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 II

2. Course Code:

CES.R.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. Khalid Turki Rashid
Email: khalid.T.Rashid@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: Fluid Flow I
14. Course Code: CES.R.233

15.	Semester / Year: 1 / (2023-2024)
16.	Description Preparation Date: 2023 / 2024
17.	Available Attendance Forms: Central / Full
18.	Number of Credit Hours (Total) / Number of Units (Total): 5Hr / 3Unt
19.	Course administrator's name (mention all, if more than one name)
	Name: Salah Salman Ibrahim Email: salah.s.ibrahim@uotechnology.edu.iq
20.	Course Objectives
Course Objectives	• Demonstrate knowledge of incompressible fluid flows, two phase flow, fluid statics, kinematics of flows and essential basic hydrodynamics. • Define and solve problems in fluid dynamics in various engineering applications. Provide the ability to describe energy variation and its application in flow and pressure measurement and frictional energy losses calculations. • Provide the ability to estimate the required energy for fluid pumping (selection the size and type of appropriate pumping for liquid). • Predict necessary fluid parameters of full scale projects by performing simple model experiments • Share ideas and work in a team in an efficient and effective manner under controlled supervision or independently.
21.	Teaching and Learning Strategies
Strategy	• Lectures, notes tutorials and discussion sessions. • Submitting and discussions, the reports in fluid flow. • Improve the work skills in teams. • Team working and presentation skills are developed by carrying out LAB experiments and submitting periodical reports.

22. Course Structure

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

1	3	Ability to characterize and specify of the fluids types issues related to the fluid mechanics.	Introduction, Types of fluids, Physical properties, mass and energy conservation laws, Newton laws of motion. Newton law of viscosity with applications.	Lectures, tutorials, example classes, 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	3				
3	3	Ability to characterize and specify of the units and their fundamental dimensions, dimensional homogeneity of equations.	Dimensional analysis, definition, dimensional homogeneity, dimensional analysis methods,	Lectures, tutorials, example classes, practical applications	partial test (oral questions :- multiple choice, alternative response), Quiz, open questions that have a definite answer, or do not have a definite answer
4	3				
5	3	Ability to characterize and specify the pressure measurement methods and devices used.	Fluid statics, definition, pressure measurement devices with applications	Lectures, tutorials, example classes, practical applications	partial test (oral questions :- multiple choice, alternative response), open questions that have a definite answer, or do not have a definite answer
6	3				
7	3	Ability to estimate the pressure drop and energy losses for fluid (single-phase), flow through piping systems, and specify the major and minor frictions,	Fluid dynamics, Reynolds experiment and flow patterns, derive the Euler equation of motion and Bernoulli's equation.	Lectures, tutorials, example classes, practical applications	partial test (oral questions:- multiple choice, alternative response), Quiz, open questions that have a definite answer, or do not have a definite answer
8	3		Derive the velocity distribution and average velocity in laminar and turbulent flow, Poiseuille's equation, Darcy equation and, types of frictions (major, minor)		
9	3		Modification of Bernoulli's equation with applications.		
10	3	Ability to estimate the pressure drop and energy losses for fluid (two phase) flow through piping systems,	Selection of pump and pipe size, unsteady state and network problems.	Lectures, tutorials, example classes, practical applications	partial test (oral questions :- multiple choice, alternative response), open questions that have a definite answer, or
11	3		Define momentum boundary layer. Two phase flow in horizontal and vertical pipes, flow		

		select the appropriate pump type and pipe size.	regimes and pressure drop calculations with applications		do not have a definite answer
12	3	Ability to specify the pumps types, heads, NPSH, cavitation and how avoid it, characterization pump curves.	Pumping of liquids, types of pumps, heads types, NPSH, cavitation, characterization pump curves with applications	Lectures, tutorials, example classes, practical applications	partial test (oral questions :- multiple choice, alternative response), Quiz, open questions that have a definite answer, or do not have a definite answer
13	3		centrifugal pump relations, pumps connection in series and in parallel with applications		
14	3	Ability to characterize and specify the Non-Newtonian fluids, types, apparent viscosity, energy losses.	Non-Newtonian fluids types, specification, apparent viscosity	Lectures, tutorials, example classes, practical applications	partial test (oral questions :- multiple choice, alternative response), Quiz, open questions that have a definite answer, or do not have a definite answer
15	3		Drive the velocity distribution of power law fluid, pressure drop calculations, with applications.		

23. Course Evaluation

- Written exams (Quizzes, midterms and finals) to assess the understanding of the basic concepts and the ability to solve problems.
- Oral and written LAB exams to assess the skills of analysis and discussion, for submitted reports.
- Class and home work to assess the ability to appropriate solution.
- Seminar discussion of the submitted report.

24. Learning and Teaching Resources

Required textbooks (curricular books, if any)	• Lecturer Notes • Curricular Books 1. Coulson, J.M and Richardson J.F. "Chemical Engineering, volume 1", Fifth edition 2002, Elsevier Science, Linacre House, Jordan Hill, Oxford 2. Coulson, J.M and Richardson J.F. "Chemical Engineering, volume 2", Fifth edition 2002, Elsevier Science, Linacre House, Jordan Hill, Oxford 3. F.A. Holland and R. Bragg "Fluid Flow for Chemical Engineers", 2nd Ed. (1995) Elisevier Ltd. 4. DARBY. R. , M. Dekker "Chemical Engineering Fluid Mechanics", 2nd Ed. (2001) 5. James O. Wilkes "Fluid Mechanics for Chemical Engineers", Prentice Hall PTR, New Jersey, USA, 1999. 6. De Nevers, N. "Fluid Mechanics for Chemical Engineers", (1991) McGraw-Hill, Singapore. 7. Streeter and Wylie "Fluid Mechanics", McGraw-Hill, (1981).
Main references (sources)	1. Coulson, J.M and Richardson J.F. "Chemical Engineering, volume 1", Fifth edition 2002, Elsevier Science, Linacre House, Jordan Hill, Oxford 2. Coulson, J.M and Richardson J.F. "Chemical Engineering, volume 2", Fifth edition 2002, Elsevier Science, Linacre House, Jordan Hill, Oxford 3. F.A. Holland and R. Bragg "Fluid Flow for Chemical Engineers", 2nd Ed. (1995) Elisevier Ltd.
Recommended books and references (scientific journals, reports…)	1. DARBY. R. , M. Dekker "Chemical Engineering Fluid Mechanics", 2nd Ed. (2001) 2. James O. Wilkes "Fluid Mechanics for Chemical Engineers", Prentice Hall PTR, New Jersey, USA, 1999. 3. De Nevers, N. "Fluid Mechanics for Chemical Engineers", (1991) McGraw-Hill, Singapore. 4. Streeter and Wylie "Fluid Mechanics", McGraw-Hill, (1981).
Electronic References, Websites	Many various videos websites submitted consequently during the course

Course Description Form

Course Name: Fuels Technology
25. Course Code: CES.R.237
26. Semester / Year: 1st Semester

The objective of this course: The objective of this course to underst and the types and properties of fuel (solid, liquid and gas), and the properties of crude oil, the physical and chemical properties of fuel and the five or six basic products of crude oil, the purification and the distillation of crude oil to obtain different products and explain in details all the properties of the products.

1. Available Attendance Forms: Real Present Attendance

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

30 T + 30 p / 3

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

Name: luma Hussein Mahmoud
Email: Luma.H.Mahmoud@uotechnology.edu.iq

4. Course Objectives

Course Objectives: at the end of the semes the student should be able to	1- Describe and solve problems on atomic arrangement and geometry of imperfections. 2. Describe and solve problems on mechanical, thermal and electrical properties of materials.

5. Teaching and Learning Strategies

Strategy	Theoretical - Practical

6. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2	To provide an derstanding of the fuel chnology and the importa fuel fractions and the ssification of fuel	**Introduction to F Technology:** Types of fuel and importance	Lecture, Data show	Daily preparat ion
2	2		**Solid Fuel:** Coal classificati composition and ba Coal preparation washing	Lecture, Data show	Reports
3-4	4	A comprehensive understanding of the petroleum product wh they appear in visible form ,such as gasoline ,diesel , kerosene , and	**Different types coal combust techniques** Combustion of c and coke making Coal liquefaction	Lecture, Data show	Question s and answers
5	2	in less visible form ov the entire spectrum of industry such as automobile	**Liquid Fuel:** Theories of petrole formation, Classification as Hydrocarbon	Lecture, Data show	Daily reparati on Quiz

		lubricants , greases, carbon black for truck tires	Resource, Product of Petroleum, Composition of Cr Oils		
6-111	12		**Evaluation of crud** - Crude oil assays - Properties of cr oil and petrole products: - Types of Gasoline it's Import Properties and t such as AS Distillation, R Octane Number, Oxidat Stability, Sulp Content etc, - Various Types Naphtha and th Important Propertie Applications. Important Tests Properties of Keros such as Flash& F Point, Smoke Poi Aniline Point etc., - Types of Diesel & Important Propertie Tests such as P Point, Diesel Ind Cetane Number etc. - Lubricating Production properties, methods Heavy Fractions l Lube Oil, Bitum Asphalt etc. & th Important.	Lecture, Data show	daily reparati on , daily oral
12-13	4		Gas Fuel: History of Gase Fuel Producing of Gas Natural G composition, classification, sweeting:	Lecture, Data show	daily preparat ion
14-15	4	Ability to think that a refinery	LPG:	Lecture, Data show	daily oral

		may produce five or six basic products such as LPG, naphtha, kerosene, diesel, and fuel oils, but specialty manufactures may produce a large number of their products from these basic refinery products	Properties of Ll composition, production, T methods,		

