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

Academic Program and Course Description Guide

2025-2026

Introduction:

The educational program is a well-planned set of courses that include procedures and experiences arranged in the form of an academic syllabus. Its main goal is to improve and build graduates' skills, so they are ready for the job market. The program is reviewed and evaluated every year through internal or external audit procedures and programs like the External Examiner Program.

The academic program description is a short summary of the main features of the program and its courses. It shows what skills students are working to develop based on the program's goals. This description is very important because it is the main part of getting the program accredited, and it is written by the teaching staff together under the supervision of scientific committees in the scientific departments.

This guide includes the description of the **Master's Program in the Department of Chemical Engineering,** College of Engineering, Al-Muthanna University, for the academic year 2025-2026. It has been prepared in a manner consistent with the requirements of postgraduate studies in Iraqi universities and in a way that reflects the specialized nature of the program in terms of its objectives, study plan, courses, and intended learning outcomes. In addition, the approved academic program description template circulated under the Studies Department letter No. T M3/2906 dated 3/5/2023 has been adopted in order to unify the formulation of program and course descriptions and to provide an approved academic and administrative reference that benefits students, faculty members, scientific committees, and the bodies responsible for quality assurance and academic accreditation.

In this regard, it is important to emphasize the significance of preparing academic program and course descriptions as an effective tool for ensuring the proper functioning of the educational process, improving its efficiency, and strengthening its ability to respond to scientific, research, and societal requirements.

Concepts and terminology:

- **Academic Program Description:** The academic program description provides a brief summary of its vision, mission and objectives, including an accurate description of the targeted learning outcomes according to specific learning strategies.
- **Course Description:** Provides a brief summary of the most important characteristics of the course and the learning outcomes expected of the students to achieve, proving whether they have made the most of the available learning opportunities. It is derived from the program description.
- **Program Vision:** An ambitious picture for the future of the academic program to be sophisticated, inspiring, stimulating, realistic and applicable.
- **Program Mission:** Briefly outlines the objectives and activities necessary to achieve them and defines the program's development paths and directions.
- **Program Objectives:** They are statements that describe what the academic program intends to achieve within a specific period of time and are measurable and observable.
- **Curriculum Structure:** All courses / subjects included in the academic program according to the approved learning system (quarterly, annual, Bologna Process) whether it is a requirement (ministry, university, college and scientific department) with the number of credit hours.
- **Learning Outcomes:** A compatible set of knowledge, skills and values acquired by students after the successful completion of the academic program and must determine the learning outcomes of each course in a way that achieves the objectives of the program.
- **Teaching and learning strategies:** They are the strategies used by the faculty members to develop students' teaching and learning, and they are plans that are followed to reach the learning goals. They describe all classroom and extra-curricular activities to achieve the learning outcomes of the program.

Academic Program Description Form

University Name: Al-Muthanna University

Faculty/Institute: College of Engineering

Scientific Department: Department of Chemical Engineering

Academic or Professional Program Name: Master's Program in Chemical Engineering

Final Certificate Name: Master of Science in Chemical Engineering

Academic System: Semester System / Coursework and Thesis

Description Preparation Date: 15 / 09 /2025

File Completion Date: 15 /01 /2026

Signature:

Head of Department Name:

Asst. Prof. Dr. Ali Abd Hassan Khadim

Date: / /

Signature:

Scientific Associate Name:

Asst. Prof. Dr. Forat Yasir Sharrad

Date: / /

The file is checked by:

Department of Quality Assurance and University Performance

Director of the Quality Assurance and University Performance Department:

Date: / /

Signature:

Approval of the Dean

1. Program Mission

The Program aims to prepare advanced academic and research cadres with knowledge in the fields of chemical process engineering and plant design, capable of employing theoretical and kinetic foundations as well as modern simulation software in addressing industrial processing problems, conducting rigorous scientific research, and providing innovative and sustainable engineering solutions that contribute to community service and meet the needs of development and the labor market.

