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:

Principles of Sustainability

2. Course Code:

CES.E.237

3. Semester / Year:

1st Semester/ Second year

4. Description Preparation Date:

2023−2024

5. Available Attendance Forms:

Real Present Attendance

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

Theoretical	Practical	Tutorial	Total	Units
2	**2**	**0**	**4**	**3**

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

Name: **Prof.Dr. Salman Hussein Abbas**
Email: **salman.h.ali@uotechnology.edu.iq**

8. Course Objectives

Course Objectives: at the end of the semester the student should be able to :	Upon completion of this course, student will be able to: • Define sustainability and understand how concepts of sustainability are connecte issues of social justice, the environment, and the economy at local, regional, and global levels. • Demonstrate knowlage of key concepts related to the study of sustainability, inclu planetary carrying. Climate change, and ecological footprint. • Explain how sustainability relates to their lives and their values, and how their act impact issures of sustainability at the individual, and at local, regional, and global levels. • Use the scientific method of inquiry to investigate the environmental worldvie politics and economics driving the human impact. • Use appropriate verbal and writing skills to communicate details of scientific meth including hypotheses, results and analyses.

9. Teaching and Learning Strategies

Strategy	Sustainability involves meeting basic human needs without undermining human communit culture, or natural environments. This difficult goal requires recognition of the comp interrelationships to technology, natural resources, natural science, human development and/or l to global politics. Students will be introduced to a verity of topics including climate change environmental pollution, local and global strategies, agriculture and sustainable food product environmental ethics and history, and social justice. The course facilitates deeper stu exploration of complex interrelationships among contemporary environmental, problems and solutions to overcome them. In addition, it will help students articulate personal philosophie guid more sustainable lifestyles (i.e. choices for resource use and other behaviors

10. Course Structure

Week	Hour	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2+1	Learning the student how	Environmental Systems	Blackboard Data Show	1. Homeworks 2. Quizzes'
2	2+1	To recognize the main	Sustainability Development Goals	Blackboard Data Show	Homeworks 2. Quizzes'
3	2+1	concept of sustainability related it sustainable development such Environment, Economic and	Global Climate Change	Blackboard Data Show	Homeworks 2. Quizzes'
4-6	4+2	Social ,	Carbon Foot Print	Blackboard Data Show	Homeworks 2. Quizzes'
7-8	2+2		Green Chemistry	Blackboard Data Show	Homeworks 2. Quizzes'
9-10	2+2		Renewable and Non-renewable Energy Sources	Blackboard Data Show	Homeworks 2. Quizzes'
11-12	2+2		Environmental Impact Assessment	Blackboard Data Show	Homeworks 2. Quizzes'
13-14	2+2		National and International Laws	Blackboard Data Show	Homeworks 2. Quizzes'

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

12. Learning and Teaching Resources

Required textbooks (curricular books if any)	Text book:- 1. Sustainability: A Comprehensive Foundation, Collection, Editor: Tom Theis and JonthanTomkin, Editors,**http://cnx.org/content/coll 1325/1.45/** Other support books :- 1. Living in Enviroment Concepts, Connections, and Solutions SIXTEENTH EDITION, G, TYLER MILLER, JR. SCOTT E. SPOOLMAN, Brooks/Cole 10 Davis Drive Belmont, CA 94002-3098 USA 2. Sustainability: A Comprehensive Foundation, Collection, Editor: Tom Theis and JonthanTomkin, CONNEXIONS, Rice University, Houston, Texas, 2012. (Referred in Weekly Schedule as SUS)
Main references (sources)	Sustainability: A Comprehensive Foundation, Collection, Editor: Tom Theis and JonthanTomkin, Editors, **http://cnx.org/content/coll 1325/1.45/**
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	

Course Description Form

1. Course Name: Fuel's and Clean Eng.

2. Course Code: CES.E.238

3. Semester / Year: 1stSemester

4. Introduction to fuels technology (solid, liquid, and gases).Procedure a characterization in terms of physic-chemical properties of these fuels. Cle energy.

5. Available Attendance Forms: Real Present Attendance

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

30 T + 30 p / 3

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 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.

9. Teaching and Learning Strategies

Strategy	Theoretical - Practical

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2	To provide an nderstanding of the histo efinition of petroleum ,a its classification , its quality during to it properties	**Introduction:** History of fuels, history of solid fuel, history of liquid fue and gases fuels, Fundamental definition, proper of liquid and gase fuels,various	Lecture, Data show	daily preparation

			measurements		
2-3	4		**Coal:** Classification, Composition basis, coal preparat and washi combustion of coal and coke making, coal distillation liquefaction, coal gasification.	Lecture, Data show	Reports
4-6	6	A comprehensive understanding of the petroleum product which they appear in visible form ,such as gasolin ,diesel , kerosene , an in less visible form o the entire spectrum of industry such as automobile lubricants , greases, carbon black for truc tires	**Crude Petroleum**: Exploration of crud Petroleum, Evaluati of crude, distillation cracking, thermal cracking catalytic cracking, reforming of naphth hydrotreatment, dewaxing deasphalting, refin equipment:	Lecture, Data show	Questions and answers
7-8	4		**Natural gas and LPG: Producer gas, wa gas, other fuel gase**	Lecture, Data show	daily preparation , Quiz
9-11	6		**Combustion air Calculation:** Calculation of calor value of fuels, flame properties, combust burners, combustion furnace	Lecture, Data show	daily preparation , daily oral
12-15	8		**Clean Energy**: Alternate Energy Sources: Solar energ Radiation measurement, applications and typ of collectors and storage, Wind powe Geothermal energy, Tidal ener Nuclear power, F cells, Biogas, Bioma	Lecture, Data show	daily preparation

11. Course Evaluation

daily preparation: 10
daily oral:10
Reports:10

Quiz:20 Monthly Exam: 50

12. 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. 1	ASTM distillation exp.
Exp. No. 2	Density and specificgravity exp
Exp. No. 3	Viscosity&viscosity index exp.
Exp. No. 4	Salt contentincrude oil
Exp. No. 5	Gum and gum stability
Exp. No. 6	Flash & fire point
Exp. No. 7	Ash content for petroleum products
Exp. No. 8	ConradSon Carbon residue of petroleum

Course Description Form

1. Course Name:

Physical chemistry I

2. Course Code:

CES.E.235

3. Semester / Year:

1st 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 + 30 p / 2

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

Name: Manal Afham Toma
Email: manal.a.toma@uotechnology.edu.iq

8. Course Objectives

Course Objectives	1- learns how to deal with applications of the equations of ideal gases for the close system with its four types of process 2- able to apply experimental techniques to the determination of rates law and rate constant, enzyme reactions kinetics. 3- deal with Surface chemistry: adsorption isotherms, surface tension, colloidal systems, and its properties.

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
١	2	Introduction and references	**Introduction to Physical chemistry**	Lectures.	Oral questions.
٢	2	The PVT behavior of pure substances, the ideal gas, close system	**Applications of the equations of ideal gases**	Lectures	Oral questions.

٣	2	the constant volume process, the constant pressure process	**Applications of the equations of ideal gases:**	Lectures and solving examples.	Quiz.
٤	2	the adiabatic process, the polytropic process	**Applications of the equations of ideal gases:**	Lectures and solving examples.	Oral questions.
٥	2	Applied and solve problem on the constant volume process, the constant pressure process	**Applications of the equations of ideal gases:**	Lectures and solving examples.	Quiz.
٦	2	Applied and solve problem on the adiabatic process, the polytropic process	**Applications of the equations of ideal gases:**	Lectures and solving examples.	Oral questions.
٧	2	Rate of consumption and formation, rate of reaction	**Chemical Kinetics**	Lectures and solving examples	
٨	2	empirical rate equation, order of reaction, Reactions having no order,	**Chemical Kinetics**	Lectures and solving examples.	Oral questions.
٩	2	First order reaction, second order	**Chemical Kinetics**	Lectures and solving examples.	Quiz.
10	2	Rate constants and rate coefficients, analysis of kinetic results.	**Chemical Kinetics**	Lectures and solving examples.	Oral questions.
11	2	Adsorption, adsorption isotherms,	Adsorption	Lectures and solving examples.	Oral questions.
12	2	adsorption isotherms,	Adsorption	Lectures and solving examples.	Oral questions.
13	2	adsorption isotherms,	Adsorption	Lectures and solving examples.	Quiz.
١٤	2	Surface tension and capillary rise, pressure difference across curved surface tension,	Adsorption	Lectures and solving examples.	Oral questions.
١٥	2	Liquid- films on surfaces, solid- liquid interfaces.	Adsorption	Lectures and solving examples.	Quiz.

