MODULE DESCRIPTION Form

University Name: .Northern Technical University.....

Faculty/Institute: .Technical Engineering College Mosul.....

Scientific Department: Chemical and Petroleum Industries Technologies Engineering

Academic or Professional Program Name: Bachelor of Chemical and Petroleum Industries Technologies Engineering

Final Certificate Name: Bachelor of Chemical and Petroleum Industries Technologies Engineering

Academic System: Bologna Process.....

Description Preparation Date: 2/9/2025

File Completion Date: 2/9/2025

Signature:

Head of Department Name:
Harder Ismael Ibrahim

Date: 2/9/2025

Signature:

Scientific Associate Name:
Prof. Dr. Mohammed Sabah Jarjees

Date: 25/9/2025

The file is checked by:

Department of Quality Assurance and University Performance

Director of the Quality Assurance and University Performance

Department: Assist. Lect. Warqaa Hashim Mahmood

Date:

Signature:

Approval of the Dean

Ministry of Higher Education and Scientific Research - Iraq
Northern Technical University
Technical Engineering College-Mosul
Engineering Technological for Chemical and Petroleum Industries

MODULE DESCRIPTOR FORM

Module Information					
Module Title	**Arabic Language**			**Module Delivery**	
Module Type	**Support**			**Theory** **Lecture** **Seminar**	
Module Code	**NTU103**				
ECTS Credits	**2**				
SWL (hr/sem)	**50**				
Module Level UGx1	1		**Semester of Delivery**	2	
Administering Department	Chemical and Oil Industries Techniques Engineering		**College**	Technical Engineering College –Mosul	
Module Leader	shamaa alobaidy		**e-mail**	shamaaalobaidy@ntu.edu.iq	
Module Leader's Acad. Title	Dr.		**Module Leader's Qualification**	Dr.	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E E-mail	
Scientific Committee Approval Date	01/06/2023		**Version Number**	1.0	

Relation with other Modules					
Prerequisite module		None		**Semester**	
Co-requisites module		None		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents		
Module Objectives	1. Learn the rules of writing and spelling accurately in the Arabic language. 2. Acquire the skills of distinguishing between doubled (shadda) and shortened letters and using them correctly. 3. Understand and correctly use the letters Daad, Thaa and Hamza, and the sun and moon letters. 4. Develop writing and linguistic communication skills and use punctuation marks effectively. 5. Learn the concepts of sentences, objects and numbers, the rules of prepositions, and how to write administrative letters professionally.	
Module Learning Outcomes	Based on the topics mentioned, what the student learns by the end of the course can be summarized as follows:	
	● Writing skills: The student acquires basic skills of Arabic writing, including writing rules,	
	differentiation between doubled and shortened letters, and the correct use of punctuation marks.	
	● Pronunciation and spelling: The student learns how to pronounce and use Arabic	

	phonetic letters such as Daad and Thaa	
	accurately, as well as how to write the Hamza in words.	
	● Linguistic rules: The student benefits from knowing the basic linguistic rules, such as the basic parts of the sentence,	
	objects and numbers.	
	● Distinguishing between sun and moon letters: The student recognizes the sun and moon letters and learns to use them	
	correctly.	
	● Administrative writing skills: The student acquires the skills of writing administrative letters professionally and becomes	
	able to interact effectively in an administrative work environment.	
Indicative Contents	1. Rules for writing the extended and shortened Alif – sun and moon letters 2. The letters Daad and Thaa 3. Writing the Hamza 4. Punctuation marks 5. The noun and the verb and how to distinguish between them 6. Objects (Al-Mafa'eel) 7. Numbers 8. Applications of common linguistic errors 9. Noon and Tanween – meanings of prepositions	
	10. Formal aspects of the administrative letter 11. The language of the administrative letter 12. Samples of administrative correspondence	

Learning and Teaching Strategies	
Strategies	The course will be assessed through a variety of exams, assignments, presentations and projects. Assessment methods may include written tests, scientific research, technical reports, oral presentations, and participation in class activities.

Student Workload (SWL)			
Structured SWL (h/sem)	32	**Structured SWL (h/w)**	2.1
Unstructured SWL (h/sem)	68	**Unstructured SWL (h/w)**	4.5
Total SWL (h/sem)	**100**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	1hr	10% (10)	7	LO #1 - #7
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

	Delivery Plan (Weekly Syllabus)
	Material Covered
Week 1	Introduction to linguistic errors – the tied Taa, the long Taa and the open Taa

Week 2	Rules for writing the extended and shortened Alif – sun and moon letters
Week 3	The letters Daad and Thaa
Week 4	Writing the Hamza
Week 5	Punctuation marks

Week 6	The noun and the verb and how to distinguish between them
Week 7	Objects (Al-Mafa'eel)
Week 8	Numbers
Weeks 9, 10	Applications of common linguistic errors
Week 11	Noon and Tanween – meanings of prepositions
Week 12	Formal aspects of the administrative letter
Weeks 13, 14	The language of the administrative letter
Week 15	Samples of administrative correspondence

Learning and Teaching Resources		
	Text	Available in the Library?
Required Texts	● Al-Imlaa Al-Wadih (Clear Spelling): Abdul-Majeed Al-Nuaimi, Daham Al-Kayyal, Dar Al-Mutanabbi Library, Baghdad, 6th ed. ● Lessons in Language, Grammar and Spelling for State Employees: Ismail Hammoud Atwan et al., Ministry of Education Press No. (3), Baghdad, 2nd ed., 1984.	Yes
Recommended Texts	● General Arabic Language for Non-Specialized Departments: Abdul-Qadir Hassan Ameen et al., Ministry of Higher Education and Scientific Research, 2nd ed., 2000. ● Min Wahy Al-Adab Al-Arabi (Inspired by Arabic Literature): Hafal Muhammad Ameen, Al-Saadoun Press, Baghdad.	Yes
Websites	● www.dalilalarab.com ● www.learningarabic.net	

Grading Scheme

Group	Grade	Rating	Marks %	Definition
Success Group (50 - 100)	A - Excellent	Excellent	90 – 100	Outstanding Performance
	B - Very Good	Very Good	80 – 89	Above average with some errors
	C - Good	Good	70 – 79	Sound work with notable errors
	D - Satisfactory	Average	60 – 69	Fair but with major shortcomings
	E - Sufficient	Acceptable	50 – 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX – Fail**	Fail (under treatment)	(45-49)	More work required but credit awarded
	F – Fail	Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark
of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

Ministry of Higher Education and Scientific Research - Iraq
Northern Technical University
Technical Engineering College-Mosul
Engineering Technological for Chemical and Petroleum Industries

MODULE DESCRIPTOR FORM

Module Information					
Module Title	**Computer Principles**			**Module Delivery**	
Module Type	**BASIC**			**Theory** **Lecture** **Lab** **Tutorial** **Practical** **Seminar**	
Module Code	**NTU102**				
ECTS Credits	**3**				
SWL (hr/sem)	**75**				
Module Level UGx1		1	**Semester of Delivery**		2
Administering Department		Chemical and Oil Industries Techniques Engineering	**College**	Technical Engineering College –Mosul	
Module Leader	luluwah Yaseen		**e-mail**	luluwah.alhubaity@ntu.edu.iq	
Module Leader's Acad. Title		Assistant Lecturer	**Module Leader's Qualification**		Master's
Module Tutor	(Not available)		**e-mail**	E-mail	
Peer Reviewer Name		Name	**e-mail**	E	E-mail
Scientific Committee Approval Date		01/06/2025	**Version Number**	1.0	

Relation with other Modules					
Prerequisite module		None		**Semester**	
Co-requisites module		None		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	1.Familiarize students with the basic components and functions of a computer system. 2.To develop practical skills in using popular software applications for word processing, spreadsheets, and presentations. 3.To enable students to effectively browse the internet, search for information, and evaluate online resources. 4. Introduce students to computer security best practices and data management techniques. 5.To enhance students' digital communication skills through email, messaging, and online collaboration tools. 6. Promote critical thinking and problem-solving skills related to computer use
Module Learning Outcomes	At the end of the semester the student should be able to: 1.Understand the basic components and functions of a computer system. 2.Explain the purpose and operation of major hardware components, such as the CPU, memory, storage devices, and input/output devices.

	3.Identify and navigate various operating systems and understand their key features. 4.Demonstrate proficiency in using common software applications, including word processing, spreadsheets, and presentations. 5.Utilize basic file management techniques to organize and retrieve files and folders. 6.Recognize and apply essential computer security practices to protect personal data and systems. 7. Students will be familiar with common computer applications and tools, such as, web browsers and email clients.
Indicative Contents	1.Introduction to Computers: • Overview of computer hardware and software • Understanding operating systems • Computer peripherals and accessories

	2.Computer Basics and File Management: • Navigating the desktop and file organization • Creating, copying, moving, and deleting files and folders • Basic troubleshooting techniques 3.Word Processing: • Creating and formatting documents • Editing and proofreading text • Inserting images, tables, and other elements 4.Spreadsheets: • Creating, formatting, and modifying spreadsheets • Working with formulas and functions • Data visualization and chart creation 5.Presentations: • Creating visually appealing slideshows • Adding text, images, and multimedia elements • Applying transitions and animations 6.Internet Skills: • Navigating web browsers and search engines • Evaluating online information and sources • Understanding internet safety and privacy • Email and Online Communication: • Setting up and managing email accounts • Composing and organizing emails 7.Computer Security and Data Management: • Best practices for password management and online security • Protecting against viruses and malware • Backing up and organizing digital files

Learning and Teaching Strategies	
Strategies	• Provide a clear and concise overview of the key concepts of computer principles .

	• Use a variety of teaching methods, including lectures, demonstrations, and hands-on activities, to engage students and help them understand the material. • Encourage students to participate in class discussions and activities. • Provide opportunities for students to apply what they have learned to solve real-world problems. • Assess student learning through a variety of methods, including quizzes, exams, and projects.

Student Workload (SWL)			
Structured SWL (h/sem)	78	**Structured SWL (h/w)**	5.2
Unstructured SWL (h/sem)	22	**Unstructured SWL (h/w)**	1.47
Total SWL (h/sem)	**100**		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO #1 - #7
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

		Material Covered
Week 1,2		Introduction to Computers
Week 3,4		Computer Basics and File Management
Week 5,6,7		Word Processing
Week 8,9		Spreadsheets
Week 10,11,12		Presentations
Week 13,14		Internet Skills
Week 15		Computer Security and Data Management
Week 16		Preparatory week before the Final Exam

Delivery Plan (Weekly Lab. Syllabus)

	Material Covered
Week 1,2	Introduction to Computers: • Navigating the desktop and accessing programs • Using the Start menu and taskbar • Exploring computer hardware components • Introduction to the operating system (e.g., Windows, macOS)
Week 3,4	File Management • Creating, renaming, copying, moving, and deleting files and folders • Organizing files and folders into directories • Using search tools to locate files • Managing file extensions and file types
Week 5,6,7	Word Processing: • Creating a new document • Formatting text (e.g., font, size, colour, style) • Applying paragraph formatting (e.g., alignment, indentation, spacing) • Inserting and formatting images, tables, and bullets • Printing documents
Week 8,9	Spreadsheets:

	• Creating and saving a new spreadsheet • Entering and formatting data in cells • Using basic formulas and functions (e.g., sum, average, max, min) • Creating charts and graphs from spreadsheet data • Printing spreadsheet
Week 10 ,11,12	Presentations: • Creating a new presentation • Formatting slides (e.g., layout, background, design) • Adding text, images, and multimedia elements to slides • Applying transitions and animations to enhance presentation

	• Printing slides
Week 13,14	Internet Skills: • Navigating web browsers (e.g., Google Chrome, Mozilla Firefox) • Searching for information using search engines (e.g., Google, Bing) • Evaluating the credibility of online sources • Saving and organizing bookmarks/favorites
Week 15	Email and Online Communication: • Setting up and configuring an email account • Composing, replying to, and forwarding emails • Attaching files to email messages • Managing email folders and filters
Week 14,15	Computer Security and Data Management: • Creating strong passwords and managing password security • Installing and updating antivirus software • Backing up files and folders • Managing digital privacy settings and protecting personal information
Week 16	**Preparatory week before the Final Exam**

Learning and Teaching Resources

	Text	**Available in the Library?**
Required Texts	• "Discovering Computers" by Misty E. Vermaat, Susan L. Sebok, and Steven M. Freund • "Computer Concepts and Microsoft Office 365 & Office 2019" by Misty E. Vermaat, Susan L. Sebok, and Steven M. Freund • "New Perspectives on Computer Concepts" by June Jamrich Parsons, Dan Oja, and Lisa Ruffolo	Yes
Recommended Texts	• "GO! with Microsoft Office 365, Word, Excel, PowerPoint & Access" by Shelley Gaskin, Alicia Vargas, Debra Geoghan, and Nancy Graviett • "Technology in Action" by Alan Evans, Kendall Martin, and Mary Anne Poatsy	Yes

Websites	www.khanacademy.org

Grading Scheme

Group	Grade	Rating	Marks %	Definition
Success Group (50 - 100)	A - Excellent	Excellent	90 - 100	Outstanding Performance
	B - Very Good	Very Good	80 - 89	Above average with some errors
	C – Good	Good	70 - 79	Sound work with notable errors
	D - Satisfactory	Average	60 - 69	Fair but with major shortcomings
	E - Sufficient	Acceptable	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX – Fail**	Fail (under treatment)	(45-49)	More work required but credit awarded
	F – Fail	Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark
of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

Module Information					
Module Title	**Electrical Circuits**			**Module Delivery**	
Module Type	**Core**			☒ **Theory**	
Module Code	**ETCP-107**			☒ **Lecture**	
ECTS Credits	6			☒ **Lab**	
SWL (hr/sem)	**150**			☐ **Tutorial**	
				☐ **Practical**	
				☐ **Seminar**	
Module Level UGx1	1		**Semester of Delivery**	2	
Administering Department	Chemical and Oil Industries Techniques Engineering		**College**	Technical Engineering College –Mosul	
Module Leader	AZAM ISAM ABDULKAREEM		**e-mail**	Azzam.esam@ntu.edu.iq	
Module Leader's Acad. Title	Assistant Lecturer		**Module Leader's Qualification**	Master's	
Module Tutor	AZAM ISAM ABDULKAREEM		**e-mail**	Azzam.esam@ntu.edu.iq	
Peer Reviewer Name	Name		**e-mail**	E E-mail	
Scientific Committee Approval Date	01/06/2025		**Version Number**	1.0	

Relation with other Modules					
Prerequisite module		None		**Semester**	
Co-requisites module		None		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	1. Gain a thorough understanding of basic elements of electrical circuits, including current sources, voltage sources, resistors, and Ohm's Law. Analyze series and parallel circuits and understand the loading effects on circuits. 2. Learn about current dividers and voltage dividers, and their applications in circuit analysis. Calculate the division of current and voltage in different circuit configurations. 3. Understand Kirchhoff's Laws (KCL and KVL) and apply them to solve DC circuits. Analyze complex circuits and determine currents and voltages. 4. Learn the loop currents and node voltages methods in DC circuit analysis. Apply these methods to solve circuits with multiple loops or nodes, providing a systematic approach to circuit analysis. 5. Explore the Superposition Theorem and Source Conversion Theorem in DC circuit analysis. Apply these theorems to simplify circuit analysis and solve complex circuits with multiple sources. 6. Understand AC circuits, sinusoidal waveforms, and their characteristics. Introduce phasors and the phasor representation of AC quantities for analyzing AC circuits. 7. Understand impedance in AC circuits and calculate reactance for inductive and capacitive elements. Understand the relationship between resistance, inductance, and capacitance in AC circuits. 8. Construct and interpret phasor diagrams to visualize magnitude and phase relationships in AC circuits. Learn phasor addition and subtraction techniques to analyze complex AC circuits. 9. Explore complex power in AC circuits, including real power, reactive power, and apparent power. Calculate complex power using phasor notation for

	understanding power flow and efficiency in AC circuits. 10. Delve into power factor and its significance in AC circuits. Calculate power factor using real and reactive power to assess the efficiency and quality of power consumption in electrical systems. 11. Analyze series and parallel AC circuits with resistive, inductive, and capacitive elements. Understand how impedance affects circuit behavior and learn techniques to effectively analyze and solve these types of circuits

Module Learning Outcomes		1. Students will gain a thorough understanding of basic elements of electrical circuits, including current sources, voltage sources, resistors, and Ohm's Law. They will learn how to analyze series and parallel circuits, and understand the loading effects on circuits. 2. Students will learn about current dividers and voltage dividers, and their applications in circuit analysis. They will understand how to calculate the division of current and voltage in different circuit configurations. 3. Students will be introduced to Kirchhoff's Laws, specifically Kirchhoff's Current Law (KCL) and Kirchhoff's Voltage Law (KVL). They will learn how to apply these laws to solve DC circuits, enabling them to analyze complex circuits and determine currents and voltages. 4. Students will learn about the loop currents and node voltages methods in DC circuit analysis. They will understand how to apply these methods to solve circuits with multiple loops or nodes, providing a systematic approach to circuit analysis. 5. Students will explore the Superposition Theorem and Source Conversion Theorem in DC circuit analysis. They will learn how to apply these theorems to simplify circuit analysis and solve complex circuits with multiple sources. 6. Students will learn about AC circuits, including an introduction to sinusoidal waveforms and their characteristics such as amplitude, frequency, and period. They will also be introduced to phasors and the phasor representation of AC quantities, which will aid in analyzing AC circuits. 7. Students will gain an understanding of impedance in AC circuits and the concept of reactance. They will learn how to calculate reactance for inductive and capacitive elements, as well as understand the relationship between resistance, inductance, and capacitance in AC circuits. 8. Students will learn how to construct and interpret phasor diagrams, which will help visualize the magnitude and phase relationships in AC circuits. They will also learn phasor addition and subtraction techniques to analyze complex AC circuits. 9. Students will explore complex power in AC circuits, including real power, reactive power, and apparent power. They will learn how to calculate complex power using phasor notation, which is crucial for understanding power flow and efficiency in AC circuits. 10. Students will delve into power factor and its significance in AC circuits. They will learn how to calculate power factor using real and reactive power, helping them assess the efficiency and quality of power consumption in electrical systems. 11. Students will analyze series and parallel AC circuits with resistive, inductive, and capacitive elements. They will understand how impedance affects circuit behavior and learn techniques to analyze and solve these types of circuits

	effectively.
Indicative Contents	1. Introduction to Electrical Circuits: • Basic elements of circuits • Current sources and voltage sources

	• Loading effects in circuits • Resistors and Ohm's Law • Series and parallel circuit analysis 2. Current Dividers and Voltage Dividers: • Current divider's law and its applications • Voltage divider's law and its applications 3. DC Circuit Analysis: Kirchhoff's Laws: • Kirchhoff's Current Law (KCL) • Kirchhoff's Voltage Law (KVL) • Applying KCL and KVL to solve DC circuits 4. DC Circuit Analysis: Loop Currents and Node Voltages Methods: • Introduction to loop currents and node voltages • Applying loop currents and node voltages methods to solve DC circuits with multiple loops or nodes 5. DC Circuit Analysis: Superposition Theorem and Source Conversion Theorem: • Superposition theorem and its application in DC circuits • Source conversion theorem and its application in DC circuits 6. DC Circuit Analysis: Thevenin and Norton Theorems and Maximum Power Theorem: • Thevenin theorem and its application in DC circuits • Norton theorem and its application in DC circuits • Maximum power transfer theorem in DC circuits 7. AC Circuits: Introduction to Alternating Current: • Introduction to sinusoidal waveforms • Characteristics of sinusoidal waveforms (amplitude, frequency, period) • Phasors and phasor representation of AC quantities 8. AC Circuit Analysis: Impedance and Reactance: • Introduction to impedance in AC circuits • Understanding resistance, inductance, and capacitance • Calculation of reactance for inductive and capacitive elements 9. AC Circuit Analysis: Phasor Diagrams: • Construction and interpretation of phasor diagrams • Phasor addition and subtraction for AC quantities 10. AC Circuit Analysis: Complex Power: • Real power, reactive power, and apparent power in AC circuits • Calculation of complex power using phasor notation 11. AC Circuit Analysis: Power Factor: • Definition and significance of power factor

	• Calculation of power factor using real and reactive power 12. AC Circuit Analysis: Series and Parallel Impedances: • Analysis of series AC circuits with resistive, inductive, and capacitive elements • Analysis of parallel AC circuits with resistive, inductive, and capacitive elements

Learning and Teaching Strategies	
Strategies	1. Use a combination of lectures, demonstrations, and hands-on activities to introduce and explain concepts. 2. Provide practical examples and real-world applications to enhance understanding. 3. Utilize visual aids, such as diagrams, graphs, and phasor diagrams, to enhance comprehension. 4. Assign regular homework and practice exercises to reinforce learning and provide opportunities for self-assessment. 5. Provide opportunities for students to engage in laboratory experiments to apply theoretical knowledge to practical scenarios. 6. Offer additional resources, such as textbooks, online tutorials, and supplementary readings, to support self-directed learning. 7. Provide timely feedback on assignments and assessments to guide students' progress and address any misconceptions. 8. Encourage students to collaborate and discuss concepts with their peers to foster a deeper understanding of the material. 9. Conduct periodic assessments, quizzes, and exams to evaluate students' knowledge and ensure comprehension of the course material.

Student Workload (SWL)			
Structured SWL (h/sem)	109	**Structured SWL (h/w)**	7

Unstructured SWL (h/sem)	91	**Unstructured SWL (h/w)**	6
Total SWL (h/sem)	**200**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO #1 - #7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction to Electrical Circuits
Week 2	Loading Effects in Circuits
Week 3	Current Dividers and Voltage Dividers
Week 4	DC Circuit Analysis: Kirchhoff's Laws
Week 5	DC Circuit Analysis: Loop Currents and Node Voltages Methods
Week 6	DC Circuit Analysis: Superposition Theorem and Source Conversion Theorem
Week 7	DC Circuit Analysis: Thevenin and Norton Theorems and Maximum Power Theorem
Week 8	AC Circuits: Introduction to Alternating Current
Week 9	AC Circuit Analysis: Impedance and Reactance

Week 10	AC Circuit Analysis: Phasor Diagrams
Week 11	AC Circuit Analysis: Complex Power
Week 12	AC Circuit Analysis: Power Factor
Week 13	AC Circuit Analysis: Series and Parallel Impedances
Week 14	AC Circuit Analysis: Series and Parallel Impedances (continued)
Week 15	Review and Practice
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Introduction to Circuit Components
Week 2	Ohm's Law
Week 3	Current and Voltage Divider Circuits
Week 4	Kirchhoff's Laws
Week 5	Analysis of Multi-Loop Circuits
Week 6	Superposition Theorem Application
Week 7	Thevenin and Norton Equivalent Circuits
Week 8	AC Voltage and Frequency Measurement
Week 9	Measurement of Impedance in AC Circuits
Week 10	Phasor Diagram Construction
Week 11	Measurement of Power in AC Circuits
Week 12	Power Factor Correction
Week 13	Analysis of Series AC Circuits
Week 14	Analysis of Parallel AC Circuits
Week 15	Comprehensive Circuit Analysis

Week 16	The preparation week before the final Exam

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Fundamentals of Electric Circuits, C.K. Alexander and M.N.O Sadiku, McGraw-Hill Education	Yes
Recommended Texts	DC Electrical Circuit Analysis: A Practical Approach Copyright Year: 2020, dissidents.	No
Websites	https://www.coursera.org/browse/physical-science-and-engineering/electrical-engineering	

Grading Scheme				
Group	**Grade**	Rating	**Marks %**	**Definition**
Success Group (50 - 100)	A - Excellent	Excellent	90 - 100	Outstanding Performance
	B - Very Good	Very Good	80 - 89	Above average with some errors
	C - Good	Good	70 - 79	Sound work with notable errors
	D - Satisfactory	Average	60 - 69	Fair but with major shortcomings
	E - Sufficient	Acceptable	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX – Fail**	Fail (under treatment)	(45-49)	More work required but credit awarded
	F – Fail	Fail	(0-44)	Considerable amount of work required
Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a				

mark
of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTOR FORM

Module Information					
Module Title	**ENGINEERING DRAWING**			**Module Delivery**	
Module Type	**Core**			**Theory** **Lecture** **Lab** **Tutorial** **Practical** **Seminar**	
Module Code	ETCP105				
ECTS Credits	8				
SWL (hr/sem)	**200**				
Module Level UGx1	1		**Semester of Delivery**	1	
Administering Department	Chemical and Oil Industries Techniques Engineering		**College**	Technical Engineering College –Mosul	
Module Leader	AZAM ISAM ABDULKAREEM		**e-mail**	Azzam.esam@ntu.edu.iq	
Module Leader's Acad. Title	Assistant Lecturer		**Module Leader's Qualification**	Master's	
Module Leader	AZAM ISAM ABDULKAREEM		**e-mail**	Azzam.esam@ntu.edu.iq	
Peer Reviewer Name	Name		**e-mail**	E E-mail	
Scientific Committee Approval Date	01/06/2025		**Version Number**	1.0	

Relation with other Modules					
Prerequisite module		None		**Semester**	
Co-requisites module		None		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	1.Understand the importance of engineering drawing in various fields, and grasp the basic principles and concepts involved in engineering drawing. Recognize the role of engineering drawing in design, manufacturing, and construction processes. 2.Familiarize yourself with AutoCAD 2D software and its applications in engineering drawing. Explore the advantages and features of AutoCAD in creating accurate and precise drawings. Learn about the AutoCAD user interface and workspace. 3.Gain proficiency in AutoCAD basics, including setting drawing boundaries, enabling grid display for precise positioning, using object snap modes for accurate object alignment, adjusting the view magnification level, and moving the view within the drawing area. 4.Develop skills in using the Draw menu in AutoCAD, such as drawing straight lines, creating connected series of lines and arcs, drawing regular polygons and rectangles, creating circular arcs and circles, inserting single points, and adding text annotations to the drawing.

	5.Learn how to utilize the Modify menu in AutoCAD effectively, which includes deleting objects from the drawing, duplicating objects, creating mirrored copies of objects, creating parallel copies of lines and curves, moving objects within the drawing, rotating objects around a specified point, trimming or extending objects to meet specified boundaries, extending objects to meet other objects, and breaking down complex objects into simpler components.
Module Learning Outcomes	1. Demonstrate an understanding of the importance of engineering drawing in various fields and its role in design, manufacturing, and construction processes. 2. Utilize AutoCAD 2D software to create accurate and precise engineering drawings, demonstrating proficiency in its features and advantages. 3. Apply the basic principles and concepts of engineering drawing, including setting drawing boundaries, enabling grid display, and using object snap modes for accurate object alignment. 4. Use the Draw Menu in AutoCAD to create various shapes and objects, such as lines, polygons, rectangles, arcs, circles, points, and text annotations. 5. Employ the Modify Menu in AutoCAD to perform actions such as erasing

	objects, copying and mirroring objects, offsetting lines and curves, moving and rotating objects, trimming and extending objects, and exploding complex objects into simpler components.
Indicative Contents	1. Introduction to Engineering Drawing: • Importance of engineering drawing in various fields • Basic principles and concepts of engineering drawing • Role of engineering drawing in design, manufacturing, and construction processes 2. Introduction to AutoCAD 2D Software in Engineering Drawing: • Overview of AutoCAD software and its applications in engineering drawing • Advantages and features of AutoCAD in creating accurate and precise drawings • Introduction to the AutoCAD user interface and workspace 3. AutoCAD Basics: • Limits: Setting the drawing boundaries • Grid: Enabling grid display for precise positioning • Object Snap: Using object snap modes for accurate object alignment • View Menu: • Zoom: Adjusting the view magnification level • Pan: Moving the view within the drawing area 4. Draw Menu: • Line: Drawing straight lines • Polyline: Creating connected series of lines and arcs • Polygon: Drawing regular polygons • Rectangle: Creating rectangular shapes • Arc: Drawing circular arcs • Circle: Creating circles • Point: Inserting single points • Text: Adding text annotations to the drawing 5. Modify Menu: • Erase: Deleting objects from the drawing • Copy: Duplicating objects • Mirror: Creating mirrored copies of objects • Offset: Creating parallel copies of lines and curves

	• Move: Moving objects within the drawing • Rotate: Rotating objects around a specified point • Trim: Trimming or extending objects to meet specified boundaries • Extend: Extending objects to meet other objects

	• Explode: Breaking down complex objects into simpler components 6. Perspective Drawing: • Introduction to perspective drawing and its applications • Basic principles of creating a perspective view in engineering drawing • Techniques for creating depth and dimension in perspective drawings 7. Orthographic Projection: • Explanation of orthographic projection and its significance • Understanding the six principal views (top, front, right side, left side, rear, bottom) • Techniques for representing objects in orthographic projection 8. First and Third Angle Projection Method: • Difference between the first and third angle projection methods • Comparative analysis of the two methods • Application scenarios for each method 9. Drawing Projection with First Angle Projection Method: • Step-by-step process of drawing an object using the first angle projection method • Creating orthographic views based on the given information • Techniques for aligning and labeling the views 10. Drawing Projection with Third Angle Projection Method: • Step-by-step process of drawing an object using the third angle projection method • Creating orthographic views based on the given information • Techniques for aligning and labeling the views 11. Drawing Three Projections with First and Third Angle Projection Method: • Simultaneously drawing the three orthographic views using both projection methods • Comparing and contrasting the results of the two methods • Identifying the advantages and disadvantages of each approach 12. Configuration of a Printing Layout and Print Scale: • Setting up a printing layout in AutoCAD • Defining the paper size, orientation, and margins • Configuring the scale for printing drawings accurately

Learning and Teaching Strategies	
Strategies	1. Hands-on AutoCAD Exercises: Students will engage in a series of hands-on exercises designed to progressively build their skills in AutoCAD. These exercises will require students to apply the principles and techniques of engineering drawing using AutoCAD commands and tools. By actively using the software, students will develop a practical understanding of drawing creation, modification, and projection methods. 2. Step-by-Step Tutorials: Step-by-step tutorials will be provided to guide students through specific tasks and functionalities in AutoCAD. These tutorials may be in the form of written instructions or recorded videos, allowing students to follow along and practice using the software. By following these tutorials, students will gain a comprehensive understanding of AutoCAD's features and how to effectively utilize them in engineering drawing. 3. Project-Based Learning: A significant component of the course will involve

	project-based learning, where students will be assigned a comprehensive project that integrates engineering drawing principles with AutoCAD. Students will be tasked with creating a complete drawing or design, applying the concepts learned in class to solve real-world design challenges. Through these projects, students will develop problem-solving skills, critical thinking abilities, and a deeper understanding of the practical applications of engineering drawing using AutoCAD. 4. Peer Collaboration and Review: Collaborative learning will be encouraged through peer collaboration and review sessions. Students will have the opportunity to work in pairs or small groups, reviewing each other's AutoCAD drawings and providing constructive feedback. This strategy fosters a supportive learning environment where students can share their insights, exchange ideas, and learn from different perspectives. By engaging in peer collaboration, students will enhance their communication, teamwork, and analytical skills, while also refining their understanding of AutoCAD techniques.