2. Program Objectives

Our program is dedicated to preparing students to:

- Develop specialized academic cadres with advanced knowledge in the fields of chemical engineering and the design and operation of chemical processes.
- Enhance research skills and analytical thinking in addressing chemical processing problems using modern theoretical, thermodynamic, and kinetic methods.
- Strengthen students' ability to use modern engineering software and tools in process simulation, modeling, and plant design.
- Enable students to provide innovative and sustainable engineering solutions that respond to community needs and labor market requirements.
- Promote commitment to professional and ethical values and support continuous learning and academic development in the field of specialization.

3. Program Accreditation

None

4. Other external influences

None

5. Program Structure

Program Structure	Number of Courses	Credit hours	Percentage	Reviews*
Institution Requirements	2	2	6.67%	—
College Requirements	1	2	6.67%	—
Department Requirements	9	18	60.00%	—
Summer Training	—	—	—	—
Thesis	1	8	26.66%	—
Total	13	30	100%	

* This can include notes whether the course is basic or optional.

6. Program Description

Year/Level	Course Code	Course Name	Credit Hours	
			theoretical	practical
First Semester	Chem.E.500	Fluid Flow	٢	—
First Semester	Chem.E.501	Reactors Design	٢	—
First Semester	Chem.E.502	Thermodynamics	٢	—
First Semester	Chem.E.503	Mass Transfer	٢	—
First Semester	Chem.E.504	Separation processes	٢	—
First Semester	GE.505	English language I	٢	—
Second Semester	Chem.E.506	Research Methodology	٢	—
Second Semester	Chem.E.507	Heat Transfer	٢	—

Second Semester	Chem.E.508	Catalysts	۲	—
Second Semester	Chem.E.509	Mathematical Modeling	۲	—
Second Semester	Chem.E.510	Renewable Energy	۲	—
Second Semester	GE.511	English language II	۲	—

7. Expected learning outcomes of the program

Knowledge	
Learning Outcomes 1	Demonstrate advanced knowledge of concepts, theories, and scientific foundations in the fields of chemical engineering.
Learning Outcomes 2	Understand the behavior of complex chemical processes and comprehend advanced principles of thermodynamics, transport phenomena, and reactor design.
Learning Outcomes 3	Recognize the theoretical, numerical, and research-based foundations related to the analysis, modeling, and optimization of chemical engineering systems.
Skills	
Learning Outcomes 1	Analyze complex chemical engineering problems using appropriate scientific, mathematical, and modeling methods.
Learning Outcomes 2	Employ specialized knowledge in evaluating chemical processes and separation systems, and selecting appropriate design solutions and alternatives.
Learning Outcomes 3	Apply scientific research skills in collecting, analyzing, and interpreting experimental and operational data in the field of chemical engineering.
Learning Outcomes 4	Prepare academic and engineering research papers and technical reports in a well-organized scientific manner.
Learning Outcomes 5	Use modern software and numerical methods in chemical process simulation, mathematical modeling, and equipment design.
Ethics	
Learning Outcomes 1	Adhere to the ethics of scientific research and academic integrity in preparing studies, experiments, and research.
Learning Outcomes 2	Assume professional responsibility in addressing chemical and environmental engineering issues in a manner that ensures safety, serves society, and protects the public interest.

Learning Outcomes 3	Work in a spirit of cooperation and effective academic communication with instructors, researchers, and fellow students.
Learning Outcomes 4	Respect standards of quality, industrial safety, accuracy, and discipline in academic, laboratory, and professional performance.
Learning Outcomes 5	Adopt positive attitudes toward community service, sustainable development, renewable energy initiatives, and responsiveness to local industrial needs.

8. Teaching and Learning Strategies

- Specialized lectures.
- In-class scientific discussions.
- Research-based learning, including the preparation of reports and scientific presentations.
- Analysis of engineering problems and study of practical cases.
- Guided self-learning based on modern scientific sources.
- Use of software and modern analytical methods.
- Academic supervision in the preparation of research and the thesis.

9. Evaluation methods

- Written examinations.
- Reports and assignments.
- Presentations and seminars.
- Class participation and scientific discussions.
- Evaluation and defense of the thesis.