11. Course Evaluation

Attendance: 2.5%
Homework, assignments 2.5%
Mid-term Exam 20%

In-class quizzes: 5 % Lab 10% Final: 60 % _____ Total: 100 %

12. Learning and Teaching Resources

Required textbooks (curricular books, if a	Atkins, P., de Paula, J. "Physical Chemistry"8ed edition, W. H. Freeman and Company. 2006
Main references (sources)	1. J. Laidler, physical chemistry, Bosten; Houghton M, ffl.n company, 1999. 2. G. Mortimer, physical chemistry, San Francisco; Altarcourt science and technology company, 2000.
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	

Exp. No.	Exp. Name.
Exp. No. 1	Hydrolysis of H_2O_2 (kinetic)
Exp. No. 2	Saponification of acetate ethyl. (kinetic)
Exp. No. 3	Surface chemistry: Adsorption by solid from solution
Exp. No. 4	Surface chemistry: Surface tension.
Exp. No. 5	Viscosity.
Exp. No. 6	Three component system (water, ethanol and ethyl acetate)

Course Description Form

1. Course Name:
Mathematics III
2. Course Code:
CES.E.221
3. Semester / Year:
1st Semester / 2 nd year
4. Description Preparation Date:
20/2/2024
5. Available Attendance Forms:
Students' attendance is recorded in the classroom and on Excel lists bas on the number of lectures and according to the dates in the schedule and sent weekly via email to the Absences Committee.
6. Number of Credit Hours (Total) / Number of Units (Total)
2 theoretical hours/1 tutorial hours during one semester. 45 / 3
7. Course administrator's name (mention all, if more than one name)
Name: Assistant Prof. Dr.Alyaa Khadhier Mageed Email: alyaa.k.mageed@uotechnology.edu.iq
8. Course Objectives

Course Objectives	1. Able to evaluate double, triple integrals and the area, volume by double & Triple Integrals respectively. 2. Understand the concept of Fourier-series representation of periodic functions and their applications.…… **3**− Develop the technical knowledge and understanding of mathematical techniques and the ability to apply them appropriately in context.
9. Teaching and Learning Strategies	
Strategy	1. **Interactive Lectures: ** Instead of traditional lectures, use interactive lectures that involve students actively in the learning process. Ask questions, encourage discussions, and use multimedia resources to illustrate key concepts. 2. **Hands-on Activities: ** Use real-world examples and case studies to demonstrate the relevance of mathematical concepts. 3. **Collaborative Learning: ** Encourage collaboration among students through group projects, problem-solving tasks, and peer teaching. Collaborative learning allows students to

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

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	Double Integral	Multiple Integrals	Lectures,Tutorials , Example Classes.	Open questions that have a definite answer , or do not have.
2	3	Area and volume by using double integral	Multiple Integrals	Lectures,Tutorials , Example Classes.	Open questions that have a definite answer , or do not have.
3	3	Double Integral in polar coordinates	Multiple Integrals	Lectures,Tutorials , Example Classes.	Open questions that have a definite answer , or do not have.
4	3	Triple Integral in rectangular coordinates, physical application of double and triple integration.	Multiple Integrals	Lectures,Tutorials , Example Classes.	partial test (Oral questions :- multiple choice ,alternative. response).
5	3	The error function, the gamma function	Function and definite Integrals	Lectures,Tutorials , Example Classes.	Open questions that have a definite answer , or do not have.
6	3	The beta function, factorial function.	Function and definite Integrals	Lectures,Tutorials , Example Classes.	Open questions that have a definite answer , or do not have.
7	3	The beta function, factorial function.	Function and definite Integrals	Lectures,Tutorials , Example Classes.	Open questions that have a definite answer , or do not have.
8	3	Sequences, Convergence, Geometric series, nth partial sum,	Infinite Sequences and Series	Lectures,Tutorials , Example Classes.	Open questions that have a definite answer , or do not have.
9	3	Sequences, Convergence, Geometric series, nth partial sum,	Infinite Sequences and Series	Lectures,Tutorials , Example Classes.	Open questions that have a definite answer , or do not have.
10	3	Tests of convergence, alternating series, power and Taylor's series	Infinite Sequences and Series	Lectures,Tutorials , Example Classes.	partial test (Oral questions :- multiple choice ,alternative.
11	3	Tests of convergence, alternating	Infinite Sequences and Series	Lectures,Tutorials , Example Classes.	partial test (Oral questions :- multiple choice ,alternative.

		series, power and Taylor's series			
12	3	Periodic functions, Fourier series	Fourier series	Lectures,Tutorials , Example Classes.	Open questions that have a definite answer , or do not have.
13	3	Periodic functions, Fourier series	Fourier series	Lectures,Tutorials , Example Classes.	Open questions that have a definite answer , or do not have.
14	3	Even and odd functions, Half range expansion.	Fourier series	Lectures,Tutorials , Example Classes.	Open questions that have a definite answer , or do not have.
15	3	Even and odd functions, Half range expansion.	Fourier series	Lectures,Tutorials , Example Classes.	Final Exam

11. Course Evaluation

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

1. **Daily Preparation (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. **Monthly Written Exams (15%): ** Assess students' understanding of course material through monthly written exams covering key concepts, theories, and problem-solving skills. Design exams to include a mix of multiple-choice questions, short answer questions, and essay questions.

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

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

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

- Daily Preparation: 10 points
- Monthly Written Exams: 15 points
- Reports/Assignments: 5 points
- Final Exam: 70 points

12. Learning and Teaching Resources

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

Course Description Form

1. Course Name: Materials Engineering

2. Course Code: CES.E.225

3. Semester / Year: 2 semester/Year Two

4. Description Preparation Date: 25/2/2024

5. Available Attendance Forms: fall

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

3 Hours / 3 units

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

Name: Prof. Dr. Adnan AbdulJabbar AbdUlRazak
Email: adnan.a.alsalim@uotechnology.edu.iq

8. Course Objectives

Course Objectives	• Study the classification of materials • Study the mechanical, thermal and electrical properties of materials. • Describe and solve problems on atomic arrangement and geometry of imperfections.

9. Teaching and Learning Strategies

Strategy	Lectures, Tutorials, Example Classes, Informal and formal teamwork, Weekly homework problems.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2	To provide classification materials	**Classification of Materials:**	Lectures,	Midterm exams, final exam, partial

			Classification of materials,		test (oral questions: - multiple choice
2	2	To provide classification materials	**Classification of Materials:** classification of materials based on structure, advanced materials	Lectures,	Midterm exams, final exam, partial test (oral questions: - multiple choice
3	2	To familiarize the students with the Mechanical Properties of Materials	**Mechanical Properties of Materials:** Stress-strain behavior,	Lectures, and team work	Midterm exams, final exam, partial test (oral questions: - multiple choice, alternative response), open questions
4	2	To familiarize the students with the Mechanical Properties of Materials	**Mechanical Properties of Materials:** ductility, brittleness, toughness,	Lectures, and team work	Midterm exams, final exam , partial test (oral questions :- multiple choice), open questions, and home work
5	2	To familiarize the students with the Mechanical Properties of Materials	**Mechanical Properties of Materials:** modulus of resilience, poisons ratio, hardness, effect of temperature.	Lectures, and team work	Midterm exams, final exam , partial test (oral questions :- multiple choice), open questions, and home work
6	2	Understanding the Atomic structure	**Atomic structure:** The structure of atom	Lectures, and team work	Midterm exams, final exam , partial test (oral questions :- multiple choice), open questions, and home work
7	2	Understanding the Atomic structure	**Atomic structure:** atomic bonding	Lectures, and team work	Midterm exams, final exam , partial test (oral questions :- multiple choice), open questions,

					and home work
8	2	Understanding the **Atomic structure**	**Atomic structure:** bonding energy and inter-atomic spacing	Lectures, and team work	Midterm exams, final exam , partial test (oral questions :- multiple choice), open questions, and home work
9	2	Allocate the Atomic order in solids	**Atomic order in solids** Types of atomic or ionic arrangements,	Lectures, and team work	Midterm exams, final exam , partial test (oral questions :- multiple choice), open questions, and home work
10	2	Allocate the Atomic order in solids	**Atomic order in solids:** crystal structure, lattice, unit cells,	Lectures, and team work	Midterm exams, final exam , partial test (oral questions :- multiple choice), open questions, and home work
11	2	Allocate the Atomic order in solids	**Atomic order in solids:** metallic crystal structure, crystal systems, crystal direction and crystal planes	Lectures, and team work	Midterm exams, final exam , partial test (oral questions :- multiple choice), open questions, and home work
12	2	Allocate the Atomic order in solids	**Atomic order in solids:** diffraction techniques for crystal structure analysis	Lectures, and team work	Midterm exams, final exam , partial test (oral questions :- multiple choice), open questions, and home work
13	2	Understanding the Thermal and electrical properties of materials	**Thermal and electrical properties of materials** Heat capacity, thermal expansion, thermal conductivity	Lectures, and team work	Midterm exams, final exam , partial test (oral questions :- multiple choice), open questions,

					and home work
14	2	Understanding the Thermal and electrical properties of materials	**Thermal and electrical properties of materials:** thermal stresses, Glass transition temperature, Creep resistance	Lectures, and team work	Midterm exams, final exam , partial test (oral questions :- multiple choice), open questions, and home work
15	2	Understanding the Thermal and electrical properties of materials	**Thermal and electrical properties of materials:** electrical conductivity, electron mobility, electrical resistivity of metals	Lectures, and team work	Midterm exams, final exam , partial test (oral questions :- multiple choice), open questions, and home work

11. Course Evaluation

Mid exam 30%
Lab 10%
Final Exam 60%

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Donaled R. Askeland, The science and engineering of materials, international student edition, 2006 .
Main references (sources)	William D. Callister, Jr., Materials science and engineering, Fifth edition, 2000.
Recommended books and references (scientific journals, reports…)	Lawrence H. Vanvlack , Elements of materials science and engineering, Fifth edition, 1987.
Electronic References, Websites	

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Course Description Form

1. Course Name:
Physical chemistry II
2. Course Code:
CES.E.236
3. Semester / Year:
2st 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: Manal Afham Toma Email: manal.a.toma@uotechnology.edu.iq
8. Course Objectives

Course Objectives	1- Be able to understand the relationship between electrical energy and chemical energy and their inter-conversion of one form to another and their calculation. 2- Be able to Identify the types of electrochemical cells and calculate cell voltages for standard conditions and other conditions using standard reduction potentials and the Nernst equation. 3- Understand the principles governing phase diagrams and be able to interpret phase diagrams for various kinds of systems.