Student Workload (SWL)			
Structured SWL (h/sem)	63	**Structured SWL (h/w)**	4.2
Unstructured SWL (h/sem)	37	**Unstructured SWL (h/w)**	2.47
Total SWL (h/sem)	**100**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO #1 - #7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
1	Introduction to engineering drawing, introduction about Auto CAD 2D software in engineering drawing. Limits, grid, object snap, view menu (zoom, pan).
2&3	Draw menu (line, poly line, polygon, rectangle, arc, circle, point, text).
4&5	Modify menu(erase, copy, mirror, offset, move, rotate, trim, extend, explode)
6&7&8	Perspective
9	Orthographic projection
10	First and third angle projection method
11	Draw the projection with the first angle projection method
12	Draw the projection with the third angle projection method
13	Drawing the three projection with the first and third angle projection method
14,15	Configuration of a printing layout and the print configuration and scale of printing
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Introduction to Engineering Drawing and AutoCAD Basics
Week 2,3	Mastering Limits, Grid, and Object Snap in AutoCAD
Week 4,5	Exploring Drawing Tools - Lines, Shapes, and Text
Week6	Manipulating Drawings - Modify Menu Techniques
Week 7,8,9	Perspective and Orthographic Projection
Week10,11	First Angle Projection Method - Drawing Projections
Week 12,13	Third Angle Projection Method - Drawing Projections
Week 14	Drawing the Three Projections - First and Third Angle Projection
Week 15	Configuring Printing Layout and Print Scale

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	• "Technical Drawing with Engineering Graphics" by Frederick E. Giesecke, Alva Mitchell, Henry C. Spencer, Ivan L. Hill, John T. Dygdon, and James E. Novak • "Engineering Graphics Essentials with AutoCAD 2022 Instruction" by Kirstie Plantenberg	Yes
Recommended Texts	• "AutoCAD 2022 for Beginners" by CADFolks • "AutoCAD 2022 Tutorial Second Level 3D Modeling" by Randy H. Shih	Yes
Websites	• www.engineeringgraphics.org • www.udemy.com	

Grading Scheme				
Group	**Grade**	Rating	**Marks %**	**Definition**
	A - Excellent	Excellent	90 - 100	Outstanding Performance
	B - Very Good	Very Good	80 - 89	Above average with some errors
	C - Good	Good	70 - 79	Sound work with notable errors
	D - Satisfactory	Average	60 - 69	Fair but with major shortcomings
	E - Sufficient	Acceptable	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX – Fail**	Fail (under treatment)	(45-49)	More work required but credit awarded
	F – Fail	Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark
of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

Module Information					
Module Title	**Engineering Mechanics &Strength of Materials**			**Module Delivery**	
Module Type	Core			☒ **Theory** ☒ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**ETCP104**				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level UGx1		1	**Semester of Delivery**		2
Administering Department		Chemical and Oil Industries Techniques Engineering	**College**	Technical Engineering College –Mosul	
Module Leader	Mohammed Abdulwahab		**e-mail**	mohammed.raad@ntu.edu.iq	
Module Leader's Acad. Title		Professor	**Module Leader's Qualification**		Ph.D.
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name		Name	**e-mail**	E E-mail	
Scientific Committee Approval Date		01/06/2023	**Version Number**	1.0	

Relation with other Modules					
Prerequisite module		None		**Semester**	
Co-requisites module		None		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	1. Develop a strong understanding of force systems, their components, and the principles governing their equilibrium. 2. Apply mathematical techniques to analyze and solve problems involving moments, couples, and equilibrium conditions. 3. Demonstrate proficiency in calculating and interpreting frictional forces, including the coefficient of friction. 4. Apply geometric and analytical methods to determine centroids and the center of gravity for different shapes and composite areas. 5. Calculate moments of inertia and understand their significance in rotational motion and stability analysis. 6. Construct accurate and detailed free body diagrams that depict all relevant forces acting on a body. 7. Apply the parallelogram law Triangle law ,Sine law, cosine law to resolve forces into their components and combine forces to determine resultant forces and equilibrant forces. 8. Apply the principles of static equilibrium to analyze and solve problems in various engineering applications. 9. Utilize integration techniques to calculate centroids of irregular shapes and composite areas. 10. Apply statics principles to analyze real-world scenarios, make informed engineering decisions, and solve practical problems.
Module Learning Outcomes	1. Analyze and solve problems involving force systems. 2. Calculate and analyze moments and couples. 3. Apply the concept of friction in static equilibrium. 4. Determine centroids and center of gravity.

	5. Analyze moments of inertia and radius of gyration. 6. Resolve and combine forces using the parallelogram law. 7. Apply static equilibrium principles to solve problems. 8. Calculate centroids of shapes and composite areas.
Indicative Contents	**1.Introduction to Engineering Mechanics:**

	• Overview of mechanics and its applications in engineering • Fundamental concepts and principles 2.Scalars and Vectors: • Differentiating between scalar and vector quantities • Vector operations, including addition, subtraction, and scalar multiplication • Cartesian coordinate systems 3. Force: • Overview of Force • Types of forces • Analysis of forces • Resultant of forces 4. analyze and solve force-related problems: • Basic laws of static • Parallelogram law • Triangle law • Sine law • cosine law 5. Moments and Couples: • Moment of a force and its physical significance • Couples and their effects on rigid bodies • Moment equilibrium and applications 6. Friction: • Definition • Theory of friction • Angle of friction • Law of friction • Friction in horizontal surfaces • Friction in inclined surfaces • Applications. 7. Centroids and Centre of gravity: • Centre of flat plate • Centroide using integration method • Centroids of composite areas • Centroids of lines using integration methods • Centroids of composite lines 8. Moments of Inertia: • Definition,

	• Properties • Moment of inertia using integration method • Moment of inertia of composite area 9. Equilibrium: • Definition • Conditions • Free body diagram • Applications

Learning and Teaching Strategies	
Strategies	1. Emphasize conceptual understanding before calculations. 2. Use interactive lectures with multimedia resources. 3. Assign problem-solving practice with increasing complexity. 4. Encourage group work and collaboration. 5. Connect static mechanics to real-life applications. 6. Integrate technology tools for visualization and interactivity.

Student Workload (SWL)			
Structured SWL (h/sem)	109	**Structured SWL (h/w)**	7
Unstructured SWL (h/sem)	91	**Unstructured SWL (h/w)**	6
Total SWL (h/sem)	**200**		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO #1 - #7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Introduction to Engineering Mechanics
Week 2,3	Scalars and Vectors
Week 4,5	Force
Week 6	analyze and solve force-related problems
Week 7,8	Moments and Couples
Week 9	Mid Exam
Week 10,11	Friction
Week 12,13	Centroids and Centre of gravity
Week 14	Moments of Inertia
Week 15	Equilibrium
Week 16	**Final Exam**

Learning and Teaching Resources

	Text	Available in the Library?
Required Texts	Engineering Mechanics (Statics) By: J.L.MERIAM	Yes
Recommended Texts	Engineering Mechanics(Dynamics) By: J.L.MERIAM	Yes
Websites	https://www.coursera.org/learn/engineering-mechanics-statics	

Grading Scheme

Group	Grade	Rating	Marks %	Definition
Success Group (50 - 100)	A - Excellent	Excellent	90 - 100	Outstanding Performance
	B - Very Good	Very Good	80 - 89	Above average with some errors
	C - Good	Good	70 - 79	Sound work with notable errors
	D - Satisfactory	Average	60 - 69	Fair but with major shortcomings
	E - Sufficient	Acceptable	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX – Fail**	Fail (under treatment)	(45-49)	More work required but credit awarded
	F – Fail	Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark
of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTOR FORM

Module Information					
Module Title	**English**			**Module Delivery**	
Module Type	BASIC			**Theory** **Lecture** **Lab** **Tutorial** **Practical** **Seminar**	
Module Code	**NTU101**				
ECTS Credits	2				
SWL (hr/sem)	50				
Module Level UGx1	1		**Semester of Delivery**	1	
Administering Department	Chemical and Oil Industries Techniques Engineering		**College**	Technical Engineering College –Mosul	
Module Leader	Sundus Falah Mohammed Ali		**e-mail**	sundus.falah@ntu.edu.iq	
Module Leader's Acad. Title	Assistant Lecturer		**Module Leader's Qualification**	Master's	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E E-mail	
Scientific Committee Approval Date	01/06/2025		**Version Number**	1.0	

Relation with other Modules					
Prerequisite module		None		**Semester**	
Co-requisites module		None		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	1.Enhance reading comprehension skills. 2.Develop writing proficiency. 3.Improve listening comprehension. 4.Enhance speaking and oral communication skills. 5.Expand vocabulary and idiomatic expressions. 6.Develop critical thinking skills. 7.Foster cultural awareness
Module Learning Outcomes	At the end of this module students will be able to: 1. Have improved their overall proficiency in English, including speaking, listening, reading, and writing skills. 2. Have a solid understanding of English grammar rules and be able to apply them correctly in their spoken and written communication. 3. Expanded their vocabulary and be able to use a wider range of words and phrases in their speech and writing. 4. Understand and extract information from various written and spoken texts, such as

	articles, essays, conversations, and presentations. 5.Students will have improved their reading comprehension skills, including skimming, scanning, and critical reading. 6.Enhanced their listening skills, including understanding spoken English in different accents and contexts. 7.Use English for practical purposes, such as making inquiries, giving directions, writing emails, and engaging in social interactions.
Indicative Contents	1. Introduction to English and Language Skills: • Course overview and expectations • Importance of English language skills • Language learning strategies 2.Reading Skills Development: • Effective reading strategies

	• Textual analysis and interpretation • Vocabulary building through reading 3.Writing Skills Development: • Basic principles of writing • Sentence structure and paragraph development • Grammar and punctuation review • Essay writing techniques 4.Listening Skills Development: • Active listening skills • Note-taking strategies • Understanding different accents and speech patterns 5.Speaking Skills Development: • Oral communication techniques • Pronunciation and intonation practice • Presentations and public speaking exercises 6.Vocabulary Expansion: • Learning new words and phrases • Contextual usage and word relationships • Idiomatic expressions and colloquial language 7.Grammar Review and Application: • Parts of speech and sentence structure • Verb tenses and agreement • Common grammatical errors and their correction

Learning and Teaching Strategies	
Strategies	The course will be assessed through a combination of examinations, assignments, presentations, and projects. The assessment methods may include written tests, research papers, technical reports, oral presentations, and participation in class activities.

Student Workload (SWL)

Structured SWL (h/sem)	32	**Structured SWL (h/w)**	2.134
Unstructured SWL (h/sem)	18	**Unstructured SWL (h/w)**	1.2
Total SWL (h/sem)	**50**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO #1 - #7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)		
		Material Covered
Week 1,2		Introduction to English and Language Skills
Week 3,4		Reading Skills Development
Week 5,6		Writing Skills Development
Week 7,8		Listening Writing Skills Development
Week 9,10		Speaking Skills Development
Week 11,12,13		Vocabulary Expansion
Week 14,15		Grammar Review and Application
Week 16		Preparatory week before the Final Exam

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	• " The language of chemical engineering in English, Roy V. Hughson • New headway plus (English Course), Liz & John Soars	Yes
Recommended Texts	• Life Lines workbook (Pre-intermediate and Intermediate level), Tom Hutchinson ,Oxford University press. • English in a simplified way, Tahir Al- Bayati	Yes
Websites	• https://www.bbc.co.uk/learningenglish/ • https://www.englishcentral.com	

Grading Scheme			
Group	**Grade**	Rating	**Marks %**	**Definition**
	A - Excellent	Excellent	90 – 100	Outstanding Performance
	B - Very Good	Very Good	80 – 89	Above average with some errors
	C - Good	Good	70 – 79	Sound work with notable errors
	D - Satisfactory	Average	60 – 69	Fair but with major shortcomings
	E - Sufficient	Acceptable	50 – 59	Work meets minimum criteria

Fail Group (0 – 49)	**FX – Fail**	Fail (under treatment)	(45-49)	More work required but credit awarded
	F – Fail	Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark
of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

Ministry of Hig her Education and Scientific Research - Iraq
Northern Technical University
Technical Engin eering College-Mosul Chemical and Oil Industries
Techniques Engineering

MODULE DESCRIPTOR FORM

Module Information					
Module Title	General Chemistry			**Module Delivery**	
Module Type	**Core**			☒ **Theory**	
Module Code	**ETCP102**			☒ **Lecture**	
ECTS Credits	8			☒ **Lab**	
SWL (hr/sem)	**200**			☐ **Tutorial**	
				☐ **Practical**	
				☐ **Seminar**	
Module Level UGx1	1		**Semester of Delivery**	2	
Administering Department	Chemical and Oil Industries Techniques Engineering		**College**	Technical Engineering College –Mosul	
Module Leader	mhmood Saleem		**e-mail**	mahmoodsaleem@ntu.edu.iq	
Module Leader's Acad. Title	**Dr.**		**Module Leader's Qualification**	Dr.	
Module Tutor	Karam Salahaldin Sharif		**e-mail**	karam.s.sharef@ntu.edu.iq	
Peer Reviewer Name	Name		**e-mail**	E E-mail	
Scientific Committee Approval Date	01/06/2023		**Version Number**	1.0	

Relation with other Modules					
Prerequisite module		None		**Semester**	

Co-requisites module		None		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	The aim of this module is to: 1- Have a perspective of the scope of modern general chemistry and its implication for society. 2- Have an understanding of the scientific methods and how it is used to answer questions in science. 3- Display mastery of these concepts of chemistry needed to success in upper level petroleum engineering courses.
Module Learning Outcomes	Students will learn to use the language of chemistry: 1) Symbolic representation, nomenclature, and terminology. 2) Students will learn to think about chemical reactions and chemical and physical properties at the particulate level and will be able to visualize and depict the structure of matter and its reactions at the microscopic (atomic and molecular) level.

	3) Students will gain a conceptual understanding of and will be able to perform quantitative problem-solving skills in atomic structure, Stoichiometry, chemical equilibria, and electrochemistry. 4) Students will be able to use their knowledge to analyze and construct solutions by instruments 5) Students will learn to use theories of bonding in coordination compounds
Indicative Contents	1) Atoms and Molecules: 2) Mechanical picture of atomic structure, Derivation of Schrodinger wave equation, Chemical Bonding- Orbital concepts in bonding, V.B. and M.O. theory, M.O. diagrams, Intermolecular interactions. 3) Quantitative analysis: Atomic weight , Molecular formula, Chemical equations, Mole concept, Chemical, equilibrium, equilibrium constants, Preparation and properties, Molarity, Normality, ppm, pH, pOH, Buffers, Solubility Ksp, Gravimetric Analysis, Precipitation reaction, Potentiometric Titration, Complex titration. 4) Types of bonds: covalent, ionic, polarized covalent, nonpolarized covalent. 5) Amounts of reactants and products- Chemical equilibrium, 6) The relationship between chemical kinetics and chemical equilibrium 7) Electrochemistry

	Arrhenius theory of electrolytic dissociation, Transport number, Kohlrausch's law, Solubility product, Redox reaction, Electrochemical and concentration cells. 8) Photochemistry and Spectroscopic Techniques: Photoexcitation of organic molecules, Jablonski diagram, Laws of photochemistry and quantum yield, Some examples of photochemical reactions, Chemistry of vision and other applications of photochemistry. General introduction to UV, IR, NMR and Chromatography. 9) Transition Metal Chemistry: Structure of coordination compounds corresponding to coordination number up to 6, Types of ligands, Isomerism [geometrical, optical, ionization, linkage and coordination], Theories of bonding in coordination compoundscrystal field theory, Valence bond theory, Chelation.

Learning and Teaching Strategies	
Strategies	Power points, youtubes when necessary using board for problem solving and diagramming and any other explanations' student will be highly engaged in the activities during the lecture.

Student Workload (SWL)			
Structured SWL (h/sem)	78	**Structured SWL (h/w)**	5.2
Unstructured SWL (h/sem)	122	**Unstructured SWL (h/w)**	8.134
Total SWL (h/sem)	**200**		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10

Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO #1 - #7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1,2	Atoms and Molecules
Week 3,4,5	Quantitative analysis
Week 6,7	Types of bonds
Week 8,9	Amounts of reactants and products- Chemical equilibrium,
Week 10,11	The relationship between chemical kinetics and chemical equilibrium
Week 12,13	Photochemistry and Spectroscopic Techniques
Week 14,15	Transition Metal Chemistry
Week 16	**Final Exam**

Delivery Plan (Weekly Lab. Syllabus)

	Material Covered
Week 1	Safety rules and laboratory equipment
Week 2	Density of solids and liquids
Week 3	Dilution of chemical solutions
Week 4	Preparation of solution from solid reagents
Week 5	Preparation of solution from the liquid reagents
Week 7,8	Acid-Base titrations
Week 8	Determination of acetic acid percentage in vinegar
Week 9	Determination of chloride ion concentration/Mohr method
Week 10	Determination of Hardness in water
Week 11	Boiling point determination of organic compounds.
Week 12	Determination of melting point for solid compound.
Week 13-14	Liquid-Liquid extraction.
Week 15	Solid purification by recrystallization method
Week 16	**Final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	• Atkins, P., de Paula, J."Physical Chemistry"8ed edition, W. H. Freeman and Company. 2006	
Recommended Texts	• Chemistry: The molecular nature of matter and change, by: M.S.Silberberg, 2013. • General Chemistry: Principles and Modern Application, by: Petrucci,Harwood,Herring ,2002.	
Websites	• www.chemguide.co.uk • www.rsc.org	

Grading Scheme

Group	Grade	Rating	Marks %	Definition
Success Group (50 - 100)	A - Excellent	Excellent	90 - 100	Outstanding Performance
	B - Very Good	Very Good	80 - 89	Above average with some errors
	C - Good	Good	70 - 79	Sound work with notable errors
	D - Satisfactory	Average	60 - 69	Fair but with major shortcomings
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Fail Group (0 – 49)	**FX – Fail**	Fail (under treatment)	(45-49)	More work required but credit awarded
	F – Fail	Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark
of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTOR FORM

Module Information					
Module Title	**MATHMATICS**			**Module Delivery**	
Module Type	**Support**			**Theory** **Lecture** **Lab** **Tutorial** **Practical** **Seminar**	
Module Code	ETCP106				
ECTS Credits	8				
SWL (hr/sem)	200				
Module Level UGx1		1	**Semester of Delivery**		2
Administering Department		Chemical and Oil Industries Techniques Engineering	**College**	Technical Engineering College –Mosul	
Module Leader	Taha Ibrahim Anwer		**e-mail**	taha.anwer@ntu.edu.iq	
Module Leader's Acad. Title		Assistant Lecturer	**Module Leader's Qualification**		Master's
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name		Name	**e-mail**	E E-mail	
Scientific Committee Approval Date		01/06/2025	**Version Number**	1.0	

Relation with other Modules						
Prerequisite module		None		**Semester**		
Co-requisites module		None		**Semester**		

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	1.Develop students' conceptual understanding of single variable functions in terms of integration applications and techniques, differential equations (elementary), sequences and series, and parametric and polar curves. 2.Train students to efficiently perform fundamental calculations involved in these topics. 3.Introduce engineering-related applications of this knowledge and skills.
Module Learning Outcomes	After the completion of this course, the students will be able to: 1.Effectively write mathematical solutions in a clear and concise manner. 2. Demonstrate ability to think critically by recognizing patterns and, determining and using appropriate techniques for solving a variety of integration and differentiation problems. 3. Demonstrate ability to think critically by setting up and solving application problems involving definite integrals. 4. Demonstrate an intuitive and computational understanding for calculus applications by solving a variety of problems from physics, engineering, and mathematics

Indicative Contents	1.Prerequisites for Calculus: Coordinates and Graphs in the Plane, Slope, and Equations for Lines, Functions and Their Graphs, Shifts, Circles and Parabolas, Trigonometric Function, Absolute Values and Target Values2. Limits and Continuity Properties, limits involving infinity, 2. Limits and Continuity: Limits, The Sandwich Theorem and (sinθ)/θ, Limits involving Infinity, Continuous Functions, Defining Limits Formally with Epsilons 3. Derivatives: Slopes, Tangent Lines and Derivatives, Differentiation Rules, Velocity, Speed and other Rates of Change, Derivatives of trigonometric Functions, Chain Rule, Implicit Differentiation and Fractional Powers, Linear Approximations and Differentials, Newton's Method for Approximating Solutions. 4. Applications of Derivatives:
	Related Rates of Change, Maxima, Minima and the Mean value Theorem, Curve Sketching with y' and y'', Graphing Rational Functions-Asymptotes and Dominant Terms, Antiderivatives, Initial Value Problems and Mathematical Modeling. 5. Integration: Calculus and Area, Formulas for Finite Sums, Definite Integrals, Fundamental Theorems of Integral Calculus, Indefinite Integrals, Integration by Substitution, Numerical Integration, Introduction to Logarithms Exponentials 6. Applications of Definite Integrals: Area between Curves, Volumes of solid of Revolution, Cylindrical Shells, Lengths of Curves in the plane, Areas of Surfaces of Revolution, Work, Fluid Pressures and Fluid Forces, Centers of Mass 7. The Calculus of Transcendental Functions: Inverse Functions and their Derivatives, lnx, ex and Logarithmic Differentiation, Other Exponential and logarithmic Functions, Growth and Decay, Indeterminate Forms and l'Hopital's Rule, Rate at which Functions Grow, Inverse Trigonometric Functions, Derivatives of Inverse Trigonometric Functions, Related Integrals, Hyperbolic Functions

Learning and Teaching Strategies	
Strategies	• Provide a clear and concise overview of the key concepts of Mathematics. • Use a variety of teaching methods, including lectures, demonstrations, and hands-on activities, to engage students and help them understand the material. • Encourage students to participate in class discussions and activities. • Provide opportunities for students to apply what they have learned to solve real-world problems. • Assess student learning through a variety of methods, including quizzes, exams, and projects.

Student Workload (SWL)

Structured SWL (h/sem)	62	**Structured SWL (h/w)**	4.134
Unstructured SWL (h/sem)	38	**Unstructured SWL (h/w)**	2.54
Total SWL (h/sem)	**100**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO #1 - #7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1,2	Prerequisites for Calculus
Week 3,4	Limits and Continuity
Week 5,6,7	Derivatives
Week 8,9	Applications of Derivatives
Week 10,11	Integration
Week 12,13,14	Applications of Definite Integrals
Week 15	The Calculus of Transcendental Functions
Week 16	Preparatory week before the final Exam

Learning and Teaching Resources

	Text	**Available in the Library?**
Required Texts	• "Calculus" by James Stewart • "Calculus: Early Transcendental" by Howard Anton, Irl Bivens, and Stephen Davis • "Calculus" by Michael Spivak	Yes
Recommended Texts	• "Calculus: Concepts and Contexts" by James Stewart • "Calculus Made Easy" by Silvanus P.	Yes
Websites	• http://www.calculus.org/ • https://www.calculus-help.com • http://tutorial.math.lamar.edu/Classes/CalcI/CalcI.aspx	

Grading Scheme

Group	Grade	Rating	Marks %	Definition
Success Group (50 - 100)	A - Excellent	Excellent	90 - 100	Outstanding Performance
	B - Very Good	Very Good	80 - 89	Above average with some errors
	C - Good	Good	70 - 79	Sound work with notable errors
	D - Satisfactory	Average	60 - 69	Fair but with major shortcomings
	E - Sufficient	Acceptable	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX – Fail**	Fail (under treatment)	(45-49)	More work required but credit awarded
	F – Fail	Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark
of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

Ministry of Hig her Education and Scientific Research - Iraq
Northern Technical University
Technical Engineering College-Mosul
Chemical and Oil Industries Techniques Engineering

MODULE DESCRIPTOR FORM

Module Information					
Module Title	Principles of Chemical Engineering			**Module Delivery**	
Module Type	**Core**			**Theory** **Lecture** **Lab** **Tutorial** **Practical** **Seminar**	
Module Code	**ETCP100**				
ECTS Credits	10				
SWL (hr/sem)	**250**				
Module Level UGx1	1		**Semester of Delivery**	2	
Administering Department	Chemical and Oil Industries Techniques Engineering		**College**	Technical Engineering College –Mosul	
Module Leader	Safa Senan Mahmod		**e-mail**	safa.senan@ntu.edu.iq	
Module Leader's Acad. Title	Dr.		**Module Leader's Qualification**	Dr.	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E E-mail	
Scientific Committee Approval Date	01/06/2025		**Version Number**	1.0	

Relation with other Modules

Prerequisite module		None		**Semester**	
Co-requisites module		None		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents

Module Objectives		To teach students fundamental knowledge of chemical engineering and application of this knowledge in the solving of material balances of chemical processes. The course will cover concepts ranging from basics such as units and dimensions, stoichiometry to the simultaneous application of material and energy balances with and without occurrence of chemical reaction.
Module Learning Outcomes		1) Identify and understand the unit operations involved in a process, draw flowcharts, and develop relationships between process variables. 2) Perform simple degree-of-freedom analysis to identify the number of unknowns relating to mass, mass flow rate, composition and energy, and develop the linearly independent mass needed to determine unknown quantities. 3) Convert from SI unit to British unit system and vice versa. 4) Understand the dimension concept, Understand of conversion coefficient

	concept and use conversion coefficient.
Indicative Contents	The general outline of topics typically covered in such a course: 1) Introduction • What Are Chemical Engineering? • A Brief History of Chemical Engineering • Where Do Chemical Engineer Work? 2) Units and Dimensions: • Introduction to units and dimensions • Conversion of units • Dimensional analysis 3) Material Balances: • Basis of calculation • Balances on single and multiple units • Balances involving reactions • Recycle and bypass streams 4) Stoichiometry: • Mole and mass relationships in chemical reactions • Limiting reactant calculations

	• Percent yield calculations

Learning and Teaching Strategies	
Strategies	Power points, YouTube when necessary using the board for problem-solving and diagramming, and any other explanations' Students will be highly engaged in the activities during the lecture.

Student Workload (SWL)			
Structured SWL (h/sem)	77	**Structured SWL (h/w)**	5.134
Unstructured SWL (h/sem)	123	**Unstructured SWL (h/w)**	8.2
Total SWL (h/sem)	**200**		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO #1 - #7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	General Knowledge of Chemical Engineering
Week 2-4	Units Dimensions and the conversion
Week 5	Moles density and concentration
Week 6	Choosing Basis

Week 7	Temperature
Week 8,9	Pressure
Week 10-11	Introduction to material balances

Week 12-13	Solving material balance problems for single units without reaction
Week 14-15	The chemical reaction equations and stoichiometry
Week 16	**Final Exam**

Learning and Teaching Resources

	Text	Available in the Library?
Required Texts	• David M. Himmelblau and James B. Riggs, "Basic Principles and Calculations in Chemical Engineering", Seventh Edition, (2004).	
Recommended Texts	• Richard M. Felder and Ronald W. Rousseau, "Elementary Principles of Chemical Processes", Third Edition, (1999). • David M. Himmelblau, "Basic Principles and Calculations in Chemical Engineering", Sixth Edition, (1996). • David M. Himmelblau, "Basic Principles and Calculations in Chemical Engineering", Fifth Edition, (1989)	
Websites	www.chemengineeringedu.org	

Grading Scheme

Group	Grade	Rating	Marks %	Definition
	A - Excellent	Excellent	90 - 100	Outstanding Performance
	B - Very Good	Very Good	80 - 89	Above average with some errors
	C - Good	Good	70 - 79	Sound work with notable errors
	D - Satisfactory	Average	60 - 69	Fair but with major shortcomings
	E - Sufficient	Acceptable	50 - 59	Work meets minimum criteria

Fail Group (0 – 49)	**FX – Fail**	Fail (under treatment)	(45-49)	More work required but credit awarded
	F – Fail	Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark
of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

Module Information					
Module Title	**Workshop**			**Module Delivery**	
Module Type	**Core**			☒ **Theory** ☒ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**ETCP103**				
ECTS Credits	**5**				
SWL (hr/sem)	**125**				
Module Level UGx1		1	**Semester of Delivery**		2
Administering Department		Chemical and Oil Industries Techniques Engineering	**College**	Technical Engineering College –Mosul	
Module Leader	Abdullah Adil Badr		**e-mail**	abdulladel06@ntu.edu.iq	
Module Leader's Acad. Title		Assistant Lecturer	**Module Leader's Qualification**		Master's
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name		Name	**e-mail**	E E-mail	
Scientific Committee Approval Date		01/06/2023	**Version Number**	1.0	

Relation with other Modules						
Prerequisite module		None		**Semester**		
Co-requisites module		None		**Semester**		

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	1.Workshop Technology is a module that focuses on providing students with a comprehensive understanding of various workshop processes, tools, and techniques used in manufacturing and fabrication. 2. The module covers a wide range of topics related to workshop practices and aims to develop practical skills required for working in a workshop environment. 3. Students will gain hands-on experience and theoretical knowledge in areas such as machining, welding, casting, forging, sheet metal work, and woodworking
Module Learning Outcomes	At the end of the semester the student should be able to 1.Understand and apply various workshop processes, such as machining, welding, casting, forging, sheet metal work, and woodworking. 2.Operate workshop tools and equipment proficiently. 3.Perform machining, fabrication, and assembly tasks with precision and efficiency. 4.Demonstrate knowledge of safety practices and regulations in a workshop environment. 5.Interpret engineering drawings and translate them into practical fabrication tasks. 6.Apply quality control measures and inspection techniques to ensure product standards. 6.Work effectively in a team and communicate with colleagues. 7.Utilize problem-solving skills to troubleshoot workshop-related challenges.
Indicative Contents	1.Tools Include recognition of different tools. Employed for surface preparation and methods of application correctly, Devices of measuring dimensions, Calipers , types and uses , drill types and dimensions 2.Tools Measuring Steel miler , Veneer , Micrometer , Height & height gauge hand tools , Saws , Hammers , Files , Scriber , Chisels , Taps and dies , Surface plate , Bench working.

	3.Workshop Welding Include recognition of tools and materials employed – Gas cylinder of oxy – Acetylene welding of surface – Electrical are welding exercise – Welding spot. 4.Workshop Lathing lathe machine – Parts – Operation - Practice on longitudinal lathing –Making center – Puncturing – Making external teeth – Practice -Employing measuring tools – internal & external lath machining. 5. Workshop Alloying Contents of alloying workshops – Alloying sands and characteristics –Additives for improvement – Metals melts – Method of casting – Sand mould shaping – Heat treatment. 6. Workshop Carpentry tools, machinery in the carpentry workshop, Fundamental principles –types of wood – application samples preparation

Learning and Teaching Strategies	
Strategies	7. Emphasize conceptual understanding before calculations. 8. Use interactive lectures with multimedia resources. 9. Assign problem-solving practice with increasing complexity. 10. Encourage group work and collaboration. 11. Connect static mechanics to real-life applications. 12. Integrate technology tools for visualization and interactivity.

Student Workload (SWL)			
Structured SWL (h/sem)	109	**Structured SWL (h/w)**	7
Unstructured SWL (h/sem)	91	**Unstructured SWL (h/w)**	6

Total SWL (h/sem)	**200**

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO #1 - #7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)		
		Material Covered
Week 1,2		Tools
Week 3,4		Tools Measuring
Week 5,6,7		Workshop Welding
Week 8,9,10		Workshop Lathing
Week 11,12,13		Workshop Alloying
Week 14,15		Workshop Carpentry

Week 16	**Final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1,2	Tools
Week 3,4	Tools Measuring
Week 5,6,7	Workshop Welding
Week 8,9,10	Workshop Lathing
Week 11,12,13	Workshop Alloying
Week 14,15	Workshop Carpentry
Week 16	**Final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	• "Workshop Technology: Volume 1 & 2" by W.A. Chapman	Yes
Recommended Texts	• "Machine Tool Practices" by Richard R. Kibbe, John E. Neely, Roland O. Meyer, and Warren T. White	Yes
Websites	www.linkedin.com/learning	

Grading Scheme				
Group	**Grade**	Rating	**Marks %**	**Definition**
	A - Excellent	Excellent	90 - 100	Outstanding Performance
	B - Very Good	Very Good	80 - 89	Above average with some errors
	C - Good	Good	70 - 79	Sound work with notable errors
	D - Satisfactory	Average	60 - 69	Fair but with major shortcomings
	E - Sufficient	Acceptable	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX – Fail**	Fail (under treatment)	(45-49)	More work required but credit awarded
	F – Fail	Fail	(0-44)	Considerable amount of work required

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of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

Ministry of Higher Education and Scientific Research - Iraq
Northern Technical University
Technical Enginee ring College-Mosul Chemical and Oil Industries
Techniques Engine ering

MODULE DESCRIPTOR FORM

Module Information					
Module Title	**Democracy and Human Rights**			**Module Delivery**	
Module Type	**BASIC**			☒ **Theory**	
Module Code	NTU100			☒ **Lecture**	
ECTS Credits	2			☒ **Lab**	
SWL (hr/sem)	**50**			☐ **Tutorial**	
				☐ **Practical**	
				☐ **Seminar**	
Module Level UGx1	1		**Semester of Delivery**	1	
Administering Department	Chemical and Oil Industries Techniques Engineering		**College**	Technical Engineering College –Mosul	
Module Leader	Mohammed Zuhair Abdulkareem		**e-mail**	mohamedzuhair87@uomosul.edu.iq	
Module Leader's Acad. Title	Professor		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E	E-mail
Scientific Committee Approval Date	01/06/2025		**Version Number**	1.0	

Relation with other Modules					
Prerequisite module		None		**Semester**	
Co-requisites module		None		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	1. Understanding the evolution of human rights: The module aims to provide students with a comprehensive understanding of the history of human rights, from primitive societies to positive (man-made) laws and international organization. The factors that led to the development of human rights over the ages and their impact on different societies are explained. 2. Identifying the types of human rights: Introducing students to the basic concepts of human rights and their classifications. Individual and collective human rights are explored, and their importance in building a just and balanced society is understood. 3. Comparative analysis between Sharia and law: A detailed comparison between legal and Sharia principles relating to human rights. Students learn the Sharia and legal foundations of public freedoms and how they are applied in the legal and Sharia contexts. 4. Understanding the foundations of democracy: Discussing the concept of democracy, its pillars and foundations. Students learn about the different models of democracy and how they are achieved and strengthened in political systems. 5. Identifying Islam's position on human rights and democracy: Learning traditional and contemporary Islamic positions and views on human rights and democracy. Issues such as

	Islam's position on women's rights, freedom of belief and the development of Islamic discourse in this context are discussed. 6. Developing legal and ethical awareness: Enhancing students' legal and ethical awareness regarding human rights and democracy. Students are encouraged to think critically and analytically and to make informed and ethical decisions in the field of human rights.
Module Learning Outcomes	First: Human Rights ● Understanding the historical development of human rights from primitive societies and prehistoric stages to Eastern and Western civilizations. ● Identifying the role of the heavenly (revealed) laws and the major religions in the development of human rights. ● Understanding the importance of positive laws and international organization in promoting human rights. Second: Democracy ● Identifying the concept of public freedoms and their linguistic, historical, legal and Sharia foundations. ● Understanding the importance of justice, equality and freedom in building a democratic society. ● Identifying the rights of opinion, thought, media and equality as the most important descriptive human rights. ● Understanding the Islamic position on women's rights and freedom of belief. ● Identifying the concept of political systems, their types and their legitimacy. ● Understanding the democratic system, its definition, components and pillars. ● Identifying the different patterns of democracy and how the transition to democracy takes place. ● Understanding centralized and decentralized administration systems and the challenges facing the democratic system. ● Identifying Islam's position on democracy through traditional and contemporary discourse.
Indicative Contents	**First: Human Rights**

	Section One: The Historical Development of Human Rights ● Primitive societies ● The prehistoric stage ● Eastern civilizations (Mesopotamia and the Pharaonic civilization as examples) ● Western civilizations (Greek and Roman as examples) Section One: The Historical Development of Human Rights (continued) ● The heavenly (revealed) laws ● Judaism ● Christianity ● Islam (in greater detail) Section One: The Historical Development of Human Rights (completed) ● The development of human rights in positive laws ● The social contract theory ● The World Wars and their impact on human rights ● International organization Section Two: Human Rights – Definition and Types ● Definition and delimitation ● The right in Islamic jurisprudence ● The right in legal jurisprudence ● Definition of human rights Section Two: Human Rights – Classifications (studied in detail and comparatively between law and Islamic Sharia) ● Collective rights (the right to self-determination, the right to development, the right to a suitable environment, the human right to live in peace) ● Individual rights (economic and cultural rights, civil and political rights, rights attached to the person) Section Three: Guarantees of Respect for and Protection of Human Rights

	● Guarantees in Islamic Sharia Section Three: Guarantees of Respect for and Protection of Human Rights (completed) ● Guarantees at the national level Second: Democracy Public Freedoms between Sharia and Law Section 1: Introduction Section 2: Defining Public Freedoms Linguistic origin

	Historical origin Legal basis Sharia basis Section 3: Foundations of Public Freedoms Justice Equality Freedom Section 4: Descriptive Public Freedoms Freedom of opinion Freedom of thought Freedom of the media Equality Section 5: Islamic Sharia and Public Freedoms Islam's position on women (inheritance, marriage, holding public office) Islam's position on freedom of belief State Administration Systems Section One: Defining Political Systems ● The idea of the political system ● Legitimacy of political systems ● Types of political systems Section Two: The Democratic System ● Foundational introduction ● Definition of democracy ● Pillars and foundations of the democratic system Section Three: Models of Democracy ● Direct democracy ● Indirect democracy ● Semi-direct democracy ● How the transition to democracy takes place Section Four: Democracy and State Administration Systems ● The centralized system

	● The decentralized system Problems of the democratic system Section Five: Islam's Position on Democracy ● Traditional Islamic discourse ● Contemporary Islamic discourse

Learning and Teaching Strategies	
Strategies	● Discussion and critical thinking about the module topics ● Using small focus groups to discuss the module topics ● Using role-playing (in-class / in-person only) to address and explain some module topics ● Writing analytical papers on the module topics, or beyond them, that are directly related to human rights and democracy

Student Workload (SWL)			
Structured SWL (h/sem)	50	**Structured SWL (h/w)**	3.34
Unstructured SWL (h/sem)	18	**Unstructured SWL (h/w)**	1.2
Total SWL (h/sem)	**50**		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO #1 - #7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1,2	Human Rights – Historical development of human rights (stages of history and civilizations)
Week 3,4	Human Rights – Historical development of human rights (heavenly laws and religions)
Week 5	Human Rights – Historical development of human rights (development in positive laws and international organization)
Week 6	Human Rights – Definition of human rights
Week 7	Human Rights – Section Two: Classifications of human rights
Week 8	Human Rights – Guarantees of respect for and protection of human rights
Week 9,10	Democracy – Public freedoms
Week 11,12	Democracy – Foundations of public freedoms
Week 13	Democracy – Islamic Sharia and public freedoms
Week 14,15	State administration systems
Week 16	**The preparation week before the final Exam**

Learning and Teaching Resources

	Text	Available in the Library?
Required Texts	Al-Sindi, Naz Badrkhan. (2012). Human Rights and Democracy. College of Education Ibn Rushd for Human Sciences, University of Baghdad.	Yes
Recommended Texts	Hadi, Riyadh Aziz. (2005). Human Rights (Their Development – Contents – Protection). (Baghdad).	No
Websites		

Grading Scheme			
Group	**Grade**	Rating	**Marks %**	**Definition**
Success Group (50 - 100)	A - Excellent	Excellent	90 - 100	Outstanding Performance
	B - Very Good	Very Good	80 - 89	Above average with some errors
	C - Good	Good	70 - 79	Sound work with notable errors
	D - Satisfactory	Average	60 - 69	Fair but with major shortcomings
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	F – Fail	Fail	(0-44)	Considerable amount of work required

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of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTOR FORM

Module Information					
Module Title	**Arabic Language**			**Module Delivery**	
Module Type	**Support**			**Theory** **Lecture** **Seminar**	
Module Code	NTU203				
ECTS Credits	**2**				
SWL (hr/sem)	**50**				
Module Level UGx1	2		**Semester of Delivery**	3	
Administering Department	Chemical and Oil Industries Techniques Engineering		**College**	Technical Engineering College –Mosul	
Module Leader	shamaa alobaidy		**e-mail**	shamaaalobaidy@ntu.edu.iq	
Module Leader's Acad. Title	Dr.		**Module Leader's Qualification**	Dr.	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E E-mail	
Scientific Committee Approval Date	01/06/2023		**Version Number**	1.0	

Relation with other Modules					
Prerequisite module		None		**Semester**	
Co-requisites module		None		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents		
Module Objectives	6. Learn the rules of writing and spelling accurately in the Arabic language. 7. Acquire the skills of distinguishing between doubled (shadda) and shortened letters and using them correctly. 8. Understand and correctly use the letters Daad, Thaa and Hamza, and the sun and moon letters. 9. Develop writing and linguistic communication skills and use punctuation marks effectively. 10. Learn the concepts of sentences, objects and numbers, the rules of prepositions, and how to write administrative letters professionally.	
Module Learning Outcomes	Based on the topics mentioned, what the student learns by the end of the course can be summarized as follows:	
	● Writing skills: The student acquires basic skills of Arabic writing, including writing rules,	
	differentiation between doubled and shortened letters, and the correct use of punctuation marks.	
	● Pronunciation and spelling: The student learns how to pronounce and use Arabic	

	phonetic letters such as Daad and Thaa	
	accurately, as well as how to write the Hamza in words.	
	● Linguistic rules: The student benefits from knowing the basic linguistic rules, such as the basic parts of the sentence,	
	objects and numbers.	
	● Distinguishing between sun and moon letters: The student recognizes the sun and moon letters and learns to use them	
	correctly.	
	● Administrative writing skills: The student acquires the skills of writing administrative letters professionally and becomes	
	able to interact effectively in an administrative work environment.	
Indicative Contents	10. Rules for writing the extended and shortened Alif – sun and moon letters 11. The letters Daad and Thaa 12. Writing the Hamza 13. Punctuation marks 14. The noun and the verb and how to distinguish between them 15. Objects (Al-Mafa'eel) 16. Numbers 17. Applications of common linguistic errors 18. Noon and Tanween – meanings of prepositions	
	10. Formal aspects of the administrative letter 11. The language of the administrative letter 12. Samples of administrative correspondence	

Learning and Teaching Strategies	
Strategies	The course will be assessed through a variety of exams, assignments, presentations and projects. Assessment methods may include written tests, scientific research, technical reports, oral presentations, and participation in class activities.

Student Workload (SWL)			
Structured SWL (h/sem)	32	**Structured SWL (h/w)**	2.1
Unstructured SWL (h/sem)	68	**Unstructured SWL (h/w)**	4.5
Total SWL (h/sem)	**100**		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	1hr	10% (10)	7	LO #1 - #7
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction to linguistic errors – the tied Taa, the long Taa and the open Taa

Week 2	Rules for writing the extended and shortened Alif – sun and moon letters
Week 3	The letters Daad and Thaa
Week 4	Writing the Hamza
Week 5	Punctuation marks
Week 6	The noun and the verb and how to distinguish between them
Week 7	Objects (Al-Mafa'eel)
Week 8	Numbers
Weeks 9, 10	Applications of common linguistic errors
Week 11	Noon and Tanween – meanings of prepositions
Week 12	Formal aspects of the administrative letter
Weeks 13, 14	The language of the administrative letter
Week 15	Samples of administrative correspondence

Learning and Teaching Resources		
	Text	Available in the Library?
Required Texts	● Al-Imlaa Al-Wadih (Clear Spelling): Abdul-Majeed Al-Nuaimi, Daham Al-Kayyal, Dar Al-Mutanabbi Library, Baghdad, 6th ed.	Yes
	● Lessons in Language, Grammar and Spelling for State Employees: Ismail Hammoud Atwan et al., Ministry of Education Press No. (3), Baghdad, 2nd ed., 1984.	
Recommended Texts	● General Arabic Language for Non-Specialized Departments: Abdul-Qadir Hassan Ameen et al., Ministry of Higher Education and Scientific Research, 2nd ed., 2000. ● Min Wahy Al-Adab Al-Arabi (Inspired by Arabic Literature): Hafal Muhammad Ameen, Al-Saadoun Press, Baghdad.	Yes
Websites	● www.dalilalarab.com ● www.learningarabic.net	

Grading Scheme

Group	Grade	Rating	Marks %	Definition
Success Group (50 - 100)	A - Excellent	Excellent	90 – 100	Outstanding Performance
	B - Very Good	Very Good	80 – 89	Above average with some errors
	C - Good	Good	70 – 79	Sound work with notable errors
	D - Satisfactory	Average	60 – 69	Fair but with major shortcomings
	E - Sufficient	Acceptable	50 – 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX – Fail**	Fail (under treatment)	(45-49)	More work required but credit awarded
	F – Fail	Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark
of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTOR FORM

Module Information					
Module Title	**Computer**			**Module Delivery**	
Module Type	**Basic**			☒ **Theory**	
Module Code	**NTU202**			☒ **Lecture**	
ECTS Credits	**3**			☒ **Lab**	
SWL (hr/sem)	**75**			☐ **Tutorial**	
				☐ **Practical**	
				☐ **Seminar**	
Module Level UGx1	2		**Semester of Delivery**	4	
Administering Department	Chemical and Oil Industries Techniques Engineering		**College**	Technical Engineering College –Mosul	
Module Leader	Hiba Abdul Kareem Saleh albadrani		**e-mail**	hiba.abdlkareem@ntu.edu.iq	
Module Leader's Acad. Title	Assistant Lecturer		**Module Leader's Qualification**	Master's	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E E-mail	
Scientific Committee Approval Date	01/06/2025		**Version Number**	1.0	

Relation with other Modules						
Prerequisite module		None		**Semester**		

Co-requisites module		None		**Semester**		

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	1.Introduce students to MATLAB as a programming language and development environment. 2.Teach students the basics of MATLAB programming, including variables, data types, and mathematical operations. 3.Familiarize students with control flow structures and loops for program control and iteration. 4.Provide an understanding of functions and scripts in MATLAB and their applications. 5.Teach students file input/output operations to read and write data from/to files in MATLAB. 6.Develop students' skills in data visualization using various plotting techniques in MATLAB. 7.Introduce advanced MATLAB programming techniques, such as complex numbers and symbolic math. 8.Teach students debugging and error handling strategies for MATLAB programs. 9.Apply MATLAB programming skills to real-world applications through projects and practical exercises.
Module Learning Outcomes	After completing the course on computer application , students will be able to 1.Understand the fundamentals of MATLAB as a programming language and development

	environment. 2.Write and execute MATLAB commands and scripts to solve mathematical problems and perform data analysis. 3.Utilize variables, arrays, and matrices effectively for storing and manipulating data in MATLAB. 4.Apply control flow structures and loops to control program execution and implement iterative processes. 5.Create and use user-defined functions to modularize code and enhance reusability. 6.Read data from files and write data to files in various formats using MATLAB. 7.Generate and customize a wide range of plots and visualizations to present data effectively.

	8.Perform advanced mathematical operations, such as symbolic mathematics and equation solving, using MATLAB. 9.Debug MATLAB programs, identify and fix errors, and handle exceptions and errors gracefully..
Indicative Contents	1.Introduction to MATLAB environment and syntax: ● Understand the basic features and capabilities of MATLAB ● Navigate the MATLAB user interface and workspace ● Write and execute simple MATLAB commands and scripts ● Learn about the syntax and structure of MATLAB programming language 2. Variables, arrays, and matrices: ● Define and manipulate variables in MATLAB ● Understand different data types and their uses in MATLAB ● Create and manipulate arrays and matrices ● Perform basic operations on arrays and matrices 3. Mathematical operations and functions: ● Perform mathematical operations in MATLAB ● Utilize built-in mathematical functions for computations ● Create user-defined functions and use them in MATLAB programs 4. Scripting and writing functions ● Write MATLAB scripts to solve complex problems ● Understand the concept of control flow and program execution order ● Develop and use functions to modularize code and improve reusability 5. Conditional statements and loops ● Use conditional statements (if-else, switch-case) to control program flow ● Implement iterative processes using loops (for, while) in MATLAB ● Understand the concept of vectorization and its benefits 6.File input/output operations ● Read data from files and write data to files in MATLAB ● Understand different file formats and their handling in MATLAB ● Import and export data to and from MATLAB workspace 7.Data visualization and plotting techniques ● Create 2D and 3D plots to visualize data ● Customize plot appearance, labels, and annotations ● Generate various types of plots, such as line plots, scatter plots, histograms, etc. 8. Symbolic mathematics and equation solving ● Perform symbolic computations using MATLAB Symbolic Math Toolbox ● Solve algebraic and differential equations symbolically

	● Manipulate and simplify mathematical expressions in MATLAB 9.Debugging and error handling ● Identify and fix errors in MATLAB programs ● Utilize debugging tools and techniques in MATLAB ● Handle exceptions and errors gracefully in MATLAB programs

Learning and Teaching Strategies	
Strategies	● Provide a clear and concise overview of the key concepts of computer applications . ● Use a variety of teaching methods, including lectures, demonstrations, and hands-on activities, to engage students and help them understand the material. ● Encourage students to participate in class discussions and activities. ● Provide opportunities for students to apply what they have learned to solve real-world problems. ● Assess student learning through a variety of methods, including quizzes, exams, and projects.

Student Workload (SWL)			
Structured SWL (h/sem)	77	**Structured SWL (h/w)**	5.1
Unstructured SWL (h/sem)	23	**Unstructured SWL (h/w)**	1.5

Total SWL (h/sem)	**100**

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	1hr	10% (10)	7	LO #1 - #7
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1,2	Introduction to MATLAB environment and syntax
Week 3,4,5	Variables, arrays, and matrices
Week 6,7	Mathematical operations and functions
Week 8	Scripting and writing functions
Week 9,10	Conditional statements and loops
Week 11	File input/output operations
Week 12,13	Data visualization and plotting techniques
Week 14	Symbolic mathematics and equation solving
Week 15	Debugging and error handling

Delivery Plan (Weekly Lab. Syllabus)

	Material Covered
Week 1,2	Basic MATLAB Commands and Scripting: ● Execute basic MATLAB commands and scripts to perform mathematical operations. ● Write MATLAB scripts to solve simple problems, such as calculating the average of a set

	of numbers or finding the roots of an equation.
Week 3,4	Data Manipulation and Visualization: ● Manipulate arrays and matrices to perform data operations, such as filtering, sorting, and indexing. ● Generate plots and visualizations for data analysis, including line plots, scatter plots, and histograms.
Week 5,6,7	Control Flow and Looping: ● Use control flow structures like if-else statements and switch-case statements to control program flow based on conditions. ● Implement loops (for and while) for iterative processes and calculations.

Week 8,9	Functions and Scripting: ● Create and use user-defined functions to modularize code and improve reusability. ● Write scripts that utilize functions to solve complex problems or perform repetitive tasks.
Week 10 ,11	File Input/output Operations: ● Read data from external files (e.g., CSV, Excel) into MATLAB for analysis. ● Write data from MATLAB to files in different formats for storage or sharing.
Week 12	Advanced Mathematical Operations: ● Perform symbolic math operations using MATLAB's Symbolic Math Toolbox. ● Solve algebraic equations symbolically and numerically
Week 13	Debugging and Error Handling: ● Identify and fix errors in MATLAB programs using debugging tools. ● Handle exceptions and errors gracefully through error handling techniques
14,15	Projects and Applications: ● Engage students in real-world projects and applications that require MATLAB programming skills. ● Encourage students to apply their knowledge to solve specific problems or analyze real datasets

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	● "MATLAB: An Introduction with Applications" by Amos Gilat ● "MATLAB for Engineers" by Holly Moore ● "MATLAB Programming for Engineers" by Stephen J. Chapman	Yes
Recommended Texts	● "Essential MATLAB for Engineers and Scientists" by Brian D. Hahn and Daniel T. Valentine	Yes
Websites	https://www.mathworks.com/matlabcentral	

Grading Scheme			
Group	**Grade**	**Marks %**	**Definition**
Success Group (50 - 100)	A - Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C – Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX – Fail**	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark
of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTOR FORM

Module Information					
Module Title	**Energy Balance**			**Module Delivery**	
Module Type	**Core**			**Theory** **Lecture** **Tutorial**	
Module Code	**ETCP207**				
ECTS Credits	6				
SWL (hr/sem)	**150**				
Module Level UGx1	2		**Semester of Delivery**	3	
Administering Department	Chemical and Oil Industries Techniques Engineering		**College**	Technical Engineering College –Mosul	
Module Leader	Safa Senan Mahmod		e-mail	safa.senan@ntu.edu.iq	
Module Leader's Acad. Title	Dr.		Module Leader's Qualification	Dr.	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E-mail	
Scientific Committee Approval Date	01/06/2025		**Version Number**	1.0	

Relation with other Modules					
Prerequisite module	Principles of Chemical Engineering		**Semester**	1	
Co-requisites module	None		**Semester**		

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	The aims of the course are to provide the Introduction to the concepts of energy balances in chemical processes, including calculations and applications, and to provide deep knowledge, wide scope, and improved understanding of the mechanisms in heat balance for closed and open systems and for the steady and unsteady state. The students should gain knowledge to apply the energy balance in engineering problems.
Module Learning Outcomes	At the end of the semester, the student should be able to : 1) The terminology associated with energy balances, concepts, and units. 2) Introduction to energy balances for processes without reaction. 3) Calculation of enthalpy changes. 4) Energy balances how to account for chemical reactions. 5) Energy balances for processes with reaction. 6) Calculation of enthalpy changes. 7) Heat of solution and Heat of mixing
Indicative Contents	The general outline of topics typically covered in such a course: 1) Energy : Terminology , Concept , and units: The terminology associated with energy balances ,

	Types of energy : Work , Heat , Kinetic energy , Potential energy , Internal energy , Enthalpy . 2) Introduction to Energy Balances for Processes without Reaction: The concept of the conservation of energy , Energy balances for closed , unsteady-state systems , Energy balances for closed , steady-state systems , Energy balances for open , unsteady state systems , Energy balances for open, steady-state systems . 3) Calculation of Enthalpy Changes: Phase transitions, Equation to estimate heat of vaporization , Heat capacity equations , Tables and charts to retrieve enthalpy values .

	4) Energy Balances : How to Account for Chemical Reaction: The standard heat of formation , The heat of reaction , Merging the heat of formation with the sensible heat or a compound in making an energy balance , The heat of combustion . 1) Energy Balances: ● Introduction to energy balances ● Types of energy (internal energy, enthalpy) ● Heat capacity and specific heat ● Calculation of heat transfer ● Heat of reaction calculations 2) Humidity (Psychrometric) Charts and Their Use ● Terminology ● The Humidity (Psychrometric) Chart ● Applications of the Humidity Chart 3) Analysis of the Degrees of Freedom in Steady-State Processes 4) Heat of solutions and Mixing 5) The Mechanical Energy Balance 6) Liquids and Gases in Equilibrium with Solids 7) Unsteady-State Material and Energy Balances

Learning and Teaching Strategies	
Strategies	Power points, YouTube when necessary using the board for problem-solving and diagramming, and any other explanations' Students will be highly engaged in the activities during the lecture.