10. Faculty

Faculty Members

Academic Rank	Specialization		Special Requirements/Skills (if applicable)	Number of the teaching staff	
	General	Special		Staff	Lecturer

Dr.Raed Tariq Hadi	Chemical Engineering	Fluid Flow			✓	
Dr.Ahmed Hassan Ali	Chemical Engineering	Water Treatment			✓	
Dr.Anas Badiwi Salman	Chemical Engineering	Mass Transfer			✓	
Dr.Adel Hatem Rashid	Chemical Engineering	Biological Processes			✓	
Dr.Furat Yasser Sharad	Chemical Engineering	Water Treatment			✓	
Dr.Ali Abdul Hassan Kadhim	Chemical Engineering	Water Treatment			✓	
Dr.Ghazi Faisal Nasser	Chemical Engineering	Water Treatment			✓	
Dr.Ali Samir Aneid	Mechanical Engineering	Refractory			✓	
Lect. Dr. Munther Shaker Joki	English Language	Teaching methods				✓

Professional Development

Mentoring new faculty members

- Preparing a comprehensive orientation program that explains the academic regulations and policies adopted by the university, college, and department.
- Involving new faculty members in pedagogical and training courses on modern teaching methods, classroom management, and assessment methods in higher education.
- Introducing them to the mechanisms of postgraduate studies and the requirements of academic and research supervision.
- Supporting their integration into the academic environment through follow-up and guidance by the scientific committees and the head of department

Professional development of faculty members

- Encouraging participation in workshops and continuous training courses in the fields of teaching, scientific research, and modern educational technologies.

- Supporting scientific publication in reputable journals and attendance at local and international conferences and seminars.
- Providing opportunities for academic missions, research visits, and scientific cooperation with universities and other academic institutions for the exchange of expertise.
- Conducting periodic evaluation of teaching and research performance in order to identify individual developmental needs and improve the quality of academic performance.
- Promoting a culture of continuous development that positively reflects on the quality of the program and its educational and research outcomes.

11. Acceptance Criterion

Applicants holding a Bachelor's degree in Chemical Engineering are eligible for admission to the Master of Chemical Engineering program, in accordance with the postgraduate studies regulations and the criteria approved by the Ministry of Higher Education and Scientific Research.

12. The most important sources of information about the program

* Approved textbooks available in the department.
* Supporting books and references available in the library.
* Faculty lecture notes.

13. Program Development Plan

١.Measuring Learning Outcomes (GOs):

- Assessment Tools: Exams, laboratory assessments, research evaluations, graduate surveys.
- Standard: Achievement rate of 60% or higher.
- Review: Annually by the chemical engineering department and faculty members.

2.Reviewing Program Educational Objectives (PEOs):

- Methods: Surveys for students, graduates, industrial advisory boards, faculty members, and employers.
- Review: Every 4–6 years.

3.Accreditation Indicators (ICAEE / Chemical Engineering Standards):

- Curriculum Review: Core chemical courses, study plan, and research sequencing (every 3 years).
- Follow-up: Graduation requirements, faculty competence, financial and administrative support (annually to every 2 years).
- Evaluation: Chemical laboratories, safety infrastructure, and facilities (as needed).

Program Skills Outline															
Required program Learning outcomes															
Year/Level	Course Code	Course Name	Basic or optional	Knowledge			Skills					Ethics				
				A1	A2	A3	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5
First Year	Chem.E.500	Fluid Flow	Basic	√	√	√	√	√	√	√	√	√	√	√	√	√
	Chem.E.501	Reactors Design	Basic	√	√	√	√	√	√	√	√	√	√	√	√	√
	Chem.E.502	Thermodynamics	Basic	√	√	√	√	√	√	√	√	√	√	√	√	√
	Chem.E.503	Mass Transfer	Basic	√	√	√	√	√	√	√	√	√	√	√	√	√
	Chem.E.504	Separation processes	Basic	√	√	√	√	√	√	√	√	√	√	√	√	√
	GE.505	English language I	Elective	√	√	√	√	√	√	√	√	√	√	√	√	√
	Chem.E.506	Research Methodology	Elective	√	√	√	√	√	√	√	√	√	√	√	√	√
	Chem.E.507	Heat Transfer	Basic	√	√	√	√	√	√	√	√	√	√	√	√	√
	Chem.E.508	Catalysts	Basic	√	√	√	√	√	√	√	√	√	√	√	√	√
	Chem.E.509	Mathematical	Basic	√	√	√	√	√	√	√	√	√	√	√	√	√
	Chem.E.510	Renewable Energy	Basic	√	√	√	√	√	√	√	√	√	√	√	√	√
	GE.511	English language II	Elective	√	√	√	√	√	√	√	√	√	√	√	√	√

- **Please tick the boxes corresponding to the individual program learning outcomes under evaluation.**

Program Description

First Year
First Semester

No	Subject Title	Weekly hours			Units/ ECTS
		Th.	Tut.	Lab./Pr.	
1	Technical English (1)	2	--	--	١
2	Advanced Fluid Flow	2	--	--	2
3	Advanced Mass Transfer	2	--	--	2
4	Reactor Design	2	--	--	2
5	Thermodynamics	2	--	--	2
6	Separation Processes	2	--	--	2
Total		١٢			١١

Course Description Form

1. Course Name:
Technical English Language (I)
2. Course Code:
GE.505
3. Semester / Year:
First Semester / 2025-2026
4. Description Preparation Date:
01/09/2025
5. Available Attendance Forms:
Attendance
6. Number of Credit Hours (Total) / Number of Units (Total)
30 hrs. /1 Unit
7. Course administrator's name (mention all, if more than one name)
Name: Assist. Prof. Munthir Shakir Jokey, Ph,D. Email: munthirshakir@mu.edu.iq
8. Course Objectives

Course Objectives	**(a) Understand the five steps for successful reading and writing in English.** **(b) Understand how to use abbreviations in the engineering field and writing resume, progress report, activity report, test report,**

	special purpose internal proposal, and questionnaire. **(c) Increase skills in reading and writing memos and bar graphs, and use headings in a document.** **(d) Increase the ability to provide professional presentations and meetings.** **(e) Increase ability to write abstracts and use citation.**

9. Teaching and Learning Strategies

Strategy	**An ability to apply knowledge of English Language; Reading, Writing, Speaking and Listening**

10. Course Structure

Week	*Hours*	*Required Learning Outcomes*	*Unit or subject name*	*Learning method*	*Evaluation method*
Week-1	*2*	*D4, D3, D2, D1*	Introduction to the steps for technical reading and writing in English.		Quiz
Week-2	*2*	*D4, D3, D2, D1*	Establishing purpose, identifying audience or readers, considering a context for writing, determining scope and coverage, and selecting the medium.		*Report*
Week-3	*2*	*D4, D3, D2, D1*	Brainstorm to determine what you already know and conduct research. Take note, interview for information, create and use questionnaires, avoid plagiarism, and document sources		*Seminar*
Week-4	*2*	*D4, D3, D2, D1*	Checking your writing: error correction – punctuate on and spelling. Writing an informal email		*Exam*
Week-5	*2*	*D4, D3, D2, D1*	Student Résumé for an entry level position (highlighting professional credentials). Writing résumé for applicant with management experience.		Quiz
Week-6	*2*	*D4, D3, D2, D1*	Advanced Résumé: Showing promotion within a single company, and combining functional and chronological elements.		*Report*
Week-7	*2*	*D4, D3, D2, D1*	Progress reports, activity reports, test reports, special purpose internal proposals, and questionnaires.		*Seminar*
Week-8	*2*	*D4, D3, D2, D1*	Writing a progress report, activity report, test report, special purpose internal proposal, and questionnaire. (continue)		*Exam*
Week-9	*2*	*D4, D3, D2, D1*	Typical Memo Format (Printed with Sender's Handwritten Initials)		Quiz
Week-10	*2*	*D4, D3, D2, D1*	Bar graph (quantities of different items during a fixed period). Bar (column)		*Report*

			graph (showing the parts that make up the whole)		
Week-11	*2*	*D4, D3, D2, D1*	Headings used in a document.		*Seminar*
Week-12	*2*	*D4, D3, D2, D1*	Presentations and Meetings. Meeting agenda, e-mail to accompany an agenda, minutes of a meeting, slides for a presentation.		*Exam*
Week-13	*2*	*D4, D3, D2, D1*	Informative abstract		Quiz
Week-14	*2*	*D4, D3, D2, D1*	Documenting sources (e.g. APA, IEEE, MLA, etc.)		*Report*
Week-15	*2*	*D4, D3, D2, D1*	Final exam (date to be assigned later)		*Seminar*