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
١	2	Introduction, classification, Factors affecting	**Electrochemistry**	Lectures, pictures	Oral questions.
٢	2	Factors affecting, conductivity, Kohlrausch's law and its application	Electrochemistry	Lectures, pictures,	Oral questions.

				Solve examples	
٣	2	Kohlrausch's law and its application	Electrochemistry	Lectures and solving examples.	Quiz.
٤	2	The Debye–Hückel theory (including mean activity coefficient), The ionic mobility	Electrochemistry	Lectures and solving examples.	Oral questions.
٥	2	Faraday's Laws of Electrolysis, Balancing redox reactions	Electrochemistry	Lectures and solving examples.	Quiz.
٦	2	Definitions, Gibbs Phase rule, One component system	Phase Equilibria	Lectures and solving examples.	Oral questions.
٧	2	Two-component systems 1- Constant pressure equilibria, Vapour pressure diagrams, composition of the vapour,	Phase Equilibria	Lectures and pictures, drawing	Oral questions.
٨	2	Temperature composition diagrams, distillation, Azeotropes	Phase Equilibria	Lectures drawing.	Quiz.
٩	2	Immiscible liquids, Heat of transformation	Phase Equilibria	Lectures derivatives.	homework
10	2	Three-component phase Diagram, solving examples	Phase Equilibria	Lectures and solving examples.	Solve example, Quiz.
11	2	Electrochemical Cells, types,	Electrochemical Cells	Lectures and video	Oral questions.
12	2	Electrochemical Cells, electromotive force, APPLICATIONS OF NERNST EQUATION	Electrochemical Cells	Lectures and video	Oral questions. solving examples.
13	2	cell diagram in accordance with IUPAC, Salt bridge,	Electrochemical Cells	Lectures and video and solving examples.	Quiz.
١٤	2	types of electrodes	Electrochemical Cells	Lectures and video and solving examples.	Oral questions,
١٥	2	batteries, corrosion	Electrochemical Cells	Lectures and solving examples.	Quiz.

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 any)	Atkins, P., de Paula, J. "Physical Chemistry"8ed edition, W. H. Freeman and Company. 2006
Main references (sources)	**1.** J. Laidler, physical chemistry, Bosten; Houghton M, ffl.n company, 1999. 2. 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

1. Course Name:
Statistics
2. Course Code:
CES.E.225
3. Semester / Year:
1 semester/year
4. Description Preparation Date:
18−2−2024
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)
2 theoretical hours/1 tutorial hours during one semester. 45 / 3
7. Course administrator's name (mention all, if more than one name)
Name: Mahir A. Abdulrahman Email: Mahir.A.AbdulRahman@uotechnology.edu.iq
8. 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.
9. 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.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
١	٣	Students comprehend basic concepts of statistics.	Introduction, statistics population, descriptive and inductive statistics	Lectures.	Oral questions.
٢	٣	The ability of students to change data to tables. Students' skills in dealing w groups of data. Student's comprehension o different graphical representations.	Frequency distribution table, types of frequency. Tutorial of frequency distribution table. Graphical representation of frequency distribution table	Lectures and solving examples. Lectures and tutorials. Lectures.	Quiz. oral questions.
٣	٣	Conversion of frequency distribution table to different shapes of graph Acknowledgment of statistical measures.	Tutorial in graphical representation. Measures of central tendency	Tutorials. Lectures and solving examples.	Quiz. Oral questions.
٤	٣	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.

٥	٣	Student's ability to find the constants of an equation with tv variables. Student's ability to find t best equation to describe the data	Curve fitting, least squares method, variance, and correlation coefficient. Tutorial of the least square methods	Lectures and solving examp	Oral questions. Solving tutorial and a quiz.
٦	٣	Determination of the constants an equation with three variables The ability to differentiate betw the solving methods of two variables or more.	Multiple and partial correlations, normal equations for the least square regression, coefficient of correlation. Tutorial in partial correlation.	Lectures and solving examp Tutorial.	Oral questions. Partial test.
٧	٣	Comprehension of the probabili definition. Student's ability to apply norma distribution.	Probability distribution, continuous and discrete dist., normal dist. Tutorial in a norma distribution.	Lectures and solving examp Tutorials.	Oral questions. Quiz.
٨	٣	Acknowledgement of discrete probability concepts. Distinguish between different probability distributions.	Binomial distribution and Poison distribution. Tutorial of a probability distribution.	Lectures and solving examples. Tutorial.	Oral questions. Partial test.
٩	٣	Student's ability to use Chi-squ to test the hypothesis. .	The chi-square test test of hypothesis.	Lectures and solving examp	Oral questions.
10	3	Student's ability to use Chi-square to test the hypothesis	The chi-square test test of hypothesis.	Lectures and solving examples.	Quiz. Oral questions
11	3	Using of Chi-square test for goodness of probability distribution	Chi-square test for goodness of fit and independence test.	Lectures and solving examp	Quiz. Oral questions
12	3	Using of Chi-square test for goodness of probability distribution	Chi-square test for goodness of fit and independence test.	Lectures and solving examp	Oral questions

13	3	Distinguish between the different uses of Chi-square	Tutorial in Chi-square. Comparison between	Tutorials.	Quiz.
١٤	٣	Students' ability to test the means.	three or more of the means. NOVA test	Lectures and solving examp	Oral questions.
١٥	٣	The use of the ANOVA test and F test.	Tutorial in ANOVA test.	Homework.	Quiz.

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

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

Course Description Form

1. Course Name:
Mathematics IV
2. Course Code:
CES.E.222
3. Semester / Year:
2 nd Semester / 2 nd year
4. Description Preparation Date:
20/2/2024
5. Available Attendance Forms:
Students' attendance is recorded in the classroom and on Excel lists bas on the number of lectures and according to the dates in the schedule and sent weekly via email to the Absences Committee.
6. Number of Credit Hours (Total) / Number of Units (Total)
2 theoretical hours/1 tutorial hours during one semester. 45 / 3
7. Course administrator's name (mention all, if more than one name)
Name: Assistant Prof. Dr.Alyaa Khadhier Mageed Email: alyaa.k.mageed@uotechnology.edu.iq
8. Course Objectives

Course Objectives	1. Understand methods of solving First order and Higher order ordinary Differential equations along with some physical applications. 2. Demonstrate the relevance of the mathematical methods learnt to chemical engineering.
9. Teaching and Learning Strategies	
Strategy	1. **Interactive Lectures: ** Instead of traditional lectures, use interactive lectures that involve students actively in the learning process. Ask questions, encourage discussions, and use multimedia resources to illustrate key concepts. 2. **Hands-on Activities: ** Use real-world examples and case studies to demonstrate the relevance of mathematical concepts. 3. **Collaborative Learning: ** Encourage collaboration among students through group projects, problem-solving tasks, and peer teaching. Collaborative learning allows students to learn from each other, discuss different approaches, and develop teamwork skills.

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

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

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

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

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

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

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
١	٣	Infinite series by Taylor theorem	Solution by Series	Lectures,Tutorials , Example Classes.	Open questions that have a definite answer , or do not have.
2	٣	Infinite series by Taylor theorem	Solution by Series	Lectures,Tutorials , Example Classes.	Open questions that have a definite answer , or do not have.
3	٣	Method of Frobenius (Case I, II, IIIa, and IIIb)	Solution by Series	Lectures,Tutorials , Example Classes.	Open questions that have a definite answer , or do not have.
4	٣	Method of Frobenius (Case I, II, IIIa, and IIIb)	Solution by Series	Lectures,Tutorials , Example Classes.	Open questions that have a definite answer , or do not have.
5	٣	Bessels's and Modified Bessel's Equation	Solution by Series	Lectures,Tutorials , Example Classes.	Open questions that have a definite answer , or do not have.
6	٣	Properties of Bessel Functions, Applications in chemical engineering, Tubular Gas Preheater	Solution by Series	Lectures,Tutorials , Example Classes.	partial test (Oral questions :- multiple choice ,alternative.
7	٣	Reaction in axisymmetric Spherical and Cylindrical pellets	Solution by Series	Lectures,Tutorials , Example Classes.	Open questions that have a definite answer , or do not have.
8	٣	Introduction, Linear equation, Bernoulli's equation, Exact differential equations, Equations reducible to exact equations.,	Ordinary Differential Equations	Lectures,Tutorials , Example Classes.	Open questions that have a definite answer , or do not have.
9	٣	Orthogonal trajectories, Newton's law of cooling. Linear differential equations with constant coefficients:	Ordinary Differential Equations	Lectures,Tutorials , Example Classes.	Open questions that have a definite answer , or do not have.