7. Course Evaluation

daily preparation: 10
daily oral:10
Reports:10
Quiz:20
Monthly Exam: 50

8. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Speight, J.G, Handbook of petroleum product analysis, John Willey & Sons,2002.
Main references (sources)	Speight J.G. and Ozum,B; Petroleum Refinery processes, Macel Dekker, New York, 2002.
Recommended books and references (scientific journals, reports…)	Speight J.G., The chemistery and Technology of petroleum, 3rd Edition. Marcel Dekker, New York 1999
Electronic References, Websites	

Exp. No.	Exp. Name.
Exp. No.	**ASTM distillation exp.**
Exp. No.	**Density and specific gravity exp**
Exp. No.	**Viscosity & viscosity index exp.**
Exp. No.	**ash content in crude oil**

Exp. No.	**Carbon content in crud oil**
Exp. No.	**Flash & fire point**

Course Description Form

1. Course Name:
Chemical Engineering Principles III
2. Course Code:
CES.R.232
3. Semester / Year:
2nd Semester / year
4. Description Preparation Date:
05/03/2024
5. 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.
6. Number of Credit Hours (Total) / Number of Units (Total)
45 hours / 2
7. Course administrator's name (mention all, if more than one name)

Name: Dr. Dhiyaa A. Hussein Al-Timimi
Email: dhiyaa.a.hussein@uotechnology.edu.iq

8. Course Objectives

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

9. Teaching and Learning Strategies

Strategy	**1.1 Knowledge and Understanding The terminology associated with energy balances, concepts, and units.** **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.** **1.2 Introduction to energy balances for processes without reaction.** **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.** **1.3 Calculation of enthalpy changes.** **Calculation of enthalpy change without change in phase and enthalpy change with phase change, also explain of sensible heat and latent heat principles.** **1.4 Energy balances: how to account for chemical reaction.** **Explain the meaning of standard heat of formation , heat of reaction, Standard Heat of consumption, Standard Heat of Reaction, Heat of reaction temperature dependence, Heat effects of industrial reactions.** **1.5 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.** **1.6 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.**

10. Course Structure

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

1	3	**1.1 Knowledge and Understanding The terminology associated w energy balances, concept and units.**	**Energy : Terminology , Concept , and units**	**Lectures.**	**Midterm exams , Final exam , Quizz Weekly homewor Team and homework proble , partial test (Oral**
2	3	**1.1 Knowledge and Understanding The terminology associated w energy balances, concept and units.**	**Energy : Terminology , Concept , and units**	**Lectures and solvi examples. Lectures and tutorials. Lectures.**	**questions :- multi choice ,alternative response), Open questions that ha definite answer , do not have a definite answer**
3	3	**1.2 Introduction to energ balances for processes without reaction.**	**Introduction to Energy Balances for Processes without Reaction The concept of the**	**Lectures and solvi examples. Lectures and tutorials.**	
4	3		**conservation of energy ,**	**Lectures**	
5	3	**1.2 Introduction to energ balances for processes without reaction.**	**Introduction to Energy Balances for Processes without Reaction The concept of the conservation of energy**	**Lectures and solvi examples. Lectures and tutorials. Lectures**	
6	3				
7	3	**1.3 Calculation of enthal changes.**	**Application of Energy Balances in the Absence c Chemical Reaction**	**Lectures and solvi examples. Lectures and tutorials. Lectures**	
8	3				
9	3	**2.1 Energy balances: how account for chemical**	**Energy Balances : How to Account for Chemical**	**Lectures and solvi examples.**	
10	3	**reaction.**	**Reaction Energy Balances that Incl**	**Lectures and tutorials.**	
11	3		**the Effects of Chemical Reaction**	**Lectures**	
12	3				
13	3	**2.2 Ideal process, efficier and the mechanical ener**	**Ideal Processes , Efficienc and the Mechanical Energ**	**Lectures and solvi examples.**	
14	3	**balance.**	**Balances**	**Lectures and**	
15	3	**2.3 Heat of solution and mixing**	**Calculation Heat of Soluti and Mixing**	**tutorials. Lectures**	

				Lectures and solvi examples. Lectures and tutorials. Lectures	

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

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

12. 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, Principle Chemical Engineering Processes, Material And Ene Balances,Second Edition,2015.**
Main references (sources)	
Recommended books and references (scientific journals, reports…)	**Skogestad, S. (2008). Chemical and energy proc engineering. CRC press.**
Electronic References, Websites	

Course Description Form

27.	Course Name: Fluid Flow II
28.	Course Code: CES.R.234
29.	Semester / Year: 2 / (2023-2024)
30.	Description Preparation Date: 2023 / 2024
31.	Available Attendance Forms: Central / Full
32.	Number of Credit Hours (Total) / Number of Units (Total): 5Hr / 3Unt
33.	Course administrator's name (mention all, if more than one name)
	Name: Salah Salman Ibrahim Email: salah.s.ibrahim@uotechnology.edu.iq
34.	Course Objectives

Course Objectives	• Define the operation principles of the different types flow measurement, solve problems in fluid flow through flow measurement devices with applications for steady and unsteady flow. • Demonstrate knowledge of compressible fluid flows, with differences of equations using depending on compressible flow conditions, sonic, sub, super, sonic flow, conversion-diversion nozzle, types of gas pumping devices. • Provide the ability to estimate the energy (power) consumption for liquid mixing equipment and to design it by predict necessary fluid parameters of full scale projects by performing simple model experiments. • Provide the ability to estimate the terminal falling velocity and description drag coefficient for flow through packed columns and pressure drop calculation for fixed and fluidized beds and transport of particles... • Predict necessary fluid parameters of full scale projects by performing simple model experiments • Share ideas and work in a team in an efficient and effective manner under controlled supervision or independently.

35. Teaching and Learning Strategies

Strategy	• Lectures, notes tutorials and discussion sessions. • Submitting and discussions, the reports in fluid flow. • Improve the work skills in teams. • Team working and presentation skills are developed by carrying out LAB experiments a submitting periodical reports.

36. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	Ability to characterize and specify the flow rate measurement methods and devices used.	Define the flow measurements methods and devices and their principles	Lectures, tutorials, example classes, practical applications	partial test (oral questions :- multiple choice, alternative response), Quiz, open questions that have a definite answer, or do not have a definite answer
2	3		Derive of local velocity equation of Pitot tube and flow rate in Venturi meter with applications		
3	3	Ability to characterize and specify the flow rate measurement methods and devices used	Derive of flow rate in orifice meter, nozzle, Rotameter with applications.	Lectures, tutorials, example classes, practical applications	partial test (oral questions :- multiple choice, alternative response), open questions that have a definite answer, or do
4	3		Define weirs and weirs types, derive of flow rate in weirs with applications		

					not have a definite answer
5	3	Ability to characterize and specify the compressible fluid flow at various velocities (subsonic, sonic, or supersonic), the energy losses and energy equations	Define the compressible fluids, derive of velocity of propagation of pressure wave, Mach Number and general equation of energy for compressible fluid flow.	Lectures, tutorials, example classes, practical applications	partial test (oral questions :- multiple choice, alternative response), Quiz, open questions that have a definite answer, or do not have a definite answer
6	3		Derive the energy equation for compressible fluid flow at isothermal conditions and equation of maximum flow and equation of critical pressure with applications		
7	3	Applications of the energy losses and energy equations (isothermal, or adiabatic) maximum flow conditions, Laval nozzle,	Derive the energy equation for compressible fluid flow at adiabatic conditions and equation of maximum flow and equation of critical pressure with applications	Lectures, tutorials, example classes, practical applications	partial test (oral questions :- multiple choice, alternative response), open questions that have a definite answer, or do not have a definite answer
8	3		Derive the equation of velocity and flow and area of flow through conversion /diversion (Laval) nozzle with describe the flow at sonic and supersonic velocity through Laval nozzle with applications.		
9	3	Define the types of gas pumping and devices, estimate the work done by the compressor (single and multistage).	Define the gas pumping devices (fans, blowers, compressors), ideal and real gas compression cycle, clearance and swept volume with applications	Lectures, tutorials, example classes, practical applications	partial test (oral questions :- multiple choice, alternative response), Quiz, open questions that have a definite answer, or do not have a definite answer
10	3		Drive the equation of work done for compression in single stage and multi-stages for ideal and real compression cycles with applications		
11	3	Ability to characterize and specify the liquid mixers types, devices, power consumption, power curves.	Define the mixing of liquids and types of mixing equipments, design of standard mixing system with applications	Lectures, tutorials, example classes, practical applications	partial test (oral questions :- multiple choice, alternative response), open questions that have a definite answer, or do not have a definite answer
12	3		Define the forces arise in mixing process and dimensionless numbers and power consumption calculation and power curves with application.		
13	3	Ability to characterize and	Define the packing types and packed columns, derive the		

		specify the backed columns, packing types, pressure drop estimation, fluidization, transport of particles.	terminal falling velocity, drug coefficient with applications	Lectures, tutorials, example classes, practical applications	partial test (oral questions :- multiple choice, alternative response), Quiz, open questions that have a definite answer, or do not have a definite answer
14	3		Darcy law and permeability, pressure drop equations and Ergun equation with applications		
15	3		Define fluidization, types, drive the minimum velocity and porosity for fluidization, pressure drop calculation and transportation of particles with applications.		

37. Course Evaluation

- Written exams (Quizzes, midterms and finals) to assess the understanding of the basic concepts and the ability to solve problems.
- Oral and written LAB exams to assess the skills of analysis and discussion, for submitted reports.
- Class and home work to assess the ability to appropriate solution.
- Seminar discussion of the submitted report.