Student Workload (SWL)			
Structured SWL (h/sem)	78	**Structured SWL (h/w)**	5.2
Unstructured SWL (h/sem)	122	**Unstructured SWL (h/w)**	8.1

Total SWL (h/sem)	**200**

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	1hr	10% (10)	7	LO #1 - #7
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Gases and Vapors Ideal gas law, Ideal gas mixtures
Week 2	Ideal gases material balance and Energy balance
Week 3	Real gases: compressibility
Week 4	Real gas : equation of state
Week 5	Energy : Terminology, Concept, and Units: The terminology associated with energy balances, Types of energy: Work, Heat, Kinetic energy, Potential energy, Internal energy, Enthalpy.
Week 6	Introduction to Energy Balances for Processes without Reaction
Week 7	Calculation of Enthalpy Changes
Week 8	Energy Balances: How to Account for Chemical Reaction:
Week 9	Applications Energy Balances for Processes without Reaction
Week 10	Applications Energy Balances for Processes with Reaction
Week 11	Humidity Charts and Their Use
Week 12	Analysis of the Degrees of Freedom in Steady-State Processes
Week 13	Heat of solutions and Mixing
Week 14	The Mechanical Energy Balance
Week 15	Liquids and Gases in Equilibrium with Solids
Week 15	Unsteady-State Material and Energy Balances
Week 16	**Final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Himmelblau D.M., Basic Principles and Calculations in Chemical Engineering, 8 thed., Prentice Hall, India, 2012	
Recommended Texts	R.M. Felder and R.W. Rousseau , Elementary Principles of Chemical Processes ,3rd Edition ,2005.	
Websites		

Grading Scheme

Group	Grade	Rating	Marks %	Definition
Success Group (50 - 100)	A - Excellent	Excellent	90 - 100	Outstanding Performance
	B - Very Good	Very Good	80 - 89	Above average with some errors
	C - Good	Good	70 - 79	Sound work with notable errors
	D - Satisfactory	Average	60 - 69	Fair but with major shortcomings
	E - Sufficient	Acceptable	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX – Fail**	Fail (under treatment)	(45-49)	More work required but credit awarded
	F – Fail	Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark
of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTOR FORM

Module Information					
Module Title	Engineering materials			**Module Delivery**	
Module Type	Core			**Theory** **Lecture** **lab**	
Module Code	ETCP203				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level 22t	2		**Semester of Delivery**	3	
Administering Department	Chemical and Oil Industries Techniques Engineering		**College**	Technical Engineering College –Mosul	
Module Leader	Haitham Mohammad Wadullah		**e-mail**	Dr.haitham@ntu.edu.iq	
Module Leader's Acad. Title	Professor		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E E-mail	
Scientific Committee Approval			**Version Number**	1.0	
Date					

Relation with other Modules					
Prerequisite module		None		**Semester**	
Co-requisites module		None		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	They have the ability to innovate and deal with the developments of the modern era in preparing engineers and technicians in both the private and public sectors. This achieved by aligning the curriculum with the needs of society under suitable conditions, developing the scientific and practical skills of students and faculty members to fulfill their duties towards society, and providing the necessary programs for different levels of students and continuing education. Additionally, serving the community by offering engineering consultations
Module Learning Outcomes	1.Apply principles and fundamentals of engineering materials, particularly focusing on the properties, design, manufacturing, and selection of materials(2.Ability to conduct tests on engineering materials, evaluating properties such as resistance to damage, mechanical, thermal, and electrical characteristics 3.Skills in using scientific tables and conducting tests like stress analysis and material resistance testing 4.Solve technical and mathematical problems related to material science and engineering design 5.Develop abilities to communicate and collaborate effectively with industrial

	institutions and apply engineering solutions in real-world scenarios
Indicative Contents	• Properties of Engineering Materials: Covering mechanical, thermal, and electrical properties of various materials • Material Testing Methods: Practical techniques such as hardness testing, impact tests (Charpy, Izod), and creep measurements • Crystalline Structure: The study of unit cells, metallic crystal structures, and their importance in engineering • Corrosion and Its Prevention: Understanding electrochemical corrosion, types of corrosion cells, and methods of protection • Composite Materials: Examining the composition, manufacturing processes, and applications of composite materials

Learning and Teaching Strategies	
Strategies	The learning and teaching strategies focus on practical application through lab activities and material testing. Collaboration is encouraged by promoting teamwork between students and faculty. Continuous assessment used to ensure that learning objectives met. Theoretical knowledge linked to practical tasks, allowing students to apply engineering concepts to real-world problems. Additionally, the strategies emphasize fostering connections with the industrial sector to prepare students for the job market.

Student Workload (SWL)			
Structured SWL (h/sem)	78	**Structured SWL (h/w)**	5.5
Unstructured SWL (h/sem)	72	**Unstructured SWL (h/w)**	4.8
Total SWL (h/sem)	**150**		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
	Midterm Exam	1hr	10% (10)	7	LO #1 - #7
Summative assessment	**Final Exam**	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1,	Introduction to classification of engineering materials, including practical exercises on basic material properties
Week 2,3,4	Study of the structure of crystalline solids, with lab experiments focused on material structure and properties
Week 5,6,7	Examination of composite materials, including hands-on experiments in material testing and analysis
Week 8,9,10	Detailed exploration of material properties like hardness and mechanical performance, with practical lab work

Week 11,12,13	Advanced topics such as material failure, corrosion, and impact testing, culminating in projects and assessments
Week 14	Prepare for exam
Week 16	Exam

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1,2,3	Introduction to composite materials, including practical lab experiments on testing mechanical properties
Week 4.5	Experiments involving automated fiber placement, focusing on fiber-reinforced composites
Week 6,7,8	Structural composite tests, including impact resistance and load-bearing properties
Week 9,10,11,12	Hands-on tests related to crystalline and non-crystalline materials, including their microstructure and mechanical behaviors

Week 13,14,15	Final experiments and evaluations, covering both theory and practical analysis of material failures and properties
Week 16	Final Exam

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	• Textbooks and Reference Materials: Comprehensive reference books on engineering materials, testing methods, and material science topics • Lab Equipment: Specialized devices for testing the properties of engineering materials, such as hardness testers (Webster, Rockwell, Leeb), impact testing apparatus, and other material testing equipment	
Recommended Texts	• Software Tools: Use of computational tools to simulate and analyze material properties, which support practical exercises and projects • Industry Collaborations: Real-world case studies and examples from industrial practices, enhancing students' exposure to current engineering challenges	
Websites	Online Resources: Websites like: • Composites World • Energy.gov • Plymouth University Resources	

Grading Scheme

Group	Grade	Rating	Marks %	Definition
Success Group (50 - 100)	A - Excellent	Excellent	90 – 100	Outstanding Performance
	B - Very Good	Very Good	80 – 89	Above average with some errors
	C - Good	Good	70 – 79	Sound work with notable errors
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of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

Ministry of Higher Education and Scientific Research - Iraq
Northern Technical University
Technical Engineering College-Mosul
Engineering Technological for Chemical and Petroleum Industries

MODULE DESCRIPTOR FORM

Module Information					
Module Title	**Engineering MATHMATICS**			**Module Delivery**	
Module Type	**Core**			☒ **Theory**	
Module Code	**ETCP201**			☒ **Lecture**	
ECTS Credits	**6**			☐ **Tutorial**	
SWL (hr/sem)	**150**			☐ **Seminar**	
Module Level UGx1	2		**Semester of Delivery**	3	
Administering Department	Chemical and Oil Industries Techniques Engineering		**College**	Technical Engineering College –Mosul	
Module Leader	Hiba Abdul Kareem Saleh albadrani		**e-mail**	hiba.abdlkareem@ntu.edu.iq	
Module Leader's Acad. Title	Assistant Lecturer		**Module Leader's Qualification**	Master's	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E E-mail	
Scientific Committee Approval Date	01/06/2025		**Version Number**	1.0	

Relation with other Modules					
Prerequisite module		Mathematics		**Semester**	
Co-requisites module		None		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	1 Students will learn how to evaluate double integrals, which involve integrating over a region in two-dimensional space. They will understand the geometric interpretation of double integrals as finding the volume under a surface. 2.Students will delve into power series, which are infinite series in which each term is a power of a variable multiplied by a coefficient. They will explore the interval of convergence for power series and understand the concept of the radius of convergence. Power series have significant applications in areas such as calculus, differential equations, and physics. 3.Students will learn about Taylor and Maclaurin series, which are power series representations of functions. 4. Students will become proficient in performing operations with Matrices 5. Students will become proficient in performing operations with vectors, such as vector addition, scalar multiplication, dot product, and cross product and study vector projections and their applications. 6. Students will explore applications of infinite sequences and series in various areas, including calculus, differential equations, physics, engineering, and finance. They will

	learn to model real-world phenomena using sequences and series and apply their knowledge to solve practical problems 7. Students will understand and work with polar coordinates, which represent points in a plane using radial distance and angle.
Module Learning Outcomes	**After studying engineering mathematics, students will be able to:**
	1.Evaluate double and triple integrals ,understand the geometric interpretation of
	multiple integrals.
	2.Perform matrix operations, including matrix multiplication and addition, calculate
	determinants and matrix inverses and analyse properties of matrices, such as
	eigenvalues and eigenvectors.
	3. develop a deep understanding of ODEs, learn various solution techniques, apply
	them to model engineering systems, and enhance problem-solving skills for real-world engineering applications. 4.Determine the convergence and divergence of series ,work with different types of series, including arithmetic, geometric, and power series. 5. Apply Taylor and Maclaurin series expansions for approximations and solving differential equations. 6.Apply the fundamental theorems of vector calculus . 7. Understand the properties and representations of plane curves, and to analyse and manipulate equations using polar coordinates for engineering applications
Indicative Contents	1.Multiple Integrals: Double Integral, Area, Volume, Double Integral in polar coordinates, Triple Integral in rectangular coordinates, physical application of double and triple integration. 2. Matrix Theory: Definition, Properties, System of Linear Equation, Gauss Elimination, Linear Independence and Rank, Determinants, Inverses, Gauss-Jordan Elimination, Matrix Eigen Values Problem, Special Matrices. 3.Ordinary Differential Equation: Definition, Type, Order, Degree, First order Ordinary Differential Equation (Separable Variable Equation, Homogeneous Equation, Linear Differential Equation, Exact Equation, Substitution Method, Integrating Factor Method, Second Order Differential Equation, Homogeneous Second Order, Non-Homogeneous Second Order (Undetermined Coefficients, Variation of Parameters), Engineering Applications, Third and Fourth Order, Solution of Differential Equation by Series 4. Infinite Series: Limits, Infinite Series, Series without Negative Terms, Series with Nonnegative Terms, Alternating Series and Absolute Convergence, Power Series, Taylor Series and Maclaurin Series 5. Vector Calculus: Scalar and Vector, Components of Vector, Vector Addition, and Multiplication of Vector, Scalar Product, Vector Product, and Line Integral Using Parametric Equation of the Path, Line Integral in Vector Field Work. 6.Plane Curves and Polar Coordinates: Conic Sections and Quadratic Equations, Graph of Quadratic Equations, Parametric Equations for Plane Curves, Calculus of Parametric Equations, Polar Coordinates,
	Graphing in Polar coordinates, Polar Equations of Conic Sections, Integration in Polar

	Coordinates

Learning and Teaching Strategies	
Strategies	● Provide a clear and concise overview of the key concepts of Engineering Mathematics. ● Use a variety of teaching methods, including lectures, demonstrations, and hands-on activities, to engage students and help them understand the material. ● Encourage students to participate in class discussions and activities. ● Provide opportunities for students to apply what they have learned to solve real-world problems. ● Assess student learning through a variety of methods, including quizzes, exams, and projects.

Student Workload (SWL)			
Structured SWL (h/sem)	62	**Structured SWL (h/w)**	4.1
Unstructured SWL (h/sem)	88	**Unstructured SWL (h/w)**	5.9
Total SWL (h/sem)	**150**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	1hr	10% (10)	7	LO #1 - #7
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1,2	Multiple Integrals
Week 3,4,5	Matrix Theory
Week 6,7,8,9	Ordinary Differential Equation
Week 10,11	Infinite Series
Week 12,13	Vector Calculus
Week 14,15	Plane Curves and Polar Coordinates
Week 16	Preparatory week before the Final Exam

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	● " Higher Engineering Mathematics "by Dr.B.S.Grewal, Khanna Publishers	Yes
Recommended Texts	● "Advanced Engineering Mathematics "by Erwin Kreyszig	Yes
Websites	https://www.khanacademy.org/math/engineering-math	

Grading Scheme

Group	Grade	Rating	Marks %	Definition
Success Group (50 - 100)	A - Excellent	Excellent	90 - 100	Outstanding Performance
	B - Very Good	Very Good	80 - 89	Above average with some errors
	C – Good	Good	70 - 79	Sound work with notable errors
	D - Satisfactory	Average	60 - 69	Fair but with major shortcomings
	E - Sufficient	Acceptable	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX – Fail**	Fail (under treatment)	(45-49)	More work required but credit awarded
	F – Fail	Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark
of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTOR FORM

Module Information					
Module Title	Fluid Flow			**Module Delivery**	
Module Type	**Core**			**Theory** **Lecture** **Lab** **Tutorial** **Practical**	
Module Code	ETCP204				
ECTS Credits	8				
SWL (hr/sem)	**200**				
Module Level UGx1	2		**Semester of Delivery**	4	
Administering Department	Chemical and Oil Industries Techniques Engineering		**College**	Technical Engineering College –Mosul	
Module Leader	Shayma Hamza		**e-mail**	Shayma.hamza@ntu.edu.iq	
Module Leader's Acad. Title	Professor		**Module Leader's Qualification**	Ph.D.	
Module Leader's Acad. Title	Assistant Lecturer		**Module Leader's Qualification**	Master's	
Peer Reviewer Name	Name		**e-mail**	E E-mail	
Scientific Committee Approval Date	01/06/2025		**Version Number**	1.0	

Relation with other Modules					
Prerequisite module		None		**Semester**	
Co-requisites module		None		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	Fluid flow is the study of the behavior of liquids and gases, particularly the forces that they produce. The purpose of this course is to teach the fundamentals of engineering fluid mechanics in a very general manner so that the students understand the way that forces are produced and transmitted by fluids that are, first, essentially at rest and, second, in motion. This will allow us to apply the physical principles behind some of the most common applications of fluid mechanics in engineering. Most of these principles should be familiar – conservation of energy, Newton's laws of motion – and so the subject concentrates on their application to liquids.
Module Learning Outcomes	By the end of this course, the students should be able to: 1) recognize some fluid properties and types of flow; 2) understand the transmission of pressure in liquids and its application to hydraulics 3) use a manometer to calculate pressures

	4) calculate hydrostatic forces on plane and curved submerged surfaces; 5) understand Archimedes' principle and buoyancy 6) employ the concept of continuity of flow 7) define viscosity 8) calculate pressure drops in pipe flow 9) use Bernoulli's equation to measure flow rate and velocity 10) Apply the momentum principle to liquids in jets and pipes 11) Define the operation principles of the different types of flow measurement, and solve problems in fluid flow through flow measurement devices with applications for steady and unsteady flow. 12) Demonstrate knowledge of compressible fluid flows, with differences of equations using depending on compressible flow conditions, sonic (sub)(super)sonic flow, conversion*diversion nozzle, and types of gas pumping devices.

	13) Provide the ability to estimate the energy (power) consumption for liquid mixing equipment and to design it by predicting necessary fluid parameters of full-scale projects by performing simple model experiments. 14) 4) 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... 15) Share ideas and work in a team in an efficient and effective manner under controlled supervision or independently.
Indicative Contents	The general outline of topics typically covered in such a course: 1) Introduction: Definition of fluid, fluid mechanics; Physical properties of fluids: Density, specific gravity, viscosity, kinematic viscosity, surface tension and capillarity, bulk modulus of elasticity, Pressure and shear stress; Types of Fluids: Newtonian, non-Newtonian fluids ideal and real fluids, Newton’s law of viscosity. 2) Dimensional Analysis: Units and dimensions; Fundamental dimensions; Dimensional homogeneity; Dimensionless number Methods of dimensional analysis, 1) Rayleigh’s method (power series) 2) Buckingham’s Π- method / Theorem 3) Fluid Statics: Basic consideration of fluid statics; Pressure head of liquid; Pressure force on surfaces; Buoyancy; Measurement of pressure: (Piezometer, Manometers, types of Manometers, Mechanical Gauges). 4) Basic consideration of fluid statics: Pressure head of liquid; Pressure force on surfaces; Buoyancy; Measurement of pressure: (Piezometer, Manometers, types of Manometers, Mechanical Gauges) Fluid Dynamics, Newtonian’s Incompressible Fluid: Fluid kinematics Continuity equation, types of flow. 5) Fluid dynamics ● Bernoulli’s and Euler’s equation+ Lab. ● flow through pipes ● Pumping of Liquids 6) Head loss due to friction, fitting, contraction, expansion 1) Pumps: Total heads, NPSH, Horse Power and cost consumption, Pumping Efficien Characteristics curves Types of pumps, Selection of Pumps. Centrifugal pump relations, homologous centrifugal pump, centrifugal pumps in series and in parallel

	2) Flow Measurement: Pitot tubes, orifice meter, venturi meter, nozzle meter, Rotameters other types of flow meters, flow in open channels and weirs with steady and unsteady applications

	compression cycle and calculation of compressor work. 3) Flow of Compressible Fluid: General equation, equation of state, sonic velocity in fluids, Mach No. Isothermal, Non-isothermal and Adiabatic flow of an ideal gas in horizontal pipes, Converging-diverging nozzle for gas flow. Types of gas pumping devices (fans, blowers compressors) compressors types and gas compression cycle and calculations of work and efficiency of compressor. 4) Liquid Mixing : Stirring and mixing and rotational force, effective forces and dimensionless numbers for rotational fluid flow. Stirred vessels (power consumption, power curve, scaled-up), equipment. 5) Flow of Fluid through Granular Bed and Packed Columns: Motion of particles in a fluid, Drag force on a particle, terminal falling velocities, Sedimentation of fine and coarse particles, Pressure drop in granular beds, packed columns: packing types, Pressure drop estimation (Kozeny and Carmen equations), Fluidization Minimum fluidization velocity, Pressure, Pressure drop, Ergun equation, bed expansion and transport of particles. 6) Pumps: Total heads, NPSH, Horse Power and cost consumption, Pumping Efficien Characteristics curves Types of pumps, Selection of Pumps. Centrifugal pump relations, homologous centrifugal pump, centrifugal pumps in series and in parallel 7) Flow Measurement: Pitot tubes, orifice meter, venturi meter, nozzle meter, Rotameters other types of flow meters, flow in open channels and weirs with steady and unsteady applications compression cycle and calculation of compressor work. 8) Flow of Compressible Fluid: General equation, equation of state, sonic velocity in fluids, Mach No. Isothermal, Non-isothermal and Adiabatic flow of an ideal gas in horizontal pipes, Converging-diverging nozzle for gas flow. Types of gas pumping devices (fans, blowers compressors) compressors types and gas compression cycle and calculations of work and efficiency of compressor. 9) Liquid Mixing : Stirring and mixing and rotational force, effective forces and dimensionless numbers for rotational fluid flow. Stirred vessels (power consumption, power curve, scaled-up), equipment. 10) Flow of Fluid through Granular Bed and Packed Columns:

	Motion of particles in a fluid, Drag force on a particle, terminal falling velocities, Sedimentation of fine and coarse particles, Pressure drop in granular beds, packed columns: packing types, Pressure drop estimation (Kozeny and Carmen equations), Fluidization Minimum fluidization velocity, Pressure, Pressure drop, Ergun equation, bed expansion and transport of particles.

Learning and Teaching Strategies	
Strategies	Power points, YouTube when necessary using the board for problem-solving and diagramming, and any other explanations' Students will be highly engaged in the activities during the lecture.

Student Workload (SWL)			
Structured SWL (h/sem)	123	**Structured SWL (h/w)**	8.2
Unstructured SWL (h/sem)	102	**Unstructured SWL (h/w)**	6.8
Total SWL (h/sem)	**225**		

Module Evaluation					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	10% (10)	Continuous	All
Summative assessment	Report	1	10% (10)	13	LO #5, #8 and #10
	Midterm Exam	2hr	10% (10)	7	LO #1 - #7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction to Fluid Flow
Week 2-3	Dimensional Analysis
Week 4	Fluid Statics
Week 5	Fluid Dynamics, Newtonian's Incompressible Fluid: Fluid kinematics
Week 6	Continuity equation, types of flow
Week 7	Fluid dynamics
Week 8	Bernoulli's and Euler's equation
Week 9	flow through pipes
Week 10	Modified Energy and Losses, friction factor
Week 11	Head loss due to friction, fitting, contraction, expansion
Week 12	Pumps
Week 13	Flow Measurements
Week 14	Flow of Compressible Fluid
Week 14	Liquid Mixing
Week 15	Flow of Fluid through Granular Bed and Packed Columns
Week 16	**Final Exam**

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Density, specific gravity Measurements Viscosity Measurement using the Stocks method Viscosity Measurement using Capillary Viscometer
Week 2	Pressure measurement Devices (Manometers)
Week 3	Calibration of Bourdon Gage Pressure
Week 4	Determination of center pressure
Week 5	Reynolds Number Determination
Week 6	Fluid Flow Measurements Using Traditional Method
Week 7	Measuring the Velocity and Pressure Distribution around the Bend in the Rectangular Duct
Week 8	Single-Stage Centrifugal Pump
Week 9	Calibration of Rotameter
Week 10	Fluid flow measurements using Venturi-meter
Week 11	Fluid flow measurements using Orifice-meter
Week 12	Fluid flow measurements using Nozzle-meter

Week 13	Airflow velocity measurements
Week 14	Determination of Centre of Pressure and Hydro-static Force on Plane surface
Week 15	Flow over the rectangular weir and V-notch
Week 16	**Final Exam**

Learning and Teaching Resources

	Text	Available in the Library?
Required Texts	1) Holland, F.A. and Bragg, R., "Fluid Flow for Chemical Engineers", 2nd Ed., Edward Arnold, 1995. 2) ext 1- Coulson, J.M. , Richardson, J.F., Backhurst, J.R. andHarker, J.H., "Chemical Engineering" Volume(1) 6thEd., Butterworth-Heinemann, 1999	pdf
Recommended Texts	1) DARBY. R. , Dekker M. "Chemical Engineering Fluid Mechanics", 2ndEd.Marcell Dekker, 2001 2) Wilkes J. O.,"Fluid Mechanics for Chemical Engineers", Coulson, J.M. , Richardson, J.F., Backhurst, J.R. andHarker, J.H., "Chemical Engineering" Volume(1) 6thEd., Butterworth-Heinemann, 1999 2nd Ed. Prentice Hall PTR, 1999.	
Websites		

Grading Scheme

Group	Grade	Rating	Marks %	Definition
Success Group (50 - 100)	A - Excellent	Excellent	90 - 100	Outstanding Performance
	B - Very Good	Very Good	80 - 89	Above average with some errors
	C - Good	Good	70 - 79	Sound work with notable errors
	D - Satisfactory	Average	60 - 69	Fair but with major shortcomings
	E - Sufficient	Acceptable	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX – Fail**	Fail (under treatment)	(45-49)	More work required but credit awarded
	F – Fail	Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark
of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTOR FORM

Module Information					
Module Title	**Kinetics**			**Module Delivery**	
Module Type	**Core**			**Theory**	
				Lecture	
Module Code	**ETCP206**			**Lab**	
ECTS Credits	**5**			**Tutorial**	
SWL (hr/sem)	**125**			**Practical**	
				Seminar	
Module Level UGx1	2		**Semester of Delivery**	4	
Administering Department	Chemical and Oil Industries Techniques Engineering		**College**	Technical Engineering College –Mosul	
Module Leader	Asmaa Baker		**e-mail**	asmaabaker@ntu.edu.iq	
Module Leader's Acad. Title	Professor		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E E-mail	
Scientific Committee Approval Date	01/06/2025		**Version Number**	1.0	

Relation with other Modules				
Prerequisite module	None		**Semester**	
Co-requisites module	None		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	Gain a fundamental understanding of chemical kinetics, including reaction rates, rate equations, factors affecting rates, differentiation between homogeneous and heterogeneous reactions, measurement and calculation of reaction rates, analysis of reaction mechanisms and elementary steps, identification and study of reaction intermediates, analysis of reaction sequences using Semenov representation, determination of rate laws and reaction orders, study of catalytic reactions, modeling of gas phase reactions, understanding activation energy and its role in reaction rates, examination of diffusion and its impact on rates, exploration of gases adsorption onto solids in heterogeneous reactions, learning experimental techniques for studying kinetic data, and understanding chain reactions involving regenerating reactive intermediates.
Module Learning Outcomes	By the end of the course, the student will have a comprehensive understanding of chemical kinetics, including concepts of reaction rates, rate equations, and factors

	influencing rates, the differentiation between homogeneous and heterogeneous reactions, the ability to measure and calculate reaction rates, the analysis of reaction mechanisms and breakdown of complex reactions into elementary steps, the identification and study of intermediate species connecting elementary steps, the analysis of reaction sequences and utilization of Semenov representation, determination of rate laws and reaction orders based on experimental data, the study of catalytic reactions and their impact on rates, modeling gas phase reactions using collision theory, transition state theory, and the Arrhenius equation, comprehension of activation energy and its role in reaction rates and transition states, understanding diffusion and its influence on rates in gaseous systems, exploration of gases adsorption onto solid surfaces in heterogeneous reactions, learning experimental techniques for kinetic data analysis, and understanding chain reactions involving regeneration and propagation of reactive intermediates.
Indicative Contents	1.Basic concept of kinetics chemistry - Chemical Reaction and Kinetic Quantities - The reaction components - Reaction zones 2.Homogeneous and heterogeneous reactions - Single zone reaction

	- Multizone reaction 3.Rate of reaction - Factors affecting reaction rate - Influence of temperature - Influence of the concentrations (or partial pressures of gases) - catalyst; order and molecularity of a reaction - Other variables - Calculation of reaction rate 4.Reaction Mechanisms and Elementary Steps - Basic premise of kinetics - Reaction mechanism - Examples of mechanisms 5.Reaction intermediates - Excited atoms (or molecules) - Free radicals - Ions - Adsorbed species - Point defects - The effect of intermediates on extent and speed 6.Reaction sequences and Semenov representation - Semenov diagram - Linear sequences and multipoint sequences- 7.rate law - specific rate constant, - integrated rate equations - - half-life (only for zero and first order reactions) 8.Order of reaction

	-First order reactions - Second order reactions - Third order reactions - Zero order reaction 9.Catalytic reactions - Homogeneous catalysis - Heterogeneous catalysis

	- Important figures in reaction mechanisms- 10.Modeling of a gas phase elementary step - Collision theory - Bimolecular reactions - Theory of activated complex 11.Activation energy: - Arrhenius equation. - Calculate activation energy- 12. Particular elementary step: diffusion - The diffusion phenomenon - Diffusion flux and Fick's first law - Reactivity and diffusion space function - Diffusion in solids 13.Gases adsorption onto solids - Chemisorption equilibrium: Langmuir model - Dissociative adsorption and the Langmuir model - Chemisorption of gas mixtures in the Langmuir model - Chemisorption kinetic in the Langmuir model 14.Experimental kinetic data of a reaction

	- Generalities on measuring methods - Chemical methods - Physical methods 15.Chain reactions - Definition - he different categories of chain reactions - The steps in a chain reaction - Sequence of chain reactions

Learning and Teaching Strategies	
Strategies	Utilize a variety of teaching methods, including lecture-based instruction with visual aids, active learning through discussions and problem-solving exercises, hands-on laboratory experiments, use of technology for simulations and modeling, case studies to demonstrate real-world applications, peer learning and group discussions, formative assessments for regular feedback, supplemental resources for further exploration, office hours for individual support, and review sessions for exam preparation

Student Workload (SWL)			
Structured SWL (h/sem)	108	**Structured SWL (h/w)**	7.2