		Definition, Theorem, Operator D, Rules for finding the complementary function			
10	٣	Orthogonal trajectories, Newton's law of cooling. Linear differential equations with constant coefficients: Definition, Theorem, Operator D, Rules for finding the complementary function	Ordinary Differential Equations	Lectures,Tutorials , Example Classes.	Open questions that have a definite answer , or do not have.
11	٣	Orthogonal trajectories, Newton's law of cooling. Linear differential equations with constant coefficients: Definition, Theorem, Operator D, Rules for finding the complementary function	Ordinary Differential Equations	Lectures,Tutorials , Example Classes.	Open questions that have a definite answer , or do not have.
12	٣	,Inverse operator, Rules for finding the particular integral, working procedure to solve the equation	Ordinary Differential Equations	Lectures,Tutorials , Example Classes.	partial test (Oral questions :- multiple choice ,alternative.
13	٣	,Inverse operator, Rules for finding the particular integral, working procedure to solve the equation	Ordinary Differential Equations	Lectures,Tutorials , Example Classes.	partial test (Oral questions :- multiple choice ,alternative.
14	٣	Representation problems of 1st ordinary differential equations (linear and nonlinear, homogeneous …etc.).	Application of Ordinary Differential Equations	Lectures,Tutorials , Example Classes.	Open questions that have a definite answer , or do not have.
15	٣	Representation problems of 2nd ordinary differential equations (linear and nonlinear, homogeneous …etc.)	Application of Ordinary Differential Equations	Lectures,Tutorials , Example Classes.	Final Exam

11. Course Evaluation

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

1. **Daily Preparation (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. **Monthly Written Exams (15%): ** Assess students' understanding of course material through monthly written exams covering key concepts, theories, and problem-solving skills. Design exams to include a mix of multiple-choice questions, short answer questions, and essay questions.

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

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

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

- Daily Preparation: 10 points
- Monthly Written Exams: 15 points
- Reports/Assignments: 5 points
- Final Exam: 70 points

12. Learning and Teaching Resources

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

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

Course Description Form

1. Course Name:

Chemical Engineering Principles I

2. Course Code:

CES.E.131

3. Semester / Year:

2nd Semester / second

4. Description Preparation Date:

23/3/2024

5. Available Attendance Forms:

Fall time

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: Dr.Samira.N.Abdullaha
Email: s a m i r a . N . a b d u l l a h a @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 and 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 and 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 and discussion
8-9	8	Heat capacity Pressure and Its Units Types of pressures Measurement of Pressure	**Concepts**	Lecture, Data show	Questions and answe rs
10-11	8	Pressure and its Units Types of pressures Measurement Pressure	**Concepts** of	Lecture, Data show	Questions answers and
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 and discussion
14-15	8	Multiple Component Systems	**Material Balance**	Lecture, Data show	daily preparation and discussion Exam and and

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 Chemical Engineering Thermodynamics 8th Ed.

Course Description Form

1 . Course Name: Fluid Flow II

2 . Course Code: CES.E.234

3 . Semester / Year: 2 / (2023-2024)

4 . Description Preparation Date: 2023 / 2024

5 . Available Attendance Forms: Central / Full

6 . Number of Credit Hours (Total) / Number of Units (Total): 5Hr / 3Unt

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

Name: zainab yousif shnain
Email: zainab.y.shnain@uotechnology.edu.iq

8 . 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.**

9 . 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.**

10 . 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 not have a definite answer
4	3		Define weirs and weirs types, derive of flow rate in weirs with applications		
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 specify the backed columns, packing types, pressure drop estimation, fluidization, transport of particles.	Define the packing types and packed columns, derive the 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.		

11. 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.

12. 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

1. Course Name:

Unit Operation 1

2. Course Code:

CES.E. 334

3. Semester / Year:

1 semester/year

4. Description Preparation Date:

15−3−2024

5. Available Attendance Forms:

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

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

3 theoretical hours/1 tutorial hours during one semester.

60 / 4

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

Name: Amer A. Abdulrahman

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

8. Course Objectives

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

9. Teaching and Learning Strategies

Strategy	**1- Understanding the basic information, concepts and terminology of the general principles of separation processes of gas-liquid separation (Tray absorption & Packed Bed absorption), Binary and Multicomponent Distillation.** 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
١	٣	Ability to understand th principle of Tray colum	Introduction to Tray column, Types of dispersion.	Lectures, Practical Applications.	partial test (Oral questions).
٢	٣	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).
٣	٣	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
٤	٣	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)

٥	٣	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
٦	٣	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.
٧	٣	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
٨	٣	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 .
٩	٣	understanding of the operations of mass transfer in Flash (equilibrium) distillation.	Flash (equilibrium) or integral distillation.	Lectures, Tutorials , Practical Applications.	partial test (Oral questions) , Open questions t at have a definite answer, or do no have a definite a swer
10	3	understanding of the operations of heat and mass transfer equipment by performing mass and energy balance calculations in continuous-multistage-fractionation of binary mixture.	Continuous-multistage-fractionation of binary mixture.	Lectures, Tutorials , Example Classes.	partial test (Oral questions), Design problems
11	3	Ability to calculate the number of trays.	Determination of the number of trays using Mccabe-Thiele-method	Lectures, Tutorials , Example	partial test (Oral questions), Design problems

			(Graphical method).	Classes.	
12	3	Understand and analyze the empirical correlations to determine the mass transfer coefficient.	Methods to determine the mass transfer coefficient.	Lectures, Tutorials.	partial test (Oral questions), Exams.
13	3	Ability to Identify the feed line. Ability to calculate the no. of ideal stages – analytically.	Types and determination of the feed line in distillation columns. Analytical determination of the No. of ideal stages (Total reflux, Minimum reflux ratio).	Lectures, Tutorials , Example Classes , Practical Applications.	partial test (Oral questions).
١٤	٣	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
١٥	٣	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).

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, 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

1. Course Name:
Equipment Design
2. Course Code:
CES.P.3311
3. Semester / Year:
1st Semester / Year
4. Description Preparation Date:
26-3-2024
5. Available Attendance Forms:
Fall time
6. Number of Credit Hours (Total) / Number of Units (Total)
3 / 2
7. Course administrator's name (mention all, if more than one name)
Name: Dr.Samira Njam Abdullaha Email: samira.N.abdullaha@uotechnology.edu.iq

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

9. 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.

10. Course Structure

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

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

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

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

11. Course Evaluation

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

12. Learning and Teaching Resources

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

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

Course Description Form

1. Course Name:
Air Pollution Control
2. Course Code:
CES.E.339
3. Semester / Year:
1st Semester / 2023-2024
4. Description Preparation Date:
4/3/2024
5. Available Attendance Forms:
6. Number of Credit Hours (Total) / Number of Units (Total)
2/2
7. Course administrator's name (mention all, if more than one name)
Name: Prof. Dr.Jenan A.Alnajar Email: jenan.a.abdulrazak@

8. Course Objectives	
Course Objectives	• Be able to identify and value the effect of the air pollutants on the environment: atmosphere, and solve the problem related to air pollution. Provide an understanding the meteorological aspect air pollutants dispersion. • To provide the student with the general methods and equipments used for controlling particulate and gaseous air pollutants

9. Teaching and Learning Strategies	
Strategy	1- Explain the Lectures through using PowerPoint. 2- conduct homework and Assignments. 3- Tests and Exams. 4- In-Class Questions and Discussions.