38. Learning and Teaching Resources

Required textbooks (curricular books, if any)	• Lecturer Notes • Curricular Books 8. Coulson, J.M and Richardson J.F. "Chemical Engineering, volume 1", Fifth edition 2002, Elsevier Science, Linacre House, Jordan Hill, Oxford 9. Coulson, J.M and Richardson J.F. "Chemical Engineering, volume 2", Fifth edition 2002, Elsevier Science, Linacre House, Jordan Hill, Oxford 10. F.A. Holland and R. Bragg "Fluid Flow for Chemical Engineers", 2nd Ed. (1995) Elisevier Ltd. 11. DARBY. R. , M. Dekker "Chemical Engineering Fluid Mechanics", 2nd Ed. (2001) 12. James O. Wilkes "Fluid Mechanics for Chemical Engineers", Prentice Hall PTR, New Jersey, USA, 1999. 13. De Nevers, N. "Fluid Mechanics for Chemical Engineers", (1991) McGraw-Hill, Singapore. 14. Streeter and Wylie "Fluid Mechanics", McGraw-Hill, (1981).
Main references (sources)	4. Coulson, J.M and Richardson J.F. "Chemical Engineering, volume 1", Fifth edition 2002, Elsevier Science, Linacre House, Jordan Hill, Oxford 5. Coulson, J.M and Richardson J.F. "Chemical Engineering, volume 2", Fifth edition 2002, Elsevier Science, Linacre House, Jordan Hill, Oxford 6. F.A. Holland and R. Bragg "Fluid Flow for Chemical Engineers", 2nd Ed. (1995) Elisevier Ltd.

Recommended books and references (scientific journals, reports…)	5. DARBY. R. , M. Dekker “Chemical Engineering Fluid Mechanics”, 2nd Ed. (2001) 6. James O. Wilkes “Fluid Mechanics for Chemical Engineers”, Prentice Hall PTR, New Jersey, USA, 1999. 7. De Nevers, N. “Fluid Mechanics for Chemical Engineers”, (1991) McGraw-Hill, Singapore. 8. Streeter and Wylie “Fluid Mechanics”, McGraw-Hill, (1981).
Electronic References, Websites	Many various videos websites submitted consequently during the course

Course Description Form

1. Course Name:	
Physical Chemistry II	
2. Course Code:	
CES.R.236	
3. Semester / Year:	
2nd Semester / 2nd year	
4. Description Preparation Date:	
18−2−2023	
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)	
30 T / 2	
7. Course administrator's name (mention all, if more than one name)	
Name: luma Hussein Mahmoud Email: Luma.H.Mahmoud@uotechnology.edu.iq	
8. Course Objectives	
Course Objectives: at end of the semester student should be able t	1- . Be able to solve problems related to the macroscopic equilibrium properties of gases and liquid. 2- Understand how the thermodynamics of non simple system is applied to electrochemical cells. 3- . Be able to calculate cell voltages for standard conditions and other conditions using standard reduction potentials and the nerst equation. 4- . Be able to solve problems relating equilibrium constants and Gibbs energy changes to electrochemically measured quantities.
9. Teaching and Learning Strategies	
Strategy	Lectures / Tutorial / Pictures and video clips
10. Course Structure	

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1-5	10	Be able to solve problems related to the macroscopic equilibrium properties of gases and liquid	**Phase Equilibria: Equilibrium** between phases, one component systems, binary systems involving vapor, liquid vapor equilibria of two component system, liquid vapor equilibrium in system not obeying Raoults law, temperature composition diagram (boiling point curves), distillation, azeotropes, solubility of gases in liquids.	Lectures, Data show	Oral questions.
6-10	10	Be able to solve problems related to the macroscopic equilibrium properties of gases and liquid Be able to calculate cell voltages for standard conditions and other conditions using standard reduction potentials and the nerst equation.	**Solutions of electrolytes** : Electrical units, Faradays laws of electrolysis, molar conductivity, weak electrolytes, strong electrolytes, activity and ionic strength, determination of activity coefficient from solubility, the Debye-Hackle theory, acid- base catalysis and their dissociation constant	Lectures and solving examples. ,Data show	Oral questions, Reports
11-15	10	Be able to solve problems relating equilibrium constants and Gibbs energy changes to electrochemically measured quantities	**Electrochemical cells:** Electromotive force (EMF) of a cell, measurements of EMF- the potentiometer, the polarity of electrodes, the cell reactions and	Lectures, Data show	Quiz, Questions and answers.

			reversible cells, free energy and reversible cells, typical of half-cell's classification EMF, standard electrode potentials, standard free energy		

11. Course Evaluation

Attendance: 2.5%
Homework, assignments 2.5%
Mid-term Exam 20%
In-class quizzes: 5 %
Final: 70 %

Total: 100 %

12. Learning and Teaching Resources

Required textbooks (curricular books, if a	J. Laidler, physical chemistry, Bosten; Houghton M, ffl.n company, 19
Main references (sources)	G. Mortimer, physical chemistry , San Francisco; Altarcourt science and technology company, 2000.
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	

Course Description Form

39. Course Name:	
Statistics	
40. Course Code:	
CES.R.225	
41. Semester / Year:	
1 semester/year	
42. Description Preparation Date:	
18−2−2024	
43.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.	
44.Number of Credit Hours (Total) / Number of Units (Total)	
2 theoretical hours/1 tutorial hours during one semester. 45 / 3	
45. Course administrator's name (mention all, if more than one name)	
Name: Mahir A. Abdulrahman Email: Mahir.A.AbdulRahman@uotechnology.edu.iq	
46. Course Objectives	
Course Objectives	1. 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.
47. 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.

48. 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 with groups of data. Student's comprehension of 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 graphs. 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 wit two variables. Student's ability to fin the 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 consta of an equation with three variables. The ability to differentiate between the solving metho 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 probability definition. Student's ability to apply normal 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 discre probability concepts. Distinguish between differe 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-square 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 th means. NOVA test	Lectures and solving examp	Oral questions.
15	3	The use of the ANOVA test and F test.	Tutorial in ANOV test.	Homework.	Quiz.

49. 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%)

50. Learning and Teaching Resources

Required textbooks (curricu books, if any)	Schaum's Outline of Theory and Problems of Statistics (Schaum's Outline Series) Paperback – January 1, 198 by Murray R. Spiegel (Author)
Main references (sources)	Schaum's Outline of Theory and Problems of Statistics (Schaum's Outline Series) Paperback – January 1, 198 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

51. Course Name:
Mass Transfer
52. Course Code:
CES.R. 333
53. Semester / Year:
1 semester/year

54. Description Preparation Date:
15−3−2024
55. Available Attendance Forms:
Students' attendance is recorded in the classroom and on Excel li based on the number of lectures and according to the dates in the schedu and is sent weekly via email to the Absences Committee.
56. Number of Credit Hours (Total) / Number of Units (Total)
2 theoretical hours/1 tutorial hours during one semester. 45 / 3
57. Course administrator's name (mention all, if more than one name)
Name: **Asst.Prof.Dr. Ali Raad Mohammed Jawad** Email: **ali.r.mohammedjawad@uotechnology.edu.iq**
58. 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.

59. 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 ordinary molecu diffusion.	Introduction ,Definition c unit operatic Introduction diffusion, Steady-state ordinary molecules diffusion.	Lectures.	partial test (Oral questions).
2	3	Ability to derive the Fick,s law.	Fick's law of diffusion,	Lectures, Exampl Classes.	In-class problem sessions, Weekly homework proplems.
3	3	Understand the Characterizatior the process for Equimolar coun diffusion.	Equimolar counter diffusion.	Lectures, Tutoria , Example Classe	partial test (Oral questions).
4	3	determine the ti required to drop level in vessel.	Diffusion in conical vess	Lectures, Examp Classes, Practica Applications.	partial test, Open questions that have a definite answer, or do not have a definite answer

5	3	Ability to estim the diffusion coefficients.	Diffusivity i gases and vapours.	Lectures, Examp Classes.	partial test (Oral questions), 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-componen t mass transfer.	Lectures, Examp Classes.	partial test (Oral questions) Exams,.
7	3	Understand the mass transfer models for fluic fluid interface (phase boundary	Methods for mass transfe at fluid-fluic interface (phase boundary).	Lectures, Examp Classes.	In-class problem sessions, Weekly homework proplems.
8	3	Ability to estim the rate of diffusion and diffusivities in liquid phase.	Molecular diffusion in liquid phase Diffusivities liquids, Diffusion of (A) through multi-component stagnant lay mixture.	Lectures, Examp Classes , Practic Applications.	In-class problem sessions, Weekly homework proplems.
9	3	Ability to estimate the rate of diffusion and diffusivities in soild phase.	Molecular diffusion in solid phase.	Lectures, Examp Classes.	partial test (Oral questions), Exams.
1(	3	Ability to derive the rate of convection mass transfer for binary gas mixture.	Convection mass transfe for binary g mixture.	Lectures, Tutoria , Example Classe	partial test (Oral questions :- multiple choice , alternative response), Open questions that have a definite answer.