11. Course Structure/ Lab

Week	*Hours*	*Required Learning Outcomes*	*Unit or subject name*	*Learning method*	*Evaluation method*
Week-1					
Week-2					
Week-3					
Week-4					
Week-5					
Week-6					
Week-7					
Week-8					
Week-9					
Week-10					
Week-11					
Week-12					
Week-13					
Week-14					
Week-15					

12. Course Evaluation

Quiz; 15 Mark, Exam; 10 Mark, Seminar; 5 Marks Final Exam; 70 Mark

13. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Philpot, S., & Curnick, L. (2013). Headway Academic Skills: Reading, Writing, and Study Skills: Level 2: Student's Book. Oxford University Press.
Main references (sources)	
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	

Course Description Form

1. Course Name:
Fluid Flow
2. Course Code:
Chem.E.500
3. Semester / Year:
1st Semester / 2025-2026
4. Description Preparation Date:
01/09/2025
5. Available Attendance Forms:
Attendance
6. Number of Credit Hours (Total) / Number of Units (Total)
30 hrs. /٢ Unit
7. Course administrator's name (mention all, if more than one name)
Name: Prof. Raid Tariq Hade ALkateeb Email: dr.raidt@mu.edu.iq
8. Course Objectives

Course Objectives	**Develop advanced understanding of Fluid Flow techniques by enabling students to formulate, analyze, and solve complex chemical engineering systems using differential equations, linear algebra, and numerical methods, while critically evaluating model assumptions, limitations, and real-world applicability in industrial and research contexts.**

9. Teaching and Learning Strategies	
Strategy	Encourage collaborative learning through group projects, research assignments, and peer discussions, supported by the use of simulation software and analytical tools, to develop critical thinking, independent inquiry, and the ability to design, analyze, and present complex mathematical models effectively.

10. Course Structure

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

Week-1	*2*	*Formulation of* Newtonian law Viscosity	Newtonian law Viscosity		Lecture
Week-2	*2*	*Formulation of* Newtonian models mechanisms	Newtonian models mechanisms		Lecture
Week-3	*2*	Newtonian models	Newtonian law Viscosity, Newtonian models mechanisms		Quiz
Week-4	*2*	*Formulation of* The equation of change	The equation of change		Lecture
Week-5	*2*	The equation of change	Newtonian models mechanisms The equation of change		*Discussion*
Week-6	*2*	*Formulation of* isothermal systems	isothermal systems		Lecture
Week-7	*2*	isothermal systems	Newtonian models mechanisms The equation of change, isothermal systems		Quiz
Week-8	*2*	Viscosity distributions with more than one independent variable	Viscosity distributions with more than one independent variable		Lecture
Week-9	*2*	*Formulation of* Velocity in turbulent flow	Velocity in turbulent flow		Lecture
Week-10	*2*	Velocity in turbulent flow	Viscosity distributions with more than one independent variable, Velocity in turbulent flow		Quiz
Week-11	*2*	Shell momentum balances and viscosity distributions in laminar flow	Shell momentum balances and viscosity distributions in laminar flow		Lecture
Week-12	*2*	*Formulation of* Interphase transport in isothermal systems	Interphase transport in isothermal systems,		Lecture
Week-13	*2*	Shell momentum balances	Shell momentum balances and viscosity distributions in laminar flow, Interphase transport in isothermal systems		Quiz
Week-14	*2*	Interphase transport	Interphase transport in isothermal systems		*Report*
Week-15	*2*	viscosity distributions in laminar	Shell momentum balances and viscosity distributions in laminar flow, Interphase transport in isothermal systems		*Exam*

11.Course Structure/ Lab

Week	*Hours*	*Required Learning Outcomes*	*Unit or subject name*	*Learning method*	*Evaluation method*
Week-1					
Week-2					
Week-3					
Week-4					
Week-5					
Week-6					
Week-7					
Week-8					
Week-9					
Week-10					
Week-11					
Week-12					
Week-13					
Week-14					
Week-15					

12.Course Evaluation	
Quiz; 15 Mark, Exam; 10 Mark, Seminar; 5 Marks Final Exam; 70 Mark	
13.Learning and Teaching Resources	
Required textbooks (curricular books, if any)	Lecture Notes for Computational Methods in Chemical Engineering (CL 701)
Main references (sources)	William L. Luyben (1996). Process modeling,simulation, and control for chemical engineers
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

14.Course Name:
Mass Transfer
15.Course Code:
Chem.E.503
16.Semester / Year:
First Semester / 2025-2026
17.Description Preparation Date:
01/09/2025
18.Available Attendance Forms:
Attendance
19.Number of Credit Hours (Total) / Number of Units (Total)
30 hrs. /٢ Unit

20. Course administrator's name (mention all, if more than one name)
Name: Pro. Dr. Anas Bdiwi Salman Email: dr.anas.bdiwi@mu.edu.iq
21. Course Objectives

Course Objectives	This course aims to develop a rigorous understanding of mass transfer phenomena grounded in the fundamental principles. Students will learn to formulate and solve molecular and convective mass transfer problems using differential and integral balances, constitutive equations, and appropriate boundary conditions. Emphasis is placed on the physical interpretation of diffusion, interphase mass transfer, and multicomponent systems, as well as the application of dimensionless analysis and analogies between momentum, heat, and mass transfer. By the end of the course, students will be able to model and analyze real engineering systems, critically evaluate transport mechanisms, and apply advanced theoretical concepts to research and industrial processes.

22. Teaching and Learning Strategies	
Strategy	The course will be delivered through a combination of focused lectures, guided problem-solving sessions, and interactive discussions that emphasize physical understanding alongside mathematical formulation. Students will engage with selected examples from *Transport Phenomena* (Bird et al.) and apply concepts to practical engineering cases. Regular assignments and in-class exercises will reinforce key principles, while encouraging independent thinking and analytical skills appropriate for postgraduate-level study.

23. Course Structure

Week	*Hours*	*Required Learning Outcomes*	*Unit or subject name*	*Learning method*	*Evaluation method*
Week-1	*2*	Recall basic transport concepts; distinguish between momentum, heat, and mass transfer; define diffusion and mass flux	introduction to Mass Transfer & Review of Fundamentals		Lecture
Week-2	*2*	Derive and apply Fick's law; analyze steady-state diffusion in simple geometries	Molecular Diffusion in Binary Systems (Ch. 17)		*Report*

Week-3	*2*	Solve diffusion problems with one species stationary; interpret equimolar counter diffusion	Diffusion Through Stationary Media		*Seminar*
Week-4	*2*	Formulate and solve diffusion-reaction equations; evaluate reaction effects on mass transfer	Diffusion with Chemical Reaction		*Exam*
Week-5	*2*	Apply transient diffusion equations; analyze time-dependent concentration profiles	Unsteady-State Diffusion		Lecture
Week-6	*2*	Explain multicomponent diffusion behavior; apply Stefan–Maxwell equations	Multicomponent Diffusion		*Report*
Week-7	*2*	Evaluate and estimate diffusivities using empirical and theoretical correlations	Estimation of Diffusion Coefficients		*Seminar*
Week-8	*2*	Define mass transfer coefficients; relate convective and molecular transport	Convective Mass Transfer Fundamentals (Ch. 19)		*Exam*
Week-9	*2*	Analyze concentration boundary layers; apply analogies with momentum and heat transfer	Boundary Layer Theory for Mass Transfer		Quiz
Week-10	*2*	Use Sherwood, Reynolds, and Schmidt numbers; apply empirical correlations	Dimensionless Analysis & Correlations		*Report*
Week-11	*2*	Describe mass transfer across phase boundaries; apply two-film theory	Interphase Mass Transfer (Ch. 20)		*Seminar*
Week-12	*2*	Analyze equilibrium relationships; solve gas–liquid mass transfer problems	Mass Transfer with Phase Equilibrium		*Discussion*
Week-13	*2*	*Conduct the formulation of*	Diffusion with variable area		Quiz

		variable area diffusion			
Week-14	*2*	Critically evaluate complex systems; integrate multicomponent and convective effects	Advanced Topics & Case Studies		*Report*
Week-15	*2*	Synthesize course concepts; present and defend analytical or applied mass transfer problems	Review and Project Presentations		*Exam*