	5- Write a report that is related to air pollution and global environmental issues.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2(Theo)	1	Introduction, Definition of some concept, 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.	Theory/ Class	Questions during the lectures ,quiz, exam, present in the class
2	2(Theo)	1	The atmosphere of Earth; Atmosphere composition; Layers of atmosphere; chemical reactions in the atmosphere. Urban Smog: photochemical smog.	Theory/ Class	Questions during the lectures ,quiz, exam, present in the class
3	2(Theo)	1	Regional and Global Issue: Global warming; Ozone layer depletion, Acid rain; The world action for the problem. International environmental agreements and protocols	Theory/ Class	Questions during the lectures ,quiz, exam, present in the class
4	2(Theo)	1	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	Theory/ Class	Questions during the lectures ,quiz, exam, present in the class
5	2(Theo)	1	The Gaussian plume model, Estimation of plume rise, Stack height	Theory/ Class	Questions during the lectures ,quiz, exam, present in the class
6	2(Theo)	1	Examples solution from Tutorial sheet about Gaussian model	Theory/ Class	Questions during the lectures ,quiz, exam, present in the class
7		-----	Exam	Theory/ Class	Questions during the lectures ,quiz, exam, present in the class
8	2(Theo)	1	Air pollution, type of air pollution, air control equipment, the parameter	Theory/ Class	Questions during the lectures ,quiz,

			determined before choice the proper equipment		exam, present in the class
9	2(Theo)	1&2	Type of particulate air control equipment, operation of each equipment, advantages and disadvantages of equipment with sketch of equipment	Theory/ Class	Questions during the lectures ,quiz, exam, present in the class
10	2(Theo)	1&2	Design of Settling Chamber	Theory/ Class	Questions during the lectures ,quiz, exam, present in the class
11	2(Theo)	1&2	Examples solution from Tutorial sheet about settling chamber	Theory/ Class	Questions during the lectures ,quiz, exam, present in the class
12	2(Theo)	1 & 2	Cyclone separator design	Theory/ Class	Questions during the lectures ,quiz, exam, present in the class
13	2(Theo)	-----	Solution of examples from Tutorial sheet	Theory/ Class	Questions during the lectures ,quiz, exam, present in the class
14	2(Theo)	-----	Techniques to remove gaseous contamination from gas stream: Absorption by liquids, adsorption by solids, combustion	Theory/ Class	Questions during the lectures ,quiz, exam, present in the class
15	2(Theo)	1 & 2	Control of specific gaseous pollutants: Control of sulfur dioxide. Control of nitrogen oxide, Control of carbon monoxide, Mobile source	Theory/ Class	Questions during the lectures ,quiz, exam, present in the class

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

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Text book: 1) C.S.Rao, "Environmental Pollution Control Engineering", 2nd Edition , New Age International(P) Limited, Published, 2006, Reprint 2007. 2) K. Wark, C.F. Warner & W.T. Davis,"Air Pollution Control: its Origin and Control. Addition-Wesley, (1998).
Main references (sources)	
Recommended books and references (scientific journals, reports…)	1) De Vevers, N., "Air Pollution Control Engineering", MC, Graw-Hill, Inc. (200) 2) D. Vallero, "A fundamental of Air Pollution "Amesterdam, 4th edition, (2008).

	3) L. Theodore, " Air Pollution Control Equipment Calculation" Willy, (228).
Electronic References, Websites	

Course Description Form

1. Course Name:
Equipment Design and Applied Computer (HYSES)
2. Course Code:
CES.P.3312
3. Semester / Year:
2nd Semester / Year
4. Description Preparation Date:
26-3-2024
5. Available Attendance Forms:
Fall time
6. Number of Credit Hours (Total) / Number of Units (Total)
5 / 3
7. Course administrator's name (mention all, if more than one name)
Name: Dr.Samira Njam Abdullaha Email: samira.N.abdullaha@uotechnology.edu.iq

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

9. 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.

10. 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	Lectures, Tutorials , Example Classes ,	Exams , Weekly homework, Team and homework solve problems , Open questions that

			simulation principle)		have a definite answer , or do not have a definite answer
2	5	prepare data sheets for vessels + the 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 , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
3	5	Connection of piping and pumps to the vessels + the knowledge of HYSYS functions	Pressure vessels design + computer aided design Laboratory	Lectures, Tutorials , Example Classes ,	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
4	5	Ability to design gas-liquid separator and prepare data 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 , Weekly homework, Team 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 separator and prepare data 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 , Weekly homework, Team 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 design for reactor with HYSYS	Heat transfer practice + computer aided design Laboratory	Lectures, , Example Classes , Practical Applications	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer

7	5	Ability to utilize books and references to obtain the required physical properties of their approach system (heat capacity …etc. + practice design for reactor with HYSYS	Heat transfer practice + computer aided design Laboratory	Lectures, , Example Classes , Practical Applications	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
8	5	Calculate Overall heat transfer coefficient. and area required for heat exchanger design + practice design for reactor	Heat transfer practice + computer aided design Laboratory	Lectures, Example Classes , Practical Applications	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
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 , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a 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 , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a 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 , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
12	5	Ability to utilize books and references 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 , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer

13	5	Practices the necessary steps for towers internal design	Mas transfer practice + computer aided design Laboratory	Lectures, Tutorials , , Practical Applications	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
14	5	Practices the necessary steps for towers internal design	Mass transfer practice + computer aided design Laboratory	Lectures, Tutorials , Practical Applications	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer.
15	5	The student had been applied all steps required to design distillation column	Mass transfer practice + computer aided design Laboratory	Example Classes , Practical Applications	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer.

11. Course Evaluation

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

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	1- Sinnott R. and Towler C; 2016 " chemical Engineering Design" 5th edition Butterworth-Heinemann . 2-Coke, A.K ;2007"Ludwig s Applied Process Design of Chemical and petrochemical Plant" vol. 1 4th edition Gulf professional Publisher. 3-Coulson ,J.M and Richardson J.F. "Chemical Engineering , volume 2", Fifth edition 2002, Elsevier Science, Linacre House, Jordan Hill, Oxford. 4-Green D ,Perry ,J.H, 2008" chemical engineering handbook ",8th edition Mc-Graw – Hill Book com.

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

Course Description Form

1. Course Name:
Solid Waste Management
2. Course Code:
CES.E.3313
3. Semester / Year:
Semester 2 / 2023-2024
4. Description Preparation Date:
5. Available Attendance Forms:
6. Number of Credit Hours (Total) / Number of Units (Total)
2/2
7. Course administrator's name (mention all, if more than one name)
Name: Prof. Dr.Jenan A.Alnajar Email: jenan.a.abdulrazak@

8. Course Objectives	
Course Objectives	• The course is intended to give the student knowledge about the different chemical processes flow sheets..... • The student is capable of eliminating or reducing the negative environmental effects of chemical process..... • .....

9. Teaching and Learning Strategies	
Strategy	1- Explain the Lectures through using PowerPoint. 2- conduct homework and Assignments. 3- Tests and Exams. 4- In-Class Questions and Discussions. 5- Write a report that is related to environmental problems.

10. Course Structure					
Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learning method**	**Evaluation method**
1	2(Theo)	1	Definition; Classification, and Composition of solid waste.	Theory/Class	Questions during the lectures ,quiz, exam, present in the class
2	2(Theo)	1	Sources of solid waste, type of material recovery from the solid waste	Theory/Class	Questions during the lectures ,quiz, exam, present in the class
3	2(Theo)	1	Physical, chemical, and biological properties of municipal solid waste	Theory/Class	Questions during the lectures ,quiz, exam, present in the class
4	2(Theo)	1	Physical, chemical, and biological properties of municipal solid waste	Theory/Class	Questions during the lectures ,quiz, exam, present in the class
5	2(Theo)	-----	Examination	Theory/Class	-----
6	2(Theo)	1	Treatment and disposal of the solid waste	Theory/Class	Questions during the lectures ,quiz, exam, present in the class
7	2(Theo)	1	Treatment and disposal of the solid waste	Theory/Class	Questions during the lectures ,quiz, exam, present in the class
8	2(Theo)		Tutorial sheet	Theory/Class	Questions during the lectures & solve problems
9	2(Theo)	1	Waste reduction. Reuse, recycle, and recovery	Theory/Class	Questions during the lectures ,quiz, exam, present in the class
10	2(Theo)	1	Waste reduction. Reuse, recycle, and recovery	Theory/Class	Questions during the lectures ,quiz, exam, present in the class
11	2(Theo)	1 & 2	Land filling with solid waste design and operation	Theory/Class	Questions during the lectures ,quiz, exam, present in the class
12	2(Theo)	-----	Tutorial sheet	Theory/Class	Questions during the lectures & solve problems

13	2(Theo)	-----	Examination	Theory/Class	-----
14	2(Theo)	1 & 2	Incineration and Energy Recovery	Theory/Class	Questions during the lectures ,quiz, exam, present in the class
15	2(Theo)	1 & 2	Hazardous waste characterization and treatment	Theory/Class	Questions during the lectures ,quiz, exam, present in the class

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

12. Learning and Teaching Resources

Required textbooks (curricular books, any)	Srinivasan D ; Environmental Engineering " P learning 2012 Ramachaudra T V "Management of Municipal So Waste ' Commonwealth of learning Canada 2006
Main references (sources)	
Recommended books and references (scientific journals, reports…)	Srinivasan D ; Environmental Engineering " P learning 2012
Electronic References, Websites	

Course Description Form

1. Course Name:

Applied Mathematics in Chemical Engineering

2. Course Code:

CES.E.322

3. Semester / Year:

2nd Semester/ third year

4. Description Preparation Date:

2023−2024

5. Available Attendance Forms:

Real Present Attendance

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

Theoretical	Practical	Tutorial	Total	Units
2	**-**	**1**	**3**	**2**

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

Name: **Prof.Dr. Salman Hussein Abbas**
Email: **salman.h.ali@uotechnology.edu.iq**

8. 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.	• ….. • ….. • …..

