrogenation		
11	Week 11 2024	Case Study - Hydrogenation of Oil		
12	Week 12 2024	Auto thermal reactors		
13	Week 13 2024	CSTR - Multiple Steady States		
14	Week 14 2024	Stability Analysis - Basics		
15	Week 15 2024	Nonideal flow and reactor performance.		
16	Week 16 2024	Problem solving-Complex reactions		
Exam 2nd Semester				

INSTRUCTOR Signature:

Dean Signature: