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

Academic Program and Course Description Guide

2024

Course Description Form

1. Course Name:

Chemical Engineering Principles I

2. Course Code:

CES.P.131

3. Semester / Year:

2nd Semester / second

4. Description Preparation Date:

23/3/2024

5. Available Attendance Forms:

6. Number of Credit Hours (Total) / Number of Units (Total)

Credit Hours:**4** / Number of Units**3**

7. Course administrator's name (mention all, if more than one name)

Name: Prof. Dr. Qusay Fadhel Abd Alhameed
Email: Qusay.F.AbdulHameed@uotechnology.edu.iq

8. Course Objectives

Course Objectives	• Have a deep knowledge, wide scope and improved understanding of the mechanisms in heat balance as well as a better insight into analytical and empirical methods applied in analysis of material balance related problems. • Gain knowledge for applying the material (equation) balance in chemical engineering problems. • To provide experience for students to solve material balance for different process

9. Teaching and Learning Strategies

Strategy	Theoretical /4

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	Definition of chemical engineering. Chemical process industries (CPI). Generalized chemical process.	**General Knowledge of Chemical Engineering**	Lecture, Data show	daily preparation and discussion

2	4	Generalized chemical process. flow sheet and block diagram of a chemical process The difference between the chemist and the chemical engineer.	**Chemical Engineering Principles**		daily preparation and discussion
3	4	Units and Dimensions	**Physical and Chemical Principles**	Lecture, Data show	daily preparation a discussion
4	4	Dimensional Consistency (Homogeneity) Nondimensional Groups:	**Physical and Chemical Principles**		
5	4	Operations with Units Addition, Subtraction, Equality Multiplication and Division	**Physical and Chemical Principles**		daily preparation a discussion
6-7	8	Four types of temperature Temperature Conversion	**Concepts of flow rates, density, specific gravity, temperature and pressure**	Lecture, Data show	daily preparation a discussion
8-9	8	Heat capacity Pressure and Its Units Types of pressures Measurement of Pressure	**Concepts**	Lecture, Data show	Questions and answe
10-11	8	Pressure and Its Units Types of pressures Measurement of Pres	**Concepts**	Lecture, Data show	Questions a answers
12-13	8	The Concept of a Material Balance Open and Closed Systems Steady-State and Unsteady-State Systems	**Introduction to Material Balances**	Lecture, Data show	daily preparation a discussion
14-15	8	Multiple Component Systems	**Material Balance**	Lecture, Data show	daily preparation a discussion a Exam

11. Course Evaluation

daily preparation: 15
daily oral:5
Reports:15

Quiz:15 Monthly Exam: 50	
12. Learning and Teaching Resources	
Required textbooks (curricular books, if any)	R.M.Felder and R.W.Rousseau ,Elementary Principles of Chemical Processes ,3rd Edition ,2005
Main references (sources)	Himmelblau, D. M., & Riggs, J. B. (2012). Basic principles and calculations in chemical engineering. FT press.
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	Smith, J. M., Van Ness, H. C., Abbott, M. M Swihart, M. T. (2018). Introduction to Chem Engineering Thermodynamics 8th Ed.

Course Description Form

13. Course Name:
Chemical Engineering Principles II
14. Course Code:
CES.P.233
15. Semester / Year:
Semester /First
16. Description Preparation Date:
1/4/2024
17.Available Attendance Forms:
18.Number of Credit Hours (Total) / Number of Units (Total)
Credit Hours:**3** / Number of Units **2**
19. Course administrator's name (mention all, if more than one name)
Name: Prof. Dr. Qusay Fadhel Abd Alhameed Email: Qusay.F.AbdulHameed@uotechnology.edu.iq
20. Course Objectives

Course Objectives	• 1- Have a deep knowledge, wide scope and improved understanding of the mechanisms in heat balance as well as a better insight into analytical and empirical methods applied in analysis of material balance related problems. • 2- Gain knowledge for applying the material (equation) balance in chemical engineering problems. • 3- To provide experience for students to solve material balance for different proc

21. Teaching and Learning Strategies	
Strategy	Theoretical /3

22. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	Material balances without chemical reactions. Material balances chemical reactions.	**Systematic steps solving material bala problems 1**	Lecture, Data show	daily preparation and discussion
2	3	Species Material Balances	**Systematic steps of solving material balance problems 2**		daily preparation and discussion

		Processes Involving a Single Reaction Processes Involving Multiple Reactions			
3	3	Element Material Balances Material balances on combustion processes	**Systematic steps solving material bala problems 3**	Lecture, Data show	daily preparation discussion
4	3	Species Material Balances Processes Involving a Single Reaction	**Material Balances for Processes Involving Chemical Reaction**		
5	3	Processes Involving Multiple Reactions Element Material Balances	**Material Balances for Processes Involving Chemical Reaction**		daily preparation discussion
6-7	6	Process flow sheet	**Material Balance Problems Involving Multiple Units**	Lecture, Data show	daily preparation discussion
8-9	6	Bypass and Purge	**Material Balance Problems Involving Multiple Units**	Lecture, Data show	Questions and answe
10-11	6	Recycle witl Chemical Reactio	**Material Balance Probl Involving Multiple Unit**	Lecture, Data show	Questions answers
12-13	6	Ideal gas law. Ideal gas mixtures.	**Gases and Vapors**	Lecture, Data show	daily preparation discussion
14-15	6	Ideal gas mixtures. Real gas relationships	**Gases and Vapors**	Lecture, Data show	daily preparation discussion Exam

23. Course Evaluation

daily preparation: 15
daily oral:5
Reports:15
Quiz:15
Monthly Exam: 50

24. Learning and Teaching Resources

Required textbooks (curricular books any)	R.M.Felder and R.W.Rousseau ,Elementary Principles of Chemical Processes ,3rd Edition ,2005
Main references (sources)	Himmelblau, D. M., & Riggs, J. B. (2012). Basic principles and calculations in chemical engineering. FT press.

Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	Smith, J. M., Van Ness, H. C., Abbott, M. M., & Swihart T. (2018). Introduction to Chemical Enginee Thermodynamics 8th Ed.

Course Description Form

25.Course Name:
Heterogeneous Reactor and Catalyst
26.Course Code:
CES.P.437
27.Semester / Year:
One semester/year
28.Description Preparation Date:
01-10-2023
29.Available Attendance Forms:
Fall
30.Number of Credit Hours (Total) / Number of Units (Total):
3 Hours / 3 Units
31.Course administrator's name (mention all, if more than one name):
Name: Prof. Dr. Bashir Yousif Sherhan Email: Bashir.Y.Sherhan@uotechnology.edu.iq

32. Course Objectives	
Course Objectives	• To introduce and define a special knowledge in the catalyst and catalysis science for 4th year B.Sc. students in the Chemical Engineering Department. • Provide the basic principles of catalyst and catalysis science using general laws mathematical equations and then applied them to study the behavior of catalysts dur chemical reactions. • Helping to understand the fundamental principles of catalyst and catalysis science it's applications in the kinetics of chemical reactions in terms of the transmission of ma heat and momentum within the catalyst in the reactors. • Taking advantage of the necessary means and available capabilities to analyze physical properties of catalysts and understand the mechanism of their effect on progress of chemical reactions.

33. Teaching and Learning Strategies	
Strategy	The development of the student's ability to apply the knowledge and the order to be able to corr analysis of the problems and issues, which are related to the catalyst and catalysis science and t put the appropriate assumptions and interpretation to reach a solution through lecturing participation by the training and conduct various tests in this topic. It can be summarized by following assessment methods: - The classroom discussions and identify the possibilities of a student on the analysis of the issues and his / her response. -Homework.

	- Sudden exams (Quizzes). - Midterm and final exams. -Open questions and reports.

34. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3 per week = (2 Theoretical + 1 Tutorial)	Definition of catalysts	Introduction of catalyst.	Encourage students through lectures on the development of their capabilities in data analysis in order to establish the problem and describe the solution.	Classroom Discussions
2	3 per week = (2 Theoretical + 1 Tutorial)	Properties (activity, acidity, selectivity, and porosity) of catalysts.	Characteristics of catalysts.	Encourage students through lectures on the development of their capabilities in data analysis in order to establish the problem and describe the solution.	Classroom Discussions Homework
3	3 per week = (2 Theoretical + 1 Tutorial)	Description the relationships between catalysts and activation energy.	Rate equations of fluid solid catalytic reactions.	Encourage students through lectures on the development of their capabilities in data analysis in order to establish the problem and describe the solution.	Classroom Discussions Quizzes
4	3 per week = (2 Theoretical + 1 Tutorial)	Description the relationships between catalysts and both rate / time of reaction, and pressure in the catalytic reactors.	Rate equations of fluid solid catalytic reactions.	Encourage students through lectures on the development of their capabilities in data analysis in order to establish the problem and describe the solution.	Classroom Discussions
5	3 per week = (2 Theoretical + 1 Tutorial)	Description theories and major design equations, which are found to be associated with	Reactions on solid catalyst.	Encourage students through lectures on the development of their capabilities in data analysis in order to establish	Classroom Discussions Homework

		the catalytic reactions.		the problem and describe the solution.	
6	3 per week = (2 Theoretical + 1 Tutorial)	External diffusion of reactant molecules on the catalyst surface in the four basic types of chemical reactors.	External diffusion and reactions in (fixed-, fluidized-, slurry-, and trickle-bed).	Encourage students through lectures on the development of their capabilities in data analysis in order to establish the problem and describe the solution.	Classroom Discussions
7	3 per week = (2 Theoretical + 1 Tutorial)	External diffusion of reactant molecules on the catalyst surface in the four basic types of chemical reactors.	External diffusion and reactions in (fixed-, fluidized-, slurry-, and trickle-bed).	Encourage students through lectures on the development of their capabilities in data analysis in order to establish the problem and describe the solution.	Classroom Discussions Quizzes
8	3 per week = (2 Theoretical + 1 Tutorial)	External diffusion of reactant molecules on the catalyst surface in the four basic types of chemical reactors.	External diffusion and reactions in (fixed-, fluidized-, slurry-, and trickle-bed).	Encourage students through lectures on the development of their capabilities in data analysis in order to establish the problem and describe the solution.	Classroom Discussions Midterm exams
9	3 per week = (2 Theoretical + 1 Tutorial)	Practical examples and applications to analyze the reaction rate within the catalytic reactions.	Practical example for catalytic reactions.	Encourage students through lectures on the development of their capabilities in data analysis in order to establish the problem and describe the solution.	Classroom Discussions
10	3 per week = (2 Theoretical + 1 Tutorial)	Internal diffusion of reactant molecules inside the framework structure of catalyst and its applications.	Internal diffusion and practical example in the heterogeneous reactions.	Encourage students through lectures on the development of their capabilities in data analysis in order to establish the problem and describe the solution	Classroom Discussions Homework
11	3 per week = (2 Theoretical	Internal diffusion of reactant	Internal diffusion and practical example in the	Encourage students through lectures on the development of	Classroom Discussions

	+ 1 Tutorial)	molecules inside the framework structure of catalyst and its applications.	heterogeneous reactions.	their capabilities in data analysis in order to establish the problem and describe the solution.	
12	3 per week = (2 Theoretical + 1 Tutorial)	Mathematical models for the design of catalyst in the catalytic reactors (parallel-pore model).	Mathematical models for the catalyst.	Encourage students through lectures on the development of their capabilities in data analysis in order to establish the problem and describe the solution.	Classroom Discussions Quizzes
13	3 per week = (2 Theoretical + 1 Tutorial)	Mathematical models for the design of catalyst in the catalytic reactors (random-pore model).	Mathematical models for the catalyst.	Encourage students through lectures on the development of their capabilities in data analysis in order to establish the problem and describe the solution.	Classroom Discussions Homework
14	3 per week = (2 Theoretical + 1 Tutorial)	The development of the catalyst industry.	Developing industrial catalysts & characterization techniques.	Encourage students through lectures on the development of their capabilities in data analysis in order to establish the problem and describe the solution.	Classroom Discussions Scientific reports
15	3 per week = (2 Theoretical + 1 Tutorial)	The development of the modern instruments and equipment used to determine the characteristics and specifications of the catalyst.	Developing industrial catalysts & characterization techniques.	Encourage students through lectures on the development of their capabilities in data analysis in order to establish the problem and describe the solution.	Classroom Discussions Final exams

35. Course Evaluation

70% Final semester central exam, 15% Monthly exams, 5% daily preparation, 5% daily oral exams, and 5% reports

36. Learning and Teaching Resources

Required textbooks (curricular books, if any)	J.F. Lepage, J. Cosyns & P.Couty Applied heterogene catalysis.
Main references (sources)	J. M. Smith (1981), Chemical Engineering Kinetics, 3rd edition, Mc Grow – Hill, Singapore.
Recommended books and references (scientific journals, reports…)	- A. Dyer (1988), An introduction to zeolite molecular sieves, by John Wiley & sons Ltd. - Daniel Decroocq (1984), catalytic cracking of heavy petroleum fractions, by imprimerie- Jean, France.
Electronic References, Websites	http://www.uotechnology.edu.iq/dep-chem-eng/LECTURE/4Y/O/Catalyst%20and%20catalysis.pdf

Course Description Form

1. Course Name:

Mass Transfer

2. Course Code:

CES.P. 333

3. Semester / Year:

1 semester/year

4. Description Preparation Date:

15−3−2024

5. Available Attendance Forms:

Students' attendance is recorded in the classroom and on Excel lists based on the number of lectures and according to the dates in the schedule and is sent weekly via email to the Absences Committee.

6. Number of Credit Hours (Total) / Number of Units (Total)

2 theoretical hours/1 tutorial hours during one semester.

45 / 3

7. Course administrator's name (mention all, if more than one name)

Name: Amer A. Abdulrahman
Email: amer.a.abdulrahman@uotechnology.edu.iq

8. Course Objectives

Course Objectives	1- The course aims to provide deeper knowledge, a wide scope and improved understanding of the mechanisms in mass transfer as well as a better insight into analytical and empirical methods applied in analysis and synthesis of mass transfer related problems. 2- The students should gain knowledge to apply the theories to relevant engineering problems. 3- Ability to lead a team, allocate tasks and assemble results.

9. Teaching and Learning Strategies

Strategy	**1- Understanding the basic information, concepts and terminology of the general principles of diffusion processes of gas-liquid-solid diffusion.** .

2- **Gain and/or improve their ability to synthesize, integrate and utilize process information in solving separations and analogy problems.**
3- **An ability to apply effective solutions, both independently and Cooperatively for problems in separation processes**
4- Demonstrating a broad and integrated knowledge and a deep understanding of issues related to separation processes in a chemical process and important role it plays in the success of the process both economically and environmentally.
5- Apply course concepts in solving interdisciplinary problems, solve the problems through logic and improve their ability to work effectively in a group of peers.
6- Work analytically in the formulation and solution of problems.
7- Ability to design separation system for the effective solution of intended problem.
8- Use engineering and measuring equipment to provide data in support of theoretical understanding.
9- Work together in same-discipline teams to solve engineering problems.

10- Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	Ability to Understand the steady state ordin molecular diffusio	Introduction ,Definition of unit operation, Introduction to diffusion, Steady-state ordinary molecules diffusion.	Lectures.	partial test (Oral questio ns).
2	3	Ability to derive t Fick,s law.	Fick's law of diffusion,	Lectures, Example Classes.	In-class problem sessions, Weekly homework proplems.

	3	3	Understand the Characterization o the process for Equimolar counte diffusion.	Equimolar counter diffusion.	Lectures, Tutorials , Example Classes.	partial test (Oral questions).
	4	3	determine the tim required to drop level in vessel.	Diffusion in conical vessel.	Lectures, Example Classes, Practical Applications.	partial test, Open questio ns th have a defini e answer, or do not ha e a definite ans wer
	5	3	Ability to estimat the diffusion coefficients.	Diffusivity in gases and vapours.	Lectures, Example Classes.	partial test (Oral questio ns), Exams.
	6	3	Understand the basic principle for the Maxwell,s law of diffusion for binary and multi-component systems.	Maxwell's law of diffusion for binary system, Maxwell,s law of diffusion for multi-component mass transfer.	Lectures, Example Classes.	partial test (Oral questio ns) Exams,.
	7	3	Understand the mass transfer models for fluid-fluid interface (phase boundary)	Methods for mass transfer at fluid-flui interface (phase boundary).	Lectures, Example Classes.	In-class prob em sessions, Weekly hom wo proplems.
	8	3	Ability to estimat the rate of diffusi and diffusivities i liquid phase.	Molecular diffusion in liquid phase, Diffusivities in liquids, Diffusion of (through multi-component stagnant lay mixture.	Lectures, Example Classes , Practical Applications.	In-class prob em sessions, Weekly hom wo proplems.

9	3	Ability to estimate the rate of diffusion and diffusivities in soild phase.	Molecular diffusion in solid phase.	Lectures, Example Classes.	partial test (Oral questi ns), Exams.
10	3	Ability to derive the rate of convection mass transfer for binary gas mixture.	Convection mass transfer for binary g mixture.	Lectures, Tutorials , Example Classes.	partial test (Oral questio s :- multiple cho ce , alternative re pon), Open questio s th have a defini e answer.
11	3	Understand and analyze the empirical correlations to determine the mass transfer coefficient.	Methods to determine the mass transf coefficient.	Lectures, Tutorials.	partial test (Oral questio s), Exams.
12	3	Understand and analyze the empirical correlations to determine the mass transfer coefficient.	Methods to determine the mass transf coefficient.	Lectures, Tutorials.	partial test (Oral questio s), Exams.
13	3	Understand the mass transfer models	Film – Pentration theory	Lectures, Tutorials , Practical Applications	In-class prob em sessions, Weekly hom wor proplems.
14	3	Understand the mass transfer models (Two film theory)	One film theory (gas-liquid case).	Lectures, Tutorials , Practical Applications	In-class prob em sessions, Weekly hom wor proplems.
15	3	Pentration theory) (gas-liquid case).	Two – film theory (gas-liquid case).	Lectures, Tutorials , Practical Applications	In-class problem sessions, Weekly homework proplems.

11- Course Evaluation

Distributing the score out of 100 according to the tasks assigned to the student such as daily preparation,
daily oral, monthly, or written exams, reports .... etc

To conduct a course evaluation and distribute scores out of 100 based on various tasks assigned to students,
one can follow a weighted grading system where each task is assigned a specific percentage of the total grade.
Here's a suggested breakdown:

1. *Daily Preparation (10%): ** This category assesses students' preparation and participation in daily class
activities, discussions, and exercises. Assign points based on attendance, assigned readings completion, class
discussion engagement, and group activity participation.

2. **Daily Oral Presentations (10%): ** Evaluate students' oral communication skills, presentation content, organization, and delivery. Assign scores based on criteria such as clarity of speech, use of visual aids, interaction with the audience, and adherence to time limits.

3. **Monthly Written Exams (30%): ** Assess students' understanding of course material through monthly
written exams covering key concepts, theories, and problem-solving skills. Design exams to include a mix of
multiple-choice questions, short answer questions, and essay questions.

4. **Reports/Assignments (25%): ** Assign written reports or assignments on specific topics related to
the course curriculum. Evaluate students' research, analysis, writing, and critical thinking skills. Provide
feedback on the quality of content, organization, citation style, and overall presentation.

5. **Final Exam (25%): ** Administer a comprehensive final exam at the end of the course to assess students'
mastery of course content. The final exam should cover all topics taught throughout the semester and may
include various question types to assess students' knowledge, comprehension, application, and synthesis
skills.

Once you have determined the weightings for each task, you can calculate students' total scores out of 100 by
summing up the scores they received in each category. For example:

- Daily Preparation: 10 points
- Daily Oral Presentations: 10 points
- Monthly Written Exams: 30 points
- Reports/Assignments: 25 points
- Final Exam: 25 points

To al Score = (Daily Preparation Score x 10%) + (Daily Oral Presentations Score x 10%) + (Monthly Written Exams Score x 30%) + (Reports/Assignments Score x 25%) + (Final Exam Score x 25%)

12- Learning and Teaching Resources

Required textbooks (curricu books, if any)	○ Lecturers ○ Book "Coulson and Richardson's Chemical Engineering volume 1, 6th Edition (International Edition), Butterworth-Heinemann, 1999." ○ Book "Coulson and Richardson,s Chemical Engineering volume 2, 5th Edition (International Edition), Butterworth-Heinemann, 2002." ○ Other support books :-

	R.E. Treybal, Mass transfer operations (3nd edit), McGraw Hill-2003

Course Description Form

10. Course Name:

Unit Operation 1

11. Course Code:

CES.P. 334

12. Semester / Year:

1 semester/year

13. Description Preparation Date:

15−3−2024

14. Available Attendance Forms:

Students' attendance is recorded in the classroom and on Excel lists based on the number of lectures and according to the dates in the schedule and is sent weekly via email to the Absences Committee.

15. Number of Credit Hours (Total) / Number of Units (Total)

3 theoretical hours/1 tutorial hours during one semester.

60 / 4

16. Course administrator's name (mention all, if more than one name)

Name: Amer A. Abdulrahman

Email: amer.a.abdulrahman@uotechnology.edu.iq

17. Course Objectives

Course Objectives	4- The course aims to provide deeper knowledge, a wide scope and improved understanding of the mechanisms in mass transfer as well as a better insight into analytical and empirical methods applied in analysis and synthesis of mass transfer related problems.
	5- The students should gain knowledge to apply the theories to relevant engineering problems.
	6- Ability to lead a team, allocate tasks and assemble results.

18. Teaching and Learning Strategies

Strategy	**13- Understanding the basic information, concepts and terminology of the general principles of separation processes of gas-liquid separation (Tray absorption & Packed Bed absorption), Binary and Multicomponent Distillation.**
	14- **Gain and/or improve their ability to synthesize, integrate and utilize process information in solving separations and analogy problems.**

15- **An ability to apply effective solutions, both independently and Cooperatively for problems in separation processes**

16- **Demonstrating a broad and integrated knowledge and a deep understanding of issues related to separation processes in a chemical process and important role it plays in the success of the process both economically and environmentally.**

17- **Apply course concepts in solving interdisciplinary problems, solve the problems through logic and improve their ability to work effectively in a group of peers.**

18- **Work analytically in the formulation and solution of problems.**

19- **Ability to design separation system for the effective solution of intended problem.**

20- **Use engineering and measuring equipment to provide data in support of theoretical understanding.**

21- **Work together in same-discipline teams to solve engineering problems.**

22– Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	Ability to understand th principle of Tray colum	Introduction to Tray column, Types of dispersion.	Lectures, Practical Applications.	partial test (Oral questions).
2	3	Ability to calculate the no. of stages by Graphical method .	Determination of the no. of stages in Counter-Current flow, Graphical construction.	Lectures, Tutorials , Example Classes.	partial test (Oral questions : multiple choice, alternative respo se).
3	3	Ability to calculate the nc stages by Algebric metho	Determination of the No. of stages in Counter-Current flow, Algebraic determination, Tray efficiency.	Lectures, Tutorials , Example Classes.	In-class problem sessions, Weekly homework propl ms, Design problems
4	3	Ability to understand t he principle of Packed column.	Introduction to Packed columns Calculation of the height of packing (for dilute mixture).	Lectures, Example Classes.	partial test (Oral questions)

5	3	Ability to calculate the height of packing.	Calculation of the height of packing (for concentrated mixture), Relation between overall and individual mass transfer coefficient.	Lectures, Tutorials , Example Classes.	In-class problem sessio homework propl ms, Design problems
6	3	Ability to understand the minimum liquid flow rate in Packed column.	Height equivalent to a theoretical plate, Minimum liquid flow rate.	Lectures, Example Classes.	partial test (Oral questions), Exams.
7	3	Ability to understand the technique of separation in distillation columns.	Introduction to distillation columns, Vapour-liquid equilibria(VLE).	Lectures, Example Classes.	partial test (Oral questions), Design problems
8	3	understanding of the operations of mass transfer in differential distillation.	Distillation processes, Differential distillation (Batch)	Lectures, Example Classes.	partial test (Oral questions) , Ope questions that ha e a definite answe , or do not have a definite answe .
9	3	understanding of the operations of mass transfer in Flash (equilibrium) distillation.	Flash (equilibrium) or integral distillation.	Lectures, Tutorials , Practical Applications.	partial test (Oral questions) , Open questions t at have a definite answer, or do no have a definite a swer
10	3	understanding of the operations of heat and mass transfer equipment by performing mass and energy balance calculations in continuous-multistage-fractionation of binary mixture.	Continuous-multistage-fractionation of binary mixture.	Lectures, Tutorials , Example Classes.	partial test (Oral questions), Design problems
11	3	Ability to calculate the number of trays.	Determination of the number of trays using Mccabe-Thiele-method	Lectures, Tutorials , Example	partial test (Oral questions), Design problems

			(Graphical method).	Classes.	
12	3	Understand and analyze the empirical correlations to determine the mass transfer coefficient.	Methods to determine the mass transfer coefficient.	Lectures, Tutorials.	partial test (Oral questions), Exams.
13	3	Ability to Identify the feed line. Ability to calculate the no. of ideal stages – analytically.	Types and determination of the feed line in distillation columns. Analytical determination of the No. of ideal stages (Total reflux, Minimum reflux ratio).	Lectures, Tutorials , Example Classes , Practical Applications.	partial test (Oral questions).
14	3	Understand the basic principle of multicomponent distillation and ability to calculate the min. no. of stages.	Multicomponent distillation (Key-component), Approximate methods calculation (The FUG Technique).	Lectures, Example Classes , Practical Applications.	partial test (Oral questions), Desig
15	3	Ability to calculate the no. of stages by using min. reflux ratio.	The Underwood equation for min. reflux, Gilliland-correlation for the No. of trays.	Lectures, Tutorials.	partial test (Oral questions).

23- Course Evaluation

Distributing the score out of 100 according to the tasks assigned to the student such as daily preparation, daily oral, monthly, or written exams, reports .... etc

To conduct a course evaluation and distribute scores out of 100 based on various tasks assigned to students, one can follow a weighted grading system where each task is assigned a specific percentage of the total grade. Here's a suggested breakdown:

1. **Daily Preparation (10%): ** This category assesses students' preparation and participation in daily class activities, discussions, and exercises. Assign points based on attendance, assigned readings completion, class discussion engagement, and group activity participation.

2. **Daily Oral Presentations (10%): ** Evaluate students' oral communication skills, presentation content, organization, and delivery. Assign scores based on criteria such as clarity of speech, use of visual aids, interaction with the audience, and adherence to time limits.

3. **Monthly Written Exams (30%): ** Assess students' understanding of course material through monthly written exams covering key concepts, theories, and problem-solving skills. Design exams to include a mix of multiple-choice questions, short answer questions, and essay questions.

4. **Reports/Assignments (25%): ** Assign written reports or assignments on specific topics related to the course curriculum. Evaluate students' research, analysis, writing, and critical thinking skills. Provide feedback on the quality of content, organization, citation style, and overall presentation.

5. **Final Exam (25%): ** Administer a comprehensive final exam at the end of the course to assess students' mastery of course content. The final exam should cover all topics taught throughout the semester and may include various question types to assess students' knowledge, comprehension, application, and synthesis skills.

Once you have determined the weightings for each task, you can calculate students' total scores out of 100 by summing up the scores they received in each category. For example:

- Daily Preparation: 10 points
- Daily Oral Presentations: 10 points
- Monthly Written Exams: 30 points
- Reports/Assignments: 25 points
- Final Exam: 25 points

Total Score = (Daily Preparation Score x 10%) + (Daily Oral Presentations Score x 10%) + (Monthly Written Exams Score x 30%) + (Reports/Assignments Score x 25%) + (Final Exam Score x 25%)

24- Learning and Teaching Resources

Required textbooks (curricular books, if any)	○ Lecturers ○ Book “Coulson and Richardson,s Chemical Engineering volume 1, 6th Edition (International Edition), Butterworth-Heinemann, 1999.” ○ Book “Coulson and Richardson,s Chemical Engineering volume 2, 5th Edition (International Edition), Butterworth-Heinemann, 2002.”

	○ Other support books :- R.E. Treybal, Mass transfer operations (3nd edit), McGraw Hill-2003

Course Description Form

19. Course Name:
Equipment Design
20. Course Code:
CESP-3313
21. Semester / Year:
1st Semester / year
22. Description Preparation Date:
05/03/2024
23.Available Attendance Forms:
Students' attendance is recorded in the classroom and on Excel lists based on the number of lectu and according to the dates in the schedule and is sent weekly via email to the Absences Committee
24.Number of Credit Hours (Total) / Number of Units (Total)
3 hours 45 hours for semester
25. Course administrator's name (mention all, if more than one name)
Name: Dr. Riyadh Sadeq Almukhtar Email: Riyadh.s.almukhtar@uotechnology.edu.iq
26. Course Objectives

Course Objectives	• The ability to apply the design equation and equipments specifications as practical. • To prepare students to be able to read and understand chemical engineering plants drawing. • The student should have the necessary skills to design equipments such vessels, gas-liquid separator …etc. by Provide practice to design. • To be a part of working group, cooperate together to use the knowledge gained to get a proper design.
27. Teaching and Learning Strategies	
Strategy	The main strategy that will be adopted in delivering this subject is to encouraging student participation in design exercises enhances engineering thinking skills through interactive classes and tutorials involving all students.
28. Course Structure	

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	To understand the nature of chemical design structure and the anatomy of chemical process	Nature of design ,the organization of a chemical engineering projects	Lectures, Tutorials , Example Classes , Practical Applications	Exams , Weekl homework, Tea and homework solve problems Open questions that have a definite answer or do not have definite answer
2	3	To understand the nature of chemical design structure and the anatomy of chemical process	Nature of design ,the organization of a chemical engineering projects	Lectures, Tutorials , Example Classes , Practical Applications	Exams , Weekl homework, Tea and homework solve problems Open questions that have a definite answer or do not have definite answer
3	3	Types of flow sheet use in chemical engineering drawing and Equipment symbols	Flow sheet design	Lectures, Tutorials , Example Classes	Exams , Weekl homework, Tea and homework solve problems Open questions that have a definite answer or do not have definite answer
4	3	To get the knowledge for preparing PFD and P&I D diagrams	flow sheet types	Lectures, Tutorials , Example Classes	Exams , Weekl homework, Tea and homework solve problems Open questions that have a definite answer or do not have definite answer
5	3	The effective factors consider in site layout and plant layout selection	Site layout Project evaluation and cost estimation	Lectures, Example Classes	Exams , Weekly homework, Team and homework solve problems , Open questions that have a

					definite answer , or do not have a definite answer
6	3	Pipe sizing , pipe fittings and valves types ,and the specifications of pumps and compressors	Piping system. ,	Lectures, Example Classes	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
7	3	Pumps type and specifications	Pumps selections	Lectures, Example Classes	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
8	3	compressors type and specifications	compressors selections	Lectures, Example Classes	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or

					do not have a definite answer
9	3	Vessels types and materials of construction	Vessels design	Lectures, Tutorials , Example Classes	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
10	3	Design equations utilized for vessel design	Vessels design	Lectures, Tutorials , Example Classes	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
11	3	Design of Gas-Liquid separators	Vertical Gas-liquid separator design	Lectures, Tutorials , Example Classes	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite

					answer
12	3	Design equations utilized and data sheet preparation	Horizontal Gas-liquid separator design	Lectures, Tutorials , Example Classes	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
13	3	Design of liquid - Liquid separators	Vessels design	Lectures, Tutorials , Example Classes	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
14	3	Introduction to heat transfer equipment	Applied Design for heat equipments (shell And tube heat exchanger, plate heat exchanger , coil type exchanger, condenser, vaporizer, air cooler …….etc) manually and with computer aided	Lectures, Tutorials , Example Classes	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer

15	3	Introduction to mass transfer equipment	Applied Design for mass transfer equipments (distillation column, absorber column	Lectures, Tutorials , Example Classes	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer

29. Course Evaluation

Midterm exams , Final exam , Quizzes, Weekly homework, Team and homew problems , partial test (Oral questions :,alternative response), Open questions that hav definite answer
Design projects and exams (30 %)
Continuous evaluation degree (10 %)
Final exam (60 %)

30. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Lectures Sinnott R. and Towler C; 2016 " chemical Engineering Design" 5th edition Butterworth-Heinemann -Coke, A.K ;2007"Ludwig s Applied Process Design of Chemical and petrochemical Plant" vol. 1 4th edition Gulf professional Publisher -Coulson ,J.M and Richardson J.F. "Chemical Engineering , volume 2", Fifth edition 2002, Elsevier Science, Linacre House, Jordan Hill, Oxford -Green D ,Perry ,J.H, 2008" chemical engineering handbook ",8th edition Mc-Graw –Hill Book com..
Main references (sources)	Lectures, field trips, pilot plant laboratory ,Summer training
Recommended books and references (scientific journals, reports…)	- Couper J. , Penny R. , Fair J and Wallas S " Chemical Process Equipment " 2nd edition 2010 Elesvier
Electronic References, Websites	Websites , Laboratory

Course Description Form

31. Course Name:
Equipment Design Using CAD
32. Course Code:
CESP.3314
33. Semester / Year:
2nd Semester / year
34. Description Preparation Date:
05/03/2024
35.Available Attendance Forms:
Students' attendance is recorded in the classroom and on Excel lists based on the number of lectu and according to the dates in the schedule and is sent weekly via email to the Absences Committee
36.Number of Credit Hours (Total) / Number of Units (Total)
5 hours / 3 75 hours for semester
37. Course administrator's name (mention all, if more than one name)
Name: Dr. Riyadh Sadeq Almukhtar Email Riyadh.s.almukhtar @uotechnology.edu.iq
38. Course Objectives

Course Objectives	• The ability to apply the design equation and equipments specifications as practical. • To prepare students to be able to read and understand chemical engineering plants drawing. • The student should have the necessary skills to design equipments such vessels, gas-liquid separator …etc. by Provide practice to design. • To be a part of working group, cooperate together to use the knowledge gained to get a proper design.

39. Teaching and Learning Strategies	
Strategy	The main strategy that will be adopted in delivering this subject is to encouraging student participation in design exercises enhances engineering thinking skills through interactive classes and tutorials involving all students.

40. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	5	Explain design procedure for vessels design by example + the concepts of simulation	Pressure vessels design + computer aided design Laboratory (Introduction to simulation principle)	Lectures, Tutorials , Example Classes ,	Exams , Weekl homework, Tea and homework solve problems Open questions that have a definite answer or do not have definite answer
2	5	prepare data sheets for vessels + tha ability to utilize computer software HYSYS	Pressure vessels design and pumps+ computer aided design Laboratory (getting start to computer software HYSYS)	Lectures, Tutorials , Example Classes , Practical Applications	Exams , Weekl homework, Tea and homework solve problems Open questions that have a definite answer or do not have definite answer
3	5	Connection of piping and pumps to the vessels + the knowledge of HYSYS functions	Pressure vessels design + computer aided design Laboratory	Lectures, Tutorials , Example Classes ,	Exams , Weekl homework, Tea and homework solve problems Open questions that have a definite answer or do not have definite answer
4	5	Ability to design gas-liquid seperator and prepare dara sheet + practice design for compressor and separator with HYSYS	gas-liquid separator, manually + computer aided design Laboratory (+ simulation of compressor and separator)	Lectures, Tutorials , Example Classes ,	Exams , Weekl homework, Tea and homework solve problems Open questions that have a definite answer or do not have definite answer
5	5	Ability to design liquid -liquid seperator and prepare dara sheet + +practice design for compressor and	liquid-liquid separator + computer aided design Laboratory (simulation of compressor and separator)	Lectures, , Example Classes ,	Exams , Weekl homework, Tea and homework solve problems Open questions that have a definite answer

		separator with HYSYS			or do not have definite answer
6	5	Basic design procedure and theories related to design + practice desigm for reactor with HYSYS	Heat transfer practice + computer aided design Laboratory	Lectures, , Example Classes , Practical Applications	Exams , Weekl homework, Tea and homework solve problems Open questions that have a definite answer or do not have definite answer
7	5	Ability to utilize books and referances to obtain the required physical properties of their approach system (heat capacity …etc + practice desigm for reactor with HYSYS	Heat transfer practice + computer aided design Laboratory	Lectures, , Example Classes , Practical Applications	Exams , Weekl homework, Tea and homework solve problems Open questions that have a definite answer or do not have definite answer
8	5	Calculate Overall heat transfer coefficient.and area required for heat exchanger design + practice desigm for reactor	Heat transfer practice + computer aided design Laboratory	Lectures, , Example Classes , Practical Applications	Exams , Weekl homework, Tea and homework solve problems Open questions that have a definite answer or do not have definite answer
9	5	The ability to calculate individual heat transfer coefficients and pressure drop for heat exchangers	Heat transfer practice + computer aided design Laboratory	Lectures, , , Practical Applications	Exams , Weekl homework, Tea and homework solve problems Open questions that have a definite answer or do not have definite answer
10	5	The student had been applied all steps required to design heat exchanger equipments	Heat transfer practice + computer aided design Laboratory	,Practical Applications	Exams , Weekl homework, Tea and homework solve problems Open questions that have a definite answer

					or do not have definite answer
11	5	Understand the main concept of tower or column in chemical engineering equipment and the differences between tray and packed column	Mass transfer practice + computer aided design Laboratory	Lectures, , Example Classes , Practical Applications	Exams , Weekl homework, Tea and homework solve problems Open questions that have a definite answer or do not have definite answer
12	5	Ability to utilize books and referances to obtain the required physical properties of their approach system X-Y diagram	Mass transfer practice + computer aided design Laboratory	Lectures, Tutorials , , Practical Applications	Exams , Weekl homework, Tea and homework solve problems Open questions that have a definite answer or do not have definite answer
13	5	Practices the the necessary steps for towers internal design	Mas transfer practice + computer aided design Laboratory	Lectures, Tutorials , , Practical Applications	Exams , Weekl homework, Tea and homework solve problems Open questions that have a definite answer or do not have definite answer
14	5	Practices the the necessary steps for towers internal design	Mass transfer practice + computer aided design Laboratory	Lectures, Tutorials , Practical Applications	Exams , Weekl homework, Tea and homework solve problems Open questions that have a definite answer or do not have definite answer
15	5	The stud had b applied steps requi to des distillation column	Mass transfer practice + computer aided design Laboratory	, Example Classes , Practical Applications	Exams , Weekl homework, Tea and homework solve problems Open questions that have a definite answer or do not have definite answer

41. Course Evaluation

Midterm exams , Final exam , Quizzes, Weekly homework, Team and homew problems , partial test (Oral questions :,alternative response), Open questions that hav definite answer Design projects and exams (30 %) Lab. (10 %) Continuous evaluation degree (10 %) Final exam (50 %)

42. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Lectures Sinnott R. and Towler C; 2016 " chemical Engineering Design" 5th edition Butterworth-Heinemann -Coke, A.K ;2007"Ludwig s Applied Process Design of Chemical and petrochemical Plant" vol. 1 4th edition Gulf professional Publisher -Coulson ,J.M and Richardson J.F. "Chemical Engineering , volume 2", Fifth edition 2002, Elsevier Science, Linacre House, Jordan Hill, Oxford -Green D ,Perry ,J.H, 2008" chemical engineering handbook ",8th edition Mc-Graw –Hill Book com.. - Couper J. , Penny R. , Fair J and Wallas S " Chemical Process Equipment " 2nd edition 2010 Elesvier
Main references (sources)	Lectures, field trips, pilot plant laboratory ,Summer training
Recommended books and references (scientific journals, reports…)	- G.F. Froment and K.B. Bischoff, Chemical Reactor Analysis and Design (3nd edit), John Wiley & Sons 2011. 2-L D Schmidt, The Engineering of Chemical Reactions (2nd Edition), OUP, 2005. 3-O. Levenspiel, Chemical React Engineering (3rd edition), John Wiley & S 1999.
Electronic References, Websites	Websites , Laboratory

Course Description Form

43.	Course Name:
	Equipment Design
44.	Course Code:
	CES.P.3311
45.	Semester / Year:
	1st Semester / Year
46.	Description Preparation Date:
	26-3-2024
47.	Available Attendance Forms:
	Fall time
48.	Number of Credit Hours (Total) / Number of Units (Total)
	3 / 2
49.	Course administrator's name (mention all, if more than one name)
	Name: Ts. Dr. Buthainah Ali Abed AL-Timimi Email: buthainah.a.abed@uotechnology.edu.iq
50.	Course Objectives

Course Objectives	• The ability to apply the design equation and equipments specifications as practical. • To prepare students to be able to read and understand chemical engineering plants drawing. • The student should have the necessary skills to design equipments such vessels, gas-liquid separator …etc. by Provide practice to design. • To be a part of working group, cooperate together to use t knowledge gained to get a proper design.

51. Teaching and Learning Strategies

Strategy	The main strategy that will be adopted in delivering this subject is to encouraging student participation in design exercises enhances engineering thinking skills through interactive classes and tutorials involving all students.

52. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	To understand the nature of chemical design structure and the anatomy of chemical process	Nature of design ,the organization of a chemical engineering projects	Lectures, Tutorials , Example Classes , Practical Applications	Exams , Weekly homework, Team and homework solve problems , Open questions that

					have a definite answer , or do not have a definite answer
2	3	To understand the nature of chemical design structure and the anatomy of chemical process	Nature of design ,the organization of a chemical engineering projects	Lectures, Tutorials , Example Classes , Practical Applications	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
3	3	Types of flow sheet use in chemical engineering drawing and Equipment symbols	Flow sheet design	Lectures, Tutorials , Example Classes	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
4	3	To get the knowledge for preparing PFD and P&I D diagrams	flow sheet types	Lectures, Tutorials , Example Classes	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
5	3	The effective factors consider in site layout and plant layout selection	Site layout Project evaluation and cost estimation	Lectures, Example Classes	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
6	3	Pipe sizing , pipe fittings and valves types ,and the specifications of pumps and compressors	Piping system. ,	Lectures, Example Classes	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer

7	3	Pumps type and specifications	Pumps selections	Lectures, Example Classes	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
8	3	compressors type and specifications	compressors selections	Lectures, Example Classes	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
9	3	Vessels types and materials of construction	Vessels design	Lectures, Tutorials , Example Classes	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
10	3	Design equations utilized for vessel design	Vessels design	Lectures, Tutorials , Example Classes	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
11	3	Design of Gas-Liquid separators	Vertical Gas-liquid separator design	Lectures, Tutorials , Example Classes	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
12	3	Design equations utilized and data sheet preparation	Horizontal Gas-liquid separator design	Lectures, Tutorials , Example Classes	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer

13	3	Design of liquid - Liquid separators	Vessels design	Lectures, Tutorials , Example Classes	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
14	3	Introduction to heat transfer equipment	Applied Design for heat equipments (shell And tube heat exchanger, plate heat exchanger , coil type exchanger, condenser, vaporizer, air cooler ….etc.) manually and with computer aided	Lectures, Tutorials , Example Classes	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
15	3	Introduction to mass transfer equipment	Applied Design for mass transfer equipments (distillation column, absorber column	Lectures, Tutorials , Example Classes	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer

53. Course Evaluation

Midterm exams, Final exam, Quizzes, Weekly homework, Team and homework problems, partial test (Oral questions, alternative response), Open questions that have a definite answer.

54. Learning and Teaching Resources

Required textbooks (curricular books, if any)	1- Sinnott R. and Towler C; 2016 " chemical Engineering Design" 5th edition Butterworth-Heinemann . 2-Coke, A.K ;2007"Ludwig s Applied Process Design of Chemical and petrochemical Plant" vol. 1 4th edition Gulf professional Publisher. 3-Coulson ,J.M and Richardson J.F. "Chemical Engineering , volume 2", Fifth edition 2002, Elsevier Science, Linacre House, Jordan Hill, Oxford.

	4-Green D ,Perry ,J.H, 2008" chemical engineering handbook ",8th edition Mc-Graw – Hill Book com. 5- Couper J. , Penny R. , Fair J and Wallas S " Chemical Process Equipment " 2nd edition 2010 Elesvier .
Main references (sources)	Lectures, field trips, pilot plant laboratory ,Summer training
Recommended books and references (scientific journals, reports…)	1- G.F. Froment and K.B. Bischoff, Chemical Reactor Analysis and Design (3nd edit), John Wiley & Sons 2011. 2-L D Schmidt, The Engineering of Chemical Reactions (2nd Edition), OUP, 2005. 3-O. Levenspiel, Chemical Reaction Engineering (3rd edition), John Wiley & Sons 1999.
Electronic References, Websites	Websites , Laboratory

Course Description Form

55. Course Name:	
Chemical Process Industries I	
56. Course Code:	
CES.P.437	
57. Semester / Year:	
1st Semester / Year	
58. Description Preparation Date:	
26-3-2024	
59. Available Attendance Forms:	
Fall time	
60. Number of Credit Hours (Total) / Number of Units (Total)	
5 / 3	
61. Course administrator's name (mention all, if more than one name)	
Name: Ts. Dr. Buthainah Ali Abed AL-Timimi Email: buthainah.a.abed@uotechnology.edu.iq	
62. Course Objectives	
Course Objectives	• This course dealing with chemical industries to provide an understanding of the synthesis, industrial manufacture, of important chemical industries. • Topics cover a general introduction to the world of industry and more specifically to those industries involving chemical processes; chemical process definition and its applications on an industrial scale. • Introduction to natural or primary raw materials and their potential use. • Introduction to the use of chemical agents in industry.
63. Teaching and Learning Strategies	
Strategy	The main strategy that will be adopted in delivering this subject is to encouraging student participation in practical experiments application enhances engineering thinking skills through interactive classes involving all students.

64. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	5	General introduction	Chemical Processing	Lectures	Open questions

2	5	synthesis, industrial manufacture, flow diagrams, properties anduses	Sulfur	Lectures, Practical Applications	Exams , Weekly homework, Open questions
3	5	synthesis, industrial manufacture, flow diagrams, properties anduses	Sulfuric acid	Lectures, Practical Applications	Exams , Weekly homework, Open questions
4	5	synthesis, industrial manufacture, flow diagrams, properties anduses	Ammonia	Lectures, Practical Applications	Exams , Weekly homework, Open questions
5	5	synthesis, industrial manufacture, flow diagrams, properties anduses	Nitric acid	Lectures, Practical Applications	Exams , Weekly homework, Open questions
6	5	synthesis, industrial manufacture, flow diagrams, properties anduses	Nitrogenous fertilizers $(NH_4)2SO_4$ $(NH_4)NO_3$	Lectures, Practical Applications	Exams , Weekly homework, Open questions
7	5	synthesis, industrial manufacture, flow diagrams, properties anduses	Nitrogenousfertilizers $(NH_4)NO_3$	Lectures, Practical Applications	Exams , Weekly homework, Open questions
8	5	synthesis, industrial manufacture, flow diagrams, properties anduses	Nitrogenous fertilizers Urea, Ammonium phosphate	Lectures, Practical Applications	Exams , Weekly homework, Open questions

9	5	synthesis, industrial manufacture, flow diagrams, properties anduses	Phosphate fertilizers superphosphate	Lectures, Practical Applications	Exams , Weekly homework, Open questions
10	5	synthesis, industrial manufacture, flow diagrams, properties anduses	Phosphate fertilizers Triple superphosphate Phosphorous,	Lectures, Practical Applications	Exams , Weekly homework, Open questions
11	5	synthesis, industrial manufacture, flow diagrams, properties and uses	Phosphate fertilizers phosphoric acid	Lectures, Practical Applications	Exams , Weekly homework, Open questions
12	5	synthesis, industrial manufacture, flow diagrams, properties and uses	Electrolytic industries	Lectures, Practical Applications	Exams , Weekly homework, Open questions
13	5	synthesis, industrial manufacture, flow diagrams, properties and uses	Electrolytic industries - Caustic soda	Lectures, Practical Applications	Exams , Weekly homework, Open questions
14	5	synthesis, industrial manufacture, flow diagrams, properties and uses	Industrial salts Nacl	Lectures, Practical Applications	Exams , Weekly homework, Open questions
15	5	synthesis, industrial manufacture, flow diagrams, properties and uses	Industrial salts Na_2CO_3	Lectures, Practical Applications	Exams , Weekly homework, Open Questions

65. Course Evaluation	
Midterm exams, Final exam, Quizzes, Weekly homework, Team and homework problems, partial test (Oral questions, alternative response), Open questions that have a definite answer, and Practical Applications.	
66. Learning and Teaching Resources	
Required textbooks (curricular books, if any)	1- Shreves chemical process industries, Austin , G. T. , 5thed , Mc Graw- Hill ,1984 2- N. Naderpour ,Petrochemical production process,1st reprint, sbspublication,New Delhi,2009. 3- Hydrocarbon processing ,Petrochemical processes,2005.
Main references (sources)	Lectures, Field trips, Practical Applications. , Summer training.
Recommended books and references (scientific journals, reports…)	1-L D Schmidt, The Engineering of Chemical Reactions (2nd Edition), OUP, 2005. 2-O. Levenspiel, Chemical Reaction Engineering (3rd edition), John Wiley & Sons 1999. 3- Couper J. , Penny R. , Fair J and Wallas S " Chemical Process Equipment " 2nd edition 2010 Elesvier .
Electronic References, Websites	Websites , Electronic Laboratory

Course Description Form

67. Course Name:	
Chemical Process Industries II	
68. Course Code:	
CES.P.438	
69. Semester / Year:	
2nd Semester / Year	
70. Description Preparation Date:	
26-3-2024	
71. Available Attendance Forms:	
Fall time	
72. Number of Credit Hours (Total) / Number of Units (Total)	
2 / 2	
73. Course administrator's name (mention all, if more than one name)	
Name: Ts. Dr. Buthainah Ali Abed AL-Timimi Email: buthainah.a.abed@uotechnology.edu.iq	
74. Course Objectives	
Course Objectives	• This course dealing with chemical industries to provide an understanding of the synthesis, industrial manufacture, of important chemical industries. • Topics cover a general introduction to the world of industry and more specifically to those industries involving chemical processes; chemical process definition and its applications on an industrial scale. • Introduction to natural or primary raw materials and their potential use. • Introduction to the use of chemical agents in industry.
75. Teaching and Learning Strategies	
Strategy	The main strategy that will be adopted in delivering this subject is to encouraging student participation in practical experiments application enhances engineering thinking skills through interactive classes involving all students.

76. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2	synthesis, industrial	Ceramic industries potteries	Lectures	Open questions

		manufacture, flow diagrams, properties and uses			
2	2	synthesis, industrial manufacture, flow diagrams, properties and uses	Ceramic industries Porcelain refractories	Lectures	Exams , Weekly homework, Open questions
3	2	Types, synthesis, industrial manufacture, flow diagrams,	Cement industries	Lectures	Exams , Weekly homework, Open questions
4	2	properties and uses	Cement industries	Lectures	Exams , Weekly homework, Open questions
5	2	Types, synthesis, industrial manufacture, flow diagrams,	Glass industries	Lectures	Exams , Weekly homework, Open questions
6	2	properties and uses	Glass industries	Lectures	Exams , Weekly homework, Open questions
7	2	Types, synthesis, industrial manufacture, flow diagrams,	Oil and fats	Lectures	Exams , Weekly homework, Open questions

8	2	properties and uses	Oil and fats	Lectures	Exams , Weekly homework, Open questions
9	2	Types, synthesis, industrial manufacture, flow diagrams,	Soap and detergents	Lectures	Exams , Weekly homework, Open questions
10	2	properties and uses	Soap and detergents	Lectures	Exams , Weekly homework, Open questions
11	2	Raw materials Types	Sugar industries Cane sugar	Lectures	Exams , Weekly homework, Open questions
12	2	synthesis, industrial manufacture, flow diagramsand properties	Sugar industries Cane sugar	Lectures	Exams , Weekly homework, Open questions
13	2	Raw materials Types synthesis, industrial manufacture, flow diagrams	Sugar industries Beet sugar	Lectures	Exams , Weekly homework, Open questions
14	2	synthesis, industrial manufacture, flow diagrams uses, and properties	Production of liquid biofuels from renewable resources bioethanol	Lectures	Exams , Weekly homework, Open questions

15	2	synthesis, industrial manufacture,flow diagramuses	Production of liquid biofuels from renewable resources biodiesel	Lectures	Exams , Weekly homework, Open questions

77. Course Evaluation

Midterm exams, Final exam, Quizzes, Weekly homework, Team and homework problems, partial test (Oral questions, alternative response), Open questions that have a definite answer.

78. Learning and Teaching Resources

Required textbooks (curricular books, if any)	4- Shreves chemical process industries, Austin , G. T. , 5thed , Mc Graw- Hill ,1984 5- N. Naderpour ,Petrochemical production process,1st reprint, sbspublication,New Delhi,2009. 6- Hydrocarbon processing ,Petrochemical processes,2005.
Main references (sources)	Lectures, Field trips, Summer training.
Recommended books and references (scientific journals, reports…)	1-L D Schmidt, The Engineering of Chemical Reactions (2nd Edition), OUP, 2005. 2-O. Levenspiel, Chemical Reaction Engineering (3rd edition), John Wiley & Sons 1999. 3- Couper J. , Penny R. , Fair J and Wallas S " Chemical Process Equipment " 2nd edition 2010 Elesvier .
Electronic References, Websites	Websites , Electronic Laboratory

Course Description Form

79. Course Name:	
Materials Engineering I	
80. Course Code:	
CES.P.225	
81. Semester / Year:	
1 semester/year	
82. Description Preparation Date:	
18−3−2024	
83.Available Attendance Forms:	
Students' attendance is documented in the classroom and tabulated on Excel lists according to the lecture dates and is sent weekly via email to the department absences committee.	
84.Number of Credit Hours (Total) / Number of Units (Total)	
2 theoretical hours/1 tutorial hours during one semester. 30 / 2	
85. Course administrator's name (mention all, if more than one name)	
Name: Haiyam Mohammed Abdalraheem Alayan Email: haiyam.m.abdalraheem@uotechnology.edu.iq	
86. Course Objectives	
Course Objectives	1. Identify the distinctive features, properties, classification, processing and application of each group of engineering materials. 2. Application of theoretical concepts in the description of characterizing materials quality 3. Apply materials concepts and features in solving different problems.
87. Teaching and Learning Strategies	
Strategy	1. Interactive Lectures: use interactive lectures that involve. Ask questions, encourage student's discussions, and use multimedia resources to illustrate key concepts. 2. Lecture notes

	3. Online meetings: Utilize technology tools to enhance learning and reinforce understanding 4. Collaborative Learning: Inspire teamwork and develop collaboration skills among students through group solving tasks, which allows students mutual learning and discussing different approaches, 5. Active Practice: Assign homework, quizzes, and exercises to give prospects for students to practice solving problems independently or in groups. 6. Assessment: Use assessment techniques such as quizzes and tests, and classroom polls to measure student's understanding and evolution throughout the course. Provide recurrent feedback to report misunderstanding and improve learning. 7. Conceptual perception: Highlight conceptual understanding rather than tedious memorization by emphasizing on the basic principles and theories of materials engineering. Support students to connect the course concepts to broader concepts in other science and engineering disciplines. 8. Real-World Applications: Integrate material science and engineering to the real-world and industrial applications to demonstrate how materials concepts and properties are used in various fields.

88. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	Identify the distinctive features, properties, classification, processir and application of each group of engineering materials. Discuss the importance of engineering materials.	Introduction to Material science and engineering	Lectures	- Oral questions.

2	3	Discuss the importance of engineering materials and properties of smart, nanomaterial, and biomaterials and their applications in real life	Introduction to Material science and engineering- Part Two	Lectures	- Oral questions
3	3	Crystal and Amorphous Structure in Materials: Ionic, Metallic and Covalent bonds, Space lattice and Unit cell, Simple cubic crystal structure	Atomic Structure and interatomic bonding	- Lectures - tutorials: solving examples.	- Oral questions. - Quiz.
4	3	Crystal and Amorphous Structure in Materials: Body - centered cubic (BCC), Faced- centered cubic (FCC), Hexagonal close- packed (HCP), Volume, Planar, and Linear density, unit cell calculation	Crystal Structure of Materials – Part One	- Lectures - tutorials: solving examples.	- Oral questions. - Quiz.
5	3	Crystal Volume, Planar, and Linear density unit cell calculation Atomic packing factor And coordination Number calculation	Crystal Structure of Materials – Part Two	- Lectures - tutorials: solving examples.	- Oral questions. - Quiz. - Exams
6	3	Drawing and identifyin Coordination for points, Vectors and planes (Miller Indices) Characterizing crystal Structure: X-Ray diffraction	Crystal Structure of Materials – Part Three	- Lectures - tutorials: solving examples.	- Oral questions. - Quiz. - Exams
7	3	Stress and Strain in Metals: Elastic and Plastic Deformation, Engineering Stress and Engineering Strain, Shear Stress and Shear Strain.	Mechanical Properties of Materials- Part One	-Lectures -Solving examples - Tutorials	- Oral questions. - Quiz.

8	3	Stress and Strain in Metals: Engineering Stress-Strain Diagram, Modulus of Elastici (E), Yield Strength, Ultimate Tensile strength (UTS), Percent Elongation, Percent reduction in area	Mechanical Properties of Materials- Part Two	-Lectures -Solving examples - Tutorials	- Oral questions. - Quiz.
9	3	Determination of mechanical properties and their characterization: (Hardness, Toughness, Resilience, Ductility)	Mechanical Properties of Materials- Part Three	Lectures and solving problems. Tutorial.	- Oral questions. - Quiz. - Exams

11. Course Evaluation

Assessment may include but not limited to assignments, quizzes, in-semester and final examinations and projects and other type of assessments. Allocation of percentages of the assessment scheme may depend on the nature of the course. Coursework is 60% and Final Examination is 40% of the total marks.

Assessment Type	Percentage (%)
Quizzes	10
In-Semester Exam 1	20
In-Semester Exam 2	20
Assignments	10
Final Exam	40

12. Learning and Teaching Resources

1. Donaled R. Askeland, The science and engineering of materials, international student edition, 2006 .
2. William D. Callister, Jr. , Materials science and engineering, Tenth edition, 2018.
3. Lawrence H. Vanvlack , Elements of materials science and engineering, Fifth edition, 1987. Microsoft office Word 2007 By: Torben Lage Frandsen & Ventus Publishing Aps, The eBookboon , The eBook compony,2010
4. Glicksman, M., Diffusion in Solids, Wiley-Interscience, New York, 2000.
5. Campbell, F. C., Phase Diagrams: Understanding the Basics, ASM International, Materials Park, OH, 2012
6. Porter, D. A., K. E. Easterling, and M. Sherif, Phase, Transformations in Metals and Alloys, 3rd edition, CRC Press, Boca Raton, FL, 2009.
7. Smith W.F. and Hashemi J. "Foundations of Materials Science and Engineering" McGraw- Hill Edition (2002) , Shackelford James " Materials Science for Engineers" Pearson 6th Ed

Course Description Form

89. Course Name:	
Materials Engineering II	
90. Course Code:	
CES.P.224	
91. Semester / Year:	
2 semester/year	
92. Description Preparation Date:	
4-4-2024	
93.Available Attendance Forms:	
Students' attendance is documented in the classroom and tabulated on Excel lists according to the lecture dates and is sent weekly via email to the department absences committee.	
94.Number of Credit Hours (Total) / Number of Units (Total)	
2 theoretical hours/1 tutorial hours during one semester/ 2 practical hours. 30 / 2	
95. Course administrator's name (mention all, if more than one name)	
Name: Haiyam Mohammed Abdalraheem Alayan Email: haiyam.m.abdalraheem@uotechnology.edu.iq	
96. Course Objectives	
Course Objectives	1. Describe the geometry of imperfections 2. Calculate the extent of diffusion- driving composition changes based 2. 3. 4. upon composition, time and temperature. 3. Predict the equilibrium microstructure of a material given the binary phase diagram, thermal history of the materials. 4. Describe the types and properties of ceramic and composite materials.
97. Teaching and Learning Strategies	
Strategy	1. Interactive Lectures: use interactive lectures that involve. Ask questions, encourage student's discussions, and use multimedia resources to illustrate key concepts.

	2. Lecture notes 3. Online meetings: Utilize technology tools to enhance learning and reinforce understanding 4. Collaborative Learning: Inspire teamwork and develop collaboration skills among students through group solving tasks, which allows students mutual learning and discussing different approaches, 5. Active Practice: Assign homework, quizzes, and exercises to give prospects for students to practice solving problems independently or in groups. 6. Assessment: Use assessment techniques such as quizzes and tests, and classroom polls to measure student's understanding and evolution throughout the course. Provide recurrent feedback to report misunderstanding and improve learning. 7. Conceptual perception: Highlight conceptual understanding rather than tedious memorization by emphasizing on the basic principles and theories of materials engineering. Support students to connect the course concepts to broader concepts in other science and engineering disciplines. 8. Real-World Applications: Integrate material science and engineering to the real-world and industrial applications to demonstrate how materials concepts and properties are used in various fields. 9. Reflection and Metacognition: Encourage students to reflect on their learning process and develop metacognitive skills by asking them to explain their problem-solving strategies, articulate their thought processes, and evaluate their understanding.

98. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	- Introduction to Diffusion - diffusion couple for metals - Introducing transfer of mass	Atom and Ion Movements in Materials	Lectures	- Oral questions.

2	3	1- Interdiffusion, 2- Self-diffusion. Diffusion mechanisms 1- Vacancy diffusion. 2- Interstitial diffusion. – The imperfections in crystals - Arrhenius equation - Arrhenius Equation and its application: Activation energy interstitial atoms, self diffusion, heterogeneous diffusion	Diffusion Types And Mechanisms	Lectures	- Oral questions
3	3	Fick's First Law [steady-state diffusion] -Factors Influencing Diffusion -Fick's second law—nonsteady-state diffusion - Solution to Fick's second law -Design of Carburizing process, diffusion temperature- heat treatment specification, design of economical heat treatment	The mathematics of diffusion	- Lectures - tutorials: solving examples.	- Oral questions. - Quiz.
4	3	- Introducing Phases and the Phase Diagram: single-phase alloys, multiple-phase alloys, solubility - Gibbs' Phase Rule - Isomorphous Phase Diagrams: Liquidus and Solidus Temperatures - Interpretation of phase diagrams: Determination of Phase Compositions, Determination of Phase Amounts (Lever Rule) - Application of Lever Rule: solidification of alloys	Phase Diagram	- Lectures - tutorials: solving examples.	- Oral questions. - Quiz.
5	3	Principles and Examples of Dispersion Strengthening - Guidelines to increase the strength and toughness - BINARY EUTECTIC SYSTEMS ~ eutectic reaction, eutectic isotherm, copper–silver system, lead – tin system	Dispersion Strengthening and Eutectic Phase Diagrams	- Lectures - tutorials: solving examples.	- Oral questions. - Quiz. - Exams

		~ Determination of phases present and their composition: (Mass and volume fractions)			
6	3	Solidification, precipitation of microstructure -Hypoeutectic and hypereutectic - Cooling curve for eutectic alloys - Solubility, maximum solubility, phases amount in Pb-Sn eutectic alloy	development of microstructure in eutectic alloys	- Lectures - tutorials: solving examples.	- Oral questions. - Quiz. - Exams
7	3	Classification (Ferrous and non-ferrous), characteristics and production of metal alloys, important application.	Engineering Alloys	-Lectures -Solving examples - Tutorials	- Oral questions. - Quiz.
8	3	Classification (thermosetting and thermoplastics), characteristics and production of plastics, important application	Polymeric materials	-Lectures -Solving examples - Tutorials	- Oral questions. - Quiz.
9	3	Classification (traditional and engineering ceramics), characteristics and production ceramics and glasses, important application	Ceramics and Glasses	Lectures and solving problems. Tutorial.	- Oral questions. - Quiz. - Exams
10	3	Classification (polymer matrix composite, ceramics matrix composite and metal matrix composite), characteristics and production of composite materials	Composite Materials		

Practical (Material Engineering Laboratory)

Exp. No.	Exp. Name.
Exp. No. 1	Tension test
Exp. No. 2	Hardness Testing
Exp. No. 3	Bending Test
Exp. No. 4	Creep Test
Exp. No. 5	Abrasion Test
Exp. No. 6	Impact Test
Exp. No. 7	Moisture Measurement in Engineering Materials
Exp. No. 9	Microstructure Examination

11. Course Evaluation

Assessment may include but not limited to assignments, quizzes, in-semester and final examinations and projects and other type of assessments. Allocation of percentages of the assessment scheme may depend on the nature of the course. Coursework is 40% and Final Examination is 60% of the total marks.

Assessment Type	Percentage (%)
Quizzes	10
In-Semester Exam 1	10
In-Semester Exam 2	10
Lab	10
Final Exam	60

12. Learning and Teaching Resources

8. Donaled R. Askeland, The science and engineering of materials, international student edition, 2006 .

9. William D. Callister, Jr. , Materials science and engineering, Tenth edition, 2018.

10. Lawrence H. Vanvlack , Elements of materials science and engineering, Fifth edition, 1987. Microsoft office Word 2007 By: Torben Lage Frandsen & Ventus Publishing Aps, The eBookboon , The eBook compony,2010

11. Glicksman, M., Diffusion in Solids, Wiley-Interscience, New York, 2000.

12. Campbell, F. C., Phase Diagrams: Understanding the Basics, ASM International, Materials Park, OH, 2012

13. Porter, D. A., K. E. Easterling, and M. Sherif, Phase, Transformations in Metals and Alloys, 3rd edition, CRC Press, Boca Raton, FL, 2009.

14. Smith W.F. and Hashemi J. “Foundations of Materials Science and Engineering” McGraw- Hill Edition (2002) , Shackelford James " Materials Science for Engineers" Pearson 6th Ed

Course Description Form

99. Course Name:

Basic Principle of Chemical Engineering III

100. Course Code:

CE/R-241, CE/P-241

101. Semester / Year:

2nd semester

102. Description Preparation Date:

Understanding the basic concepts and expressions in chemical engineering and learning calculations for energy balance in clo & open system, steady & unsteady state system with & without chemical reactions

103. Available Attendance Forms:

104. Number of Credit Hours (Total) / Number of Units (Total)

45 hr/

105. Course administrator's name (mention all, if more than one name)

Name: : Dr. Ali Abdulrahman nsaif al_ezzi
Email: ali.a.nsaif@uotechnology.edu.iq

106. Course Objectives

1. The aims of the course provide a deep knowledge, wide scope and improved understanding of the mechanism heat balance for closed and open system and for steady and unsteady state.
2. The students should gain knowledge to apply the energy balance in engineering problems

107. Teaching and Learning Strategies

1.1 Knowledge and Understanding The terminology associated with energy balances, concepts, and units. 1.2 Introduction to energy balances for processes without reaction. 1.3 Calculation of enthalpy changes.	Define or explain energy, system,closed system, nonflow system,open system, flow system,surroundings, property, extensive property, intensive property, state ,heat, work, kinetic energy, potential energy internal energy, enthalpy, initial state, final state, state variable, cyclical process, and path function Calculate enthalpy and internal energy changes from heat capacity equations, graphs and charts,and tables given the initial and final states of the material .Express the general energy balance in words write it down with symbols and variables for open system .write it down with symbols and variables for closed system . Explain the meaning of standard heat of formation , heat of reaction

2.1 Energy balances: how to account for chemical reaction. 2.2 Ideal process, efficiency, and the mechanical energy balance. material and energy balances..	Write down each of the terms in the steady state mechanical energy balance for an open system .Apply the mechanical energy balance when appropriate to problems so that you can predict pressure drops ,velocities, friction losses ,and pump sizes . Distinguish between ideal solutions and real solutions . balances

108. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method & Evaluation method	
1	3	1.1 Knowledge and Understanding T terminology associated with energy balances, concepts, and units. 1.2 Introduction to energy balances processes without reaction.	Energy Terminology Concept , units	Midterm exams , Final exam , Quiz Weekly homework, Team homework problems , partial test (questions :- multiple ch ,alternative response), O questions that have a definite ans , or do not have a definite answer	
2	3	1.3 Calculation of enthalpy changes. 2.1 Energy balances: how to accoun for chemical reaction. 2.2 Ideal process, efficiency, and the mechanical energy balance. 2.3 Heat of solution and mixing	Introduction Energy Balan for Proce without React The concept the conserva of energy ,		
3	3		Calculation Enthalpy Char		
4	3		Application Energy Balan in the Absenc Chemical Reaction		
5	3		Energy Balanc How to Acc for Chen Reaction		
6	3		Energy Balan that Include Effects Chemical Reaction		
7	3		Ideal Process Efficiency , the Mechan Energy Balanc		

8	3		Heat of Solution and Mixing		
9	3				
10	3				
11	3				
12	3				
13	3				
14	3				
15	3				

109. Course Evaluation

Distributing the score out of 100 according to the tasks assigned to the student such as daily preparation, daily oral, monthly, or written exams, reports .... etc

Quiz (20%)
Home work (10%)
Final exam (70%)

110. Learning and Teaching Resources

Required textbooks (curricular books, if any)	1) D.M.Himmelblau and J.B.Riggs ,Basic Principles and Calculations in Chemical Engineering ,7th Edition , 2004 . 2) Nayef Ghasem and Redhouane Henda, Princi of Chemical Engineering Processes, Material Energy Balances,Second Edition,2015.
Main references (sources)	
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	

Course Description Form

111.	Course Name: Fuel's & Energy Engineering
112.	Course Code: CES.P.237
113.	Semester / Year: First Semester 2023-2024
114.	Description Preparation Date: 19/03/2024
115.	Available Attendance Forms:

الجامعة التكنولوجية — سجل الدوام اليومي — المادة:

قسم الهندسة الكيمياوية — المرحلة الثانية-فرع هندسة العمليات الكيمياوية — الحد الأعلى:

الدراسة الصباحية — للعام الدراسي ٢٠٢٣ / ٢٠٢٤

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116.	Number of Credit Hours (Total) / Number of Units (Total)

3 units/4 hours per week	
117. Course administrator's name (mention all, if more than one name)	
Name: Dr. Nabil Majd Alawi Email: nabil.m.alawi@uotechnology.edu.iq	
118. Course Objectives	
Course Objectives	1- Introduces basic knowledge about solid, liquid and gases fuels, their origin, classification. 2- Knowledge of preparation, procedure and characterization in terms of physic-chemical properties. 3- Knowledge in liquid fuel section. Petroleum is the liquid fuel which is elaborated in terms of distillation and secondary processing. Different important gaseous fuels are included in gaseousfuel section.
119. Teaching and Learning Strategies	
Strategy	-Differentiation -Blended learning -Gamification -Questioning -Connect with learners -Experiential learning -Personalized learning -Behavior management -Explicit instruction -Group learning -Interdisciplinary teaching -Active learning -Technology -Feedback -Lecture -Reciprocal questioning -Relevant vocabulary
120. Course Structure	

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2	Introduction	-Fuel's & Energy Engineering	Power point	Ask questions
2	2	Introduction	-History of fuels -History of solid fuel -History of liquid fuels and gases fuels	Power point	Ask questions
3	2	Introduction	-Fundamental definition properties of liquid and gaseous fuels -Various measurement	Power point	Quiz
4	2	Coal	-Classification - Composition and basis -Coal preparation and washing combustion of coal and coke and making	Power point	Quiz
5	2	Coal	-Coal tar distillation -Coal liquefaction -Coal gasification	Power point	Quiz
6	2	Crude Petroleum	-Exploration of crude Petroleu Evaluation of crude -Distillation cracking –Thermal cracking catalytic cracking	Power point	Quiz
7	2	Crude Petroleum	-Reforming of naphtha - Hydrotreatment –Dewaxing deasphalting -Refinery equipment	Power point	Quiz
8	2	Natural gas and LPG	-Producer gas -Water gas -Other fuel gases	Power point	Quiz
9	2	Combustion air Calculation	-Calculation of calorific -Value of fuels flame propertie -Combustion burners -Combustion furnaces	Power point	Quiz
10	2	Energy Engineering	-Past, Present and Future Energy Use Bioenergy -Geothermal Energy -Nuclear Energy -Solar Energy and Solar Photovoltaics	Power point	Quiz
12	2	Energy Engineering	-Wind, Ocean Wave, Tide, Current and Thermal Energy Conversion -Energy Carriers and Fuel Cells	Power point	Quiz

121. Course Evaluation

20 Mid Exam
5 Attendance
5 Evaluation score
10 Laboratory
60 Final Exam

122. Learning and Teaching Resources

Required textbooks (curricular books, if any)	1. Speight, J.G, Handbook of petroleum product analysis, John Willey & Sons, 2002. 2. Speight J.G. and Ozum, B; Petroleum Refinery processes, Macel Dekker, New York, 2002. 3. Speight J.G. The chemistry and Technology of petroleum, 3rdEdition.Marcel Dekker, New York 1999. 4. Petroleum Fuels manufacturing handbook; Surinder Parkash, McGraw-Hillcompanies, 2010. 5. Fundamentals of Petroleum and Petrochemical Engineering, Uttam Ray Chaudhuri, Taylor& Francis Group, 2011
Main references (sources)	
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	

Course Description Form

123. Course Name: Petrochemical Industries

124. Course Code: CES.P.4310

125. Semester / Year: Second Semester 2023-2024

126. Description Preparation Date: 19/03/2024

127. Available Attendance Forms:

الجامعة التكنولوجية سجل الدوام اليومي الدراسة الصباحية

قسم الهندسة الكيمياوية المرحلة الرابعة:فرع هندسة العمليات الكيمياوية

للعام الدراسي ٢٠٢٣ / ٢٠٢٤

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128. Number of Credit Hours (Total) / Number of Units (Total)

2 units/3 hours per week

129. Course administrator's name (mention all, if more than one name)

Name: Dr. Nabil Majd Alawi
Email: nabil.m.alawi@uotechnology.edu.iq

130. Course Objectives

Course Objectives	1. To introduce and develop an understanding of raw materials of petrochemicals.Petrochemical. 2. To introduce petrochemical generation first: Basic petrochemicals, second: Intermediates and third: final products: polymers. 3. To give the learner the skills necessary to accommodate considered what has beenstudied. 4. To provide the student with confidence and study the skills to enable them to progress.

131. Teaching and Learning Strategies

Strategy	–Differentiation –Blended learning –Questioning –Connect with learners –Experiential learning –Personalized learning –Behavior management –Explicit instruction –Group learning –Interdisciplinary teaching –Active learning –Feedback –Lecture –Reciprocal questioning –Relevant vocabulary

132. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	Introduction	-Petrochemical Industries	Power point	Ask questions
2	3	Introduction	-Raw material -Characterization	Power point	Ask questions
3	3	Basic Petrochemical Materials	-Low Olefins: Ethylene production by steam Cracking processes -butylenes: conversion process for production of olefins -Isobutylene production	Power point	Quiz
4	3	Basic Petrochemical Materials	-Diolefin: Butadiene Separation -Higher Olefins: -Production methods -Linear: Alkyl benzene Complex (LAB)	Power point	Quiz
5	3	Basic Petrochemical Materials	-Aromatics: Sources, Separation of benzene Toluene Xylene -Syntheses gas: H_2 production: Steam reforming, Partial Oxidation	Power point	Quiz
6	3	Intermediate Petrochemicals	-Methanol -Acetic acid -Vinyl chloride M -Ethylene Oxide Ethanolamine -Ethylene glycol – Acrylonitrile	Power point	Quiz
7	3	Basic Petrochemical Materials	-Adipic Acid	Power point	Quiz

			-Methyl Tetra butyl ether -Ethyl benzene -Styrene -Phenol		
8	3	Basic Petrochemical Materials	-Nitrobenzene -Cyclohexane -Benzoic acid -Terephthalic acid	Power point	Quiz
9	3	Polymers	-LDPE -HDPE -PP	Power point	Quiz
10	3	Polymers	-PVC -PP Synthetic Fibers	Power point	Quiz
11	3	Petrochemical Complexes	-Ethylene -Propylene -Benzen	Power point	Quiz
12	3	Petrochemical Complexes	-C_4 -BTX	Power point	Quiz

133. Course Evaluation

20 Mid Exam
5 Attendance
5 Sinemer
70 Final Exam

134. Learning and Teaching Resources

Required textbooks (curricular books, if any)	1. Sami Matar, Lewis F. Hatch, Chemistry of Petrochemical Process, 2nd edition. 2. William D. Callister, David G. RETHWISC, Materials Science and Engineering.
Main references (sources)	
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

1. Course Name:

Process Dynamics

2. Course Code:

CES.P. 433

3. Semester / Year:

1st Semester / Fourth year

4. Description Preparation Date:

10−10−2023

5. Available Attendance Forms:

Students' attendance is recorded in the classroom and on Excel lists based the number of lectures and according to the dates in the schedule and is se weekly via email to the Absences Committee.

6. Number of Credit Hours (Total) / Number of Units (Total)

45 / 2

7. Course administrator's name (mention all, if more than one name)

Name: Afraa Hilal Kamel
Email: afraa.h.kamel@uotechnology.edu.iq

8. Course Objectives

Course Objectives	1. To provide an understanding of the dynamic analysis of chemical processes to allow students to identify the system under different operating conditions. 2. Ability to formulate transfer function of the system. 3. Selecting of critical process variables. 4. Provide practice at developing critical thinking skills, solving open ended problems and to work in teams.

9. Teaching and Learning Strategies

Strategy	Lectures / seminars / Pictures and video clips

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	Introduction to Process Dynamics	**Introduction to Process Dynamics**	Lectures and solving examples.	Oral questions.
2	3	Laplace transform of the derivatives, Laplace transform of Integral, Laplace Transform of t.f (t) (multiplication by t), and Properties of Laplace transform.	**Laplace transforms**	Lectures and solving examples.	Oral questions.

3	3	Properties of Lapalce transform (Initial value theorem, final value theorem, real time translation). Laplace transform of special functions (step, pulse, Impulse, ramp and periodic functions), Convolution theorem.	**Laplace transforms**	Lectures and solving examples.	Quiz.
4	3	First shifting properties, second shifting properties, Inverse of Laplace transform, Inverse Laplace transform of derivatives, Inverse Laplace Transform of Integrals Partial fraction expansion	**Inverse of Laplace transforms**	Lectures and solving examples.	Oral questions.
5	3	Solution of differential equations, Solution of simultaneous ordinary differential equations.	**Laplace transforms**	Lectures and solving examples.	Quiz.
6	3	Mathematical description of Continuous Stirred Tank Heater, Liquid holding system, CSTR, Bioreactor First order systems.	**First order systems**	Lectures and solving examples.	Oral questions.
7	3	Derivation of the transfer function for a standard first order system.	**First order systems**		Quiz.
8	3	Response of a first order system to pulse, step and sinusoidal inputs.	**Dynamic response of first order systems**	Lectures and solving examples.	Oral questions.
9	3	Dynamic response of first order systems. 1. Dynamics of a liquid level tank 2. Dynamics of a temperature measuring system. 3. Dynamics of a mixing process. 4. Dynamics of an under damped second order system.	**Dynamic response of first order systems**	Lectures and solving examples.	Quiz.
10	3	Graphical fitting of first-order plus time-delay models using step tests. Approximation of higher-order systems (model reduction)	**Graphical fitting**	Lectures and solving examples.	Oral questions.
11	3	First order systems in series. Non-interacting and interacting systems. Dynamics of interacting first order systems in series. Dynamics of non-interacting first order systems in series.	**First order systems in series**	Lectures and solving examples.	Quiz.
12	3	Linearization technique for a non-linear systems, transportation lag. Transport delay, dynamic response of time delay systems	**Linearization**	Lectures and solving examples.	Oral questions.
13	3	General form of the transfer function of a second order system Underdamp Critically damping Over damp	**Second order systems**	Lectures and solving examples.	Quiz.

14	3	Response of a second order underdamped system step inputs.	**Second order systems**	Lectures and solving examples.	Oral questions.
15	3	Response of a second order underdamped system to pulse and sinusoidal inputs.	**Second order systems**	Lectures and solving examples.	Quiz.

11. Course Evaluation

Attendance: 5%
Homework, assignments 5%
Mid term Exam 10%
In-class quizzes: 10 %
Final: 70 %

_____
Total: 100 %

12. Learning and Teaching Resources

Required textbooks (curricular books, if an	1. D.R. Coughanowr and S. LeBlanc, Process Systems Analysis and Control, McGraw-Hill, 3 nd edition, 2008. 2. Stephanopoulos G., "Chemical Process Control-An Introduction to Theory and Practice, "Prentice -Hall, New Jersey, 1984.
Main references (sources)	1. Luyben W. L., "Process Modeling, Simulation and Control for Chemical Engineers," McGraw-Hill, New York, 2nd Ed., 1990 . 2. *Process Dynamics: Modeling, Analysis and Simulation, by Wayne Bequette.*
Recommended books and references (scientific journals, reports…)	Dale E. Seborg, Thomas F. Edgar, and Duncan A. Mellichar Process dynamics & control. Wiley. com, 2006.
Electronic References, Websites	

Course Description Form

135. Course Name:
Process Control and Instruments
136. Course Code:
CES.P. 434
137. Semester / Year:
2nd Semester / Fourth year
138. Description Preparation Date:
13−2−2024
139. Available Attendance Forms:
Students' attendance is recorded in the classroom and on Excel lists based the number of lectures and according to the dates in the schedule and is se weekly via email to the Absences Committee.
140. Number of Credit Hours (Total) / Number of Units (Total)
45 / 3
141. Course administrator's name (mention all, if more than one name)
Name: Afraa Hilal Kamel Email: afraa.h.kamel @uotechnology.edu.iq
142. Course Objectives

Course Objectives	Process control is concerned with the "control" or "manipulation" of process behavior so that the process operates close to the desired operating point even in the presence of inevitable upsets and disturbances. Process control plays a central role in the efficient and trouble-free operation of modern processing plants. This course will introduce the concepts of systems modeling, transient response analysis and feedback control. At the end of this course, students will be able to: • Model and simulate the behavior of 1st, 2nd and higher order dynamical systems. • Analysis of closed-loop system and response of controlled system under different operating conditions. • Design and tune feedback controllers and obtain a hands-on experience in doing this via simulation and experimentally on pilot-scale processes. • Configure and analyze control loops for stability and performance.

143. Teaching and Learning Strategies

Strategy	Lectures / seminars / Pictures and video clips

144. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method

1	3	Classify process variables Control & instrumentation diagram Control configurations Control block diagram	**Introduction to process control**	Lectures and solving examples.	Oral questions
2	3	Concept of feedback control Analysis of feedback-controlled processes Basic feedback controller design	**Feedback Control Systems**	Lectures and solving examples.	Oral questions
3	3	Servo Vs regulator problem Closed loop control systems Development of block diagram for feed-back control systems-servo problems	**Design of Feedback Controllers**	Lectures and solving examples.	Quiz.
4	3	Dynamic behavior of closed-loop systems Development of empirical models from process data Development of transfer function for ON-OFF, P, PD, PI, PID controllers.	**Feedback control and PID controller**	Lectures and solving examples.	Oral questions
5	3	Transient response of a first-order system under P feedback control Transient response of a first-order system under PI feedback control	**Dynamic behavior of closed-loop control systems.**	Lectures and solving examples.	Quiz.
6	3	Transient response of a first-order system under PD feedback control Transient response of a first-order system under PID feedback control	**Dynamic behavior of closed-loop control systems.**	Lectures and solving examples.	Quiz.

7	3	Development of block diagram for feed-back control systems – regulator problems Overall transfer function of a closed-loop control system	**Block diagram reduction**	Lectures and solving examples. .	Oral questions
8	3	**Mid Course examination**			
9	3	Stability of feedback control system, Closed loop stability, Routh's test	**Stability analysis of control systems**	Lectures and solving examples.	Oral questions
10	3	Transient response of closed-loop control systems and their stability.	**Stability analysis of control systems**	Lectures and solving examples.	Quiz.
11	3	Performance criteria controllers design & tuning Quarter Decay Ratio IAE, ISE and ITAE	**Controller tuning**	Lectures and solving examples.	Oral questions
12	3	Types of controller tuning Process reaction curve method Direct synthesis method Integral error criteria based tuning method Open loop tuning (Cohen-Coon),	**Controller tuning**	Lectures and solving examples.	Quiz.
13	3	Closed loop tuning (Ziegler-Nichols, continuous cycling, relay auto) Tuning of P, PI and PID controllers for chemical engineering process systems.	**Controller tuning**	Lectures and solving examples.	Oral questions
14	3	Characteristics Of Measurement System-Pressure Measurement-	**Control system instrumentation**	Lectures and solving examples.	Quiz.

		Temperature Measurement - Flow Measurement-			
15	3	Characteristics Of Measurement System- Level Measurement- Selection of sensors, transmitters, transducers Types of control valves	**Control system instrumentation**	Lectures and solving examples.	Quiz.

145. Course Evaluation

Attendance: 5%
Homework's: 5 %
In-class quizzes: 10 %
Midterm: 10 %
Laboratory: 10%
Final: 60 %

_____
Total: 100 %

146. Learning and Teaching Resources

Required textbooks (curricular books, if any)	1. D.R. Coughanowr and S. LeBlanc, Process Systems Analysis and Control, McGraw-Hill, 3rd edition, 2008. 2. Stephanopoulos G., "Chemical Process Control-An Introduction to Theory and Practice, "Prentice -Hall, New Jersey, 1984.
Main references (sources)	1. Luyben W. L., "Process Modeling, Simulation and Control for Chemical Engineers," McGraw-Hill, New York, 2nd Ed., 1990. 2. Process Dynamics: Modeling, Analysis and Simulation, by Wayne Bequette.
Recommended books and references (scientific journals, reports…)	Dale E. Seborg, Thomas F. Edgar, and Duncan A. Mellichamp. Process dynamics & control. Wiley. com, 2006.
Electronic References, Websites	

Course Description Form

147. Course Name:	
Statistics	
148. Course Code:	
CES.P.225	
149. Semester / Year:	
1 semester/year	
150. Description Preparation Date:	
18−2−2024	
151. Available Attendance Forms:	
Students' attendance is recorded in the classroom and on Excel lists based on t number of lectures and according to the dates in the schedule and is sent weel via email to the Absences Committee.	
152. Number of Credit Hours (Total) / Number of Units (Total)	
2 theoretical hours/1 tutorial hours during one semester. 45 / 3	
153. Course administrator's name (mention all, if more than one name)	
Name: Mahir A. Abdulrahman Email: Mahir.A.AbdulRahman@uotechnology.edu.iq	
154. Course Objectives	
Course Objectives	5. Teaching students how to use statistical methods. 2. Application of statistical methods in the description and analysis of data. 3. Use of statistics in solving different problems.
155. Teaching and Learning Strategies	
Strategy	1. **Interactive Lectures: ** Instead of traditional lectures, use interactive lectures that involve students actively in the learning process. Ask questions, encourage discussions, and use multimedia resources to illustrate key concepts. 2. **Hands-on Activities: ** Incorporate hands-on activities such as experiments, data collection, and analysis to make statistics more tangible and engaging. Use real-world

	examples and case studies to demonstrate the relevance of statistical concepts. 3. **Collaborative Learning: ** Encourage collaboration among students through group projects, problem-solving tasks, and peer teaching. Collaborative learning allows students to learn from each other, discuss different approaches, and develop teamwork skills. 4. **Technology Integration: ** Utilize technology tools such as statistical software (e.g., SPSS, R), interactive simulations, and online resources to enhance learning. These tools can facilitate data analysis, visualization, and experimentation, making statistics more accessible and interactive. 5. **Visual Aids: ** Use visual aids such as charts, graphs, diagrams, and multimedia presentations to represent statistical data and concepts. Visualizations help students grasp complex information more easily and reinforce understanding. 6. **Active Practice: ** Provide opportunities for students to practice solving statistical problems independently or in groups. Assign homework, quizzes, and exercises that require applying statistical methods to real-world scenarios. 7. **Formative Assessment: ** Use formative assessment techniques such as quizzes, pre-tests, and classroom polls to gauge students' understanding and progress throughout the course. Provide timely feedback to address misconceptions and guide further learning. 8. **Conceptual Understanding: ** Emphasize conceptual understanding over rote memorization by focusing on the underlying principles and theories of statistics. Help students connect statistical concepts to broader concepts in mathematics and other disciplines. 9. **Real-World Applications: ** Integrate real-world applications of statistics into the curriculum to demonstrate how statistical methods are used in various fields such as business, social sciences, healthcare, and engineering. Show examples of statistical analysis in news articles, research studies, and everyday situations. 10. **Differentiated Instruction: ** Recognize that students have diverse learning styles, backgrounds, and abilities. Differentiate instruction by providing multiple learning pathways, offering additional support for struggling

	students, and challenging advanced learners with enrichment activities. 11. **Reflection and Metacognition: ** Encourage students to reflect on their learning process and develop metacognitive skills by asking them to explain their problem-solving strategies, articulate their thought processes, and evaluate their understanding.

156. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	Students comprehend basic concepts of statistics.	Introduction, statistics population, descriptive and inductive statistics	Lectures.	Oral questions.
2	3	The ability of students to change data to tables. Students' skills in dealing w groups of data. Student's comprehension o different graphical representations.	Frequency distribution table, types of frequency. Tutorial of frequency distribution table. Graphical representation of frequency distribution table	Lectures and solving examples. Lectures and tutorials. Lectures.	Quiz. oral questions.
3	3	Conversion of frequency distribution table to different shapes of graph Acknowledgment of statistical measures.	Tutorial in graphical representation. Measures of central tendency	Tutorials. Lectures and solving examples.	Quiz. Oral questions.
4	3	Students' ability to distinguish between different statistical measures. Differentiation between statistical measures.	Measures of dispersion. Tutorials in the center and dispersion measures.	Lectures and solving examples. Lectures and tutorials	Oral questions. Quiz.

5	3	Student's ability to find the constants of an equation with tv variables. Student's ability to find t best equation to describe the data	Curve fitting, least squares method, variance, and correlation coefficient. Tutorial of the least square methods	Lectures and solving examp	Oral questions. Solving tutorial and a quiz.
6	3	Determination of the constants an equation with three variables The ability to differentiate betw the solving methods of two variables or more.	Multiple and partial correlations, normal equations for the least square regression, coefficient of correlation. Tutorial in partial correlation.	Lectures and solving examp Tutorial.	Oral questions. Partial test.
7	3	Comprehension of the probabili definition. Student's ability to apply norma distribution.	Probability distribution, continuous and discrete dist., normal dist. Tutorial in a norma distribution.	Lectures and solving examp Tutorials.	Oral questions. Quiz.
8	3	Acknowledgement of discrete probability concepts. Distinguish between different probability distributions.	Binomial distribution and Poison distribution. Tutorial of a probability distribution.	Lectures and solving examples. Tutorial.	Oral questions. Partial test.
9	3	Student's ability to use Chi-squ to test the hypothesis. .	The chi-square test test of hypothesis.	Lectures and solving examp	Oral questions.
10	3	Student's ability to use Chi-square to test the hypothesis	The chi-square test test of hypothesis.	Lectures and solving examples.	Quiz. Oral questions
11	3	Using of Chi-square test for goodness of probability distribution	Chi-square test for goodness of fit and independence test.	Lectures and solving examp	Quiz. Oral questions
12	3	Using of Chi-square test for goodness of probability distribution	Chi-square test for goodness of fit and independence test.	Lectures and solving examp	Oral questions

13	3	Distinguish between the different uses of Chi-square	Tutorial in Chi-square. Comparison between	Tutorials.	Quiz.
14	3	Students' ability to test the means.	three or more of the means. NOVA test	Lectures and solving examp	Oral questions.
15	3	The use of the ANOVA test and F test.	Tutorial in ANOVA test.	Homework.	Quiz.

157. Course Evaluation

Distributing the score out of 100 according to the tasks assigned to the student such as daily preparation, daily oral, monthly, or written exams, reports .... etc

To conduct a course evaluation and distribute scores out of 100 based on various tasks assigned to students, one can follow a weighted grading system where each task is assigned a specific percentage of the total grade. Here's a suggested breakdown:

1. **Daily Preparation (10%): ** This category assesses students' preparation and participation in daily class activities, discussions, and exercises. Assign points based on attendance, assigned readings completion, class discussion engagement, and group activity participation.

2. **Daily Oral Presentations (10%): ** Evaluate students' oral communication skills, presentation content, organization, and delivery. Assign scores based on criteria such as clarity of speech, use of visual aids, interaction with the audience, and adherence to time limits.

3. **Monthly Written Exams (30%): ** Assess students' understanding of course material through monthly written exams covering key concepts, theories, and problem-solving skills. Design exams to include a mix of multiple-choice questions, short answer questions, and essay questions.

4. **Reports/Assignments (25%): ** Assign written reports or assignments on specific topics related to the course curriculum. Evaluate students' research, analysis, writing, and critical thinking skills. Provide feedback on the quality of content, organization, citation style, and overall presentation.

5. **Final Exam (25%): ** Administer a comprehensive final exam at the end of the course to assess students' mastery of course content. The final exam should cover all topics taught throughout the semester and may include various question types to assess students' knowledge, comprehension, application, and synthesis skills.

Once you have determined the weightings for each task, you can calculate students' total scores out of 100 by summing up the scores they received in each category. For example:

- Daily Preparation: 10 points
- Daily Oral Presentations: 10 points
- Monthly Written Exams: 30 points
- Reports/Assignments: 25 points
- Final Exam: 25 points

Total Score = (Daily Preparation Score x 10%) + (Daily Oral Presentations Score x 10%) + (Monthly Written Exams Score x 30%) + (Reports/Assignments Score x 25%) + (Final Exam Score x 25%)

158. Learning and Teaching Resources	
Required textbooks (curricular boo if any)	Schaum's Outline of Theory and Problems of Statistics (Schaum's Outline Series) Paperback – January 1, 1989 by Murray R. Spiegel (Author)
Main references (sources)	Schaum's Outline of Theory and Problems of Statistics (Schaum's Outline Series) Paperback – January 1, 1989 by Murray R. Spiegel (Author)
Recommended books and references (scientific journals, reports…)	1. Statistics, Murray R. Spiegel, 7 Ed. 2009 2. Statistical methods for technologists, C.G. Paradise.2005 3. Statistical Methods in Analytical Chemistry, Peter C. Meier and Richard E. Zund, 2 Ed, A Wily-Intercedence Publication,2000
Electronic References, Websites	There are several electronic references and websites available for studying statistics. Here are some highly recommended ones: 1. **Khan Academy - Statistics and Probability:** Khan Academy offers comprehensive tutorials and exercises covering various topics in statistics and probability. It includes instructional videos, practice problems, and quizzes to help learners understand statistical concepts. Website: Khan Academy - Statistics and Probability 2. **StatTrek:** StatTrek provides free resources for learning statistics, including tutorials, examples, and interactive tools. It covers a wide range of topics such as descriptive statistics, probability distributions, hypothesis testing, and regression analysis. Website: StatTrek 3. **Wolfram Alpha - Statistics & Data Analysis:** Wolfram Alpha is a computational search engine that provides instant answers and solutions to statistical queries. It offers statistical calculators, visualizations, and step-by-step solutions for various statistical problems. Website: Wolfram Alpha - Statistics & Data Analysis 4. **Coursera:** Coursera offers online courses on statistics taught by instructors from leading universities and institutions. These courses

	cover introductory to advanced topics in statistics and data analysis, providing video lectures, assignments, and interactive quizzes. Website: Coursera - Statistics Courses 5. **OpenIntro Statistics:** OpenIntro Statistics provides free textbooks, videos, and resources for learning introductory statistics. It offers interactive visualizations, practice exercises, and datasets for hands-on learning. Website: OpenIntro Statistics 6. **Statistics.com:** Statistics.com offers online courses and certificate programs in statistics, data analysis, and machine learning. It provides instructor-led courses with interactive lessons, assignments, and forums for discussion and collaboration. Website: Statistics.com 7. **Statistical Analysis System (SAS) - Free Statistical Software:** SAS offers free statistical software for data analysis, visualization, and reporting. It includes a comprehensive set of statistical procedures and tools for performing various analyses. Website: SAS - Free Statistical Software 8. **R Project for Statistical Computing:** R is a free and open-source programming language and software environment for statistical computing and graphics. It offers a wide range of packages and libraries for statistical analysis, data visualization, and machine learning. Website: R Project for Statistical Computing These electronic references and websites provide valuable resources for self-study, supplemental learning, and professional development in statistics. Whether you're a beginner or an experienced practitioner, you can find useful materials and tools to enhance your understanding and skills in statistics and data analysis.

Course Description Form

1. Course Name: Unit Operation II

2. Course Code: CES.E. 431

3. Semester / Year: 1 st Semester

4. Description Preparation Date:2023 /2024

5. Available Attendance Forms: central / full

6. Number of Credit Hours (Total) / Number of Units (Total) 5hr / 3unit

7. Course administrator's name (mention all, if more than one name)

Name: May Ali Alsaffar
Email: may.a.muslim@uotechnology.edu.iq

8. Course Objectives

Course Objectives	1.To provide an understanding of the general principles of separation processes to allow students to make sensible options given a separation (Humidification, Dehumidification and Cooling tower, Evaporation, crystallization, and Wet Solid Drying). 2- A comprehensive understanding of the transport processes related to chemical engineering operations, with focus on both theory and applications. 3- Ability to select of appropriate equipment for the separation of materials in process plant. 4- Provide practice at developing critical thinking skills, solving open ended problems and to work in teams……

9. Teaching and Learning Strategies

Strategy	**Written method implies** the following forms of activity: copying, taking notes, composing theses, writing essays, etc. **Laboratory method** implies the following forms of activity: conducting experiments, showing video materials, etc. **Practical methods** unite all the teaching forms that stimulate developing practical skills in students . **Explanatory method** is based on discussing a given issue. Designing and presenting a project . **Discussion/debates**. This is the most widely spread method of interactive teaching. **Case study** – the teacher discusses concrete cases together with the students and they study the issue thoroughly.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1st semester					
1	3	provide an understanding of the general principles of Drying wet solid	Drying wet solid:–introduction and general principle in drying, rate of drying, the mechanism of moisture movement.	Lectures, Practical Applications	partial test (Oral questions :– multiple choice ,alternative response), Open questions that have a definite answer , or do not have a definite answer
2		Basic principles of drying depend on rate regime (constant and falling regime)	Calculation of rate of drying, moisture transport in solids at constant in continuous dryers.	Lectures, Example Classes, Practical Applications	Exams, Weekly homework, Team and homework problems, Open questions that have a definite answer, or do not have a definite answer, partial test (Oral questions)
3		Demonstrating a broad and integrated knowledge and a deep understanding of issues related to Drying wet solid	Types of dryers and falling rate period , capillary movement , material and energy balances	Demonstrating a broad a deep understanding of is	Weekly homework, Team and homework solve problems, Open questions that have a definite answer, or do not have a definite answer, partial test (Oral questions)
4		Apply course concepts in solving interdisciplinary problems of cooling tower	Mechanism of cooling tower , minimum gas flow rate	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
5		provide an understanding of the general principles of Humidification ,saturation , dew point , wet and adiabatic saturation temperature ,humid heat and volume	Humidification, temperature humidification chart, enthalpy – humidification temperature chart.	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems Analysis of cases linked to the work environment	Exams, Weekly homework, Team and homework solve problems, Open questions that have a definite answer, or do not have a definite answer, partial test (Oral questions)
6		evaluate information and ideas in the handling of transport phenomena issues	Addition of steam to gas stream , Addition of gas to gas stream	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer, partial test (Oral questions)
7		Apple to use concepts in solving interdisciplinary problems of dehumidification tower	Mechanism of dehumidification tower , minimum gas flow rate	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
8		understanding of the transport processes related to Evaporation	Evaporation : introduction , types of evaporators ,forward ,backward and parallel evaporators, heat transfer in evaporation process boiling point rise	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , partial test (Oral questions), Open questions that have a definite answer , or do not have a definite answer

9		Design of single evaporators	Arrangement of evaporators :- single evaporators	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
10		Design of double evaporators	Arrangement of evaporators :- Design of double evaporators , comparison of forward and backward evaporators	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , partial test (Oral questions),Open questions that have a definite answer , or do not have a definite answer
11		Factors influence on the arrangement of evaporators and design	Arrangement of evaporators :- Design of triple evaporators , comparison of forward and backward evaporators	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, partial test (Oral questions), Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
12		Understand the Crystallization fundamentals	Batch and continuous crystallization Crystallizer selection	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer

10. Course Evaluation

Distributing the score out of 100 according to the tasks assigned to the student such as daily preparation, daily oral, monthly, or written exams, reports .... etc

11. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Perry,J.H," chemical engineering handbook ",Mc-Graw –Hill Book com.1975.
Main references (sources)	Colulsson ,J.M and Richardson J.F. "Chemical Engineering , volume 1", 3ed edition ,Robert Maxwell.M.C. Colulsson ,J.M and Richardson J.F. "Chemical Engineering , volume 2", 3ed edition ,Robert Maxwell.M.C. Colulsson ,J.M and Richardson J.F. "Chemical Engineeri volume 6", 3ed edition, Robert Maxwell.M.C
Recommended books and references (scientific journals, reports…)	Binay.K.Dutta "'mass transfer and separation process "2007. Trebal Robert E.,"mass transfer operation"2ed edition, Mc-Graw –Hill Book com.1975.
Electronic References, Websites	

Course Description Form

1. Course Name: Unit Operation III

2. Course Code: CES.E. 432

3. Semester / Year: 2 st Semester

4. Description Preparation Date:2023 /2024

5. Available Attendance Forms: central / full

6. Number of Credit Hours (Total) / Number of Units (Total) 5hr / 3unit

7. Course administrator's name (mention all, if more than one name)

Name: May Ali Alsaffar
Email: may.a.muslim@uotechnology.edu.iq

8. Course Objectives

Course Objectives	1.To provide an understanding of the general principles of separation processes to allow students to make sensible options given a separation (Humidification, Dehumidification and Cooling tower, Evaporation, crystallization, and Wet Solid Drying). 2- A comprehensive understanding of the transport processes related to chemical engineering operations, with focus on both theory and applications. 3- Ability to select of appropriate equipment for the separation of materials in process plant. 4- Provide practice at developing critical thinking skills, solving open ended problems and to work in teams……

9. Teaching and Learning Strategies

Strategy	**Written method implies** the following forms of activity: copying, taking notes, composing theses, writing essays, etc. **Laboratory method** implies the following forms of activity: conducting experiments, showing video materials, etc. **Practical methods** unite all the teaching forms that stimulate developing practical skills in students . **Explanatory method** is based on discussing a given issue. Designing and presenting a project . **Discussion/debates**. This is the most widely spread method of interactive teaching. **Case study** – the teacher discusses concrete cases together with the students and they study the issue thoroughly.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
2st semester					
1		Understand the selection of proper equipment for extraction process and operation process	Extraction (liquid–liquid):–definition ,extraction process, equilateral triangle coordinates system of liquid –one pair partially soluble ,choice solvent	Lectures, Practical Applications	partial test (Oral questions :– multiple choice ,alternative response), Open questions that have a definite answer , or do not have a definite answer
2		Understand the partial soluble system	Equipment of extractor partial soluble system in cross–current extraction single and multistage	Lectures , Example Classes , Practical Applications	Exams , Weekly homework, Team and homework problems , Open questions that have a definite answer , or do not have a definite answer, partial test (Oral questions)
3		Understand the insoluble solvent system	Equipment of extractor insoluble solvent in cross–current extraction single and multistage	Lectures, Tutorials , Example Classes , Practical Applications	Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer, partial test (Oral questions)
4		Design continuous counter–current extraction single and multistage	Equipment of extractor partial soluble system in continuous counter–current extraction single and multistage	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer, partial test (Oral questions)
5		Design continuous counter–current extraction single and multistage	Equipment of extractor insoluble solvent in continuous counter–current extraction single and multistage	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer, partial test (Oral questions)
6		Minimum solvent required	Minimum solvent required	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
7		Understand the operation of plate and frame filter	Plate and frame filter (filtration at constant pressure drop and at constant filtrate) , washing time	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
8		Understand the operation of leaf filter	Leaf filter(filtration at constant pressure drop and at constant filtrate) , washing time	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer

9		Determine the optimum cake thickness and max. throughput	Maximum rate of filtration for Plate and frame filter	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
10		Understand the settling and sedimentation theory.	Basic assumption (Kynch theory)	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer

10. Course Evaluation

Distributing the score out of 100 according to the tasks assigned to the student such as daily preparation, daily oral, monthly, or written exams, reports .... etc

11. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Perry,J.H," chemical engineering handbook ",Mc-Graw –Hill Book com.1975.
Main references (sources)	Colulsson ,J.M and Richardson J.F. "Chemical Engineering , volume 1", 3ed edition ,Robert Maxwell.M.C. Colulsson ,J.M and Richardson J.F. "Chemical Engineering , volume 2", 3ed edition ,Robert Maxwell.M.C. Colulsson ,J.M and Richardson J.F. "Chemical Engineeri volume 6", 3ed edition, Robert Maxwell.M.C
Recommended books and references (scientific journals, reports…)	Binay.K.Dutta "'mass transfer and separation process "2007. Trebal Robert E.,"mass transfer operation"2ed edition, Mc-Graw –Hill Book com.1975.
Electronic References, Websites	

Course Description Form

159.Course Name:
Mathematics III
160. Course Code:
CES.P.221
161.Semester / Year:
1st Semester / 2 nd year
162. Description Preparation Date:
4/10/2023
163. Available Attendance Forms:
Students' attendance is recorded in the classroom and on Excel lists based on t number of lectures and according to the dates in the schedule and is sent weel via email to the Absences Committee.
164. Number of Credit Hours (Total) / Number of Units (Total)
2 theoretical hours/1 tutorial hours during one semester. 45 / 3
165. Course administrator's name (mention all, if more than one name)
Name: Prof. Dr. Zainab Yousif Shnain & Dr. Afraa Hilal Kamel Email: zainab.y.shnain@uotechnology.edu.iq afraa.h.kamel@uotechnology.edu.iq
166. Course Objectives

Course Objectives	1. Able to evaluate double, triple integrals and the area, volume double & Triple Integrals respectively. 2. Understand the concept of Fourier-series representation periodic functions and their applications..... **3-** Develop the technical knowledge and understanding of mathematical techniques and the ability to apply them appropriately in context.
167. Teaching and Learning Strategies	
Strategy	1. **Interactive Lectures: ** Instead of traditional lectures, use interactive lectures that involve students actively in the learning process. Ask questions, encourage discussions, and use multimedia resources to illustrate key concepts.

	2. **Hands-on Activities: ** Use real-world examples and case studies to demonstrate the relevance of mathematical concepts. 3. **Collaborative Learning: ** Encourage collaboration among students through group projects, problem-solving tasks, and peer teaching. Collaborative learning allows students to learn from each other, discuss different approaches, and develop teamwork skills. 4. **Active Practice: ** Provide opportunities for students to practice solving problems independently or in groups. Assign homework, quizzes, and exercises that require applying mathematical methods to real-world scenarios. 5. **Formative Assessment: ** Use formative assessment techniques such as quizzes, pre-tests, and classroom polls to gauge students' understanding and progress throughout the course. Provide timely feedback to address misconceptions and guide further learning. 6. **Conceptual Understanding: ** Emphasize conceptual understanding over rote memorization by focusing on the underlying principles and theories of mathematical. Help students connect mathematical concepts to broader concepts in mathematics and other disciplines. 7. **Real-World Applications: ** Integrate real-world applications of mathematics into the curriculum to demonstrate how mathematical methods are used in various fields such as business, social sciences, healthcare, and engineering. Show examples of mathematical analysis in news articles, research studies, and everyday situations. 8. **Differentiated Instruction: ** Recognize that students have diverse learning styles, backgrounds, and abilities. Differentiate instruction by providing multiple learning pathways, offering additional support for struggling students, and challenging advanced learners with enrichment activities. 9. **Reflection and Metacognition: ** Encourage students to reflect on their learning process and develop metacognitive skills by asking them to explain their problem-solving strategies, articulate their thought processes, and evaluate their understanding.

168. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	Double Integral	Multiple Integrals	Lectures, Tutorials, Example Classes.	Open questions that have a definite answer , or do not have.
2	3	Area and volume by using double integral	Multiple Integrals	Lectures, Tutorials, Example Classes.	Open questions that have a definite answer , or do not have.
3	3	Double Integral in polar coordinates	Multiple Integrals	Lectures, Tutorials, Example Classes.	Open questions that have a definite answer , or do not have.
4	3	Triple Integral in rectangular coordinates, physical application of double and triple integration.	Multiple Integrals	Lectures, Tutorials, Example Classes.	partial test (Oral questions :- multiple choice ,alternative. response).
5	3	The error function, the gamma function	Function and definite Integrals	Lectures, Tutorials, Example Classes.	Open questions that have a definite answer , or do not have.
6	3	The beta function, factorial function.	Function and definite Integrals	Lectures, Tutorials, Example Classes.	Open questions that have a definite answer , or do not have.
7	3	The beta function, factorial function.	Function and definite Integrals	Lectures, Tutorials, Example Classes.	Open questions that have a definite answer , or do not have.
8	3	Sequences, Convergence, Geometric series, nth partial sum,	Infinite Sequences and Series	Lectures, Tutorials, Example Classes.	Open questions that have a definite answer , or do not have.

9	3	Sequences, Convergence, Geometric series, nth partial sum,	Infinite Sequences and Series	Lectures, Tutorials, Example Classes.	Open questions that have a definite answer , or do not have.
10	3	Tests of convergence, alternating series, power and Taylor's series	Infinite Sequences and Series	Lectures, Tutorials, Example Classes.	partial test (Oral questions :- multiple choice ,alternative.
11	3	Tests of convergence, alternating series, power and Taylor's series	Infinite Sequences and Series	Lectures, Tutorials, Example Classes.	partial test (Oral questions :- multiple choice ,alternative.
12	3	Periodic functions, Fourier series	Fourier series	Lectures, Tutorials, Example Classes.	Open questions that have a definite answer , or do not have.
13	3	Periodic functions, Fourier series	Fourier series	Lectures, Tutorials, Example Classes.	Open questions that have a definite answer , or do not have.
14	3	Even and odd functions, Half range expansion.	Fourier series	Lectures, Tutorials, Example Classes.	Open questions that have a definite answer , or do not have.
15	3	Even and odd functions, Half range expansion.	Fourier series	Lectures, Tutorials, Example Classes.	Final Exam

169. Course Evaluation

To conduct a course evaluation and distribute scores out of 100 based on various tasks assigned to students, one can follow a weighted grading system where each task is assigned a specific percentage of the total grade. Here's a suggested breakdown:

1. **Daily Preparation (5%): ** This category assesses students' preparation and participation in daily class activities, discussions, and exercises. Assign points based on attendance, assigned readings completion, class discussion engagement, and group activity participation.

2. **Monthly Written Exams (20%): ** Assess students' understanding of course material through monthly written exams covering key concepts, theories, and problem-solving skills. Design exams to include a mix of multiple-choice questions, short answer questions, and essay questions.

3. **Reports/Assignments (5%): ** Assign written reports or assignments on specific topics related to the course curriculum. Evaluate students' research, analysis, writing, and critical thinking skills. Provide feedback on the quality of content, organization, citation style, and overall presentation.

4. **Final Exam (70%): ** Administer a comprehensive final exam at the end of the course to assess students' mastery of course content. The final exam should cover all topics taught throughout the semester and may include various question types to assess students' knowledge, comprehension, application, and synthesis skills.

Once you have determined the weightings for each task, you can calculate students' total scores out of 100 by summing up the scores they received in each category. For example:

- Daily Preparation: 5 points
- Monthly Written Exams: 20 points
- Reports/Assignments: 5 points
- Final Exam: 70 points

170. Learning and Teaching Resources

Required textbooks (curricular books, if any)	○ Lecturers ○ Text book: Higher Engineering Mathematics by Dr.B.S.Grewal, Khanna Publishers, 40th Edition, 2007.
Main references (sources)	○ Reference book: Advanced Engineering Mathematics by Erwin Kreyszig, 8th edition, 2007.
Recommended books and references (scientific journals, reports...)	○ Lecturers ○ Text book: Higher Engineering Mathematics by Dr.B.S.Grewal, Khanna Publishers, 40th Edition, 2007.
Electronic References, Websites	

Course Description Form

171.Course Name:
Mathematics IV
172. Course Code:
CES.P.222
173.Semester / Year:
2nd Semester / 2nd year
174. Description Preparation Date:
12/2/2024
175. Available Attendance Forms:
Students' attendance is recorded in the classroom and on Excel lists based on t number of lectures and according to the dates in the schedule and is sent weel via email to the Absences Committee.
176. Number of Credit Hours (Total) / Number of Units (Total)
2 theoretical hours/1 tutorial hours during one semester. 45 / 3
177. Course administrator's name (mention all, if more than one name)
Name: Prof. Dr. Zainab Yousif Shnain & Dr. Afraa Hilal Kamel Email: zainab.y.shnain@uotechnology.edu.iq afraa.h.kamel@uotechnology.edu.iq
178. Course Objectives

Course Objectives	1. Understand methods of solving First order and Higher order ordinary Differential equations along with some physical applications. 2. Demonstrate the relevance of the mathematical methods learnt to chemical engineering.

179. Teaching and Learning Strategies

Strategy	1. **Interactive Lectures: ** Instead of traditional lectures, use interactive lectures that involve students actively in the learning process. Ask questions, encourage discussions, and use multimedia resources to illustrate key concepts. 2. **Hands-on Activities: ** Use real-world examples and case studies to demonstrate the relevance of mathematical concepts. 3. **Collaborative Learning: ** Encourage collaboration among students through group projects, problem-solving tasks, and peer teaching. Collaborative learning allows students to learn from each other, discuss different approaches, and develop teamwork skills.

4. **Active Practice: ** Provide opportunities for students to practice solving problems independently or in groups. Assign homework, quizzes, and exercises that require applying mathematical methods to real-world scenarios.

5. **Formative Assessment: ** Use formative assessment techniques such as quizzes, pre-tests, and classroom polls to gauge students' understanding and progress throughout the course. Provide timely feedback to address misconceptions and guide further learning.

6. **Conceptual Understanding: ** Emphasize conceptual understanding over rote memorization by focusing on the underlying principles and theories of mathematical. Help students connect mathematical concepts to broader concepts in mathematics and other disciplines.

7. **Real-World Applications: ** Integrate real-world applications of mathematics into the curriculum to demonstrate how mathematical methods are used in various fields such as business, social sciences, healthcare, and engineering. Show examples of mathematical analysis in news articles, research studies, and everyday situations.

8. **Differentiated Instruction: ** Recognize that students have diverse learning styles, backgrounds, and abilities. Differentiate instruction by providing multiple learning pathways, offering additional support for struggling students, and challenging advanced learners with enrichment activities.

9. **Reflection and Metacognition: ** Encourage students to reflect on their learning process and develop metacognitive skills by asking them to explain their problem-solving strategies, articulate their thought processes, and evaluate their understanding.

180. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	Infinite series by Taylor theorem	Solution by Series	Lectures, Tutorials , Example Classes.	Open questions that have a definite answer , or do not have.
2	3	Infinite series by Taylor theorem	Solution by Series	Lectures, Tutorials , Example Classes.	Open questions that have a definite answer , or do not have.
3	3	Method of Frobenius (Case I, II, IIIa, and IIIb)	Solution by Series	Lectures, Tutorials , Example Classes.	Open questions that have a definite answer , or do not have.
4	3	Method of Frobenius (Case I, II, IIIa, and IIIb)	Solution by Series	Lectures, Tutorials , Example Classes.	Open questions that have a definite answer , or do not have.
5	3	Bessels's and Modified Bessel's Equation	Solution by Series	Lectures, Tutorials , Example Classes.	Open questions that have a definite answer , or do not have.
6	3	Properties of Bessel Functions, Applications in chemical engineering, Tubular Gas Preheater	Solution by Series	Lectures, Tutorials , Example Classes.	partial test (Oral questions :- multiple choice ,alternative.
7	3	Reaction in axisymmetric Spherical and Cylindrical pellets	Solution by Series	Lectures, Tutorials , Example Classes.	Open questions that have a definite answer , or do not have.
8	3	Introduction, Linear equation, Bernoulli's equation, Exact differential equations, Equations reducible to exact equations.‘	Ordinary Differential Equations	Lectures, Tutorials , Example Classes.	Open questions that have a definite answer , or do not have.
9	3	Orthogonal trajectories, Newton's law of cooling. Linear differential equations with constant coefficients: Definition, Theorem,	Ordinary Differential Equations	Lectures, Tutorials , Example Classes.	Open questions that have a definite answer , or do not have.

		Operator D, Rules for finding the complementary function			
10	3	Orthogonal trajectories, Newton's law of cooling. Linear differential equations with constant coefficients: Definition, Theorem, Operator D, Rules for finding the complementary function	Ordinary Differential Equations	Lectures, Tutorials , Example Classes.	Open questions that have a definite answer , or do not have.
11	3	Orthogonal trajectories, Newton's law of cooling. Linear differential equations with constant coefficients: Definition, Theorem, Operator D, Rules for finding the complementary function	Ordinary Differential Equations	Lectures, Tutorials , Example Classes.	Open questions that have a definite answer , or do not have.
12	3	‹Inverse operator, Rules for finding the particular integral, working procedure to solve the equation	Ordinary Differential Equations	Lectures, Tutorials , Example Classes.	partial test (Oral questions :- multiple choice ,alternative.
13	3	‹Inverse operator, Rules for finding the particular integral, working procedure to solve the equation	Ordinary Differential Equations	Lectures, Tutorials , Example Classes.	partial test (Oral questions :- multiple choice ,alternative.
14	3	Representation problems of 1st ordinary differential equations (linear and nonlinear, homogeneous …etc.).	Application of Ordinary Differential Equations	Lectures, Tutorials , Example Classes.	Open questions that have a definite answer , or do not have.
15	3	Representation problems of 2nd ordinary differential equations (linear and nonlinear, homogeneous …etc.)	Application of Ordinary Differential Equations	Lectures, Tutorials , Example Classes.	Final Exam

181. Course Evaluation

To conduct a course evaluation and distribute scores out of 100 based on various tasks assigned to students, one can follow a weighted grading system where each

task is assigned a specific percentage of the total grade. Here's a suggested breakdown:

1. **Daily Preparation (5%): ** This category assesses students' preparation and participation in daily class activities, discussions, and exercises. Assign points based on attendance, assigned readings completion, class discussion engagement, and group activity participation.

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3. **Reports/Assignments (5%): ** Assign written reports or assignments on specific topics related to the course curriculum. Evaluate students' research, analysis, writing, and critical thinking skills. Provide feedback on the quality of content, organization, citation style, and overall presentation.

4. **Final Exam (70%): ** Administer a comprehensive final exam at the end of the course to assess students' mastery of course content. The final exam should cover all topics taught throughout the semester and may include various question types to assess students' knowledge, comprehension, application, and synthesis skills.

Once you have determined the weightings for each task, you can calculate students' total scores out of 100 by summing up the scores they received in each category. For example:

- Daily Preparation: 5 points
- Monthly Written Exams: 20 points
- Reports/Assignments: 5 points
- Final Exam: 70 points

182. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Lecturers ○ Text book: ○ Higher Engineering Mathematics by Dr.B.S.Grewal, Khanna Publishers, 40th Edition, 2007. **Reference book**: 1. Advanced Engineering Mathematics by Erwin Kreyszig, 8th edition, 2007
Main references (sources)	Reference book: ○ Advanced Engineering Mathematics by Erv Kreyszig, 8th edition, 2007. **Text book:** 1. Higher Engineering Mathematics Dr.B.S.Grewal, Khanna Publishers, 40th Edit 2007. **Reference bo**

	1. Advanced Engineering Mathematics by Er Kreyszig, 8th edition, 2007
Recommended books and references (scientific journals, reports...)	Lecturers ○ Text book: ○ Higher Engineering Mathematics by Dr.B.S.Grewal, Khanna Publishers, 40th Edition, 2007.
Electronic References, Websites	