9. 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.

10. 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 problems in the field of chemical engineering , then find a practical models related to the industrial processes	**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). L3: Combination of Variables (Variation of Parameters). L4: Laplace Transforms.	Blackboard	Homeworks 2. Quizzes' 3. Examinations
6-8	8		**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

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

12. Learning and Teaching Resources

Required textbooks (curricular books any)	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. 3- "Applied Mathematical Methods for Chemical Engineers",Loney, 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

1. Course Name: Unit Operation II

2. Course Code: CES.E. 431

3. Semester / Year: 1 st Semester

4. Description Preparation Date:٢٠٢٣ /٢٠٢٤

5. Available Attendance Forms: central / full

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

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

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

8. Course Objectives

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

9. Teaching and Learning Strategies

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

10. Course Structure

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

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

10. Course Evaluation

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

11. Learning and Teaching Resources

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

Course Description Form

1. Course Name:
Water and Wastewater Treatment Engineering /1
2. Course Code:
CES.E.435
3. Semester / Year:
1st Semester / Fourth
4. Description Preparation Date:
23/3/2024
5. Available Attendance Forms:
6. Number of Credit Hours (Total) / Number of Units (Total)
3 / 2
7. Course administrator's name (mention all, if more than one name)
Name: Dr. Samira.N.abdullaha Email: samira.N.abdullaha@uotechnology.edu.iq
8. Course Objectives

Course Objectives	1-The aim of this course is to introduce the students to the area of water and wastewater treatment. The course will cover water chemistry, characteristics of water and wastewater, preliminary, primary, secondary and tertiary treatment processes, sludge disposal; and design of water and wastewater treatment plants • 2-Understand the nature of impurities in water and wastewater;their concentrations,unit operationand unit process. • 2-To identify laws and regulations that apply to water and /or wastewater treatment.
9. Teaching and Learning Strategies	
Strategy	1-To help students develop the ability to apply basic understanding physical, chemical, and biological phenomena to the successful des and operation of water and wastewater treatment plants. 2- To study the principles and design of water and wastew treatment processes.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
١	3	Introduction to water & wastewater, basics of wastewater management explain the principles of wastewater treatment, understand the main design criteria and operational parameters, apply the knowledge in	Introduction of Water and wastewater Treatment	Lecture, Data show	daily preparation an discussion

		the process design.,.			
2	3	Learn about the parameters used to measure the quality of wastewater, Identify pollution problems associated with water and wastewater discharge and sludge disposal.	Introduction to water & wastewater,	Lecture, Data show	daily preparation an discussion
3	3	Describe the main physical, chemical and biological unit operations applied in municipal and industrial,	Water and wastewater methods,flow chart for (WWTP)	Lecture, Data show	daily preparation discussion
4-5	6	Preliminary & Primary Treatments in this treatment, cases and conditions of mass balance and reactors .	physical treatment screening and grit removal, sedimentation and filtration	Lectures,Example classes practical applications	Exams,weekly homework,solve problems
6	3	Principles of Sedimentation: Types of settling and settling equations, design criteria and design of settling tanks.	Physical Treatment Design of Sedimentation Tank	Lectures,Example classes practical applications	Exams,weekly homework, sc problems
7-8	6	Coagulation and Flocculation phenomena, Theory of coagulation and flocculation,coagulation chemistry,colloidal destabilization,factors affecting coagulation	Chemical Treatment coagulation and flocculation, Rapid mixing tank design	Lectures,Example classes prac applications	daily preparation discussion
9-10	6	Secondary Treatment ,Principle and processes involved in the use of microorganisms in sewage treatment plants, to remove organic matter	**Biological wastewater Treatment**	Lecture, Data show	Exams,weekly homework,solve problems
11	3	Principle of activated sludge	Design of activated sludge processes	Lectures,Example classes practical applications	Exams,weekly homework,solve problems
12-13	3	Principle, Types of trickling filters	Design of Trick Filter	Lectures,Example classes prac applications	Exams,weekly homework,solve problems
14-15		Tertiary Treatment	Nitrifcation-Denitrification processes	Lecture, Data show	daily preparation and discussion
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)	1- Hammer,M.J., "Water & Wastewater Technology", John Wiley & Sons,1977. 2- Mackenzie, L.D., "Water & Wastewater Engineering, Design Principles & Practice", McGraw-Hill International Ed., 2011. 3- Raju, B.S.N.," Water supply Wastewater Engineering", Tata McGraw-Hill pvt.co.Ltd.,New Delhi,(1995). 4- Fair,G.M., Geyer J.C and Okun," Water and Wastewater Engineering",vol.11,John Wiely publications. 5- Weber,W.J.," Physico- Chemical Processes for water quality control",(1975). 6-Vesilind,P.A., & Jeffrey,J.P.,"Environmental Engineering" Ann Arbor As. Publishers,(1982).
Main references (sources)	Metcalf & Eddy, "Wastewater Engineering, Treatment & Reuse" McGraw-Hill, 4th Ed.2003.
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	

Course Description Form

1. Course Name: Catalysis and Catalytic Engineering
2. Course Code: CES.P. 437
3. Semester / Year: 1st Semester
4. Description Preparation Date: Theory, Heterogeneous catalysis (Classification of solid catalyst, types of catalyst carrier, physical properties of solid catalyst (solid density, bed density, macro-pore, micro-pore, phase holdups, types of diffusivity), Overview of transport and reaction steps, Rate equations for fluid- solid catalytic reactions, External transport process in heterogeneous reactions, Internal transport processes-reaction and diffusion in porous catalysts (Thiele module and effectiveness factor), Isothermal and adiabatic heterogeneous catalytic reactors, Isothermal reactors with multiphase system.
4. Available Attendance Forms: Fall time
5. Number of Credit Hours (Total) / Number of Units (Total)
3
6. Course administrator's name (mention all, if more than one name)
Name: Dr. Zahraa Al-Auda Email: Zahraa.f.zuhwar@uotechnology.edu.iq
7. Course Objectives

Course Objectives	• Gain fundamental knowledge on solid catalysts and transport phenomena. • apply reaction kinetics principles in Heterogeneous Reactors. • Identify and formulate problems in Heterogeneous Reactors and Catalysis and find appropriate solutions. • Specify and size the most common industrial chemical reactors to achieve production goals for processes involving heterogeneous reaction systems.

8. Teaching and Learning Strategies	
Strategy	Lectures, activates, participations, examples.

9. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
5	15	L1: Classification of solid catalyst, types of catalyst carrier, physical properties of solid catalyst (solid density, bed density, macro-pore, micro- pore, phase holdups, types of diffusivity- bulk, Knudsen and effective-) L2: Overview of transport and reaction steps, L3: Rate equations for fluid-solid catalytic reactions L4: External transport	Heterogeneous Catalysis	Lectures, examples, homework.	Oral questions, multiple choice, conceptual questions, exams.

		process in heterogeneous reactions L5: Internal transport processes- reaction and diffusion in porous catalysts (Thiele module and effectiveness factor) L6: Catalyst deactivation: definition, types, and simple rate equation			
2	7	L7: Classification, Performance equation for isothermal fixed bed reactors containing porous catalyst L8: Design of a single adiabatic packed bed reactor.	**Isothermal and adiabatic heterogeneous catalytic reactors**		
3	8	L9: Design of a slurry reactor L10: Design of			

		a trickle bed reactor	**Isothermal reactors with multiphase system**		

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 .... etc	
11.Learning and Teaching Resources	
Required textbooks (curricular books, any)	1-Levenspiel, O. Chemical Reaction Engineering. 3rd edition, New York, NY: Wiley, 1999. ISBN: 9780471254249. 2-Smith, J. Chemical Engineering Kinetics. 3rd edition, New York, NY: McGraw-Hill, 1981. ISBN: 9780070587106
Main references (sources)	Fogler, H.S., Elements of Chemical Reacti Engineering, 3rd edition, Prentice-Hall of Inc New Delhi , 1997
Recommended books and references (scientific journals, reports...)	Concepts of catalysis Industrial catalysis
Electronic References, Websites	Principles and Practice of Heterogeneous Catalysis

Course Description Form

1. Course Name:	
Industrial and Petroleum Pollution Control	
2. Course Code:	
CES.E.437	
3. Semester / Year:	
1st Semester / 2023−2024	
4. Description Preparation Date:	
4/5/2024	
5. Available Attendance Forms:	
6. Number of Credit Hours (Total) / Number of Units (Total)	
2/2	
7. Course administrator's name (mention all, if more than one name)	
Name: Prof. Dr.Jenan A.Alnajar Email: jenan.a.abdulrazak@uotechnology.edu.iq	
8. Course Objectives	
Course Objectives	• The course is intended to give the student knowledge about the different chemical processes flow sheets. • 2. The student be capable to eliminate or reduce the negative environmental effects of chemical process.....
9. Teaching and Learning Strategies	
Strategy	1- Explain the Lectures through using PowerPoint. 2- conduct homework and Assignments. 3- Tests and Exams. 4- In-Class Questions and Discussions. 5- Write a report that is related to environmental problems.
10. Course Structure	