11	3	Understand and analyze the empirical correlations to determine the mass transfer coefficient.	Methods to determine th mass transfe coefficient.	Lectures, Tutoria	partial test (Oral questions), Exams.
12	3	Understand and analyze the empirical correlations to determine the mass transfer coefficient.	Methods to determine th mass transfe coefficient.	Lectures, Tutoria	partial test (Oral questions), Exams.
13	3	Understand the mass transfer models	Film – Pentration theory	Lectures, Tutoria , Practical Applications.	In-class problem sessions, Weekly homework proplems.
14	3	Understand the mass transfer models (Two film theory)	One film theory (gas-liquid case).	Lectures, Tutoria , Practical Applications.	In-class problem sessions, Weekly homework proplems.
15	3	Pentration theory) (gas-liquid case).	Two – film theory (gas-liquid case).	Lectures, Tutoria , 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

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%)

12- Learning and Teaching Resources

Required textbooks (curricular books 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

60. Course Name:
Heat Transfer I

61. Course Code:
CES.R.337
62. Semester / Year:
Two semester / year
63. Description Preparation Date:
20/3/2024
64.Available Attendance Forms:
65.Number of Credit Hours (Total) / Number of Units (Total)
Theoretical (3hr/week) / 2 Units
66. Course administrator's name (mention all, if more than one name)
Name: Dr.Wallaa A. Noori Email: wallaa.a.noori@uotechnology.edu.iq
67. Course Objectives

Course Objectives	- To introduce and develop an understanding the modes of heat transfer (conduction, convection and radiation). Derive and discuss all types of the equation in these modes of heat transfer. - Analyze heat transfer rate data in different modes.

68. Teaching and Learning Strategies	
Strategy	Lectures, Tutorials, Example Classes, Informal and formal teamwork, Weekly homework problems Team working.

69. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	Ability to characterization and specify the heat transfer issues related to the heat transfer modes.	Modes of Heat Transfer: Conduction, Convection and Radiation.	Lectures, Tutorials, Example Classes, Practical Applications.	Partial test (Oral questions:- multiple choice, alternative response), Open questions that have a definite answer or do

					not have a definite answer and homeworks.
2	3	Ability to characterization and specify the heat transfer issues related to the heat transfer modes.	Steady State Heat Conduction in One Dimension, Plane wall.	Lectures, Tutorials, Example Classes, Practical Applications.	Partial test (Oral questions:- multiple choice, alternative response), Open questions that have a definite answer or do not have a definite answer and homeworks.
3	3	Ability to characterization and specify the heat transfer issues related to the heat transfer modes.	Steady State Heat Conduction in One Dimension, Radial systems.	Lectures, Tutorials, Example Classes, Practical Applications.	Partial test (Oral questions:- multiple choice, alternative response), Open questions that have a definite answer or do not have a definite answer and homeworks.

4	3	Ability to characterization and specify the heat transfer issues related to the heat transfer modes.	Heat source systems.	Lectures, Tutorials, Example Classes, Practical Applications.	Partial test (Oral questions:- multiple choice, alternative response), Open questions that have a definite answer or do not have a definite answer and homeworks .
5	3	Ability to characterization and specify the heat transfer issues related to the heat transfer modes.	Boundary surrounded by fluids.	Lectures, Tutorials, Example Classes, Practical Applications.	Partial test (Oral questions:- multiple choice, alternative response), Open questions that have a definite answer or do not have a definite answer and homeworks.
6	3	Ability to characterization and specify the heat transfer issues related to the heat transfer modes.	Overall heat transfer coefficient.	Lectures, Tutorials, Example Classes, Practical Applications.	Partial test (Oral questions:- multiple choice, alternative response), Open questions that have a definite answer or do

					not have a definite answer and homeworks.
7	3	Ability to characterization and specify the heat transfer issues related to the heat transfer modes.	Extended surface.	Lectures, Tutorials, Example Classes, Practical Applications.	Partial test (Oral questions:- multiple choice, alternative response), Open questions that have a definite answer or do not have a definite answer and homeworks.
8	3	Ability to characterization and specify the heat transfer issues related to the heat transfer modes.	Conduction-convection systems and fins.	Lectures, Tutorials, Example Classes, Practical Applications.	Partial test (Oral questions:- multiple choice, alternative response), Open questions that have a definite answer or do not have a definite answer and homeworks.

9	3	Ability to characterization and specify the heat transfer issues related to the heat transfer modes.	Unsteady State Heat Transfer, Temperature as a function of time	Lectures, Tutorials, Example Classes, Practical Applications.	Partial test (Oral questions:- multiple choice, alternative response), Open questions that have a definite answer or do not have a definite answer and homeworks.
10	3	Ability to characterization and specify the heat transfer issues related to the heat transfer modes.	Lumped capacity system, quenching of small bodies and heating of tank reactor.	Lectures, Tutorials, Example Classes, Practical Applications.	Partial test (Oral questions:- multiple choice, alternative response), Open questions that have a definite answer or do not have a definite answer and homeworks.
11	3	Ability to characterization and specify the heat transfer issues related to the heat transfer modes.	Principles of Convection, Transport equations.	Lectures, Tutorials, Example Classes, Practical Applications.	Partial test (Oral questions:- multiple choice, alternative response), Open questions that have a definite answer or

					do not have a definite answer and homeworks.
12	3	Ability to characterization and specify the heat transfer issues related to the heat transfer modes.	Fluid mechanism aspect of convection.	Lectures, Tutorials, Example Classes, Practical Applications.	Partial test (Oral questions:- multiple choice, alternative response), Open questions that have a definite answer or do not have a definite answer and homeworks.
13	3	Ability to characterization and specify the heat transfer issues related to the heat transfer modes.	Laminar boundary layer, Thermal boundary layer.	Lectures, Tutorials, Example Classes, Practical Applications.	Partial test (Oral questions:- multiple choice, alternative response), Open questions that have a definite answer or do not have a definite answer and homeworks.

14	3	Ability to characterization and specify the heat transfer issues related to the heat transfer modes.	Empirical and practical relations for pipe.	Lectures, Tutorials, Example Classes, Practical Applications.	Partial test (Oral questions:- multiple choice, alternative response), Open questions that have a definite answer or do not have a definite answer and homeworks.
15	3	Ability to characterization and specify the heat transfer issues related to the heat transfer modes.	Tube flow and flow normal to single and tube banks.	Lectures, Tutorials, Example Classes, Practical Applications.	Partial test (Oral questions:- multiple choice, alternative response), Open questions that have a definite answer or do not have a definite answer and homeworks.

70. Course Evaluation

This course is an introduction to the principal concepts and methods of heat transfer. The objectives of this integrated subject are to develop the fundamental principles and laws of heat transfer (conduction, convection and radiation), and to explore the implications of these principles for system behaviour; to formulate the models necessary to study, analyze and design heat transfer systems through the application of these principles; to develop the problem-solving skills essential to good engineering practice of heat transfer in real-world applications.

71. Learning and Teaching Resources

Required textbooks (curricular books, if any)	

Main references (sources)	- J.P.Holman , "Heat Transfer", Nint edition.
Recommended books and references (scientific journals, reports…)	- Frank P. Incropera & David P. Dewitt, "Fundamentals of Heat an Mass Transfer", Fifth Edition. - Colulsson ,J.M and Richardson J.F. "Chemical Engineering , volume 1 Third edition ,Robert Maxwell. M.
Electronic References, Websites	Google classroom

Course Description Form

72. Course Name:
Combustion
73. Course Code:
CES.R.339
74. Semester / Year:

1st. Semester /2023-2024
75. Description Preparation Date:
Sep-2023
76. Available Attendance Forms:
Full time
77. Number of Credit Hours (Total) / Number of Units (Total):
2 hrs.-week/30 hrs.-Semester
78. Course administrator's name (mention all, if more than one name)
Name: Asst. Prof. Dr. Firas K. AL-Zuhairi Email: 150009@uotechnology.edu.iq
79. Course Objectives

Course Objectives	• Study the nature of combustion ,scope of internal combustion engine • Types of flame ,study the effect of temp and pressure • study the types of solid fuels and the drying of solid fuels • Study the types of furnaces and furnaces efficiency
80. Teaching and Learning Strategies	
Strategy	Theoretical lectures, discussion and dialogue, brainstorming, and examples are used to achieve the goals.

81. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2	Understanding the general information, concepts, and importance of combustion nature.	Scope and history of combustion: The nature of combustion, Historical perspective of fuels.	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
2	2	Understanding the general information, concepts, and and importance of combustion nature and combustion engines	Historical perspective of combustion technology (lighting /steam boilers/ internal – combustion engines/compression ignition engines/gas turbines/rocket engines).	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
3	2	Apply course concepts in solving interdisciplinary problems of Combustion of Gaseous and Vapourized Fuels in Furnaces	Combustion of gaseous and vapourized fuels : Furnaces and tubular furnace	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
4	2	An ability to apply effective solutions, both independently	Chemical Engineering Principle II and furnace	Theoretical lectures,	

		and cooperatively, for problems in Chemical Engineering Principle and furnace efficiency	efficiency (Furnace efficiency and heat loss calculations).	discussion and examples	Discussions during the lectures and daily exams
		Student teams are asked to help solve sample problems in class.	Burners types, radiation and convection rooms in furnace, furnace wall layers and refractories		
5	2	Illustrate and analyze information and ideas in burners types and heat transfer in furnace and ,chimney height calculation.	,chimney height calculation, tube layers in furnaces.	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
6	2	Understanding the general information, concepts, and and importance of first law combustion calculations and tyes of flames and effected parameter.	Flames: First law combustion calculations (adiabatic flame temperature), Laminar premixed flames: (effect of stoichiometry on laminar burning velocity /effect of reactant pressure and temperature on laminar burning velocity/stabilization of a premixed flame),	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
7	2	Apply course concepts in solving interdisciplinary problems, solve the problems through logic and improve their ability to work effectively in a group of peers	Laminar flame theory(laminar burning velocity theory /simplified laminar flame model).	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
8	2	An ability to apply effective solutions, both independently and cooperatively, for problems in Diffusion flames, combustion zones and temperature profiles.	Diffusion flames, combustion zones and temperature profiles.	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
		An ability to apply effective solutions,			