Unstructured SWL (h/sem)	42	**Unstructured SWL (h/w)**	2.8
Total SWL (h/sem)	**150**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects	1	10% (10)	Continuous	All
	Report/Lab	1	10% (10)	13	LO #5, #8 and #10
Summative	**Midterm Exam**	1hr	10% (10)	7	LO #1 - #7

assessment	**Final Exam**	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Basic concept of kinetics chemistry
Week 2	Homogeneous and heterogeneous reactions
Week 3	Rate of reaction
Week 4	Reaction Mechanisms and Elementary Steps
Week 5	Reaction intermediates
Week 6	Reaction sequences and Semenov representation
Week 7	rate law
Week 8	Order of reaction
Week 9	Catalytic reactions
Week 10	Modeling of a gas phase elementary step
Week 11	activation energy
Week 12	Particular elementary step: diffusion
Week 13	Gases adsorption onto solids
Week 14	Experimental kinetic data of a reaction
Week 15	Chain reactions
Week 16	**The preparation week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Straight-line equation
Week 2	Calculation the constant of burette spillage
Week 3	Saponification of ethylacetal
Week 4	Study the hydrolysis rate of aspirin by ultra violet spectroscopy
Week 5	Catalytic decomposition of hydrogen peroxide
Week 6	Hydrolysis of ethyl acetate in acidic medium
Week 7	Itydrolysis of ethyl actec in alkaline medium
Week 8	Determination the order ,rate and activation energy for dyes
Week 9	Effect of salt as Catalyst on reaction
Week 10	Study the Autocatalytic reaction between potassium permanganate and oxalic acid
Week 11	Effect of temperature on the rate reaction
Week 12	Measurement of velocity constant by conductimetric method s
Week 13	Measurement of velocity constant by spectrophotometric method s
Week 14	Effect the concertation on reaction rate
Week 15	Determination of the rate constant and activation energy for Methyl acetate
Week 16	**Final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	● "Chemical Kinetics and Dynamics" by Jeffrey Steinfeld, Joseph S. Francisco, and William L. Hase	Yes

	●	
Recommended Texts	● " Elements of Chemical Reaction Engineering" by H. Scott Fogler: ● "Chemical Kinetics: Fundamentals and New Developments" by Luis G. Arnaut and José A. Martinho Simões	Yes

Websites	https://chem.libretexts.org/Courses/University_of_California_Davis/UCD_Chem_110A:_Physical_Chemistry_I

Grading Scheme

Group	Grade	Rating	Marks %	Definition
Success Group (50 - 100)	A - Excellent	Excellent	90 - 100	Outstanding Performance
	B - Very Good	Very Good	80 - 89	Above average with some errors
	C - Good	Good	70 - 79	Sound work with notable errors
	D - Satisfactory	Average	60 - 69	Fair but with major shortcomings
	E - Sufficient	Acceptable	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX – Fail**	Fail (under treatment)	(45-49)	More work required but credit awarded
	F – Fail	Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark
of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

Ministry of Higher Education and Scientific Research - Iraq
Northern Technical University
Technical Engineering College-Mosul
Engineering Technological for Chemical and Petroleum Industries

MODULE DESCRIPTOR FORM

Module Information					
Module Title	**Petroleum Chemistry**			**Module Delivery**	
Module Type	**Core**			**Theory** **Lecture** **Lab** **Tutorial** **Practical** **Seminar**	
Module Code	**ETCP200**				
ECTS Credits	**8**				
SWL (hr/sem)	**200**				
Module Level UGx1		2	**Semester of Delivery**		3
Administering Department		Chemical and Oil Industries Techniques Engineering	College	Technical Engineering College –Mosul	
Module Leader	Huda Abdul- Razzak Younis		**e-mail**	huda.younis@ntu.edu.iq	
Module Leader's Acad. Title		Professor	**Module Leader's Qualification**		Ph.D.
Module Tutor	Name (if available)		**e-mail**	hudaa.younis@ntu.edu.iq	
Peer Reviewer Name		Name	**e-mail**	E E-mail	
Scientific Committee Approval Date		01/06/2025	**Version Number**	1.0	

Relation with other Modules					
Prerequisite module		General Chemistry	**Semester**		2
Co-requisites module		None	**Semester**		

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	1) An Introduction to Organic Compounds, preparation, and Reaction including Petroleum and Heterocyclic Compounds. 2) An introduction to petroleum feedstock, refining processes, and its products. 3) To know the properties of petroleum fractions
Module Learning Outcomes	at the end of the semester the student should be able to:- 1) Students will learn the basic concepts of organic chemistry 2) understanding the concepts of organic reactions for analysis of unit processes 3) Students will learn Petroleum chemistry and refining 4) Learn methods of separation of main petroleum fractions 5) Become knowledgeable in the composition, properties, and classification of crude oil or petroleum.
Indicative Contents	The general outline of topics typically covered in such a course: 1) An Introduction to Organic Compounds: Nomenclature, Physical Properties, and Representation of Structure 2) Preparation and Reactions : Alkanes, Alkenes, Dienes, Alkynes, aromatic hydrocarbon

	3) Preparation and Reactions: Alkanes derivative (RX, ROH, RCOOH, RCOH, RCOR,….etc. Organometallic 4) Mechanisms of organic reactions: ● Elimination ● substation ● addition 5) Petroleum : Origin of petroleum, Composition, Refining, Kerosene, Naphtha 4hr Heterocyclic compounds: Isolation and reactions of furan, pyrrole, pyridine 3hr Terpenes

	6) Petroleum Processing Overview : History of Petroleum Production, What is Petroleum, History of Petroleum Processing, Modern Petroleum Processing. Refinery Feed-stocks and Products 7) Thermo-physical Properties of Petroleum Fractions and Crude Oils: 8) Specific Gravity, Boiling Point Curves, Breakup of TBP Curve into Pseudo components, Thermo-physical Properties Calculation. 9) Heating of Crude oil : Types of pipe still heaters , calculations of radiant absorption rates 10) Crude Distillation : 11) Desalting Crude Oils, Atmospheric distillation tower: types of refluxes. Energy balance in a topping tower and calculations involve the estimation of top, side, bottom draw tray temperatures 12) Thermal and Catalytic Cracking : 13) Coking, Visbreaking, Fluid Catalytic Cracking, Hydrotreating and Hydrocracking. 14) Catalytic Reforming: Objectives, process, Reactions, catalysts and effect of process variables. 15) Isomerization, Alkylation and Polymerization: Objectives, process, Reactions, catalysts and effect of process variables. 16) Products blending : Reid Vapor Pressure, Octane Blending. 17) Supporting Processes: Hydrogen Production, Gas Processing Unit, Acid Gas Removal, Sulfur Recovery Processes.

Learning and Teaching Strategies	
Strategies	Power points, you tubes when necessary using board for problem solving and diagramming and any other explanations' student will be highly engaged in the activities during the lecture.

Student Workload (SWL)			
Structured SWL (h/sem)	93	**Structured SWL (h/w)**	6.2
Unstructured SWL (h/sem)	57	**Unstructured SWL (h/w)**	3.8
Total SWL (h/sem)	**150**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	10% (10)	Continuous	All

	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	1hr	10% (10)	7	LO #1 - #7
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	An Introduction to Organic Compounds
Week 2	Preparation and Reactions
Week 3	Mechanisms of organic reactions
Week 4	Petroleum
Week 5	Petroleum Processing Overview
Week 6	Thermophysical Properties of Petroleum Fractions and Crude Oils
Week 7	Heating of Crude oil
Week 8	Heating of Crude oil
Week 9	Crude Distillation
Week 10	Thermal and Catalytic Cracking
Week 11	Catalytic Reforming
Week 12	Isomerization, Alkylation
Week 13	Polymerization
Week 14-15	Products blending
Week 16	**Final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Safety Rules and Laboratory Equipment
Week 2	Introduction to The Lab
Week 3	Standard Test Method for Dropping Point of Lubricating Grease
Week 4	Smoke Point of Kerosene
Week 5	Amount of Aromatic Hydrocarbons
Week 6	Determination of Acid Number for Lubricating Oil
Week 7	Determination of Acidity of Petroleum Products by Color Indicator Titration Method
Week 8	Exam
Week 9	Standard Test Method for Conrad Son Carbon Residue of Petroleum Products
Week 10	Standard Test Method for Pour Point and Cloud Point of Petroleum Product
Week 11	Aniline Point of Petroleum Products
Week 12	Ash Content from Petroleum Products
Week 13	Softening Point of Bitumen
Week 14	Standard Test Method for Ductility of Bituminous Materials
Week 15	Standard Test Method for Penetration of Bituminous Materials
Week 16	**Final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	1) Ghatak, k.l," Textbook of organic Chemistry and problem	

	analysis", PHL Learning.2014. 2) W.L..Nelson" Petroleum Refining Engineering " 4th Edition. McGraw Hill, New York, 1985	
Recommended Texts	1) Morrison, Thornton R.; Boyd, Neilson, R. "Organic Chemistry" 6th edition, J. Chem. Educ. 1992 2) Bruice, P.Y., J.M "Organic chemistry",7th edition, Books a la Carte Edition, 2014 3) Characterization and Properties of Petroleum Fractions. M.R.Raiz-1st ed.	
Websites	https://scholar.google.com/scholar?q=petroleum+fluid+properties+pdf&hl=en&as_sdt=0&as_vis=1&oi=scholart	

Grading Scheme

Group	Grade	Rating	Marks %	Definition
Success Group (50 - 100)	A - Excellent	Excellent	90 - 100	Outstanding Performance
	B - Very Good	Very Good	80 - 89	Above average with some errors
	C - Good	Good	70 - 79	Sound work with notable errors
	D - Satisfactory	Average	60 - 69	Fair but with major shortcomings
	E - Sufficient	Acceptable	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX – Fail**	Fail (under treatment)	(45-49)	More work required but credit awarded
	F – Fail	Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark
of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTOR FORM

Module Information					
Module Title	**Petroleum Fluid Properties**			**Module Delivery**	
Module Type	**Core**			**Theory** **Lecture** **Lab** **Tutorial** **Practical** **Seminar**	
Module Code	**ETCP207**				
ECTS Credits	**4**				
SWL (hr/sem)	**100**				
Module Level UGx1	2		**Semester of Delivery**	4	
Administering Department	Chemical and Oil Industries Techniques Engineering		College	Technical Engineering College –Mosul	
Module Leader	Huda Abdul- Razzak Younis		e-mail	huda.younis@ntu.edu.iq	
Module Leader's Acad. Title	Professor		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E E-mail	
Scientific Committee Approval Date	01/06/2025		**Version Number**	1.0	

Relation with other Modules					
Prerequisite module		None		**Semester**	
Co-requisites module		None		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	The objective of this course is to understand the physical and chemical properties of petroleum specialty products which are invisible fuels, and explain in detail all the properties of these products.
Module Learning Outcomes	at the end of the semester the student should be able to:- 1) A comprehensive understanding of petroleum product that appears in less visible .form over the entire spectrum of industry such as automobile lubricants, greases, and carbon black for truck tires. 2) Ability to think that a refinery may produce specialty manufactures a large number of the products from the basic refinery products such as (LPG, naphtha, kerosene, diesel, and fuel oils).
Indicative Contents	The general outline of topics typically covered in such a course 1) Bitumen: Introduction, Bitumen composition{ Asphaltine, resinearomatic oil, saturated oil}, Bitumen for pavement, Bitumen evaluation for pavement 2) Types of Bitumen:

	Cut back bitumen, bitumen emulsion, polymer modified bitumen, oxidized bitumen,Industrialuses of bitumen, storage and handling of bitumen. 3) Petroleum Coke: Introduction, manufacturing process, petroleum coke type, properties of calcined coke, uses of petroleum coke 4) Carbon black:

	Introduction, manufacturing processes,channel black process, carbon black process, carbon black properties, secondary properties. 5) Carbon black test methods: Application and uses 6) Lube base stocks : Introduction conventional process, catalytic dewaxing, API classification of base oil 7) Lubricating oil blending : Introduction, classification of lubricating oils, effect of viscosity on fuel economy , automotive oil additives, viscosity index improvers, detergent inhibitors . 8) Engine oil formulation: effect of base stock quality, gear oil, automotive lubricants test methods 9) Synthetic lubricants 10) Turbine oil : Introduction, base oil, formulation, life of turbine oil, tests method{ acid number, copper corrosion , rust test, foam test, turbine oil test} 11) Lubricating greases: Introduction, grease composition, base oil, grease thickeners, additives 12) Grease manufacture: Lubricating grease quality, automotive greases, aircraft greases, marine greases, and high-temperature grease. 13) Waxes Introduction, nonpetroleum waxes, other plant waxes, properties, test method melting point, hardness, color, oil content, viscosity, acid number) 14) Microcrystalline waxes Petroleum wax manufacture

Learning and Teaching Strategies	
Strategies	Power points, you tubes when necessary using board for problem solving and diagramming and any other explanations' student will be highly engaged in the activities during the lecture.

Student Workload (SWL)			
Structured SWL (h/sem)	93	**Structured SWL (h/w)**	6.2
Unstructured SWL (h/sem)	57	**Unstructured SWL (h/w)**	3.8
Total SWL (h/sem)	**150**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative	**Midterm Exam**	2hr	10% (10)	7	LO #1 - #7

assessment	**Final Exam**	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)		
		Material Covered
Week 1		Bitumen
Week 2		Types of Bitumen
Week 3		Petroleum Coke
Week 4		Carbon black
Week 5		Carbon black test methods
Week 6		Carbon black test methods
Week 7		Lube base stocks
Week 8		Lubricating oil blending
Week 9		Turbine oil
Week 10		Lubricating greases:
Week 11-12		Grease manufacture
Week 13		Waxes
Week 14-15		Microcrystalline waxes
Week 16		Final Exam

Delivery Plan (Weekly Lab. Syllabus)		
		Material Covered
Week 1		Safety Rules and Laboratory Equipment
Week 2		Standard Test Method for Dropping Point of Lubricating Grease
Week 3		Smoke Point of Kerosene
Week 4		Amount of Aromatic Hydrocarbons
Week 5		Determination of Acid Number for Lubricating Oil
Week 6		Determination of Acidity of Petroleum Products by Colour Indicator Titration Method
Week 7		Exam
Week 8		Standard Test Method for Conrad Son Carbon Residue of Petroleum Products
Week 9		Standard Test Method for Pour Point and Cloud Point of Petroleum Product
Week 10		Aniline Point of Petroleum Products
Week 11		Ash Content from Petroleum Products
Week 12		Softening Point of Bitumen
Week 13		Standard Test Method for Ductility of Bituminous Materials
Week 14-15		Standard Test Method for Penetration of Bituminous Materials
Week 16		**Final exam**

Learning and Teaching Resources			
	Text		**Available in the Library?**
Required Texts	1) Speight, J.G, Handbook of petroleum product analysis, John Willey & Sons,2002. 2) W.L..Nelson" Petroleum Refining Engineering " 4th Edition. McGraw Hill, New York, 1985		
Recommended Texts	3) Speight J.G. and Ozum,B; Petroleum Refinery processes, Macel Dekker, New York, 2002.		

	4) Speight J.G., The chemistery and Technology of petroleum, 3rd Edition. Marcel Dekker, New York 1999. 5) Petroleum Fuels Manufacturing hand book; SurinderParkash, McGraw-Hill companies, 2010.	
Websites	https://scholar.google.com/scholar?q=petroleum+fluid+properties+pdf&hl=en&as_sdt=0&as_vis=1&oi=scholart	

Grading Scheme

Group	Grade	Rating	Marks %	Definition
Success Group (50 - 100)	A - Excellent	Excellent	90 - 100	Outstanding Performance
	B - Very Good	Very Good	80 - 89	Above average with some errors
	C - Good	Good	70 - 79	Sound work with notable errors
	D - Satisfactory	Average	60 - 69	Fair but with major shortcomings
	E - Sufficient	Acceptable	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX – Fail**	Fail (under treatment)	(45-49)	More work required but credit awarded
	F – Fail	Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark
of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

Ministry of Higher Education and Scientific Research - Iraq
Northern Technical University
Technical Enginee ring College-Mosul Engineering Technolo gical for
Chemical and Petroleum Industries

MODULE DESCRIPTOR FORM

Module Information					
Module Title	**Physical Chemistry**			**Module Delivery**	
Module Type	**Core**			**Theory** **Lecture** **Lab** **Practical**	
Module Code	**ETCP203**				
ECTS Credits	**6**				
SWL (hr/sem)	**150**				
Module Level UGx1	2		**Semester of Delivery**	3	
Administering Department	Chemical and Oil Industries Techniques Engineering		**College**	Technical Engineering College –Mosul	
Module Leader	Asmaa Baker		**e-mail**	asmaabaker@ntu.edu.iq	
Module Leader's Acad. Title	Professor		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E-mail	
Scientific Committee Approval Date	01/06/2025		**Version Number**	1.0	

Relation with other Modules					
Prerequisite module		None		**Semester**	
Co-requisites module		None		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	1.Provide a fundamental understanding of the principles and concepts of physical chemistry. 2. Bridge the gap between theory and applications, showing how physical chemistry principles can be applied to areas such as chemical reactions, materials science, and environmental chemistry. 3. Develop critical thinking skills and problem-solving strategies that can be applied to chemical systems. 4. Introduce students to scientific inquiry, encouraging them to explore and investigate the underlying principles through laboratory work, literature reviews, and research projects.
Module Learning Outcomes	At the end of this module students will be able to: 1.Understand the fundamental principles and concepts of physical chemistry. 2.Relate physical chemistry theories to real-world applications in various fields. 3.Develop critical thinking and problem-solving skills specific to physical chemistry. 4.Conduct scientific inquiry and research in physical chemistry.

	5.Recognize interdisciplinary connections between physical chemistry and other scientific disciplines. 6.Communicate effectively about physical chemistry concepts and research findings. 7.Apply experimental techniques and data analysis methods commonly used in physical chemistry. 8.Critically evaluate scientific literature in physical chemistry. 9.Demonstrate a comprehensive understanding of the interplay between theory and experiment in physical chemistry
Indicative Contents	**1.States of matter:** **● Gas** **● liquid**

	● solid 2.Liquid properties: ● Vapor Pressure ● Viscosity, Surface Tension ● Refractive Index, Phases 3.Phases: ● Homogenies phase ● Hetrogenies phase ● Multi component phast ● Diagram of phasis 4.Gibbs law ● Gibbs' law - the system composed of one component ● Gibbs' law - the system consisting of more than one component 5.Liquids properties : ● kinetic theory of liquid ● Solution, Property of dilute solution (colligative properties) ● Chemical equilibria 6.Surface chemistry and the catalyst: ● The Catalyst ● The General Principles Of The Work Of The Catalyst ● Type Of Catalysis 7.Adsorption ● interpretation of the phenomenon of adsorption ● adsorption of gases on the surfaces of solid materials ● factors affecting the phenomenon of adsorption ● types of adsorption (chemical, physical) , its properties. 8.Electrochemistry ● Used units ● Ohm's law electrolytic conductivity (solids, liquid) ● faraday's first and second laws ● Specific resistance ● Specific conductivity ● Equivalent conduction - equivalent conduction at final dilution (kohler's law) ● Degree and ionization constant- ● Conduction CELL ● ION MIGRATION (TRANSITION PREPARATION) METHOD TO FIND THE TRANSITION ● Cells

	● Voltaic (REVERSE AND NON-REVERSE) - measurement OF ELECTROMOTIVE FORCE 11.Emulsifiers : ● Emulsifying agents

	● Types of emulsions ● calculation methods 12.Spectroscopy ● Spectral methods ● Spectroscopy region ● Example on the spectroscopy ● Microwave radiation ● IR ● UV and Visible ● NMR 14.Nuclear chemistry ● Introduction to nuclear chemistry ● Radiation chemistry ● Nuclear fission ● Nuclear fusion 15.Physical basis of some chemical analysers ● Chromatography ● HPLC ● T.G Polymer

Learning and Teaching Strategies	
Strategies	The course will be assessed through a combination of examinations, assignments, presentations, and projects. The assessment methods may include written tests, research papers, technical reports, oral presentations, and participation in class activities.

Student Workload (SWL)

Structured SWL (h/sem)	138	**Structured SWL (h/w)**	9.2
Unstructured SWL (h/sem)	87	**Unstructured SWL (h/w)**	5.8
Total SWL (h/sem)	**200**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	1hr	10% (10)	7	LO #1 - #7
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

		Material Covered
Week 1		States of matter
Week 2		Liquid properties
Week 3		Phases
Week 4		Gibbs law

Week 5		Liquids properties
Week 6		Surface chemistry and the catalyst
Week 7		Adsorption
Week 8,9,10		Electrochemistry
Week 11		Emulsifiers
Week 12,13		Spectroscopy
Week 14		Nuclear chemistry
Week 15		Physical basis of some chemical analysers
Week 16		Final Exam

Delivery Plan (Weekly Lab. Syllabus)

	Material Covered
Week 1	Viscosity - using the Ostold Quitter method or the Hubler apparatus.
Week 2	Determination of liquid density and specific gravity using hydrometer, pycnometer
Week 3	Finding the molecular weight Measurement of the molecular weight of a volatile substance by Victor Meyer method
Week 4	Molecular Weight Measurement (by Boiling Height Method)
Week 5	Refractive index measurement
Week 6	Electrical conductivity (determination of conductivity for different solutions strong electrolyte and weak electrolyte) and determination of the degree of ionization and ionization constant
Week 7	Surface tensile strength measurement Using capillary tubes or using surface tension balance
Week 8	Find the common solubility curve for phenol and water
Week 9	distribution constant
Week 10	Heat of dissolution: determination of the temperature of a solution of an organic acid by dissolving it at different temperatures
Week 11	Measurement heat of neutralization
Week 12	Heat of solution
Week 13	Adsorption (adsorption of organic acid by activated carbon)
Week 14	Spectroscopy analysis by using UV spectroscopy
Week 15	Measure the concentration of solutions using UV spectrometer

Learning and Teaching Resources

	Text	**Available in the Library?**
Required Texts	● "Physical Chemistry" by Peter Atkins and Julio de Paula.	
	● "Principles of Physical Chemistry" by Hans Kuhn, Horst-Dieter Försterling, and Peter W. Atkins.	
Recommended Texts	"Physical Chemistry for the Chemical and Biological Sciences" by Raymond Chang and Jr. Thoman John W.	
Websites	https://ocw.mit.edu/index.htm	

Grading Scheme

Group	Grade	Rating	Marks %	Definition
Success Group (50 - 100)	A - Excellent	Excellent	90 – 100	Outstanding Performance
	B - Very Good	Very Good	80 – 89	Above average with some errors
	C - Good	Good	70 – 79	Sound work with notable errors
	D - Satisfactory	Average	60 – 69	Fair but with major shortcomings
	E - Sufficient	Acceptable	50 – 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX – Fail**	Fail (under treatment)	(45-49)	More work required but credit awarded
	F – Fail	Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark
of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTOR FORM

Module Information					
Module Title	**Crimes of the Baath Regime in Iraq**			**Module Delivery**	
Module Type	**BASIC**			**Theory** **Lecture** **Seminar**	
Module Code	**NTU200**				
ECTS Credits	**2**				
SWL (hr/sem)	**50**				
Module Level UGx1		2	**Semester of Delivery**		3
Administering Department		Chemical and Oil Industries Techniques Engineering	**College**	Technical Engineering College –Mosul	
Module Leader	Mohammed Zuhair Abdulkareem		**e-mail**	mohamedzuhair87@uomosul.edu.iq	
Module Leader's Acad. Title		Professor	**Module Leader's Qualification**		Ph.D.
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name		Name	**e-mail**	E E-mail	
Scientific Committee Approval Date		01/06/2023	**Version Number**	1.0	

Relation with other Modules					
Prerequisite module		None		**Semester**	
Co-requisites module		None		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents		
Module Objectives	1. Understanding the history and political context of the Baath regime in Iraq. 2. Documenting and understanding the crimes and violations that took place during this period. 3. Enhancing the legal understanding of the crimes and violations and the importance of achieving justice. 4. Understanding the psychological, social and environmental effects of those crimes. 5. Contributing to truth and justice and raising awareness of human rights and environmental issues.	
Module Learning Outcomes	Based on the topics mentioned, what the student learns by the end of the course can be summarized as follows:	
	● Understanding the history and legal context of the crimes of the Baath regime in Iraq and documenting them according to the Law of the Iraqi Supreme Criminal Tribunal	
	of 2005.	
	● Classifying and understanding crimes through understanding the concept of crimes and their categories, including international crimes.	
	● Identifying psychological and social crimes, their mechanisms and their effects on	

	society.	
	● Understanding environmental crimes and researching the impact of war pollution and environmental destruction.	
	● Identifying the crimes of mass graves and understanding the events of the genocide mass graves and classifying them chronologically.	
	●	
Indicative Contents	Chapter One Crimes of the Baath regime according to the Law of the Iraqi Supreme Criminal Tribunal of 2005 1.1 The concept of crimes and their categories 1.1.1 Definition of crime, linguistically and technically 1.1.2 Categories of crimes 1.2 Crimes of the Baath regime as documented by the Law of the Iraqi Supreme Criminal Tribunal of 2005 1.2.1 Types of international crimes 1.2.2 Decisions issued by the Supreme Criminal Tribunal Chapter Two Psychological and social crimes and their effects, and the most prominent violations of the Baathist regime in Iraq 2.1 Psychological crimes 2.1.1 Mechanisms of psychological crimes 2.1.2 Effects of psychological crimes	
	2.2 Social crimes 2.2.1 Militarization of society 2.2.2 The position of the Baathist regime on religion 2.3 Violations of Iraqi laws 2.3.1 Forms of human rights violations and crimes of authority 2.3.2 Some decisions of political and military violations by the Baath regime 2.3.3 Locations of prisons and detention centers of the Baath regime Chapter Three Environmental crimes of the Baath regime in Iraq 3.1 War pollution, radiation and landmine explosions 3.2 Destruction of cities and villages (scorched-earth policy) 3.3 Draining of the marshes 3.4 Bulldozing of palm groves, trees and crops Chapter Four Crimes of mass graves 4.1 Events of the genocide mass graves committed by the Baathist regime in Iraq 4.2 Chronological classification of the genocide mass graves in Iraq for the period 1963 – 2003	

Learning and Teaching Strategies	
Strategies	The course will be assessed through a variety of exams, assignments, presentations and projects. Assessment methods may include written tests, scientific research, technical reports, oral presentations, and participation in class activities.

Student Workload (SWL)			
Structured SWL (h/sem)	32	**Structured SWL (h/w)**	2.1
Unstructured SWL (h/sem)	68	**Unstructured SWL (h/w)**	4.5
Total SWL (h/sem)	**100**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	1hr	10% (10)	7	LO #1 - #7
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
Material Covered	

Week 1	Chapter One
Week 2	
Week 3	
Week 4	
Week 5	Chapter Two
Week 6	
Week 7	
Week 8	
Weeks 9, 10	
Week 11	Chapter Three
Week 12	
Week 13	Chapter Four
Week 14	
Week 15	

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	● Salim Matar, Encyclopedia of the Iraqi Environment, first Arabic edition, 2010. ● Jundi Abdul-Malik, The Criminal Encyclopedia, Part Three, Dar Ihyaa Al-Turath Al-Arabi, Beirut, 1990.	Yes

Recommended Texts	● Archive of the Iraqi Center for Documenting Extremist Crimes at the Holy Al-Abbas Shrine.	Yes
Websites	● The official website of the United Nations (https://www.un.org/)	

Grading Scheme			
Group	**Grade**	**Marks %**	**Definition**
Success Group (50 - 100)	A - Excellent	90 – 100	Outstanding Performance
	B - Very Good	80 – 89	Above average with some errors
	C - Good	70 – 79	Sound work with notable errors
	D - Satisfactory	60 – 69	Fair but with major shortcomings
	E - Sufficient	50 – 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX – Fail**	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark
of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

Ministry of Higher Education and Scientific Research - Iraq
Northern Technical University
Technical Engineering College-Mosul
Engineering Technological for Chemical and Petroleum Industries

MODULE DESCRIPTOR FORM

Module Information					
Module Title	**Automation in Chemical Industries**			**Module Delivery**	
Module Type	**Core**				
Module Code	**ETCP305**			**Lecture** **Tutorial** **Seminar**	
ECTS Credits	4				
SWL (hr/sem)	**100**				
Module Level	3		**Semester of Delivery**	5	
Administering Department	Chemical and Oil Industries Techniques Engineering		**College**	Technical Engineering College –Mosul	
Module Leader	AZAM ISAM ABDULKAREEM		**e-mail**	Azzam.esam@ntu.edu.iq	
Module Leader's Acad. Title	Assistant Lecturer		**Module Leader's Qualification**	Master's	
Module Leader	AZAM ISAM ABDULKAREEM		**e-mail**	Azzam.esam@ntu.edu.iq	
Peer Reviewer Name	Name		**e-mail**	E E-mail	
Scientific Committee Approval Date	01/06/2025		**Version Number**	1.0	

Relation with other Modules

Prerequisite module	Process Control	**Semester**		6
Co-requisites module	None	**Semester**		

Module Aims, Learning Outcomes and Indicative Contents

Module Objectives	This course covers the principles and applications of automation in chemical and petroleum industries, including industrial instrumentation, sensors and transmitters, signal conditioning, final control elements, control loops, PLC, DCS, SCADA, HMI, alarm management, safety interlocks, industrial communication networks, process monitoring, data acquisition, and automation case studies for chemical plants, refineries, and petrochemical units.
Module Learning Outcomes	at the end of the semester the student should be able to: 1) Explain the role of automation systems in safe, efficient, and reliable chemical plant operation. 2) Identify major industrial instruments used to measure temperature, pressure, flow, level, and composition. 3) Interpret basic P&ID symbols, instrumentation loops, and automation documentation used in process plants. 4) Select suitable sensors, transmitters, final control elements, and control valves for

	chemical processes. 5) Describe the structure and operation of PLC, DCS, SCADA, HMI, and data acquisition systems. 6) Develop simple automation logic and control-loop strategies for common chemical process operations. 7) Analyze alarm, interlock, and safety instrumented functions related to industrial process safety. 8) Evaluate automation applications in refineries, petrochemical units, utilities, and environmental control systems.
Indicative Contents	The general outline of topics typically covered in such a course: 1) Introduction to industrial automation: Automation hierarchy, objectives, benefits, limitations, and applications in chemical and petroleum industries. 2) Process instrumentation fundamentals: Measurement principles, accuracy, calibration, range, span, errors, and signal standards.

	3) Industrial sensors and transmitters: Temperature, pressure, flow, level, analytical, and composition measurement devices. 4) Signal conditioning and data acquisition: Analog and digital signals, converters, noise reduction, sampling, and data logging. 5) Final control elements: Control valves, actuators, positioners, variable-speed drives, and selection criteria. 6) Control-loop structures: Feedback, feedforward, cascade, ratio, split-range, and override control strategies. 7) PLC systems: PLC hardware, input/output modules, ladder logic, timers, counters, and basic sequencing. 8) DCS, SCADA, and HMI: Distributed control architecture, supervisory control, operator interfaces, trends, alarms, and historian systems. 9) Industrial communication networks: Fieldbus, Profibus, Modbus, Ethernet-based networks, and integration of plant devices. 10) Safety and reliability in automation: Alarm management, interlocks, safety instrumented systems, emergency shutdown, and basic cybersecurity awareness. 11) Automation case studies: Applications in distillation columns, reactors, heat exchangers, boilers, compressors, water treatment, and refinery units.

Learning and Teaching Strategies	
Strategies	Power points, YouTube when necessary using the board for problem-solving and diagramming, and any other explanations' Students will be highly engaged in the activities during the lecture.

Student Workload (SWL)			
Structured SWL (h/sem)	77	**Structured SWL (h/w)**	5.1

Unstructured SWL (h/sem)	48	**Unstructured SWL (h/w)**	3.2
Total SWL (h/sem)	**125**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative	**Quizzes**	2	10% (10)	5 and 10	LO #1 and #2

assessment	**Assignments**	2	10% (10)	2 and 12	LO #3 and #4
	Projects	1	10% (10)	Continuous	LO #5, #6 and #8
	Report	1	10% (10)	13	LO #7 and #8
Summative assessment	**Midterm Exam**	1hr	10% (10)	7	LO #1 - #4
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Introduction to automation in chemical industries and automation hierarchy
Week 2	Process measurement fundamentals, calibration, errors, range, and signal standards
Week 3	Temperature and pressure measurement instruments
Week 4	Flow and level measurement instruments
Week 5	Analytical instruments and composition measurement in process plants
Week 6	P&ID symbols, instrumentation diagrams, and loop documentation
Week 7	Final control elements: control valves, actuators, positioners, and drives
Week 8	Feedback, feedforward, cascade, ratio, and override control loops
Week 9	PID control concepts and controller tuning for chemical processes
Week 10	PLC hardware, input/output modules, and ladder logic basics
Week 11	DCS architecture and distributed control of chemical plants
Week 12	SCADA systems, HMI design, alarms, trends, and historian systems
Week 13	Industrial communication networks and device integration
Week 14	Safety interlocks, SIS, emergency shutdown, and alarm management
Week 15	Automation case studies in refineries, reactors, distillation columns, and utilities
Week 16	Final Exam

Learning and Teaching Resources

	Text	**Available in the Library?**
Required Texts	1) Dale E. Seborg, Thomas F. Edgar, Duncan A. Mellichamp, and Francis J. Doyle III, Process Dynamics and Control, 4th Edition, Wiley. 2) B. R. Mehta and Y. Jaganmohan Reddy, Industrial Process Automation Systems: Design and Implementation, 1st Edition, Butterworth-Heinemann/Elsevier. 3) Béla G. Lipták and Kriszta Venczel, Instrument and Automation Engineers' Handbook: Process Measurement and Analysis, 5th Edition, CRC Press.	
Recommended Texts	1) George Stephanopoulos, Chemical Process Control: An Introduction to Theory and Practice, Prentice Hall. 2) Curtis D. Johnson, Process Control Instrumentation Technology, Pearson. 3) International Society of Automation (ISA) publications and technical resources related to instrumentation and industrial automation.	
Websites	ISA resources, vendor technical manuals, NPTEL process control lectures, and selected scientific videos related to process automation.	

Grading Scheme

Group	Grade	Rating	Marks %	Definition
Success Group (50 - 100)	A - Excellent	Excellent	90 - 100	Outstanding Performance
	B - Very Good	Very Good	80 - 89	Above average with some errors
	C - Good	Good	70 - 79	Sound work with notable errors
	D - Satisfactory	Average	60 - 69	Fair but with major shortcomings
	E - Sufficient	Acceptable	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX – Fail**	Fail (under treatment)	(45-49)	More work required but credit awarded
	F – Fail	Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark
of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTOR FORM

Module Information					
Module Title	Chemical Engineering Thermodynamics			**Module Delivery**	
Module Type	**Core**			**Theory**	
				Lecture	
Module Code	ETCP302			**Lab**	
ECTS Credits	5			**Tutorial**	
				Practical	
SWL (hr/sem)	**125**			**Seminar**	
Module Level UGx1	3		**Semester of Delivery**	5	
Administering Department	Chemical and Oil Industries Techniques Engineering		**College**	Technical Engineering College –Mosul	
Module Leader	Ali Younis		**e-mail**	alim7791ntu@ntu.edu.iq	
Module Leader's Acad. Title	Professor		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E-mail	
Scientific Committee Approval Date	01/06/2023		**Version Number**	1.0	

Relation with other Modules					
Prerequisite module	Physical Chemistry		**Semester**		3
Co-requisites module	None		**Semester**		

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	The course of chemical engineering thermodynamics comprises the study of volumetric properties of pure fluids; Entropy and second law analysis of engineering systems; Thermodynamic properties of fluids; Applications of thermodynamics to flow processes. The discussion of the study of Power cycles; Refrigeration and liquefaction process; Theory and application of solution thermodynamics; Vapor/liquid equilibrium in both: binary and multi-components; Ideal and non-ideal solutions are discussed using Raoult's and modified Raoult's law; Fugacity and fugacity coefficient definitions; Chemical reaction equilibrium and thermodynamic analysis of processes.
Module Learning Outcomes	at the end of the semester the student should be able to:- 1) To familiarize the students with basic concepts of the first and second laws of thermodynamics and their applications in engineering problems. 2) Develop a practical ability to solve energy balance problems and minimum

	work. 3) Students will demonstrate a basic understanding of the basics and definitions of thermodynamics and properties of pure substances. 4) Describe the reversible and irreversible processes (macroscopic description of ideal and real processes). 5) Apply the laws of thermodynamics to the power, refrigeration and liquefaction cycle. 6) Establish thermodynamic constraints that apply to VLE, and explain qualitatively the VLE diagram. 7) Apply thermodynamics to VLE of pure components and solutions in terms of fugacity and fugacity coefficients. 8) Apply equilibrium criteria to chemical reactions and evaluate the effect of temperature.
Indicative Contents	The general outline of topics typically covered in such a course: 1) Volumetric properties of pure fluids : Review on the virile equation of state, cubic equation of state, generalized correlations

	for gases and for liquids. 2) The 2nd law of thermodynamics : Review on the 2nd law and Carnot heat engine, entropy balance for open system, calculation of ideal work, lost work. 3) Thermodynamic properties of fluids : Review on the property relations (ΔH, ΔS, ΔU and ΔG) residual properties, two phase systems, thermodynamic diagrams and tables, generalized property correlations for gases. 4) Applications of thermodynamics to flow processes Duct flow of compressible fluids, pipe flow, nozzles, throttling process, turbines, compression processes compressors, ejectors. 5) Production of power from heat: The steam power plant, Rankin cycle, the regenerative cycle, internal combustion engines Otto engine, diesel engine, gas turbine engine. 6) Refrigeration and liquefaction: The Carnot refrigerator, the vapor compression cycle, the choice of refrigerant, absorption refrigeration, the heat pump, liquefaction processes. 7) Vapor\liquid equilibrium; introduction : The nature of equilibrium, the phase rule, Duhem,s theorem, diagrams for vapor liquid equilibrium, simple models for VL equilibrium: Rault,s law, dew point and bubble point calculations, Henrys law, VLE by modified Raults law, VLE from K value correlations, flash calculations. 8) Solution thermodynamics: theory Fundamental property relations, the chemical potential and phase equilibrium, ideal gas mixtures, fugacity and fugacity coefficient, the fundamental residual property relations, the ideal solutions. 9) Chemical Reaction equilibrium: The reaction coordinate, standard Gibbs energy change and equilibrium constant, effect of temperature on equilibrium constant, evaluation of equilibrium constant, liquid phase reactions, equilibrium conversion for single reactions. 10) Thermodynamic analysis of processes: Second law relation for steady state flow processes, calculation of ideal work, thermodynamic analysis of steady state flow processes.

Learning and Teaching Strategies	
Strategies	Power points, YouTube when necessary using the board for problem-solving and diagramming, and any other explanations' Students will be highly engaged in the

	activities during the lecture, in addition to the practical part inside Lab.

Student Workload (SWL)			
Structured SWL (h/sem)	123	**Structured SWL (h/w)**	8.2
Unstructured SWL (h/sem)	77	**Unstructured SWL (h/w)**	5.1
Total SWL (h/sem)	**200**		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	1hr	10% (10)	7	LO #1 - #7
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

		Material Covered
Week 1-2		Volumetric properties of pure fluids
Week 3-4		The 2nd law of thermodynamics
Week 5-6		Thermodynamic properties of fluids
Week 7		Applications of thermodynamics to flow processes
Week 8		Production of power from heat
Week 9		Production of power from heat
Week 10-11		Refrigeration and liquefaction:
Week 12		Vapor\liquid equilibrium; introduction
Week 13		Solution thermodynamics
Week 14		Chemical Reaction equilibrium
Week 15		Thermodynamic analysis of processes
Week 16		**Final Exam**

Delivery Plan (Weekly Lab. Syllabus)

		Material Covered
Week 1		Calibration of Thermocouple
Week 2		Joules law
Week 3		Boyles low
Week 4		Calorific Value
Week 5		Specific heat
Week 6		Determination of the sensible heat
Week 7		Determination of the Evaporation of latent heat
Week 8-9		Pressure and Temperature relationship for steam
Week 10-12		Refrigeration and Heat Pump
Week 13		Calculating the Cooling Effect in the Heat Pump

Week 14		Measurements of Specific Heat Ratio of Air
Week 15		The efficiency of Steam Boiler
Week 16		**Final Exam**

Learning and Teaching Resources

	Text	Available in the Library?
Required Texts	1) J. M. Smith, H.C. Van Ness, Introduction to chemical engineering thermodynamics, 6th edition (International Edition), Mc-Grew Hall, 2008.	
Recommended Texts	1) K.V. Narayanan, A textbook of chemical engineering thermodynamics, Prentice Hall of India, New Delhi, 2011. 2) B.G. Kyle, Chemical and process thermodynamics, 3rd Edition), Prentice Hall Inc. New Jersey, 1984.	
	3) J. Rayner, Basic engineering thermodynamics in SI units, printed in Great Britain,1971	
Websites		

Grading Scheme

Group	Grade	Rating	Marks %	Definition
Success Group (50 - 100)	A - Excellent	Excellent	90 - 100	Outstanding Performance
	B - Very Good	Very Good	80 - 89	Above average with some errors
	C - Good	Good	70 - 79	Sound work with notable errors
	D - Satisfactory	Average	60 - 69	Fair but with major shortcomings
	E - Sufficient	Acceptable	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX – Fail**	Fail (under treatment)	(45-49)	More work required but credit awarded
	F – Fail	Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark
of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTOR FORM

Module Information					
Module Title	**ENGINEERING ANALYSIS**			**Module Delivery**	
Module Type	Support			☒ **Theory** ☒ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	ETCP306				
ECTS Credits	2				
SWL (hr/sem)	**50**				
Module Level UGx1	3		**Semester of Delivery**	5	
Administering Department	Chemical and Oil Industries Techniques Engineering		**College**	Technical Engineering College –Mosul	
Module Leader	RAID ABDULHADI ABDULQADER		**e-mail**	raid.alabdullah@ntu.edu.iq	
Module Leader's Acad. Title	Assistant Lecturer		**Module Leader's Qualification**	Master's	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E	E-mail
Scientific Committee Approval Date	01/06/2023		**Version Number**	1.0	

Relation with other Modules					
Prerequisite module		None		**Semester**	
Co-requisites module		None		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	1. Students will have a solid understanding of the basic concepts and principles underlying engineering analysis, such as mathematical modeling, data analysis, and problem-solving techniques. 2. Students will be equipped with the skills necessary to apply mathematical and computational methods to analyze and solve engineering problems. This includes proficiency in mathematical modeling 3. Students will learn how to collect, organize, and analyze data relevant to engineering analysis. They will be able to apply statistical techniques to interpret data and draw meaningful conclusions. 3. Students will gain knowledge about different software tools and resources available for engineering analysis. They will develop the ability to evaluate the suitability of various tools for specific engineering tasks and make informed decisions regarding their use. 4. Students will learn how to design and conduct simulations and experiments to validate engineering models and analyze their performance. They will understand the

	importance of testing and validation in engineering analysis. 5. Students will be able to communicate their analysis results effectively through technical reports, presentations, and visualizations. They will develop skills in conveying complex engineering concepts and analysis outcomes to both technical and non-technical audiences.
Module Learning Outcomes	After the completion of this course, the students will be able to:
	1.Apply mathematical and computational tools to solve engineering problems.
	2.Formulate and model engineering problems using mathematical techniques.
	3.Analyze and interpret data using statistical methods.
	4.Utilize numerical methods to solve engineering problems.
	5.Perform engineering simulations and validate designs.
	6.Apply critical thinking and make informed decisions based on engineering analysis.
	7.Communicate technical findings effectively through reports and presentations.

	8.Collaborate in interdisciplinary teams to solve complex problems. 9.Apply engineering analysis skills across various disciplines. 10.Demonstrate professional ethics and responsibility in engineering analysis work.
Indicative Contents	1.Mathematical Tools for Analysis: ● Review of essential mathematical concepts such as functions, vectors, matrices, and calculus. ● Linear algebra and matrix operations. 2.Fourier Series and Transforms: ● Fourier series for periodic functions ● Fourier series for a non-periodic function ● Even and odd functions and half-range Fourier series. ● Fourier series over any range. ● A numerical method of harmonic analysis. ● The complex or exponential form of a Fourier series. 3.Laplace transforms: ● Introduction, Properties of Laplace Transform ● Laplace Transform of Functions ● The Initial and Final Value Theorems ● Inverse Laplace transform ,Inverse Laplace transform using Partial Fraction ● Solution of differential equation using Laplace transformation 4. Partial differential equations, Finite differences 5.Application of boundary conditions to solve differential equation 6.Case Studies and Applications: ● Practical engineering problems and case studies. ● Analysis of real-world systems using the techniques learned.

Learning and Teaching Strategies

Strategies	● Provide a clear and concise overview of the key concepts of Engineering Analysis. ● Use a variety of teaching methods, including lectures, demonstrations, and hands-on activities, to engage students and help them understand the material. ● Encourage students to participate in class discussions and activities. ● Provide opportunities for students to apply what they have learned to solve real-world problems. ● Assess student learning through a variety of methods, including quizzes, exams, and projects.

Student Workload (SWL)			
Structured SWL (h/sem)	63	**Structured SWL (h/w)**	4.2
Unstructured SWL (h/sem)	87	**Unstructured SWL (h/w)**	5.8
Total SWL (h/sem)	**150**		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	1hr	10% (10)	7	LO #1 - #7
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Mathematical Tools for Analysis
Week 2,3,4	Fourier Series and Transforms
Week 5,6,7	Laplace transforms
Week 8,9,10	Partial differential equations, Finite differences
Week 11,12,13	Application of boundary conditions to solve differential equation
Week 14,15	Case Studies and Applications
Week 16	Final Exam

Delivery Plan (Weekly Lab. Syllabus)

	Material Covered
Week 1	Introduction to Matlab
Week 2,3	Matrix Functions in Matlab
Week 4	Mathematical Operations using MATLAB
Week 5,6	implement Bessel's equation, modified Bessel's equation, and the generalized Bessel equation in MATLAB
Week 7,8	Fourier Series and Transforms using matlab
Week 9,10,11	Laplace and Inverse Laplace Transformation Using Matlab
Week 12,13	Partial differential equations using matlab
Week 14,15	Projects using matlab
Week 16	Final Exam

Learning and Teaching Resources

	Text	Available in the Library?
Required Texts	● "Advanced Engineering Mathematics" by Erwin	Yes

	Kreyszig ● "Numerical Methods for Engineers" by Steven C. Chapra and Raymond P. Canale ● "MATLAB: An Introduction with Applications" by Amos Gilat	
Recommended Texts	● "Statistics for Engineers and Scientists" by William Navidi	Yes
Websites	https://www.engineering.com/	

Grading Scheme

Group	Grade	Rating	Marks %	Definition
	A - Excellent	Excellent	90 - 100	Outstanding Performance
(50 - 100)	B - Very Good	Very Good	80 - 89	Above average with some errors
	C – Good	Good	70 - 79	Sound work with notable errors
	D - Satisfactory	Average	60 - 69	Fair but with major shortcomings
	E - Sufficient	Acceptable	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX – Fail**	Fail (under treatment)	(45-49)	More work required but credit awarded
	F – Fail	Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark
of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

Ministry of Higher Education and Scientific Research - Iraq
Northern Technical University
Technical Engineering College-Mosul
Engineering Technological for Chemical and Petroleum Industries

MODULE DESCRIPTOR FORM

Module Information					
Module Title	Heat Transfer 1			**Module Delivery**	
Module Type	**Core**			**Theory** **Lecture** **Lab** **Tutorial** **Practical**	
Module Code	**ETCP301**				
ECTS Credits	5				
SWL (hr/sem)	**125**				
Module Level UGx1	3		**Semester of Delivery**	5	
Administering Department	Chemical and Oil Industries Techniques Engineering		College	Technical Engineering College –Mosul	
Module Leader	Rafie Rushdy Mohammed		**e-mail**	rafie.rushdy@ntu.edu.iq	
Module Leader's Acad. Title	Professor		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E E-mail	
Scientific Committee Approval Date	01/06/2023		**Version Number**	1.0	

Relation with other Modules

Prerequisite module	None		**Semester**		
Co-requisites module	None		**Semester**		

Module Aims, Learning Outcomes and Indicative Contents

Module Objectives	This course covers: 1) Introducing and developing an understanding of the modes of heat transfer (conduction, convection, and radiation). 2) Derive and discusses all types of the equation in these modes of heat transfer. Analyze heat transfer rate data in different modes. 3) Derive the necessary equations for hydrodynamics and thermal boundary layer. 4) Characterization the design procedures for different heat transfer equipment is as heat exchanger. 5) Discuss the heat transfer in boiling and condensation processes. 6) Characterization the design procedures for furnace.
Module Learning Outcomes	at the end of the semester the student should be able to:- 1) Develop a deep understanding of issues related to the heat and energy balance for different chemical process 2) Define and solve problems in heat transfer mechanisms in various engineering applications.

	3) Explain and derive heat equations for the conduction and convection heat transfer. 4) Apply the analytical equations and correlations in convection heat transfer problems. 5) Design heat exchanger equipment. 6) Define and solve problems in boiling and condensation heat transfer. 7) Design the furnace and understand the radiation heat transfer. 8) Solve problems in heat transfer applications.
Indicative Contents	The general outline of topics typically covered in such a course: 1) Modes of Heat Transfer: Conduction, Convection, and Radiation. 2) Steady State Heat Conduction in One Dimension: General heat conduction equation in different coordinates, Plane wall, Radial systems, heat source systems, Boundary surrounded by fluids, Overall heat transfer coefficient, Conduction convection systems, and fins.

	3) Unsteady State Heat Transfer: Temperature as a function of time, lumped capacity system, quenching of small bodies, and heating of tank. 4) Principles of Convection: Transport equations, Fluid mechanism aspect of convection, laminar boundary layer, a turbulent portion of the boundary layer, and The laminar sub-layer. Thermal boundary layer, Empirical and practical relations for pipe and tube flow and flow normal to single and tube banks. Reynolds analogy. 5) Heat Exchangers: Various types and their general characteristics, Overall heat transfer coefficient, fouling factor, Heat exchangers mean temperature differences, and Co-current and counter-current flow. 6) Shell and Tube Exchanger: Types and various specifications, design calculations by conventional and effective (NTU) methods, and optimum design calculation. 7) Condensation and Boiling Heat Transfer: Condensation of single vapors, Laminar film condensation Design calculations for condenser, Pool and flow boiling, Boiling regime, General aspects, Boiling correlations. 8) Radiation and Furnace design: Radiation properties, shape factor, heat exchange for nonblack bodies, parallel planes, shields, gas tradition.

Learning and Teaching Strategies	
Strategies	Power points, YouTube when necessary using the board for problem-solving and diagramming, and any other explanations' Students will be highly engaged in the activities during the lecture, in addition to practical part inside Lab.

Student Workload (SWL)					
Structured SWL (h/sem)		123	**Structured SWL (h/w)**		8.2

Unstructured SWL (h/sem)	77	**Unstructured SWL (h/w)**	5.1
Total SWL (h/sem)	**200**		

Module Evaluation				
	Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**

Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	1hr	10% (10)	7	LO #1 - #7
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1-2	Modes of Heat Transfer
Week 3-4	Steady State Heat Conduction in One Dimension
Week 5-6	Unsteady State Heat Transfer
Week 7-8	Principles of Convection
Week 9-10	Heat Exchangers
Week 11-12	Shell and Tube Exchanger
Week 13	Condensation and Boiling Heat Transfer
Week 14	Condensation and Boiling Heat Transfer
Week 15	Radiation and Furnace design
Week 16	**Final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Temperature measurements
Week 2	Thermal conductivity.
Week 3	Calibration of thermocouple
Week 4	Flow across tube banks
Week 5	Heat exchangers
Week 6	Critical Heat Flux
Week 7	Heat Transfer through the Lagged Pipe
Week 8	Thermal Conductivity of Insulating Powder
Week 9	Heat Transfer from a Pin-Fin Apparatus
Week 10	Heat Transfer through Composite Wall
Week 11	Heat Transfer in Forced Convection
Week 12	Parallel Flow / Counter Flow Heat Exchanger
Week 13	Heat Transfer in Natural Convection
Week 14	Thermal Conductivity of Metal Rod
Week 15	Emissivity Measurement Apparatus
Week 16	**Final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	1) J.P. Holman, Heat Transfer, Ninth edition. 2) Frank P. Incropera & David P. Dewitt, Fundamentals of Heat and Mass Transfer, Fifth Edition.	
Recommended	1) Coulson, J.M and Richardson J.F. "Chemical Engineering,	

Texts	volume 1", 3rd edition.	
Websites		

Grading Scheme

Group	Grade	Rating	Marks %	Definition
Success Group (50 - 100)	A - Excellent	Excellent	90 - 100	Outstanding Performance
	B - Very Good	Very Good	80 - 89	Above average with some errors
	C - Good	Good	70 - 79	Sound work with notable errors
	D - Satisfactory	Average	60 - 69	Fair but with major shortcomings
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Ministry of Higher Education and Scientific Research - Iraq
Northern Technical University
Technical Engineering College-Mosul
Engineering Technological for Chemical and Petroleum Industries

MODULE DESCRIPTOR FORM

Module Information					
Module Title	**Instrumental of Chemical Analysis**			**Module Delivery**	
Module Type	CORE			**Theory** **Lecture** **Lab** **Tutorial** **Practical** **Seminar**	
Module Code	**ETCP304**				
ECTS Credits	4				
SWL (hr/sem)	100				
Module Level UGx1	3		**Semester of Delivery**	6	
Administering Department	Chemical and Oil Industries Techniques Engineering		**College**	Technical Engineering College –Mosul	
Module Leader	Asmaa Baker		**e-mail**	asmaabaker@ntu.edu.iq	
Module Leader's Acad. Title	Professor		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E E-mail	
Scientific Committee Approval Date	01/06/2025		**Version Number**	1.0	

Relation with other Modules				
Prerequisite module	None		**Semester**	
Co-requisites module	None		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	1. Understand the fundamental principles and concepts of analytical chemistry, including qualitative and quantitative analysis. 2. Gain proficiency in operating and utilizing spectrophotometers for various analytical purposes. 3. Comprehend the laws of UV-Visible absorption radiation, such as Beer's Lambert law, and identify deviations from this law. 4. Acquire knowledge of the principles and components of flame photometry and its advantages and disadvantages. 5. Familiarize oneself with the principles, components, and applications of atomic absorption spectroscopy (AAS), including different types of atomizers. 6. Explore the phenomenon of interference in flame atomic absorption, including fluorescence and phosphorescence, and understand the functioning and applications of fluorimeters. 7. Develop an understanding of the principles and components of turbidimetry

	and nephelometry, and recognize their advantages, disadvantages, and applications.
Module Learning Outcomes	At the end of the semester the student should be able to: 1. Students will gain knowledge and comprehension of the fundamental principles and concepts of analytical chemistry, including qualitative and quantitative analysis. 2.Students will learn about the principles, components, and types of spectrophotometers, as well as the advantages, disadvantages, and applications of spectrophotometry in analytical chemistry. 3. Students will study the laws of radiation absorption, including Beer's Lambert law, and understand deviations from this law. They will also explore the principles of flame photometry and its components. 4. Students will be introduced to AAS, including its principles, components, atomizers, and reaction in the hollow cathode lamp. They will also learn about the advantages, disadvantages, and applications of AAS.

	5. Students will study fluorescence and phosphorescence, factors affecting them, and the components, advantages, disadvantages, and applications of fluorimeters. They will also explore Chemiluminescence. 6. Students will understand the principles and components of turbidimetry and nephelometry, factors affecting light scattering, and the advantages, disadvantages, and applications of these techniques. 7. Students will learn the general principles of chromatography, including separation methods based on the physical state of stationary or mobile phases. They will also explore different types of chromatography, such as column chromatography, thin-layer chromatography, and paper layer chromatography. Additionally, students will understand the advantages and disadvantages of chromatograph
Indicative Contents	1.Analytical Chemistry •qualitative analysis •electromagnetic radiation •properties electromagnetic radiation •absorption and emission of electromagnetic spedrum •kind of transitior •spectroscopy photo analysis •spectra types 2.Spectrophotometer: •principles of spectrophotometer •component of spectrophotometer a) Types of radiation source b) Types of monochromators c) Sample cell d) types of detector •types of spectrophotometer 3.advantage and disadvantage of spectrophotometer ● application of spectrophotometer and visible absorption radiation ● laws of radiation absorption ● •beer's Lambert law ● •deviation from Beer’s Lambert law

	4.Flam photometry: •Principles of a flame photometry •Components of flame photometry •Advantages and disadvantages of plan photometry 5.Atomic absorption spectroscopy (AAS): •Introduction

	•principles of (AAS) •components (AAS) •Reaction in the hollow cathode lamp •atomizer •types of atomizer •applications of (AAS) •Advantages and disadvantages of flam (AAS) •Advantages and disadvantages of electro thermal •Atomization 6.Interference in flame Atomic absorption: •fluorescence of phosphorescence •factors affecting fluorescence of phosphorescence •Fluorimeter •Components of Fluorimeter •Advantages and disadvantages of Fluorimeter •Application of Fluorimeter •Types of Fluorimeter •Chemiluminescence 7.Turbidimetry and nephelometry: •introduction •Components

	•factors affecting light scattering •Advantages and disadvantages •Application of turbidimetry and nephelometry 9.Electrophoresis : •turbidimetry and nephelometry of Electrophoresis •Factors impacting Electrophoresis •Electrophoresis Components •Types of Electrophoresis •Paper Electrophoresis •Gel Electrophoresis •Capillary 10.Chromatography: •general principles of chromatography •chromatography separation method •based on physical state of stationary or mobile phase •based on basic principles involved 11.Classification based on nature of equipment used: •column chromatography •Thin layer chromatography •Paper layer chromatography •An advantage and disadvantages of chromatography •Gas chromatography •general principles of Gas chromatography •components of gas chromatography •An advantage and disadvantages of Gas chromatography 12.Electrochemistry

	•introduction •electrode •tyles of electrode •references electrode •saturated calomel electrode •saturated hydrogen electrode

	•silver/silver chloride electrode •direct indicator electrode •metallic electrode •members electrode •glass membrane electrode •ion selective membrane electrode •an electrochemical general principles, types of electrochemical cell •galvanic cell and , electrolytic cell

Learning and Teaching Strategies	
Strategies	1.Hands-on laboratory work: Engage students in practical experiments to develop their analytical skills and reinforce theoretical concepts. 2.Case studies and real-world applications: Integrate real-life examples to help students connect theory to practical scenarios and enhance their problem-solving abilities. 3.Interactive discussions and debates: Encourage critical thinking through debates and small group discussions on analytical chemistry topics.

Student Workload (SWL)			
Structured SWL (h/sem)	93	**Structured SWL (h/w)**	6.3

Unstructured SWL (h/sem)	57	**Unstructured SWL (h/w)**	3.8
Total SWL (h/sem)	**150**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	1hr	10% (10)	7	LO #1 - #7
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	analytical chemistry
Week 2	spectrophotometer
Week 3	Advantages and disadvantages of spectrophotometer
Week 4	Flam photometry
Week 5,6	Atomic absorption spectroscopy (AAS)
Week 7	Interference in flame Atomic absorption
Week 8	Turbidimetry and nephelometry
Week 9	Electrophoresis
Week 10	Types of Electrophoresis
Week 11	Chromatography
Week 12	classification based on nature of equipment used

Week 13,14,15	Electrochemistry, spectrophotometer
Week 16	exam

Delivery Plan (Weekly Lab. Syllabus)

	Material Covered
Week 1	Work security in chemical laboratories.
Week 2	Preparation of different types of solution.
Week 3	Quantitative and qualitative analysis using Spectro photo meter.
Week 4	Deter amination ƛ max of potassium permanganate solution.
Week 5	Beers lambert law.
Week 6	Determination paracetamol by Spectro photometric method
Week 7	Determination dyes by Spectro photometric method
Week 8	Determination paracetamol by Spectro photometric method
Week 9	Determination sodium by flame photometry.
Week 10	Determination potassium by flame photometry.
Week 11	Determination aluminum in water by atomic absorption Spectro photometer.
Week 12	Determination calcium by atomic absorption Spectro photometer.
Week 13	Turbidity.
Week 14	Gas liquid chromatography.
Week 15	Work security in chemical laboratories.
Week 16	Preparatory week before the Final Exam

Learning and Teaching Resources

	Text	Available in the Library?
Required Texts	● " Principles and Practice of Analytical Chemistry" by F.W. Fifield and David Kealey	Yes
Recommended Texts	● "Instrumental Analysis" by Robert M. Granger	Yes

Websites	● analytical--chemistry.com ● chromedia.org

Grading Scheme

Group	Grade	Rating	Marks %	Definition
Success Group (50 - 100)	A - Excellent	Excellent	90 - 100	Outstanding Performance
	B - Very Good	Very Good	80 - 89	Above average with some errors
	C – Good	Good	70 - 79	Sound work with notable errors
	D - Satisfactory	Average	60 - 69	Fair but with major shortcomings
	E - Sufficient	Acceptable	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX – Fail**	Fail (under treatment)	(45-49)	More work required but credit awarded
	F – Fail	Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark
of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

Ministry of Higher Education and Scientific Research - Iraq
Northern Technical University
Technical Engineering College-Mosul
Engineering Technological for Chemical and Petroleum Industries

MODULE DESCRIPTOR FORM

Module Information					
Module Title	Mass Transfer			**Module Delivery**	
Module Type	**Core**				
Module Code	ETCP300			**Lecture**	
				Lab	
ECTS Credits	5			**Tutorial**	
SWL (hr/sem)	**125**			**Practical**	
Module Level UGx1	3		**Semester of Delivery**	5	
Administering Department	Chemical and Oil Industries Techniques Engineering		College	Technical Engineering College –Mosul	
Module Leader	Zainab Ali Ibrahim		**e-mail**	zainabalaskari@ntu.edu.iq	
Module Leader's Acad. Title	Dr.		**Module Leader's Qualification**	Dr.	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E-mail	
Scientific Committee Approval Date	01/06/2025		**Version Number**	1.0	

Relation with other Modules					
Prerequisite module		None		**Semester**	
Co-requisites module		None		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	This course covers diffusion and mass transfer in binary& multi-components, molecular diffusion in fluids, convective mass transfer, mass transfer coefficients, mass transfer correlations, interphase mass transfer, and mass transfer theories, gas absorption, stripping, and distillation for binary and multi-component mixtures. Concepts to design mass transfer equipment.
Module Learning Outcomes	at the end of the semester the student should be able to:- 1) Understand the basics of diffusion as applicable to mass transfer phenomena. 2) Estimate Molar fluxes in convective and interphase mass transfer. 3) Explain the concept of diffusion theories. 4) Applying the convective mass transfer correlations to calculate mass transfer rates in many units operating. 5) Understand the basics of gas absorption, stripping, and distillation. 6) Design absorbers, strippers, and distillation columns. 7) Find Operating lines, feed line, and No. of trays or amounts of packing required.

	8) Calculate column efficiency.
Indicative Contents	The general outline of topics typically covered in such a course: 1) Introduction : Fundamentals of mass transfer processes, concentrations, velocities, mass & molar fluxes. 2) Diffusion in binary gaseous : Fick's first law of diffusion. Diffusion in gas mixtures, Equimolecular diffusion, and diffusion in the stationary layer. Correlations to calculate diffusivity, correcting diffusivity.

	3) Diffusion in multi-component mixtures: Multi-component gas phase systems, effective diffusivity. Maxwell's law of diffusion, 4) Diffusion in liquids. 5) Diffusion in solids. 6) Diffusion theories: Diffusion across phase boundary, Film theory, two film theory, Mass transfer coefficients (individual & overall) in a laminar and turbulent flow. 7) Diffusion resistances: Calculating the resistance to mass transfer in both phases. Calculating intermediate concentrations. 8) Unsteady state mass transfer: Introduction to unsteady state mass transfer, mass transfer accompanied by a chemical reaction. 9) Introduction to separation processes: General separation techniques. The mechanism of absorption and stripping processes. Flow regimes. 10) Absorption in packed bed columns: Constructions, mass transfer coefficients & specific area, capacity, height of columns based on gas film, liquid film, and based on overall conditions, operating line, the transfer units, the importance of gas and liquid flow rates. 11) Absorption in Tray towers : Types of trays, number of trays analytically and graphically. How to calculate the tray and column efficiency. 12) Introduction to distillation process: Partial pressure, Dalton's, Raoult's& Henry's laws. Relative volatility, non ideal systems. Method of diffusion, binary mixtures, batch distillation, flash distillation, steam distillation. Fractionating column. 13) Fractionating process: Number of plates required importance of reflux ratio, location of feed point, multiple feeds and side streams. 14) Multi-component Distillation : Key components. Components distributions, equilibrium data, feed & product compositions, minimum reflux ratio, calculation number of trays required, the relation between reflux ratio & a number

	of plates. 15) Plate & packed distillation columns: General designed methods, column efficiency

Learning and Teaching Strategies	
Strategies	Power points, YouTube when necessary using the board for problem-solving and diagramming, and any other explanations' Students will be highly engaged in the activities during the lecture, in addition to the practical part inside Lab.

Student Workload (SWL)			
Structured SWL (h/sem)	123	**Structured SWL (h/w)**	8.2
Unstructured SWL (h/sem)	77	**Unstructured SWL (h/w)**	5.1
Total SWL (h/sem)	**200**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
	Quizzes	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
Formative assessment	**Assignments**	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	1hr	10% (10)	7	LO #1 - #7
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction
Week 2	Diffusion in binary gaseous
Week 3	Diffusion in multi-component mixtures
Week 4	Diffusion in liquids
Week 5	Diffusion in solids
Week 6	Diffusion theories
Week 7	Diffusion resistances
Week 8	Introduction to separation processes
Week 9	Absorption in packed bed columns
Week 10	Absorption in Tray towers
Week 11	Introduction to distillation process:
Week 12-13	Fractionating process
Week 14	Multi-component Distillation :
Week 15	Plate & packed distillation columns:
Week 16	**Final Exam**

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction to Lab + Report Preparation
Week 2-3	Diffusion
Week 3-5	Packed Bed
Week 6	Simple Distillation
Week 7-8	Batch Distillation Column
Week 9-10	Fraction Distillation
Week 11-12	Steam Distillation
Week 13-14	Tray Tower

Week 15	Scientific Trip to Refinery
Week 16	**Final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	1) Coulson, J. M & Richardson J. F. (2006). "Chemical engineering, Volume 1", 3rd Edition, Robert Maxwell. M. C. 2) Dutta Binary K. (2007), "Principles of Mass Transfer & Separation Process", Bvt. Ltd. Prentice Hall, ISPN 8-1203-2990-2.	
Recommended Texts	1) Treybal Robert E. (1975), "Mass transfer Operation" 2ed Edition, Mc-Graw-Hill Book. 2) McCabe, W., Smith, J., Harriott, P. (2004), "Unit Operations of Chemical Engineering", Mc-Graw-Hill Co., 7th Edition, ISBN0072848235.	
Websites		

Grading Scheme

Group	Grade	Rating	Marks %	Definition
Success Group (50 - 100)	A - Excellent	Excellent	90 - 100	Outstanding Performance
	B - Very Good	Very Good	80 - 89	Above average with some errors
	C - Good	Good	70 - 79	Sound work with notable errors
	D - Satisfactory	Average	60 - 69	Fair but with major shortcomings
	E - Sufficient	Acceptable	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX – Fail**	Fail (under treatment)	(45-49)	More work required but credit awarded
	F – Fail	Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark
of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

Ministry of Higher Education and Scientific Research - Iraq
Northern Technical University
Technical Engineering College-Mosul
Engineering Technological for Chemical and Petroleum Industries

MODULE DESCRIPTOR FORM

Module Information

Module Title	Reactor Design		**Module Delivery**	
Module Type	**Core**			
Module Code	ETCP303		**Lecture** **Tutorial** **Seminar**	
ECTS Credits	5			
SWL (hr/sem)	125			
Module Level UGx1	3	**Semester of Delivery**	5	
Administering Department	Chemical and Oil Industries Techniques Engineering	College	Technical Engineering College –Mosul	
Module Leader	Haider Ismael Ibrahim	**e-mail**	haideralkarawi@ntu.edu.iq	
Module Leader's Acad. Title	Dr.	**Module Leader's Qualification**	Dr.	
Module Tutor	Name (if available)	**e-mail**	E-mail	
Peer Reviewer Name	Name	**e-mail**	E E-mail	
Scientific Committee Approval Date	01/06/2025	**Version Number**	1.0	

Relation with other Modules

Prerequisite module	Kinetics		**Semester**		4
Co-requisites module	None		**Semester**		

Module Aims, Learning Outcomes and Indicative Contents

Module Objectives	This course covers Theory, design fundamentals, and mass conservation equations for ideal reactors, isothermal reactors for homogeneous reactions, non-isothermal reactors, and multiple reactor Systems.
Module Learning Outcomes	at the end of the semester the student should be able to: 1) Apply reaction kinetics principles in chemical reactor engineering. 2) Identify and formulate problems in chemical reactor engineering and find appropriate solutions. 3) specify and size the most common industrial chemical reactors to achieve production goals for processes involving homogeneous reaction systems
Indicative Contents	The general outline of topics typically covered in such a course: 1) Introduction to reactor design: ● Interpretation of rate data, scale-up, and design ● Classification of reactors. 2) Design fundamentals and mass conservation equations for ideal reactors:

	● Conservation of mass in reactors. ● The ideal stirred-tank reactor (Batch and steady-state flow) ● The ideal tubular flow reactor (PFR) ● Space-time and space velocity 3) Isothermal reactors for homogeneous reactions: ● Design procedure: Batch reactor (constant volume and constant pressure) ● Design procedure: Continuous stirred-tank reactors (Single and multiple reactions) ● Design procedure: Tubular-flow reactors ● Comparison of the stirred tank and tubular-flow reactors. ● Flow recycle reactors ● Non-steady flow (semi-batch) reactors 4) Non-isothermal reactors:

	● L11: Energy conservation equations ● L12: Batch stirred-tank reactors ● L13: Continuous stirred-tank reactors 5) Multiple reactor System: ● Plug flow reactors in series and/or parallel ● Equal-size mixed flow reactors in series (first-order and second-order reactions) ● Mixed Flow Reactors of different sizes in series. ● Best arrangement of a set of ideal reactors

Learning and Teaching Strategies	
Strategies	Power points, YouTube when necessary using the board for problem-solving and diagramming, and any other explanations' Students will be highly engaged in the activities during the lecture.

Student Workload (SWL)			
Structured SWL (h/sem)	77	**Structured SWL (h/w)**	5.1
Unstructured SWL (h/sem)	62	**Unstructured SWL (h/w)**	4.1
Total SWL (h/sem)	**150**		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	1hr	10% (10)	7	LO #1 - #7
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1-2	Introduction to reactor design

Week 3-6	Design fundamentals and mass conservation equations for ideal reactors
Week 7-9	Isothermal reactors for homogeneous reactions
Week 9-12	Non-isothermal reactors
Week 12-15	Multiple reactor Systems
Week 16	**Final Exam**

Learning and Teaching Resources

	Text	Available in the Library?
Required Texts	1) Octave Levenspiel (1999), CHEMICAL REACTOR ENGINEERING, 3rd edition, John Wiley & Sons Inc., USA ISBN: 9780471254249. 2) H. S. Fogler, Elements of Chemical Reaction Engineering, 4th Ed (2006), Prentice Hall, NewYork.	
Recommended Texts	1) Ronald W. Missen; Charles A. Mims; Bradley A. Saville (1999), INTRODUCTION TO CHEMICAL REACTION ENGINEERING AND KINETICS,1st edition, John Wiley & Sons Inc., USA. 2) J.M. Smith (1987), CHEMICAL ENGINEERING KINETICS, 3rd edition, McGraw-Hill International Editions, Singapore.	
Websites		

Grading Scheme

Group	Grade	Rating	Marks %	Definition
Success Group (50 - 100)	A - Excellent	Excellent	90 - 100	Outstanding Performance
	B - Very Good	Very Good	80 - 89	Above average with some errors
	C - Good	Good	70 - 79	Sound work with notable errors
	D - Satisfactory	Average	60 - 69	Fair but with major shortcomings
	E - Sufficient	Acceptable	50 - 59	Work meets minimum criteria
	FX – Fail	Fail (under treatment)	(45-49)	More work required but credit awarded
	F – Fail	Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark
of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTOR FORM

Module Information					
Module Title	Chemical Engineering Thermodynamics			**Module Delivery**	
Module Type	**Core**			**Theory**	
				Lecture	
Module Code	ETCP302			**Lab**	
ECTS Credits	5			**Tutorial**	
				Practical	
SWL (hr/sem)	**125**			**Seminar**	
Module Level UGx1	3		**Semester of Delivery**	6	
Administering Department	Chemical and Oil Industries Techniques Engineering		**College**	Technical Engineering College –Mosul	
Module Leader	Ali Younis		**e-mail**	alim7791ntu@ntu.edu.iq	
Module Leader's Acad. Title	Professor		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E-mail	
Scientific Committee Approval Date	01/06/2023		**Version Number**	1.0	

Relation with other Modules					
Prerequisite module	Physical Chemistry		**Semester**		3
Co-requisites module	None		**Semester**		

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	The course of chemical engineering thermodynamics comprises the study of volumetric properties of pure fluids; Entropy and second law analysis of engineering systems; Thermodynamic properties of fluids; Applications of thermodynamics to flow processes. The discussion of the study of Power cycles; Refrigeration and liquefaction process; Theory and application of solution thermodynamics; Vapor/liquid equilibrium in both: binary and multi-components; Ideal and non-ideal solutions are discussed using Raoult's and modified Raoult's law; Fugacity and fugacity coefficient definitions; Chemical reaction equilibrium and thermodynamic analysis of processes.
Module Learning Outcomes	at the end of the semester the student should be able to:- 9) To familiarize the students with basic concepts of the first and second laws of thermodynamics and their applications in engineering problems. 10) Develop a practical ability to solve energy balance problems and minimum

	work. 11) Students will demonstrate a basic understanding of the basics and definitions of thermodynamics and properties of pure substances. 12) Describe the reversible and irreversible processes (macroscopic description of ideal and real processes). 13) Apply the laws of thermodynamics to the power, refrigeration and liquefaction cycle. 14) Establish thermodynamic constraints that apply to VLE, and explain qualitatively the VLE diagram. 15) Apply thermodynamics to VLE of pure components and solutions in terms of fugacity and fugacity coefficients. 16) Apply equilibrium criteria to chemical reactions and evaluate the effect of temperature.
Indicative Contents	The general outline of topics typically covered in such a course: 11) Volumetric properties of pure fluids : Review on the virile equation of state, cubic equation of state, generalized correlations

	for gases and for liquids. 12) The 2nd law of thermodynamics : Review on the 2nd law and Carnot heat engine, entropy balance for open system, calculation of ideal work, lost work. 13) Thermodynamic properties of fluids : Review on the property relations (ΔH, ΔS, ΔU and ΔG) residual properties, two phase systems, thermodynamic diagrams and tables, generalized property correlations for gases. 14) Applications of thermodynamics to flow processes Duct flow of compressible fluids, pipe flow, nozzles, throttling process, turbines, compression processes compressors, ejectors. 15) Production of power from heat: The steam power plant, Rankin cycle, the regenerative cycle, internal combustion engines Otto engine, diesel engine, gas turbine engine. 16) Refrigeration and liquefaction: The Carnot refrigerator, the vapor compression cycle, the choice of refrigerant, absorption refrigeration, the heat pump, liquefaction processes. 17) Vapor\liquid equilibrium; introduction : The nature of equilibrium, the phase rule, Duhem,s theorem, diagrams for vapor liquid equilibrium, simple models for VL equilibrium: Rault,s law, dew point and bubble point calculations, Henrys law, VLE by modified Raults law, VLE from K value correlations, flash calculations. 18) Solution thermodynamics: theory Fundamental property relations, the chemical potential and phase equilibrium, ideal gas mixtures, fugacity and fugacity coefficient, the fundamental residual property relations, the ideal solutions. 19) Chemical Reaction equilibrium: The reaction coordinate, standard Gibbs energy change and equilibrium constant, effect of temperature on equilibrium constant, evaluation of equilibrium constant, liquid phase reactions, equilibrium conversion for single reactions. 20) Thermodynamic analysis of processes: Second law relation for steady state flow processes, calculation of ideal work, thermodynamic analysis of steady state flow processes.

Learning and Teaching Strategies	
Strategies	Power points, YouTube when necessary using the board for problem-solving and diagramming, and any other explanations' Students will be highly engaged in the

	activities during the lecture, in addition to the practical part inside Lab.

Student Workload (SWL)			
Structured SWL (h/sem)	123	**Structured SWL (h/w)**	8.2
Unstructured SWL (h/sem)	77	**Unstructured SWL (h/w)**	5.1
Total SWL (h/sem)	**200**		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	1hr	10% (10)	7	LO #1 - #7
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

		Material Covered
Week 1-2		Volumetric properties of pure fluids
Week 3-4		The 2nd law of thermodynamics
Week 5-6		Thermodynamic properties of fluids
Week 7		Applications of thermodynamics to flow processes
Week 8		Production of power from heat
Week 9		Production of power from heat
Week 10-11		Refrigeration and liquefaction:
Week 12		Vapor\liquid equilibrium; introduction
Week 13		Solution thermodynamics
Week 14		Chemical Reaction equilibrium
Week 15		Thermodynamic analysis of processes
Week 16		**Final Exam**

Delivery Plan (Weekly Lab. Syllabus)

		Material Covered
Week 1		Calibration of Thermocouple
Week 2		Joules law
Week 3		Boyles low
Week 4		Calorific Value
Week 5		Specific heat
Week 6		Determination of the sensible heat
Week 7		Determination of the Evaporation of latent heat
Week 8-9		Pressure and Temperature relationship for steam
Week 10-12		Refrigeration and Heat Pump
Week 13		Calculating the Cooling Effect in the Heat Pump

Week 14		Measurements of Specific Heat Ratio of Air
Week 15		The efficiency of Steam Boiler
Week 16		**Final Exam**

Learning and Teaching Resources

	Text	Available in the Library?
Required Texts	2) J. M. Smith, H.C. Van Ness, Introduction to chemical engineering thermodynamics, 6th edition (International Edition), Mc-Grew Hall, 2008.	
Recommended Texts	4) K.V. Narayanan, A textbook of chemical engineering thermodynamics, Prentice Hall of India, New Delhi, 2011. 5) B.G. Kyle, Chemical and process thermodynamics, 3rd Edition), Prentice Hall Inc. New Jersey, 1984.	
	6) J. Rayner, Basic engineering thermodynamics in SI units, printed in Great Britain,1971	
Websites		

Grading Scheme

Group	Grade	Rating	Marks %	Definition
Success Group (50 - 100)	A - Excellent	Excellent	90 - 100	Outstanding Performance
	B - Very Good	Very Good	80 - 89	Above average with some errors
	C - Good	Good	70 - 79	Sound work with notable errors
	D - Satisfactory	Average	60 - 69	Fair but with major shortcomings
	E - Sufficient	Acceptable	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX – Fail**	Fail (under treatment)	(45-49)	More work required but credit awarded
	F – Fail	Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark
of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTOR FORM

Module Information					
Module Title	Chemical Process Simulation			**Module Delivery**	
Module Type	**Core**			**Lecture** **Lab** **Tutorial** **Project**	
Module Code	ETCP312				
ECTS Credits	4				
SWL (hr/sem)	**100**				
Module Level UGx1	3		**Semester of Delivery**	6	
Administering Department	Chemical and Oil Industries Techniques Engineering		**College**	Technical Engineering College –Mosul	
Module Leader	Safa Senan Mahmod		e-mail	safa.senan@ntu.edu.iq	
Module Leader's Acad. Title	Dr.		Module Leader's Qualification	Dr.	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E E-mail	
Scientific Committee Approval Date	01/06/2023		**Version Number**	1.0	

Relation with other Modules					
Prerequisite module		None		**Semester**	
Co-requisites module		None		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	The objective of the subject is to engage students with chemical plants by explaining to them the main items of plant design and teaching them procedures to design different equipment with Aspen Hysys software.
Module Learning Outcomes	at the end of the semester the student should be able to:- 1) The course will help students to bridges theoretical study and practical 2) Students will execute many operations in oil, gas, and petrochemicals 3) The course qualifies the students to enter and pass the exam from the American company (Aspentech) to get a certificate of Aspen User.
Indicative Contents	The general outline of topics typically covered in such a course: 1) Introduction: History, how to use Aspen Hysys and deal with its Graphic User Interface (GUI). 2) Starting with Aspen HYSYS ● Starting Aspen HYSYS and how to select the right components and fluid package for simulation purposes. ● Knowing how to start Aspen HYSYS and get familiar with its desktop is very important.

	● How to enter and reenter the simulation environment and get familiar with the simulation flowsheet. In this part, users will be informed of some important features of Aspen HYSYS. ● Dealing with how to add and specify material streams for simulation. ● Variables specification is one of the important steps that users need to understand when dealing with Aspen HYSYS.

	3) Simulation for Pressure vessels, pumps, and compressors flash drum, gas-liquid separator, liquid-liquid separator, gas movers, and compressors with Aspen Hysys. **4) Simulation of heat transfer equipment (shell And tube heat exchanger, plate heat exchanger, coil type exchanger, condenser, vaporizer, air cooler …….etc) with Aspen Hysys.** **5) Simulation of mass transfer equipment (distillation column, absorber column, leaching equipment, scrubber……..etc) with Aspen Hysys.** **6) Flash Calculations** **7) Gas Liquefaction** **8) Mixing Two Raw Gas Streams** **9) Simple Vapor Compression Refrigeration Cycle** **10) Gas Compression Station** **11) Gas Pipeline Calculations** **12) Raw Gas Dehydration Using TEG** **13) Raw Gas Sweetening Using DEA** **14) Production of Propylene Glycol (PG)**

Learning and Teaching Strategies	
Strategies	Power points, and YouTube when necessary to help the students to understand before excitation the case study using the computer for 1 h students will be highly engaged in the activities during the lecture, and follow the practical part inside Lab for 3 h.

Student Workload (SWL)			
Structured SWL (h/sem)	63	**Structured SWL (h/w)**	4.2
Unstructured SWL (h/sem)	37	**Unstructured SWL (h/w)**	2.5
Total SWL (h/sem)	**100**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Lab.	1	10% (10)	Continuous	All
	Project	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	1hr	10% (10)	7	LO #1 - #7
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction

Week 2	Starting with Aspen HYSYS
Week 3-4	Pressure vessels, pumps, compressors flash drum, gas-liquid separator, liquid-liquid separator, gas movers and compressors
Week 5	Heat transfer equipment
Week 6-7	Mass Transfer Equipments
Week 8	Flash Calculations
Week 9	Gas Liquefaction

Week 10	Mixing Two Raw Gas Streams
Week 11	Simple Vapor Compression Refrigeration Cycle
Week 12	Gas Compression Station
Week 13	Gas Pipeline Calculations
Week 14	Raw Gas Dehydration Using TEG
Week 15	Raw Gas Sweetening Using DEA
Week 15	Production of Propylene Glycol (PG)
Week 16	**Final Exam**

Learning and Teaching Resources

	Text	**Available in the Library?**
Required Texts		
Recommended Texts		
Websites	● https://www.aspentech.com/en ● https://www.aspentech.com/en/training-and-support/training-courses	

Grading Scheme

Group	**Grade**	Rating	**Marks %**	**Definition**
	A - Excellent	Excellent	90 - 100	Outstanding Performance
	B - Very Good	Very Good	80 - 89	Above average with some errors
	C - Good	Good	70 - 79	Sound work with notable errors
	D - Satisfactory	Average	60 - 69	Fair but with major shortcomings
	E - Sufficient	Acceptable	50 - 59	Work meets minimum criteria

Fail Group (0 – 49)	**FX – Fail**	Fail (under treatment)	(45-49)	More work required but credit awarded
	F – Fail	Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark
of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

Ministry of Higher Education and Scientific Research - Iraq
Northern Technical University
Technical Engineering College-Mosul
Engineering Technological for Chemical and Petroleum Industries

MODULE DESCRIPTOR FORM

Module Information

Module Title	**Heat Transfer 2**		**Module Delivery**	
Module Type	**Core**		**Theory** **Lecture** **Lab** **Tutorial** **Practical**	
Module Code	**ETCP309**			
ECTS Credits	5			
SWL (hr/sem)	**150**			
Module Level UGx11	3	**Semester of Delivery**	6	
Administering Department	Chemical and Oil Industries Techniques Engineering	College	Technical Engineering College –Mosul	
Module Leader	Rafie Rushdy Mohammed	e-mail	rafie.rushdy@ntu.edu.iq	
Module Leader's Acad. Title	Professor	**Module Leader's Qualification**	Ph.D.	
Module Tutor	Name (if available)	**e-mail**	E-mail	
Peer Reviewer Name	Name	**e-mail**	E E-mail	
Scientific Committee Approval Date	30/06/2025	**Version Number**	1.0	

Relation with other Modules

Prerequisite module	Heat Transfer 1	**Semester**		5
Co-requisites module	None	**Semester**		

Module Aims, Learning Outcomes and Indicative Contents

Module Objectives	This course covers: 1) Extending students' understanding of advanced heat-transfer applications in chemical and petroleum process equipment. 2) Analyzing and designing heat exchangers using LMTD and NTU methods, including fouling and operating constraints. 3) Applying convection correlations for internal flow, external flow, tube banks, and natural convection systems. 4) Solving boiling and condensation heat-transfer problems related to condensers, evaporators, and reboilers. 5) Applying radiation heat-transfer principles to industrial furnaces and process heaters. 6) Evaluating heat-transfer equipment performance, energy efficiency, and safety in industrial thermal systems.
Module Learning Outcomes	At the end of the semester the student should be able to: 1) Explain advanced heat-transfer mechanisms in convection, phase change, and radiation. 2) Solve engineering problems using dimensionless groups and empirical heat-transfer correlations. 3) Calculate the overall heat-transfer coefficient, fouling resistance, and required exchanger area. 4) Design and select double-pipe, shell-and-tube, plate, and compact heat exchangers for process duties. 5) Analyze condensers, boilers, evaporators, and reboilers under practical operating conditions.

	6) Evaluate radiation exchange between black and nonblack surfaces and estimate furnace heat duty. 7) Interpret laboratory data for heat-transfer equipment and compare it with theoretical predictions. 8) Prepare engineering calculations and technical reports for heat-transfer applications.
Indicative Contents	The general outline of topics typically covered in this course: 1) Review of Heat Transfer and Dimensionless Analysis: conduction, convection, radiation, Reynolds, Prandtl, Nusselt, and Grashof numbers. 2) Advanced Convection: forced convection in pipes and ducts, flow across cylinders and tube banks, natural and mixed convection.