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2	1	Introduction to Environmental Issues and Environmental legislations	Theory/ Class	Questions during the lectures ,quiz, exam, present in the class
2	2	1&2	Petroleum refinery	Theory/ Class	Questions during the lectures ,quiz, exam, present in the class
3	2	1&2	Petroleum refinery	Theory/ Class	Questions during the lectures ,quiz, exam, present in the class
4	2	1&2	Petrochemical and allied petroleum products	Theory/ Class	Questions during the lectures ,quiz, exam, present in the class
5	2	1&2	Exam-1	Theory/ Class	Questions during the lectures ,quiz, exam, present in the class
6	2	1&2	Soap and detergent	Theory/ Class	Questions during the lectures ,quiz, exam, present in the class
7	2		Soap and detergent: Soap		
8	2	1&2	Paints and Dyes	Theory/ Class	Questions during the lectures ,quiz, exam, present in the class
9	2	1&2	Paints and Dyes	Theory/ Class	Questions during the lectures ,quiz, exam, present in the class
10	2	1&2	Sugar and fermentation products	Theory/ Class	Questions during the lectures ,quiz, exam, present in the class
11	2	1&2	Sugar and fermentation products	Theory/ Class	Questions during the lectures ,quiz, exam, present in the class
12	2	1&2	Exam-2	Theory/ Class	Questions during the lectures ,quiz, exam, present in the class
13	2	1&2	Textile	Theory/ Class	Questions during the lectures ,quiz, exam, present in the class
14	2	1&2	Pesticide	Theory/ Class	Questions during the lectures ,quiz, exam, present in the class
15	2	1&2	Final Exam	Theory/ Class	Questions during the lectures ,quiz, exam, present

					in the class

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

12. Learning and Teaching Resources

Required textbooks (curricular books, if a	Textbook: Rao C.S.," Environmental Pollution and Cont engineering", Willy Eastern Limited 1993
Main references (sources)	
Recommended books and references (scientific journals, reports…)	Nanley , N., and Bhatia, S.C.,"Pollution control Chemical and Allied Industries", CBS, Publish and Distributors Pvt. Ltd. 1st ed. 2010
Electronic References, Websites	

Course Description Form

1. Course Name: Unit Operation III

2. Course Code: CES.E. 432

3. Semester / Year: 2 st Semester

4. Description Preparation Date:٢٠٢٣ /٢٠٢٤

5. Available Attendance Forms: central / full

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

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

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

8. Course Objectives

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

9. Teaching and Learning Strategies

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

10. Course Structure

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

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

10. Course Evaluation

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

11. Learning and Teaching Resources

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

TEMPLATE FOR COURSE SPECIFICATION

HIGHER EDUCATION PERFORMANCERE VIEW: PROGRAMME REVIEW

COURSE SPECIFICATION

ThisCourseSpecificationprovidesaconcisesummary ofthemainfeaturesofthe course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification.

1. Teaching Institution	University of Technology
2. University/Department/Centre	Chemical Engineering Department-Chemical Engineering and Oil Pollution
3.Course title/code	Process Control/ CE.443
4.Programme(s) to which it contributes	CE.2
5.Modesof Attendance offered	Full time
6.Semester/Year	2 semesters/year
7. Number of hours tuition (total)	3
8. Date of production/revision of this Specification	16-3-2023
9. Aims of the Course	
Study of Dynamics and Control of Chemical Processes	

10·LearningOutcomes, Teaching,LearningandAssessmentMethod

A-Knowledge andUnderstanding

A1. Basic information, concepts and terminology of the general principles of Control Process

A2. Demonstrating a broad and integrated knowledge and a deep understanding of issues related to Control processes in a chemical Engineering and important role it plays in the success of the process.

A3. Ability to design Control process for the effective solution of intended problem.

B. Subject-specific skills

B1. Gain and/or improve their ability to synthesize, integrate and utilize process information in solving Control process problems.

B2. Analyze Control process issue, when necessary, design experiments to gain new data.

B3. Give an awareness and understanding of professional responsibilities concerned mainly with Control process that take place in industrial units, and, in particular, with determining the factors that influence on it.

B4. Use laboratory, engineering and measuring equipment to provide data in support of theoretical understanding

Teaching and Learning Methods

Lectures, Tutorials , Example Classes

Assessmentmethods

Midterm exams ,Final exam ,Quizzes, Weekly homework

C. Thinking Skills

C1. An ability to apply effective, creative and innovative solutions, both independently and cooperatively, to current and future problems inControl process.

C2. Apply course concepts in solving interdisciplinary problems, solve the problems through logic and improve their ability to work effectively in a group of peers.

C3. Present and evaluate information and ideas in the handling of Control process issues.

C4. Analyze and solve engineering problems often on the basis of limited and contradictory information.

TeachingandLearningMethods

Lectures, Tutorials, Example Classes

Assessmentmethods

Midterm exams,Final exam,Quizzes, Weekly homework.

D. General and Transferable Skills (other skills relevant to employ ability and personal development).

D1. Work together in same-discipline teams to solve engineering problems.

D2. Be creative, particularly and analytical in the formulation and solution of problems.

D3. Speed intuitive, predictability and evaluate information and ideas in the handling of Control process issues.

E. Identify, formulate, and solve engineering problems

An ability to identify and solve innovative solutions, both independently and cooperatively, to current and future problems in Control process.

K. Use the techniques, skills, and modern engineering tools necessary for engineering practice.

Have ability and skills to use modern control tools inthe operational units in factories and refineries.

11.Course Structure

Week	Hours	ILOs	Unit/Moduleor Topic Title	Teaching Method	Assessment Method
1st semester					
1	3	Response of First-order Systems,		Lectures, Example Classes, Practical Applications.	**Quiz**
2	3	Transfer Function		Lectures, Example Classes, Practical Applications.	
3	3	Transient Response Dynamic behavior of 1st order system		Lectures, Example Classes, Practical Applications.	
4	3	Transient Response Dynamic behavior of 1st order system		Lectures, Example Classes, Practical Applications.	**Quiz**
5	3	Dynamic behavior of 1st order system		Lectures, Example Classes, Practical Applications.	
6	3	Linearization.		Lectures, Example Classes, Practical Applications.	
7	3	Non-interacting System, Interacting System		Lectures, Example Classes, Practical Applications.	
8	3	2nd order Under-Damped System		Lectures, Example Classes, Practical Applications.	

9	3	2nd order Over-damped System Transportation Lag		Lectures, Example Classes, Practical Applications.	**Quiz**
10	3	Controllers ,P		Lectures, Example Classes, Practical Applications.	
11	3	Controllers ,PI,PD	-	Lectures, Example Classes, Practical Applications.	
12	3	Controllers ,PID		Lectures, Example Classes, Practical Applications.	
13	3	Final Control Elements		Lectures, Example Classes, Practical Applications.	
14	3	Overall Closed-Loop Transfer Functions		Lectures, Example Classes, Practical Applications.	
15	3	Overall Closed-Loop Transfer Functions		Lectures, Example Classes, Practical Applications.	**Quiz**
2nd semester					
16	3	Transient Response of Simple Control Systems		Lectures, Example Classes, Practical Applications.	
17	3	Transient Response of Simple Control Systems		Lectures, Example Classes, Practical Applications.	
18	3	Stability		Lectures, Example Classes, Practical Applications.	
19	3	Introduction to Frequency Response, Bode Diagrams		Lectures, Example Classes, Practical Applications.	
20	3	System Design by Frequency Response		Lectures, Example Classes, Practical Applications.	**Quiz**
21	3	Ziegler-Nichols Controller Settings.		Lectures, Example Classes, Practical Applications.	
22	3	Pneumatic Controller Mechanisms		Lectures, Example Classes, Practical Applications.	
23	3	Industrial Pneumatic Controller		Lectures, Example Classes, Practical Applications.	

24	3	Control of Complex Processes		Lectures, Example Classes, Practical Applications.	
25	3	Control of Distillation Column		Lectures, Example Classes, Practical Applications.	
26	3	Control of Heat Exchanger		Lectures, Example Classes, Practical Applications.	
27	3	Control of Chemical Reactor		Lectures, Example Classes, Practical Applications.	
28	3	Feed-forward Control, Ratio Control		Lectures, Example Classes, Practical Applications.	**Quiz**
29	3	Adaptive Control, Selective Control Systems.		Lectures, Example Classes, Practical Applications.	
30	3	Computer Control Loops		Lectures, Example Classes, Practical Applications.	