9	2	both independently and cooperatively, for problems in flammability limits, flame stability, flame and combustion speed.	Flammability limits, flame stability, flame and combustion speed.	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
10	2	Understanding the general information, concepts, and importance Combustion of Liquid Fuels	Combustion of Liquid Fuels: 1- Spray Formation And Droplet Behavior Spray formation, size distributions, fuel injectors, spray dynamics (diesel	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
11	2	An ability to apply effective solutions, both independently and cooperatively, for problems in vaporization of single liquid droplets	spray dynamics, single –droplet dynamics), vaporization of single droplets.	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
12	2	An ability to apply effective solutions, both independently and cooperatively, for oil –fired furnaces combustion and combustor design	2-Oil –Fired Furnaces Combustion Gas turbine sprays combustion, Gas turbine operating parameters, combustor design, combustion rate, Liner heat transfer.	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
13	2	An ability to apply effective solutions, both independently and cooperatively, for Direct –Injection Engine Combustion.	3-Direct –Injection Engine Combustion introduction to diesel engine combustion, fuel injection, combustion rates	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
14	2	An ability to apply effective solutions, both independently and cooperatively, for combustion of solid fuels:	Combustion of solid fuels: Solid fuel combustion mechanisms	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
15	2	An ability to apply effective solutions, both independently and cooperatively, for	Solid fuel, drying of solid fuels, devolatilization of solid fuels.	Theoretical lectures,	Discussions during the

		combustion mechanisms.		discussion and examples	lectures and daily exams

82. Course Evaluation	
Oral questions and discussions during the lectures, daily exams, quarterly exams, documented examinations, and, final exams.	
83. Learning and Teaching Resources	
Required textbooks (curricular books, if any)	Gary L.borman,(Combustion Engineering),1998 by Mc Grawhill
Main references (sources)	Gary L.borman,Combustion(Engineering),1998 by Mc Grawhill
Recommended books and references (scientific journals, reports...)	Stephen R.turns,(An introduction to Combustion), 2000 by Mc Grawhill. F .ElMahallawy and S.ElD in Habik ,"(Fundamentals and Technology of Combustion)",2002 by Elsevier
Electronic References, Websites	……..

Course Description Form

84. Course Name: Applied Mathematics in Chemical Engineering
85. Course Code: CES.R.322
86. Semester / Year: 2nd Semester/ third year
87. Description Preparation Date: 2023−2024
88.Available Attendance Forms: Real Present Attendance
89.Number of Credit Hours (Total) / Number of Units (Total)

Theoretical	Practical	Tutorial	Total	Units
2	-	1	3	2

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

Name: **Asst.Prof.Dr. Ali Raad Mohammed Jawad**
Email: **ali.r.mohammedjawad@uotechnology.edu.iq**

91. Course Objectives

Course Objectives: at the end of the semester the student should be able to Apply different analytical methods to solve chemical engineering problems.	• ….. • ….. • …..

92. Teaching and Learning Strategies

Strategy	This course introduces students to: Solve ordinary differential equations: apply Laplace transform to solve various systems of ordinary differential equations: Solve different types of partial differential equations. At the end of the course students should be able to apply these methods to tackle all kinds of problems that appear in chemical engineering.

93. Course Structure

Week	Hour	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1-2	6	Learning the student how to apply several types of mathematical equations upon an industrial	**Review: (Ordinary Differential Equations):** L1: First Order Ordinary Differenti Equations. L2: Second Order Ordinary Differential Equations. L3: Higher Order Ordinary Differential Equations.	Blackboard	1. Homeworks 2. Quizzes' 3. Examinations
3-5	8		**Partial Differential Equations:** L1: Method of Direct Integration. L2: Separation of Variables (Forier Transforms).	Blackboard	Homeworks 2. Quizzes' 3. Examinations

6-8	8	problems in the field of chemical engineering , then find a practical models related to the industrial processes	L3: Combination of Variables (Variation of Parameters). L4: Laplace Transforms. **Laplace Transforms** L1: Definitions (Laplace Transforms of Some Elementary Functions, Rules of Laplace Transforms). L2: The First Shifting Theorem, Multiplicity by X or X^n. L3: The Inverse of Laplace Transforms (Completing the Square in the Denominator, By Partial Fractions, By Convolution Integral, By Conversion Integral) L4: Laplace Transform of Derivatives L5: Solution of Ordinary Differential Equations (Ordinary Differential Equations with Constant Coefficient, Ordinary Differential Equations with Variable Coefficient). L6: Partial Differential Equations. L7: The Unit Step Function, The Ur Impulse Function. L8: The Second Shifting Theorem	Blackboard	Homeworks 2. Quizzes' 3. Examinations
9-12	8		**Formulation of Chemical Engineering Problems (Modeling):** L1: Storage Tanks. L2: Mixing Tanks. L3: Chemical Reaction Vessels. L4 Heat Transfer Problems. L5: Mass Transfer Problems. L6: Momentum Transfer Problem L7: Process Control System. L8: Another Problem.	Blackboard	Homeworks 2. Quizzes' 3. Examinations

94. 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

95. Learning and Teaching Resources

Required textbooks (curricular books any)		1- "Mathematical Methods in Chemical Engineering", Jenson. and Jeffereys, G.V, 2nd Edition, Academic Press New York, 1977 2- "Applied Mathematics and Modeling for Chemical Engineer Rice R G. and. Do D. D., John Wiley and Sons, New York, 1995. 3- "Applied Mathematical Methods for Chemical Engineers",L Norman W., 2 edition, CRC Press Boca Raton, 2007.
Main references (sources)	1- "Mathematical Methods in Chemical Engineering", Jenson. V.J. and Jeffereys, G.V, 2nd Edition, Academic Press New York, 1977. 2- "Applied Mathematics and Modeling for Chemical Engineers", Rice R G. and. Do D. D., John Wiley and Sons, New York, 1995.	
Recommended books and references (scientific journals, reports…)		
Electronic References, Websites		

Course Description Form

96. Course Name:

Unit Operation 1

97. Course Code:

CES.R. 334

98. Semester / Year:

1 semester/year

99. Description Preparation Date:

15−3−2024

100. 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.

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

3 theoretical hours/1 tutorial hours during one semester.

60 / 4

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

Name: Prof. Dr. Talib M. Albayati
Email: talib.m.naieff@uotechnology.edu.iq

103. 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.

104. 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 that have a definite answer, or do no have a definite answer)
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 (Graphical method).	Lectures, Tutorials , Example Classes.	partial test (Oral questions), Design problems
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

105. Course Name:
Heat Transfer II
106. Course Code:
CES.R.338
107. Semester / Year:
Two semester / year
108. Description Preparation Date:
20/3/2024
109. Available Attendance Forms:
110. Number of Credit Hours (Total) / Number of Units (Total)
Theoretical (3hr/week) / 2 Units Practical (3hr/week)
111. Course administrator's name (mention all, if more than one name)
Name: Dr.Wallaa A. Noori Email: wallaa.a.noori@uotechnology.edu.iq
112. Course Objectives

Course Objectives	- Characterization of the design procedure for different heat transfer equipment as a heat exchanger. - Provide practice at developing critical thinking skills, solving open-ended problems and to work in teams.

113. Teaching and Learning Strategies	
Strategy	Lectures, Tutorials, Example Classes, Informal and formal teamwork, Weekly homework problems, Analysis of cases linked to the work environment, Practical Applications.

114. Course Structure

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

1	3	Ability to characterization and specify the heat transfer issues related to the heat transfer modes.	Heat Exchangers, Various types and their general characteristics, fouling factor.	Lectures, Tutorials, Example Classes, Practical Applications.	Partial test (Oral questions:- multiple choice, alternative response), Open questions that have a definite answer or do not have a definite answer and homeworks.
2	3	Ability to characterization and specify the heat transfer issues related to the heat transfer modes.	Heat exchangers mean temperature difference.	Lectures, Tutorials, Example Classes, Practical Applications.	Partial test (Oral questions:- multiple choice, alternative response), Open questions that have a definite answer or do not have a definite answer and homeworks.
3	3	Ability to characterization and specify the heat transfer issues related to the heat transfer modes.	Co-current and counter-current flow, solving problems.	Lectures, Tutorials, Example Classes, Practical Applications.	Partial test (Oral questions:- multiple choice, alternative response), Open questions that have a definite answer or do not have a definite

					answer and homeworks.
4	3	Ability to characterization and specify the heat transfer issues related to the heat transfer modes.	Shell and Tube Exchangers, Types and various specifications.	Lectures, Tutorials, Example Classes, Practical Applications.	Partial test (Oral questions:- multiple choice, alternative response), Open questions that have a definite answer or do not have a definite answer and homeworks .
5	3	Ability to characterization and specify the heat transfer issues related to the heat transfer modes.	Effectiveness (NTU) methods.	Lectures, Tutorials, Example Classes, Practical Applications.	Partial test (Oral questions:- multiple choice, alternative response), Open questions that have a definite answer or do not have a definite answer and homeworks.