	3) Heat Exchangers: overall coefficient, fouling factor, LMTD method, NTU-effectiveness method, exchanger selection, and pressure drop. 4) Shell-and-Tube and Compact Exchangers: construction, specifications, baffle effects, rating, sizing, and performance evaluation. 5) Phase-Change Heat Transfer: condensation, boiling regimes, critical heat flux, condenser, evaporator, and reboiler calculations. 6) Radiation and Furnace Design: blackbody and gray-body radiation, shape factors, shields, gas radiation, process-heater efficiency, and safety.

Learning and Teaching Strategies	
Strategies	PowerPoint presentations, board-based problem solving, interactive discussions, design calculations, laboratory demonstrations, case-study analysis, and engineering reports. Students will be engaged in solving industrial heat-transfer problems and interpreting experimental data from the practical part.

Student Workload (SWL)			
Structured SWL (h/sem)	123	**Structured SWL (h/w)**	8.2
Unstructured SWL (h/sem)	77	**Unstructured SWL (h/w)**	5.1
Total SWL (h/sem)	**200**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1, #2
	Assignments	2	10% (10)	2 and 12	LO #3, #4
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #6, #7, #8
Summative assessment	**Midterm Exam**	1hr	10% (10)	7	LO #1 - #5
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1-2	Review of heat-transfer mechanisms and dimensionless analysis
Week 3-4	Forced and natural convection correlations for practical systems
Week 5-6	Overall heat-transfer coefficient, fouling factor, and LMTD method
Week 7-8	NTU-effectiveness method and heat-exchanger selection
Week 9-10	Shell-and-tube, plate, and compact heat-exchanger design
Week 11-12	Condensation, boiling, evaporators, and reboilers
Week 13	Radiation heat transfer: blackbody, gray body, and shape factors
Week 14	Gas radiation, radiation shields, insulation, and thermal safety
Week 15	Furnace and process-heater design with thermal efficiency evaluation

Week 16	**Final Exam**

Delivery Plan (Weekly Lab. Syllabus)

	Material Covered
Week 1	Temperature measurement review and experimental uncertainty
Week 2	Forced convection in pipe flow
Week 3	Natural convection apparatus
Week 4	Flow across tube banks
Week 5	Double-pipe heat exchanger: parallel and counter flow
Week 6	Overall heat-transfer coefficient and fouling estimation
Week 7	LMTD method in heat-exchanger analysis
Week 8	NTU-effectiveness method in heat-exchanger analysis
Week 9	Shell-and-tube heat-exchanger performance
Week 10	Plate heat-exchanger performance
Week 11	Condensation heat-transfer experiment
Week 12	Boiling heat-transfer and critical heat flux
Week 13	Radiation heat transfer and emissivity measurement
Week 14	Insulation and lagged-pipe heat-loss experiment
Week 15	Furnace/process-heater thermal efficiency calculation
Week 16	**Final Exam**

Learning and Teaching Resources

	Text	Available in the Library?
Required Texts	1) Frank P. Incropera, David P. DeWitt, Theodore L. Bergman, and Adrienne S. Lavine, Fundamentals of Heat and Mass Transfer. 2) J.P. Holman, Heat Transfer.	
Recommended Texts	1) D.Q. Kern, Process Heat Transfer. 2) Coulson, J.M. and Richardson, J.F., Chemical Engineering, Volume 1.	
Websites	MIT OpenCourseWare: Heat Transfer NPTEL: Heat Transfer Coursera: Heat Transfer and Thermal Systems courses	

Grading Scheme

Group	Grade	Rating	Marks %	Definition
Success Group (50 - 100)	A - Excellent	Excellent	90 - 100	Outstanding Performance
	B - Very Good	Very Good	80 - 89	Above average with some errors
	C - Good	Good	70 - 79	Sound work with notable errors
	D - Satisfactory	Average	60 - 69	Fair but with major shortcomings
	E - Sufficient	Acceptable	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX – Fail**	Fail (under treatment)	(45-49)	More work required but credit awarded
	F – Fail	Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

Ministry of Higher Education and Scientific Research - Iraq
Northern Technical University
Technical Engineering College-Mosul
Technological Engineering for Chemical and Oil Industries

MODULE DESCRIPTOR FORM

Module Information					
Module Title	Industrial Safety			**Module Delivery**	
Module Type	**Core**			**Theory** **Lecture** **Tutorial** **Seminar**	
Module Code	**ETCP204**				
ECTS Credits	4				
SWL (hr/sem)	**100**				
Module Level UGx1	3		**Semester of Delivery**	5	
Administering Department	Chemical and Oil Industries Techniques Engineering		College	Technical Engineering College –Mosul	
Module Leader	Taha Ibrahim Anwer		e-mail	taha.anwer@ntu.edu.iq	
Module Leader's Acad. Title	Assistant Lecturer		Module Leader's Qualification	Master's	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E E-mail	
Scientific Committee Approval Date	01/06/2025		**Version Number**	1.0	

Relation with other Modules					
Prerequisite module		None		**Semester**	
Co-requisites module		None		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	Introduction to industrial safety, Risk Assessment & Hazard IdentificationFire and explosion, Toxicology, Leaks and leakage , Safety in process design
Module Learning Outcomes	at the end of the semester, the student should be able to : 1) The course attainted to give the student knowledge about the risk of chemical processes 2) The student be capable to use safety policy to eliminate accidents
Indicative Contents	The general outline of topics typically covered in such a course: 1) Introduction to industrial safety Important of industrial safety, History and development of safety movement, Need for safety, Safety legislation: Acts and rules, Safety standards and codes, Safety policy: safety organization and responsibilities and authorities of different levels.Accident sequence theory, Causes of accidents, Accident prevention, and control techniques, Plant. 2) Risk Assessment & Hazard Identification

	Risk definition, Risk analysis, Major hazard control, Identification of hazard, Categorization methods for elimination of hazard, Mechanical hazards, machine guarding, Pressure vessel hazards and their control, Safety in material handling: hazards and safe Practices, safety with storage of materials, Electrical hazards: classification, safe work practices, Chemical hazards: laboratory safety, bulk handling of chemicals. 3) Fire and explosion

	Introduction-Industrial processes and hazards potential, mechanical electrical, thermal and process hazards. Safety and hazards regulations, Industrial hygiene. Shock wave propagation, vapour cloud and boiling liquid expanding vapours explosion , mechanical and chemical explosion, multiphase reactions, transport effects and global rates. Fire and explosion hazards, Fire detection, Prevention ,control, and extinguishments, Industrial layout, Industrial waste management. 4) Toxicology Hazards identification-toxicity, fire, static electricity, noise and dust concentration; Material safety data sheet, hazards indices- Dow and Mond indices, hazard operability (HAZOP) and hazard analysis (HAZAN). 5) Leaks and leakage Spill and leakage of liquids, vapors, gases and their mixture from storage tanks and equipment; Estimation of leakage/spill rate through hole, pipes and vessel burst; Isothermal and adiabatic flows of gases, spillage and leakage of flashing liquids, pool evaporation and boiling; Release of toxics and dispersion. 6) Safety in process design and pressure system design Design process, conceptual design and detail design, assessment, inherently safer design chemical reactor, types, batch reactors, reaction hazard evaluation, assessment, reactor safety, operating conditions, unit operations and equipments, utilities. Pressure system, pressure vessel design, standards and codes- pipe works and valves- heat exchangers- process machineryover pressure protection, pressure relief devices and design, fire relief, vacuum and thermal relief, special situations, disposal-flare and vent systems failures in pressure system

Learning and Teaching Strategies

Strategies	1) Use a variety of teaching methods 2) Provide opportunities for students to apply what they are learning 3) Create a supportive and collaborative learning environment. 4) Provide regular feedback to students

Student Workload (SWL)

Structured SWL (h/sem)	47	**Structured SWL (h/w)**	3.1
Unstructured SWL (h/sem)	53	**Unstructured SWL (h/w)**	3.5
Total SWL (h/sem)	**100**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10

Summative assessment	**Midterm Exam**	1hr	10% (10)	7	LO #1 - #7
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1-2	Introduction to industrial safety
Week 3-5	Risk Assessment & Hazard Identification
Week 6-8	Fire and explosion
Week 9-10	Toxicology Hazards
Week 11-13	Leaks and leakage
Week 14-15	Safety in process design and pressure system design
Week 16	**Final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	1) Crowl D.A. and Louvar J.F., "Chemical Process Safety: Fundamentals with Applications", 2nd Ed., Prentice Hall.2001.	
Recommended Texts	1) Fawcett, H..and Wood, "Safety and Accident Prevention in Chemical Operations" Wiley inters, Second Edition. 2) David B., "Engineering Safety", McGraw-Hill UK, Copyright 1992.	
Websites		

Grading Scheme				
Group	**Grade**	Rating	**Marks %**	**Definition**
Success Group (50 - 100)	A - Excellent	Excellent	90 - 100	Outstanding Performance
	B - Very Good	Very Good	80 - 89	Above average with some errors
	C - Good	Good	70 - 79	Sound work with notable errors
	D - Satisfactory	Average	60 - 69	Fair but with major shortcomings
	E - Sufficient	Acceptable	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX – Fail**	Fail (under treatment)	(45-49)	More work required but credit awarded
	F – Fail	Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark
of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

Module Information

Module Title	Mass Transfer 2	**Module Delivery**	
Module Type	**Core**	**Theory**	
Module Code	ETCP308		
		Lecture	
ECTS Credits	5	**Lab**	
		Tutorial	
SWL (hr/sem)	**125**		
		Practical	

Module Level	3	**Semester of Delivery**	6
Administering Department	Chemical and Oil Industries Techniques Engineering	College	Technical Engineering College –Mosul
Module Leader	Zainab Ali Ibrahim	**e-mail**	zainabalaskari@ntu.edu.iq
Module Leader's Acad. Title	Dr.	**Module Leader's Qualification**	Dr.
Module Tutor	Name (if available)	**e-mail**	E-mail
Peer Reviewer Name	Name	**e-mail**	E -mail
Scientific Committee Approval Date	01/06/2023	**Version Number**	1.0

Relation with other Modules					
Prerequisite module		None		**Semester**	
Co-requisites module		None		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents

Module Objectives	This course covers: 1) Extending students' understanding of advanced mass-transfer and separation operations used in chemical and petroleum industries. 2) Applying equilibrium-stage and rate-based concepts to gas absorption, stripping, distillation, liquid-liquid extraction, leaching, adsorption, drying, and membrane separation. 3) Developing design calculations for packed and tray columns, including transfer units, operating lines, stage requirements, efficiency, and pressure drop. 4) Analyzing multicomponent separation systems using equilibrium data, material balance, and shortcut methods. 5) Evaluating equipment performance, energy requirements, solvent selection, safety, and environmental aspects in separation processes. 6) Interpreting laboratory data and preparing technical reports for mass-transfer equipment.
Module Learning Outcomes	At the end of the semester the student should be able to: 1) Explain advanced mass-transfer mechanisms in gas-liquid, liquid-liquid, and solid-fluid systems. 2) Apply material balances, equilibrium relations, and mass-transfer coefficients to separation-process calculations. 3) Construct operating and equilibrium lines and determine stages or column height for absorption, stripping, and distillation. 4) Design and evaluate packed and tray columns considering efficiency, pressure drop, loading, and flooding limits. 5) Analyze liquid-liquid extraction, leaching, adsorption, drying, humidification, and membrane-separation applications. 6) Select suitable solvents, packing, trays, and operating conditions for industrial separation duties. 7) Interpret experimental mass-transfer data and compare it with design correlations. 8) Prepare engineering calculations and technical reports for mass-transfer applications.
Indicative Contents	The general outline of topics typically covered in this course: 1) Review of Mass Transfer and Equilibrium Concepts: Diffusion, fluxes, concentrations, mass-transfer coefficients, interphase equilibrium, and material balances. 2) Gas Absorption and Stripping:

	Packed and tray columns, operating lines, HTU/NTU, overall coefficients, pressure drop, loading, and flooding. 3) Distillation and Multicomponent Separations: Vapor-liquid equilibrium, McCabe-Thiele method, reflux ratio, feed condition, tray efficiency, and shortcut multicomponent design. 4) Liquid-Liquid Extraction and Leaching: Ternary diagrams, solvent selection, stage calculations, continuous contactors, and solid-liquid extraction. 5) Adsorption, Ion Exchange, and Membrane Separation: Adsorption isotherms, breakthrough curves, fixed-bed design, ion exchange, reverse osmosis, dialysis, and gas separation. 6) Humidification, Drying, and Crystallization: Psychrometric analysis, drying-rate curves, dryer selection, crystallization principles, and energy and mass balances.

Learning and Teaching Strategies

Strategies	Power points, YouTube when necessary using the board for problem-solving and diagramming, and any other explanations' Students will be highly engaged in the activities during the lecture, in addition to the practical part inside Lab.

Student Workload (SWL)			
Structured SWL (h/sem)	123	**Structured SWL (h/w)**	8.2
Unstructured SWL (h/sem)	77	Unstructured SWL (h/w)	5.1
Total SWL (h/sem)	**200**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1 and #2
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #7 and #8
Summative assessment	**Midterm Exam**	1hr	10% (10)	7	LO #1 - #5
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
Week	**Material Covered**
Week 1-2	Review of mass-transfer coefficients and phase-equilibrium concepts
Week 3-4	Gas absorption and stripping in packed columns
Week 5-6	Tray towers, HTU/NTU, flooding, and column efficiency
Week 7-8	Binary distillation: McCabe-Thiele method, reflux ratio, and feed point
Week 9-10	Multicomponent distillation and shortcut design methods
Week 11-12	Liquid-liquid extraction and leaching operations
Week 13	Adsorption, ion exchange, and fixed-bed breakthrough analysis
Week 14	Membrane separation and gas and liquid permeation processes
Week 15	Humidification, drying, crystallization, and industrial review
Week 16	Final Exam

Delivery Plan (Weekly Lab. Syllabus)	
Week	**Material Covered**
Week 1	Laboratory safety, data analysis, and report preparation
Week 2	Diffusion and mass-transfer coefficient measurement

Week 3	Packed-bed hydrodynamics and pressure drop
Week 4	Gas absorption in a packed column
Week 5	Stripping column performance
Week 6	Tray tower operation and efficiency
Week 7	Simple and batch distillation
Week 8	Fractional distillation column
Week 9	VLE data and McCabe-Thiele analysis
Week 10	Liquid-liquid extraction
Week 11	Leaching / solid-liquid extraction
Week 12	Adsorption column breakthrough
Week 13	Drying-rate experiment
Week 14	Humidification / dehumidification experiment
Week 15	Scientific trip to refinery or separation-process unit
Week 16	Final Exam

Learning and Teaching Resources

	Text	Available in the Library?
Required Texts	1) Treybal, R. E., Mass Transfer Operations. 2) McCabe, W. L., Smith, J. C., and Harriott, P., Unit Operations of Chemical Engineering.	
Recommended Texts	1) Coulson, J. M. and Richardson, J. F., Chemical Engineering, Volume 2: Particle Technology and Separation Processes. 2) Geankoplis, C. J., Transport Processes and Separation Process Principles.	
Websites	MIT OpenCourseWare: Separation Processes NPTEL: Mass Transfer Operations Coursera: Separation Processes and Chemical Engineering courses	

Grading Scheme

Group	Grade	Rating	Marks %	Definition
Success Group (50 - 100)	A - Excellent	Excellent	90 - 100	Outstanding Performance
	B - Very Good	Very Good	80 - 89	Above average with some errors
	C - Good	Good	70 - 79	Sound work with notable errors
	D - Satisfactory	Average	60 - 69	Fair but with major shortcomings
	E - Sufficient	Acceptable	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX – Fail**	Fail (under treatment)	(45-49)	More work required but credit awarded
	F – Fail	Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

Ministry of Higher Education and Scientific Research - Iraq
Northern Technical University
Technical Engineering College-Mosul
Engineering Technological for Chemical and Petroleum Industries

MODULE DESCRIPTOR FORM

Module Information

Module Title	**Reactor Design 2**		**Module Delivery**	
Module Type	**Core**			
Module Code	**ETCP311**		**Lecture** **Tutorial** **Seminar**	
ECTS Credits	5			
SWL (hr/sem)	**125**			
Module Level UGx1	3	**Semester of Delivery**	6	
Administering Department	Chemical and Oil Industries Techniques Engineering	College	Technical Engineering College –Mosul	
Module Leader	Haider Ismael Ibrahim	e-mail	haideralkarawi@ntu.edu.iq	
Module Leader's Acad. Title	Dr.	Module Leader's Qualification	Dr.	
Module Tutor	Name (if available)	**e-mail**	E-mail	
Peer Reviewer Name	Name	**e-mail**	E E-mail	
Scientific Committee Approval Date	01/06/2025	**Version Number**	1.0	

Relation with other Modules

Prerequisite module	Reactor Design 1	**Semester**		5
Co-requisites module	None	**Semester**		

Module Aims, Learning Outcomes and Indicative Contents

Module Objectives	This course covers advanced chemical reactor design with emphasis on non-ideal flow, residence-time distribution, heterogeneous catalytic reactors, diffusion and heat-transfer limitations, packed-bed and fluidized-bed reactors, catalyst deactivation, multiphase reaction systems, reactor stability, safety, scale-up, and industrial reactor selection.
Module Learning Outcomes	at the end of the semester the student should be able to: 1) Analyze residence-time-distribution data and evaluate deviations from ideal reactor behavior. 2) Apply non-ideal reactor models, including tanks-in-series, dispersion, segregated-flow, and maximum-mixedness models. 3) Formulate design equations for heterogeneous catalytic reactors and packed-bed reactor systems. 4) Evaluate external and internal diffusion limitations using effectiveness-factor and Thiele-modulus concepts. 5) Solve non-isothermal catalytic reactor problems considering heat effects, hot spots, and stability constraints.

	6) Select and analyze suitable reactor types for gas-solid, gas-liquid, and multiphase industrial reactions. 7) Assess catalyst deactivation, regeneration strategies, and safe reactor operation. 8) Compare reactor configurations and optimize conversion, selectivity, pressure drop, and operating performance.
Indicative Contents	The general outline of topics typically covered in such a course: 1) Review of ideal reactor design: Reaction kinetics, conversion, selectivity, yield, batch, CSTR, and PFR design equations. 2) Residence-time distribution (RTD): Tracer tests, E(t), F(t), mean residence time, variance, and diagnosis of non-ideal behavior. 3) Non-ideal reactor models:

	Tanks-in-series model, axial dispersion model, segregated-flow model, and maximum-mixedness model. 4) Heterogeneous catalytic reactions: Catalyst properties, reaction mechanisms, rate expressions, and design of fixed-bed catalytic reactors. 5) Mass-transfer and heat-transfer limitations: External film resistance, pore diffusion, Thiele modulus, effectiveness factor, and diagnostic criteria. 6) Packed-bed reactor design: Design equations, pressure-drop effects, Ergun equation, adiabatic operation, hot spots, and non-isothermal operation. 7) Catalyst deactivation: Causes of deactivation, activity models, regeneration, and effect on reactor performance. 8) Fluidized-bed reactors: Fluidization regimes, design concepts, heat and mass transfer characteristics, and industrial applications. 9) Gas-solid and gas-liquid reactors: Shrinking-core model, slurry reactors, trickle-bed reactors, two-film theory, and mass-transfer coefficients. 10) Reactor safety and scale-up: Thermal runaway, multiplicity, stability, scale-up criteria, and industrial reactor case studies.

Learning and Teaching Strategies	
Strategies	Power points, YouTube when necessary using the board for problem-solving and diagramming, and any other explanations' Students will be highly engaged in the activities during the lecture.

Student Workload (SWL)			
Structured SWL (h/sem)	77	**Structured SWL (h/w)**	5.1

Unstructured SWL (h/sem)	48	**Unstructured SWL (h/w)**	3.2
Total SWL (h/sem)	**125**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1 and #2
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #5
	Projects	1	10% (10)	Continuous	LO #6, #7 and #8

	Report	1	10% (10)	13	LO #5, #7 and #8
Summative assessment	**Midterm Exam**	1hr	10% (10)	7	LO #1 - #4
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Review of ideal reactor design, reaction kinetics, conversion, selectivity, and yield
Week 2	Residence-time distribution (RTD) and tracer-test methods
Week 3	RTD functions: E(t), F(t), mean residence time, variance, and data interpretation
Week 4	Non-ideal flow models: tanks-in-series and axial dispersion
Week 5	Segregated-flow and maximum-mixedness models
Week 6	Heterogeneous catalytic reactions and catalyst properties
Week 7	External mass-transfer and heat-transfer limitations in catalytic reactors
Week 8	Internal diffusion, Thiele modulus, and effectiveness factor
Week 9	Packed-bed reactor design and pressure-drop effects
Week 10	Non-isothermal packed-bed reactors, hot spots, and stability
Week 11	Catalyst deactivation, activity models, and regeneration
Week 12	Fluidized-bed reactor fundamentals and industrial applications
Week 13	Gas-solid non-catalytic reactions and shrinking-core model
Week 14	Gas-liquid, slurry, and trickle-bed reactor design concepts
Week 15	Reactor safety, scale-up, and industrial reactor case studies
Week 16	Final Exam

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	1) H. Scott Fogler, Elements of Chemical Reaction Engineering, 6th Edition, Pearson. 2) Octave Levenspiel (1999), Chemical Reactor Engineering, 3rd Edition, John Wiley & Sons Inc., USA, ISBN: 9780471254249.	
Recommended Texts	1) Gilbert F. Froment, Kenneth B. Bischoff, and Juray De Wilde, Chemical Reactor Analysis and Design, 3rd Edition, Wiley. 2) Ronald W. Missen, Charles A. Mims, and Bradley A. Saville (1999), Introduction to Chemical Reaction Engineering and Kinetics, 1st Edition, John Wiley & Sons Inc., USA.	
	3) J. M. Smith (1987), Chemical Engineering Kinetics, 3rd Edition, McGraw-Hill International Editions, Singapore.	
Websites	Open educational resources, publisher companion materials, and selected scientific videos related to chemical reactor engineering.	

Grading Scheme				
Group	**Grade**	Rating	**Marks %**	**Definition**
Success Group (50 - 100)	A - Excellent	Excellent	90 - 100	Outstanding Performance
	B - Very Good	Very Good	80 - 89	Above average with some errors
	C - Good	Good	70 - 79	Sound work with notable errors

	D - Satisfactory	Average	60 - 69	Fair but with major shortcomings
	E - Sufficient	Acceptable	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX – Fail**	Fail (under treatment)	(45-49)	More work required but credit awarded
	F – Fail	Fail	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark
of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

Ministry of Higher Education and Scientific Research - Iraq
Northern Technical University
Technical Engineering College-Mosul
Engineering Technological for Chemical and Petroleum Industries

MODULE DESCRIPTOR FORM

Module Information					
Module Title	**Renewable Energies**			**Module Delivery**	
Module Type	**Core**				
Module Code	**ETCP313**			**Lecture** **Tutorial** **Seminar**	
ECTS Credits	3				
SWL (hr/sem)	**75**				
Module Level	3		**Semester of Delivery**	6	
Administering Department	Chemical and Oil Industries Techniques Engineering		College	Technical Engineering College –Mosul	
Module Leader	Noori Raad Noori		**e-mail**	noori.raad@ntu.edu.iq	
Module Leader's Acad. Title	Assistant Lecturer		Module Leader's Qualification	Master's	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E-mail	
Scientific Committee Approval Date	01/06/2025		**Version Number**	1.0	

Relation with other Modules

Prerequisite module	None		**Semester**		
Co-requisites module	None		**Semester**		

Module Aims, Learning Outcomes and Indicative Contents

Module Objectives	This course covers the fundamentals and engineering applications of renewable energy systems, including solar radiation, photovoltaic systems, solar thermal systems, wind energy, biomass and biofuels, geothermal energy, hydropower, energy storage, green hydrogen, hybrid systems, environmental impacts, economic assessment, and integration of renewable energy technologies in chemical and petroleum industries.
Module Learning Outcomes	at the end of the semester the student should be able to: 1) Explain the main renewable energy resources and their role in sustainable industrial energy systems. 2) Calculate basic solar, wind, biomass, geothermal, and hydropower energy potentials using engineering principles. 3) Describe the operating principles and components of photovoltaic and solar thermal systems. 4) Analyze wind turbine performance and identify the factors affecting wind energy conversion. 5) Compare biomass, biofuels, geothermal, hydropower, and waste-to-energy technologies

	for industrial applications. 6) Evaluate energy storage, green hydrogen, and hybrid renewable systems for reliable process operation. 7) Perform preliminary techno-economic and environmental assessments of renewable energy projects. 8) Propose suitable renewable energy solutions for chemical plants, refineries, utilities, and remote facilities.
Indicative Contents	The general outline of topics typically covered in such a course: 1) Introduction to renewable energies: Energy resources, sustainability, energy demand, environmental drivers, and renewable energy classifications. 2) Solar radiation and energy balances: Solar geometry, irradiance, collector orientation, energy balance, and useful solar energy calculations.

	3) Solar thermal systems: Flat-plate and concentrating collectors, solar water heating, solar drying, and industrial process heat. 4) Photovoltaic systems: PV cell principles, modules, arrays, inverters, batteries, grid-connected and stand-alone system sizing. 5) Wind energy: Wind resources, turbine types, power coefficient, power curve, site selection, and basic performance analysis. 6) Biomass and biofuels: Biomass resources, combustion, gasification, anaerobic digestion, biodiesel, bioethanol, and biogas applications. 7) Geothermal and hydropower systems: Geothermal resources, heat extraction, small hydropower, turbine selection, and site characteristics. 8) Energy storage technologies: Battery storage, thermal storage, pumped hydro, compressed air, and storage selection for renewable systems. 9) Green hydrogen and fuel cells: Electrolysis, hydrogen storage, fuel cells, power-to-gas, and applications in chemical and petroleum industries. 10) Hybrid renewable systems: Hybrid solar-wind-battery systems, microgrids, reliability, load matching, and energy management. 11) Project evaluation and industrial integration: Techno-economic analysis, life-cycle assessment, carbon reduction, safety, and case studies for process plants.

Learning and Teaching Strategies	
Strategies	Power points, YouTube when necessary using the board for problem-solving and diagramming, and any other explanations' Students will be highly engaged in the activities during the lecture.

Student Workload (SWL)

Structured SWL (h/sem)	77	**Structured SWL (h/w)**	5.1
Unstructured SWL (h/sem)	48	**Unstructured SWL (h/w)**	3.2
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Summative assessment	**Midterm Exam**	1hr	10% (10)	7	LO #1 - #4
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Introduction to renewable energy resources, sustainability, and industrial energy demand
Week 2	Solar radiation, solar geometry, irradiance, and energy balance calculations
Week 3	Solar thermal collectors and solar process heat applications
Week 4	Photovoltaic cell principles, PV modules, arrays, and inverters
Week 5	PV system sizing, stand-alone systems, grid-connected systems, and performance factors
Week 6	Wind energy resources, wind turbine types, power curves, and site assessment
Week 7	Biomass resources, combustion, gasification, anaerobic digestion, and biogas
Week 8	Biofuels: biodiesel, bioethanol, production routes, and industrial applications
Week 9	Geothermal energy systems and small hydropower technologies
Week 10	Energy storage technologies: batteries, thermal storage, pumped hydro, and compressed air
Week 11	Green hydrogen production, storage, fuel cells, and power-to-gas systems
Week 12	Hybrid renewable systems, microgrids, load matching, and energy management
Week 13	Integration of renewable energy in chemical plants, refineries, utilities, and remote sites
Week 14	Environmental assessment, life-cycle analysis, carbon reduction, and safety considerations
Week 15	Economic evaluation, feasibility study, and renewable energy case studies
Week 16	Final Exam

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	1) John Twidell, Renewable Energy Resources, 4th Edition, Routledge, 2021. 2) Godfrey Boyle, Renewable Energy: Power for a Sustainable Future, 3rd Edition, Oxford University Press, 2012. 3) John A. Duffie and William A. Beckman, Solar Engineering of Thermal Processes, 4th Edition, Wiley, 2013.	
Recommended Texts	1) Volker Quaschning, Renewable Energy and Climate Change, Wiley. 2) Gilbert M. Masters, Renewable and Efficient Electric Power Systems, Wiley. 3) International Renewable Energy Agency (IRENA), selected technical reports and renewable energy statistics.	
Websites	IRENA, NREL, NPTEL renewable energy lectures, and selected scientific videos related to renewable energy systems and industrial applications.	

Grading Scheme

Group	Grade	Rating	Marks %	Definition
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