12.Infrastructure	
Requiredreading: ·CORETEXTS ·COURSEMATERIALS ·OTHER	○ Lecturers ○ Book -References ○ D.R. Coughanowr and S. LeBlanc, Process Systems Analysis and Control, McGraw-Hill, 3rd edition, 2008. ○ Stephanopoulos G., “Chemical Process Control-An Introduction to Theory and Practice, "Prentice -Hall, New Jersey, 1984. ○ Luyben W. L., “Process Modeling, Simulation and Control for Chemical Engineers,” McGraw-Hill, New York, 2nd Ed., 1990.
Specialrequirements(include for example workshops,periodicals, ITsoftware, websites)	websites

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

13. Admissions	
Pre-requisites	Before undertaking this module the student should have undertaken the following: Basic Principles of chemical engineering I and II, mathematics I and II ,mass transfer ,heat transfer, reactors as well simultaneous courses:- Thermodynamics , and applied mathematics
Minimumnumber ofstudents	Central Admission
Maximumnumber ofstudents	Central Admission

Course Description Form

1. Course Name:

Water and Wastewater Treatment Engineering /2

2. Course Code:

CES.E. 436

3. Semester / Year:

2nd Semester /Fourth

4. Description Preparation Date:

23/3/2024

5. Available Attendance Forms:

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

5/2

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

Name: Dr. Samira.N.abdullaha
Email: : samira.N.abdullaha@uotechnology.edu.iq

8. Course Objectives

Course Objectives	1- This course deals with discussion of tertiary (Advanced) treatment processes, including, disinfection, adsorption, membrane processes (Reverse osmosis & electrodialysis), ion exchange,sludge treatment of wastewater treatment plants . 2-Understand the basic principles of advanced wastewater treatment methodes

9. Teaching and Learning Strategies

Strategy	To help students develop the ability to apply basic understanding of to the successful design and operation of water and wastewate treatment plants,design parameters and operating of Tertiary Treatment. To enable the students to understand the basic concepts of water supply,consumption and wastewater quantity.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	Introduction to water & wastewa basics of advanced of water treatm definitions and distinctions discussed.	Tertiary wastew treatment	Lecture, Data show	daily preparation a discussion
2	3	Disinfection of wastewater: principles, definition, factors affecting the disinfection process, physical and chemical	Disinfection of wastewater/ Part 1	Lecture, Data show	daily preparatio and discussion

		methods .			
3-4	6	Disinfection by chlorination, Chemistry of chlorine in water, Break point chlorination	Chlorination Tank design criteria/Part 2		daily preparatio and discussion
5	3	Adsorption Process: definition,Types, Factors affecting adsorption, activated carbon characteristics, kinetics and equilibrium-different isotherm equations and their applications	Introducti inAdsorpt Process	Lecture, Data show	daily preparatio and discussion
6	3	Adsorption by activated carbon Freundlich isotherm and Langmuir isotherm.	Adsorption, Isotherms / part 2	Lecture, Data show	Questions answers
7-8	6	Adsorption process,/ part 3/desig packed column ,using kin equation	Packed bed colu design	Lecture, Data show	Questions answers
9-10	6	Membrane Process Technology , Types, Applications,Reverse Osmosis Treatment(RO)/ part 1 principles, applied, mathematical model	Reverse Osmosis/ mathemat model	Lecture, Data show	daily preparation discussion
11-12	6	Electrodialyssis treatment(ED),principles;system layout of (ED) treatment process Electrodialyssis treatment(ED), Design equations of (ED),Applications	Electrodialyssis treatment(ED/Part	Lecture, Data show	daily preparatio and discussion and Exam
13-14	6	Tertiary treatment, Ion exchange (IE), Principles ,Definition, Types of ion exchange resins, (IE) chemistry, Softening, Demineralization.	Ion Excha process/part 1		
15	3	Sludge Management,in this lecture,learn about Sludge management processes,sludge sources, processing, thickening, stabilization, conditioning, dewatering .	Sludge treatment,de ofgravity thickeners,design anaerobic digester		

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)	1- Hammer,M.J., "Water & Wastewater Technology", John Wiley & Sons,1977. 2- Mackenzie, L.D., "Water & Wastewater Engineering, Design

	Principles & Practice", McGraw-Hill International Ed., 2011. 3- Raju, B.S.N.," Water supply Wastewater Engineering", Tata McGraw-Hill pvt.co.Ltd.,New Delhi,(1995). 4- Fair,G.M., Geyer J.C and Okun," Water and Wastewater Engineering",vol.11,John Wiely publications.
Main references (sources)	Metcalf & Eddy, "Wastewater Engineering, Treatment & Reuse" McGraw-Hill, 4th Ed.2003
Recommended books and references (scientific journals, reports…)	Vesilind,P.A., & Jeffrey,J.P.,"Environmental Engineering" Ann Arbor As. Publishers,(198
Electronic References, Websites	
Water and wastewater treatment lab.	1-Sedimentation 2-Adsorption 3-Desalination,Reverse osmosis 4-Ion Exchange 5-coagulation and flocculation,Jar Test 6-Chemical Oxygen Demand 7-Disinfection

Course Description Form

1. Course Name: Corrosion Engineering \ 439

2. Course Code: CES.P. 439

3. Semester / Year: semester 2/year

4. Description Preparation Date: 24-3-2024

5. Available Attendance Forms: Lectures, Tutorials, Example Classes, homework, problem, reports.

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

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

Name: Prof. Dr. Khalid Hamid Rashid
Email: khalid.h.rashid@uotechnology.edu.iq

8. Course Objectives

Course Objectives	1. To introduce and develop and understanding the material that are precious resources, how th resources are destroyed by corrosion and how they must be preserved by applying corro protection technology. 2. Inspect the corrosion process, and the form of corrosion. 3. Determine the corrosion rate, and electrochemical behavior of the metals. 4. Applying the corrosion prevention technology.

9. Teaching and Learning Strategies

Strategy	Lectures, Tutorials, Example Classes, homework, problem, reports.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
16	2	To introduce , develop and understanding the material that are precious resources and how these resources are	Introduction ,definition ,corrosive environment ,consequence o corrosion, cost corrosion ,why metals corrode	Lectures, case study	Oral questions, discussion

		destroyed by corrosion	,basic concept i corrosion		
17	2	ility to understand types of rrosion and forms of corrosion	Classification of corrosi anodic and cathodic reactic type of cells, w corrosion, dry corrosion.	Lectures, case study	Oral questions, discussion
18	2	ility to understand types of rrosion and forms of corrosion	Forms of corrosion	Lectures, case study	Quiz
19	2	bility to correlate between electrochemistry (faradays law)and corrosion	Kinetics of aqueous corrosion	Lectures, Examples, Tutorials	Oral questions, discussion
20	2	bility to correlate between electrochemistry (faradays law)and corrosion	Current density, polarization ,activation ,concentration a combined polarization	Lectures	Oral questions, discussion
21	2	Ability to correlate free rgy and corrosion	Thermodynamics, free energy, cell potential, reversible electrode poten Nernst equation	Lectures, Examples, Tutorial	Quiz.
22	2	Ability to calculate the corrosion rate	Determining the corrosi rate ,corrosion r measurement u methods determining corrosion rate (immersion test	Lectures, Examples, Tutorial	Oral questions, discussion
23	2	Ability to calculate the corrosion rate	Electrochemical techniq ,Tafel extrapolation ,Linear polarization	Lectures, Examples, Tutorial	Quiz.
24	2	ility to distinguish between electrochemical behavior of metals	Passivity, active passive metal ,condition for passivity ,kinetics for passivity ,stable and unstable passivity	Lectures, Examples, Practical application	Oral questions, discussion
25	2	ility to distinguish between electrochemical behavior of metals	Reference electrodes, hydrogen electrode, Ag\AgCl, $Cu\CuSO_4$,$Zn\ZnCl_2$ $Pb\PbCl_2$ electrode	Lectures, Examples, tutorial	Oral questions, discussion
26	2	lity to thinking of different methods for rosion prevention	Corrosion prevention, material selecti alteration of environment, design, coating,	Lectures, Examples, practical application	Oral questions, discussion
27	2	lity to thinking of different methods for rosion prevention	Cathodic and Anodic protection	Lectures, Examples, practical application	Oral questions, discussion

28	2	lity to thinking of different methods for rosion prevention	Corrosion control by inhibition ,important consideration in selection of inhibitor ,classification o inhibitor, description of inhibitors	Lectures, Examples, practical application	Oral questions, discussion
29	2	lity to thinking of different methods for rosion prevention	Effect of inhibitor on polarization behavior, calculation of inhibitor concentration ,inhibitor efficiency	Lectures, Examples, practical application	Oral questions, discussion
30	2	lity to thinking of efficient oiler requirement	Boiler corrosion, major corrosion probl in boilers.	Lectures, Examples, practical application	Quiz.

11. Course Evaluation

Develop a deep understanding of issues related to the corrosion science and electrochemistry. Ability to predict the form of corrosion. Ability to apply corrosion prevention

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	M.G.FONTANA and N.D.GREENE,CORROSION ENGINEERING ,3rd Edition, Mc-GRAW-HILL BOOK COMPANY 1985
Main references (sources)	ZAKI AHMAD, PRINCIPLES OF CORROSION ENGINEERING AND CORROSION CONTROL,1ST ,IChe , 2006
Recommended books and references (scientific journals, reports…)	Journals of corrosion Journal of Bio- and Tribo-Corrosion
Electronic References, Websites	Special requirements (include for example workshops, periodicals, IT software, websites)