6	3	Ability to characterization and specify the heat transfer issues related to the heat transfer modes.	Design calculation for heat exchanger.	Lectures, Tutorials, Example Classes, Practical Applications.	Partial test (Oral questions:- multiple choice, alternative response), Open questions that have a definite answer or do not have a definite answer and homeworks.
7	3	Ability to characterization and specify the heat transfer issues related to the heat transfer modes.	Heat Transfer, Condensation of single vapors, Design calculations for condenser.	Lectures, Tutorials, Example Classes, Practical Applications.	Partial test (Oral questions:- multiple choice, alternative response), Open questions that have a definite answer or do not have a definite answer and homeworks.
8	3	Ability to characterization and specify the heat transfer issues related to the heat transfer modes.	Pool and flow boiling.	Lectures, Tutorials, Example Classes, Practical Applications.	Partial test (Oral questions:- multiple choice, alternative response), Open questions that have a definite answer or do not have a definite

					answer and homeworks.
9	3	Ability to characterization and specify the heat transfer issues related to the heat transfer modes.	Radiation, Radiation properties.	Lectures, Tutorials, Example Classes, Practical Applications.	Partial test (Oral questions:- multiple choice, alternative response), Open questions that have a definite answer or do not have a definite answer and homeworks.
10	3	Ability to characterization and specify the heat transfer issues related to the heat transfer modes.	Shape factor, heat exchange for non-black bodies.	Lectures, Tutorials, Example Classes, Practical Applications.	Partial test (Oral questions:- multiple choice, alternative response), Open questions that have a definite answer or do not have a definite answer and homeworks.

11	3	Ability to characterization and specify the heat transfer issues related to the heat transfer modes.	parallel planes, shields.	Lectures, Tutorials, Example Classes, Practical Applications.	Partial test (Oral questions:- multiple choice, alternative response), Open questions that have a definite answer or do not have a definite answer and homeworks.
12	3	Ability to characterization and specify the heat transfer issues related to the heat transfer modes.	Gas tradition.	Lectures, Tutorials, Example Classes, Practical Applications.	Partial test (Oral questions:- multiple choice, alternative response), Open questions that have a definite answer or do not have a definite answer and homeworks.
13	3	Ability to characterization and specify the heat transfer issues related to the heat transfer modes.	Furnace design.	Lectures, Tutorials, Example Classes, Practical Applications.	Partial test (Oral questions:- multiple choice, alternative response), Open questions that have a definite answer or do

					not have a definite answer and homeworks.
14	3	Ability to characterization and specify the heat transfer issues related to the heat transfer modes.	Renewable Energy.	Lectures, Tutorials, Example Classes, Practical Applications.	Partial test (Oral questions:- multiple choice, alternative response), Open questions that have a definite answer or do not have a definite answer and homeworks.
15	3	Ability to characterization and specify the heat transfer issues related to the heat transfer modes.	Types of renewable energy.	Lectures, Tutorials, Example Classes, Practical Applications.	Partial test (Oral questions:- multiple choice, alternative response), Open questions that have a definite answer or do not have a definite answer and homeworks.
115. Course Evaluation					

This course is an introduction to the principal concepts and methods of heat transfer. The objectives of this integrated subject are to develop the fundamental principles and laws of heat transfer (conduction, convection and radiation), and to explore the implications of these principles for system behaviour; to formulate the models necessary to study, analyze and design heat transfer systems through the application of these principles; to develop the problem-solving skills essential to good engineering practice of heat transfer in real-world applications.

116. Learning and Teaching Resources	
Required textbooks (curricular books, if a	
Main references (sources)	- J.P.Holman , "Heat Transfer", Ninth edition.
Recommended books and references (scientific journals, reports…)	- Frank P. Incropera & David P. Dewitt, "Fundamentals of Heat and Mass Transfer", Fifth Editio - Colulsson ,J.M and Richardson J. "Chemical Engineering , volume 1", Third edition ,Robert Maxwe M.C.
Electronic References, Websites	Google classroom

Course Description Form

117. Course Name:
Equipment Design Using CAD
118. Course Code:
CES.R.3312
119. Semester / Year:
2nd Semester / year
120. Description Preparation Date:
05/03/2024
121. 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
122. Number of Credit Hours (Total) / Number of Units (Total)
5 hours / 3 75 hours for semester
123. Course administrator's name (mention all, if more than one name)
Name: Dr. Dhiyaa A. Hussein Al-Timimi Email: dhiyaa.a.hussein@uotechnology.edu.iq

124. 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.

125. 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.

126. 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 +	Pressure vessels design + computer aided	Lectures, Tutorials ,	Exams , Weekl homework, Tea and homework

		the knowledge of HYSYS functions	design Laboratory	Example Classes ,	solve problems Open questions that have a definite answer or do not have a 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 a definite answer
5	5	Ability to design liquid -liquid seperator and prepare dara sheet + +practice design for compressor and separator with HYSYS	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 or do not have a 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 a 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 a definite answer
8	5	Calculate Overall heat transfer	Heat transfer practice +	Lectures, , Example	Exams , Weekl homework, Tea

		coefficient.and area required for heat exchanger design + practice desigm for reactor	computer aided design Laboratory	Classes , Practical Applications	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

127. 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 %)

128. 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

129.	Course Name:
	Petroleum and Gas Field Processing
130.	Course Code:
	CES.R.3313
131.	Semester / Year:
	2nd. Semester /2023-2024
132.	Description Preparation Date:
	Jan-2024
133.	Available Attendance Forms:
	Full time
134.	Number of Credit Hours (Total) / Number of Units (Total):
	2 hrs.-week/30 hrs.-Semester
135.	Course administrator's name (mention all, if more than one name)
	Name: Asst. Prof. Dr. Firas K. AL-Zuhairi Email: 150009@uotechnology.edu.iq
136.	Course Objectives
Course Objectives	• To provide an understanding of the general principles and importance of petroleum and gas field processing in the petroleum industry. • A comprehensive understanding the fundamentals of the Petroleum and Gas Field Processing mechanisms at the basis of the processes. • Provide criteria affect the processing options and the processing equipment required in a petroleum and gas field processing at developing critical thinking skills, solving open-ended problems and to work in teams.
137.	Teaching and Learning Strategies
Strategy	Theoretical lectures, discussion and dialogue, brainstorming, and examples are used to achieve the goals.
138. Course Structure	

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2	Understanding the general information, concepts, and and importance of Petroleum and Gas Field Processing in the petroleum industry.	Formation and Accumulation of Oil and Gas. Types of Petroleum Reservoir,	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
2	2	Understanding the general information, concepts, and and importance of Petroleum and Gas Field Processing in the petroleum industry.	Two-Phase Gas-Oil Separation : Introduction. The Separation Problem.	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
3	2	Gain and/or improve their ability to synthesize, integrate and utilize process information in the phase's separation and treatment of gas and petroleum.	Theory of Gas-Oil Separation. Methods of Separation.	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
4	2	Apply course concepts in solving interdisciplinary problems of phases separation and treatment of gas and petroleum.	Gas-Oil Separation Equipments	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
5	2	An ability to apply effective solutions, both independently and cooperatively, for problems in phase's separation and treatment of gas and petroleum.	Three-Phase Oil-Water-Gas: Introduction, Separation Theory. Separator Types.	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams

6	2	Student teams are asked to help solve sample problems in class. Illustrate and analyze information and ideas in the phase's separation and treatment of gas and petroleum	Separator Sizing Equation and Rules.	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
7	2	Understanding the general information, concepts, and and importance of Petroleum and Gas Field Processing in the petroleum industry. Apply course concepts in solving interdisciplinary problems, solve the problems through logic and improve their ability to work effectively in a group of peers	Treatment of Crude Oil : Emulsion Treatment and Dehydration of Crude Oil	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
8	2	An ability to apply effective solutions, both independently and cooperatively, for problems in phase's separation and treatment of gas and petroleum.	Desalting of Crude Oil	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
9	2	An ability to apply effective solutions, both independently and cooperatively, for problems in phase's separation and treatment of gas and petroleum.	Crude Oil Stabilization and Sweetening	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams

10	2	Understanding the general information, concepts, and and importance of Gas Field Processing in the petroleum industry.	Field Processing and Treatment of Natural Gas : Overview of Gas Field Processing	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
11	2	An ability to apply effective solutions, both independently and cooperatively, for problems in treatment of gas.	Sour Gas Treating	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
12	2	An ability to apply effective solutions, both independently and cooperatively, for problems in treatment of gas.	Gas Dehydration	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
13	2	An ability to apply effective solutions, both independently and cooperatively, for problems in treatment of gas.	Gas Dehydration and Recovery	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
14	2	An ability to apply effective solutions, both independently and cooperatively, for problems in treatment of gas.	Gas Separation Fractionation of Natural Gas Liquids	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
15	2	An ability to apply effective solutions, both independently and cooperatively, for problems in treatment of gas.	Fractionation of Natural Gas Liquids	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams

139. Course Evaluation
Oral questions and discussions during the lectures, daily exams, quarterly exams, documented examinations, and, final exams.
140. Learning and Teaching Resources
Required textbooks (curricular books, if any)

	H. K. Abdel- Aal, Mohamed eggour, M. M Fahim "Petroleum and Gas Field Processing, (2016).
Main references (sources)	H. K. Abdel- Aal, Mohamed eggour, M. M Fahim "Petroleum and Gas Field Processing, (2003).
Recommended books and references (scientific journals, reports...)	Francis S. Manning-Oilfield Processing of Petroleum, Vol. 1_ Natural Gas, (1991). Francis S. Manning, Richard E. Thompson-Oilfield Processing, Vol. 2_ Crude Oil, (1995).
Electronic References, Websites	https://www.linkedin.com/pulse/top-oil-gas-websites-jaya-priya

Course Description Form

1. Course Name: Unit Operation II

2. Course Code: CES.R. 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: Ali Raad Mohammed Jawad
Email: ali.r.mohammedjawad@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:
Process Dynamics

2. Course Code:

CES.R. 433

3. Semester / Year:

1st Semester / Fourth year

4. Description Preparation Date:

8−10−2023

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: Zaidoon Mohsin Shakor
Email: zaidoon.m.shakor@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,	**Laplace transforms**	Lectures and solving examples.	Quiz.

		ramp and periodic functions), Convolution theorem.			
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 %

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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, 3nd 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

1. Course Name:
Petroleum Refinery Eng. II
2. Course Code:
CES. R.435
3. Semester / Year:
1st. Semester /2023-2024
4. Description Preparation Date:
April-2024
5. Available Attendance Forms:
Full time

6. Number of Credit Hours (Total) / Number of Units (Total):					
3 hrs.-week/45 hrs.-Semester					
7. Course administrator's name (mention all, if more than one name)					
Name: Prof. Dr. Talib M. Albayati Email: talib.m.naieff@uotechnology.edu.iq					
8. Course Objectives					
Course Objectives	**1- To provide an understanding of the general principles and importance of conversion processes in the refining industry,** **2- A comprehensive understanding the fundamentals of the chemical mechanisms at the basis of the processes. These disciplines are thermodynamics, chemical kinetics, reactor calculation and industrial catalysts.** **3- Provide criteria affect the processing options and the processing equipment required in a modern refinery.**				
9. Teaching and Learning Strategies					
Strategy	Theoretical lectures, discussion and dialogue, brainstorming, and examples are used to achieve the goals.				
10. Course Structure					
Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learning method**	**Evaluation method**

1	3	Understanding the general information, concepts, and importance of Petroleum Refinery Processing in the petroleum industry.	Fundamentals of Petroleum Refining	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
2	3	Understanding the general information, concepts, and importance of Petroleum Refinery Processing in the petroleum industry.	Physical Separation Processes	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
3	3	A comprehensive understanding the fundamentals of the chemical conversion process.	Chemical Catalytic Conversion Processes	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
4	3	Apply course concepts in solving interdisciplinary problems of thermal Conversion Processes. .	Thermal Chemical Conversion Processes	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
5	3	An ability to apply effective solutions, both independently and cooperatively, for problems in petroleum refinery processes	Refining Processes	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
6	3	Student teams are asked to help solve sample problems in Catalytic Reforming Unit.	Catalytic Reforming	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
7	3	Understanding the general information, concepts, and importance of Petroleum Refinery Processing industry.	Isomerization Process in petroleum refinery	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
8	3	Apply course concepts in solving interdisciplinary problems, solve the problems through logic and improve their ability to work effectively in a group of peers	Thermal Cracking and Coking		

9	3	An ability to apply effective solutions, both independently and cooperatively, for problems in phase's separation and treatment of gas and petroleum.	Visbreaking	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
10	3	An ability to apply effective solutions, both independently and cooperatively, for problems in phase's separation and treatment of gas and petroleum.	Delayed Coking	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
11	3	Understanding the general information, concepts, and importance of Fluid Coking Processing in the petroleum industry.	Fluid Coking	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
12	3	An ability to apply effective solutions, both independently and cooperatively, for problems in Flexi coking.	Flexi coking	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
13	3	An ability to apply effective solutions, both independently and cooperatively, for problems in Alkylation process.	Alkylation	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
14	3	An ability to apply effective solutions, both independently and cooperatively, for problems in Solid Catalyst Alkylation.	Solid Catalyst Alkylation	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
15	3	An ability to apply effective solutions, both independently and cooperatively, for problems in hydroconversion process	Hydroconversion	Theoretical lectures, discussion and examples	Discussions during the lectures and daily exams
11. Course Evaluation					
Oral questions and discussions during the lectures, daily exams, quarterly exams, documented examinations, and, final exams.					
12. Learning and Teaching Resources					

Required textbooks (curricular books, if any)	W.L..Nelson " Petroleum Refining Engineering " 4th Edition. McGraw Hill, New
Main references (sources)	York, 1985Mohamed A. Fahim, Taher A. Al-Sahhaf, Amal Elkilani-Fundamentals of Petroleum Refining-Elsevier Science (2009)
Recommended books and references (scientific journals, reports...)	Pierre Leprince-PETROLEUM REFINING V.3_ Conversion Processes (Publication IFP)-Editions Technip (2000)
Electronic References, Websites	http://eprints.abuad.edu.ng/555/1/Handbook_of_ Petroleum_Refining-1.pdf

Course Description Form

141. Course Name:
Heterogeneous Reactor and Catalyst
142. Course Code:
CES.R. 437

143. Semester / Year:
First semester/2023-2024
144. Description Preparation Date:
Sep-2023
145. Available Attendance Forms:
Full Time
146. Number of Credit Hours (Total) / Number of Units (Total):
3 hrs.-week / 3 Units
147. Course administrator's name (mention all, if more than one name):
Name: Asst. Prof. Dr. Firas K. AL-Zuhairi Email: 150009@uotechnology.edu.iq

148. 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.

149. 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.

150. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3 per week = (2	Definition of catalysts	Introduction of catalyst.	Encourage students through lectures on	Classroom Discussions

	Theoretical + 1 Tutorial)			the development of their capabilities in data analysis in order to establish the problem and describe the solution.	
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 the catalytic reactions.	Reactions on solid 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
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	Classroom Discussions

				describe the solution.	
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 + 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
12	3 per week = (2 Theoretical	Mathematical models for the design of catalyst in the catalytic	Mathematical models for the catalyst.	Encourage students through lectures on the development of their capabilities in	Classroom Discussions Quizzes

	+ 1 Tutorial)	reactors (parallel-pore model).		data analysis in order to establish the problem and describe the solution.	
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

151. Course Evaluation

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

152. 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

153. Course Name:
Environmental Pollution. & Safety in Petroleum Refineries
154. Course Code:
CES.R. 438
155. Semester / Year:
1st Semester / year
156. Description Preparation Date:
01/04/2024
157. 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
158. Number of Credit Hours (Total) / Number of Units (Total)
3 hours / 2

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

Name: Dr. Dhiyaa A. Hussein Al-Timimi
Email: dhiyaa.a.hussein@uotechnology.edu.iq

160. Course Objectives

Course Objectives	**1-** Understand the concept of the environment and environmental pollution and global problems resulting from environmental pollution. **2**- Provide solutions to environmental problems. **3**- Concerned with local and worldwide environmental issues. **4**- Design devices that are used in the control of air pollution. **5**- Environmental engineers conduct hazardous-waste management studies in which they evaluate the significance of the hazard, offer analysis on treatment and containment.

161. Teaching and Learning Strategies

Strategy	1. The student shall have the general information about the air pollution such as the concept of air pollution, the type of air pollutants, the sources and effect of air pollutants, and select the most appropriate technique to purify and/or control the emission of pollutants. 2. the students shall have a comprehensive knowledge about the Earth's atmosphere and its composition, the effect of air pollutants on the environment and the global environmental issue resulting from air pollution. 3. Be able to understand of the transportation and dispersion of air pollutants. 4. Be able to classify the air pollutants and select the most appropriate technique to purify and/or control the emission of pollutants. 5. be able to design the equipment used to control the particulate air pollutants. 6. Be able to design processes and equipment to control the gaseous pollutants.

162. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	Introduction, definition: Environment, environmental Engineering,	Introduction	Lectures, Tutorials , Example Classes	Exams , Weekl homework, Tea and homework solve problems

		environmental pollution, Pollutants, Kind of Pollutants, Source of pollutants Air pollution: definition, classification of air pollutants, source of air pollution, Pollutants and their effects, Particulate matter, Air born particulate.			Open questions that have a definite answer or do not have a definite answer
2	3	The atmosphere and its structure, layers, and composition. Greenhouse gases and greenhouse effect.	The Impact of Production Operations	Lectures, Tutorials , Example Classes	Exams , Weekl homework, Tea and homework solve problems Open questions that have a definite answer or do not have a definite answer
3	3	Regional and Global Issue: Global warming; Ozone layer depletion, Acid rain; The world action for the problem. International environmental agreements and protocols	Global warming management	Lectures, Tutorials , Example Classes	Exams , Weekl homework, Tea and homework solve problems Open questions that have a definite answer or do not have a definite answer
4	3	Meteorological aspect of air pollutants dispersion: Lapse rate, Type of Lapse Rate, Dive the dry Adiabatic Lapse Rate equation., Atmospheric stability, Inversion, Atmospheric turbulence, Plume behavior, type of plumes	Treatment of Air Emissions	Lectures, Tutorials , Example Classes	Exams , Weekl homework, Tea and homework solve problems Open questions that have a definite answer or do not have a definite answer
5	3	The Gaussian plume model, Estimation of plume rise, Stack height	The Gaussian plume idea	Lectures, , Example Classes	Exams , Weekl homework, Tea and homework solve problems Open questions that have a definite answer

					or do not have definite answer
6	3	Examples solution from Tutorial sheet about Gaussian model		Lectures, , Example Classes	Exams , Weekl homework, Tea and homework solve problems Open questions that have a definite answer or do not have definite answer
7	3	Air pollution, type of air pollution, air control equipment, the parameter determined before choice the proper equipment	Treatment of Air Emissions	Lectures, , Example Classes	Exams , Weekl homework, Tea and homework solve problems Open questions that have a definite answer or do not have definite answer
8	3	Type of particulate air control equipment, operation of each equipment, advantages and disadvantages of equipment with sketch of equipment	Treatment of Solids	Lectures, Example Classes	Exams , Weekl homework, Tea and homework solve problems Open questions that have a definite answer or do not have definite answer
9	3	Design of Settling Chamber		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
10	3	Examples solution from Tutorial sheet about settling chamber		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
11	3	Cyclone separator design		Lectures, Tutorials , Example Classes	Exams , Weekl homework, Tea and homework solve problems

					Open questions that have a definite answer or do not have a definite answer
12	3	Solution of examples from Tutorial sheet		Lectures, Tutorials , Example Classes	Exams , Weekl homework, Tea and homework solve problems Open questions that have a definite answer or do not have a definite answer
13	3	Techniques to remove gaseous contamination from gas stream: Absorption by liquids, adsorption by solids, combustion		Lectures, Tutorials , Example Classes	Exams , Weekl homework, Tea and homework solve problems Open questions that have a definite answer or do not have a definite answer
14	3	Control of specific gaseous pollutants: Control of sulfur dioxide. Control of nitrogen oxide, Control of carbon monoxide, Mobile source		Lectures, Tutorials , Example Classes	Exams , Weekl homework, Tea and homework solve problems Open questions that have a definite answer or do not have a definite answer
15	3	Safety in Petroleum Refinery: Fire Prevention and Control. Materials handling and storage, Noise Hazardous, Radiation Hazardous, Common Hazardous Materials in Refinery	Safety manageme	Lectures, Tutorials , Example Classes	Exams , Weekl homework, Tea and homework solve problems Open questions that have a definite answer or do not have a definite answer

163. 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

Quiz (20%)
Homework and continuous evolution (10%)
Final exam (70%)

164. Learning and Teaching Resources	
Required textbooks (curricular books, if any)	Lectures 1- C.S.Rao, "Environmental Pollution Cor Engineering", 2nd Edition, New Age International Limited, Published, 2006, Reprint 2007. 2- R. K. Sinnott, Chemical Engineering Design, Vol. 6. edition, Chemical Engineering Design, 2005, pp. 450- 3- Noel de Never, "Air Pollution Control Engineeri McGrow-Hill, Inc 1987.
Main references (sources)	
Recommended books and references (scientific journals, reports…)	(1) R. Weiner & R. Matthews, "Environmental Engineering" ButterwothHeinemann, 2003. (2) N.W. Jern, "Industrial Wastewater Treatment" Imperial College Press, 2006. (3) S.D. Lin & C.C. Lee, "Water and wastewater Calculation Manual" Mc-GrawHill, 2001. (4) M.J. Hammer,"Water & Wastewater Technology" John wiley & Sons, End Edition. (5) P.A. Vesilind & J. Jeffrey, "Environmental Engineering" Ann Afbar Sc., 2003. (6) Ray Asfahl, "Industrial Safety and Health Management" Prentice Hall.
Electronic References, Websites	Websites , Laboratory

Course Description Form

1. Course Name: Unit Operation III

2. Course Code: CES.R. 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: Ali Raad Mohammed Jawad
Email: ali.r.mohammedjawad@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

165. Course Name:

Process Control and Instruments for Petroleum Refinery
166. Course Code:
CES.R. 434
167. Semester / Year:
2nd Semester / Fourth year
168. Description Preparation Date:
2024-2-18
169. 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.
170. Number of Credit Hours (Total) / Number of Units (Total)
45 / 3
171. Course administrator's name (mention all, if more than one name)
Name: Zaidoon Mohsin Shakor Email: zaidoon.m.shakor@uotechnology.edu.iq
172. 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.

173. Teaching and Learning Strategies

Strategy	Lectures / seminars / Pictures and video clips

174. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	Classify process variables Control & instrumentation diagram	**Introduction to process control**	Lectures and solving examples.	Oral questions

		Control configurations Control block diagram			
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-Temperature	**Control system instrumentation**	Lectures and solving examples.	Quiz.

		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.

175. Course Evaluation

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

Total: 100 %

176. 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

177.	Course Name:
Industrial Management	
178.	Course Code: **CE- 423**
179.	Semester / Year: 1st Semester - 2023-2024
Description Preparation Date: Theory and applications, of Industrial Engineering Management which are mostly employed in	

1. The chemical industry Industrial Engineering Management; ,Industrial organization, Maintenance W Measurement Techniques, Engineering Ethics, Quality Control, ISO and Safety Requirements.

2. Available Attendance Forms: Real Present Attendance

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

2/2

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

Name: ALAA MSHJEL ALI
Email: alaa.m.ali@uotechnology.edu.iq

5. Course Objectives

Course Objectives	• To helps and learn in the optimum use of plant equipment, efforts towa productivity improvement. • TO establishing the most efficient and effective utilization of human ef and synchronizing various resources like men, machine and material as v as Engineering Ethics.

6.

Strategy	Theoretical

7. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4hr	To helps and learn in the optimum use of plant, equipment, efforts towards productivit y	Principle of managem types and classificati management responsibi organization responsibili	Lecture, Data sh	laily preparation
					Reports
					Questions and answers
					daily preparation , Quiz
2	3hr		Site, Feasibility st Development of effic work method (plant lay flow of material, mat handling), Workstati Inputs and Outp Production planning (t of Productions).		daily preparation , daily oral
					daily preparation
					daily oral
					Questions and answers
					daily preparation , Quiz
					Exam
					daily preparation
					daily oral

3 4 5 6 7 8 9	3hr 3hr 3hr 3hr	improvement, establishing the most efficient and effective utilization of human effort and synchronizing various resources like men, machine and material as well as Engineering Ethics.	**Maintenance** Classification, C Machine replacements, C studies and examples. **Network Analysis** Principles and applicati Critical path method (CM Gant Chart, Pert technic (examples and case studi **Work Measurement Techniques** Time and Motion study. **Engineering Ethics:** Engineering has a direct and vital impact on the quality of life for all people. Engineering is an important and learned job. Engineers are expected to exhibit the highest standards of honesty and integrity. Accordingly, the services provided by engineers require honesty, impartiality, fairness, and equity, and must be dedicated to the protection of the public health, safety, and welfare. Engineers must perform under a standard of professional behavior that requires adherence to the highest principles of ethical conduct. **Quality Control:**		Questions and answers daily preparation , Quiz Exam

			Standardization, Specification, Sampling techniques, Inspection- analysis of results. Quality costs (preventive cost, appraisal cost and failure cost). Application of quality control chart- examples, Reliability. **ISO:** Requirements, applications, ISO series, Quality management system (QMS), Total Quality management (TQM), Requirements and applications. **Safety Requirements:** Hazards (type's e.g. industrial hazards, pollution (air pollution, water pollution, industrial pollution). Industrial by products and industrial waste, Safety requirements of industrial sites, Requirements of suitable work environment (examples with particular emphasis in chemical industry).		

8. Course Evaluation

daily preparation: 10
daily oral:10
Reports:10
Quiz:20
Monthly Exam: 50

9. Learning and Teaching Resources

Required textbooks (curricu books, if any)	
Main references (sources)	T.R. Banga and S.C. Sharma "Industrial Engineering Management" including Production Management, Eleventh Edition:2008.
Recommended books and references (scientific journals, reports…)	. M.S. Peters, K.D. Timmerhaus and R.E. West "Plant Design and Econom for Chemical Engineers" Fifth Edition: 2003.
Electronic Referenc Websites	-

Course Description Form

180. Course Name:
Corrosion Eng. In Petroleum Refinery
181. Course Code:
CES.R. 439
182. Semester / Year:
2/2024
183. Description Preparation Date:
20/3/2024
184. Available Attendance Forms: Real Present Attendance
185. Number of Credit Hours (Total) / Number of Units (Total)
Credit Hours:2 / Number of Units:2
186. Course administrator's name (mention all, if more than one name)
Name: Asst. Prof. Basheer A. Abdulhussein

Email: basheer.a.abdulhussein@uotechnology.edu.iq

187. Course Objectives

Course Objectives	**. Understanding the concept of corrosion. The form of corrosion, How material destroyed by corrosion.** **- Determine the corrosion rates and electrochemical behavior of the metals and the thermodynamics of corrosion reactions.** **- Applying the corrosion prevention technology.** **- Selection of materials involved in applying the corrosion prevention technology in petroleum refineries.**

188. Teaching and Learning Strategies

Strategy	Theoretical /2

189. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2	**. Understanding the conc of corrosion. The form corrosion, How the mate destroyed by corrosion**	Introduction Corrosion Eng.	Lecture, Data show	daily preparation
2-3	4	**Understanding the type of corrosion**	Classification corrosion	Lecture, Data show	Reports
4-5	4		Kinetics aqueous corrosion:	Lecture, Data show	Questions and answers
6-7	4	**Study thermodynamics corrosion**	Thermodynar s and application corrosion	Lecture, Data show	daily preparation , Quiz
8-9	4	**Determine the corros rates and electrochem behavior of the metals**	Determining corrosion rate	Lecture, Data show	daily preparation , daily oral
10	2	**Study the passivity metals**	Passivity	Lecture, Data show	daily preparation
11	2	**Study the types reference electrodes**	Reference electrodes	Lecture, Data show	daily oral
12	2	**The effects of petrole and products on corrosion of equipmen**	Corrosion prevention in Industry	Lecture, Data show	Questions and answers
13	2	**Study the effect of pH a potential on m corrosion**	Pourbaix diagram:	Lecture, Data show	daily preparation , Quiz

14-15	4	**Study the types cathodic protection**	Cathodic Protection:	Lecture, Data show	Exam

190. Course Evaluation

daily preparation: 10
daily oral:10
Reports:10
Quiz:20
Monthly Exam: 50

191. Learning and Teaching Resources

Required textbooks (curricular books, if any)	
Main references (sources)	Zaki Ahmed, "Principle of Corrosion Engineering and Corrosion Control",1ST Edition, ,IChemE ,ELSEVIER, 2006.
Recommended books and references (scientific journals, reports…)	Denny A. Jones, "Principle and Prevention of Corrosion nd Edition, Prentice Hall, 1996.
Electronic References, Websites	