24.Course Structure/ Lab

Week	*Hours*	*Required Learning Outcomes*	*Unit or subject name*	*Learning method*	*Evaluation method*
Week-1					
Week-2					
Week-3					
Week-4					
Week-5					
Week-6					
Week-7					
Week-8					
Week-9					
Week-10					
Week-11					
Week-12					
Week-13					
Week-14					
Week-15					

25.Course Evaluation

Quiz; 10 Mark, Exam; 15 Mark, Seminar; 5 Marks Final Exam; 70 Mark

26.Learning and Teaching Resources

Required textbooks (curricular books, if any)	Introductory transport phenomena, 2014
Main references (sources)	Transport phenomena, Bird, 2000
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

1. Course Name:
Reactor Design
2. Course Code:
Chem.E.501
3. Semester / Year:
Second Semester / 2025-2026
4. Description Preparation Date:
01/09/2025
5. Available Attendance Forms:
Attendance
6. Number of Credit Hours (Total) / Number of Units (Total)
30 hrs. /٢ Unit
7. Course administrator's name (mention all, if more than one name)
Name: Assist. Prof. Dr. Forat Yasir Sharrad Email: furatyasir@mu.edu.iq
8. Course Objectives

Course Objectives	Introducing students to the behavior of non-ideal chemical reactors such as tube and tank reactors, and examples of non-ideal behavior such as dead volume, dispersion, etc.
9. Teaching and Learning Strategies	
Strategy	Enhancing collaborative learning through group reports, research tasks, and peer discussions, supported by the use of simulation software and analytical tools, to develop critical thinking, independent inquiry, and the ability to effectively design, analyze, and present complex mathematical models.

10. Course Structure

Week	*Hours*	*Required Learning Outcomes*	*Unit or subject name*	*Learning method*	*Evaluation method*
Week-1	*2*	Characterization and Diagnostics	To diagnose problems of reactors in operation		Lecture
Week-2	*2*	Characterization and Diagnostics	To predict conversion or effluent concentrations in existing/available reactors when a new reaction is used in the reactor		Lecture
Week-3	*2*	Residence-Time Distribution (RTD) Function	Measurement of the RTD		Lecture
Week-4	*2*	Residence-Time Distribution (RTD) Function	Pulse Input Experiment		*Exam*
Week-5	*2*		Step Input Experiment		Lecture

		Residence-Time Distribution (RTD) Function			
Week-6	*2*	Characteristics of the RTD	Integral Relationships, Mean Residence Time		*Report*
Week-7	*2*	Characteristics of the RTD	Other Moments of the RTD		*Seminar*
Week-8	*2*	RTD in Ideal Reactors	RTDs in Batch and Plug-Flow Reactors		*Exam*
Week-9	*2*	RTD in Ideal Reactors	Single-CSTR RTD		Quiz
Week-10	*2*	Diagnostics and Troubleshooting	Simple Diagnostics and Troubleshooting Using the RTD for Ideal Reactors		*Report*
Week-11	*2*	Diagnostics and Troubleshooting	PFR/CSTR Series RTD		*Seminar*
Week-12	*2*	Models for Nonideal Reactors	One-Parameter Models		*Discussion*
Week-13	*2*	Models for Nonideal Reactors	Two-Parameter Models		Quiz
Week-14	*2*	Models for Nonideal Reactors	Dispersion Model		*Report*
Week-15	*2*	Final Exam	Final Exam		*Exam*

11.Course Structure/ Lab

Week	*Hours*	*Required Learning Outcomes*	*Unit or subject name*	*Learning method*	*Evaluation method*
Week-1					
Week-2					
Week-3					
Week-4					
Week-5					
Week-6					
Week-7					
Week-8					
Week-9					
Week-10					
Week-11					
Week-12					
Week-13					
Week-14					
Week-15					

12.Course Evaluation

Quiz; 10 Mark, Exam; 10 Mark, Seminar; 10 Marks Final Exam; 70 Mark

13.Learning and Teaching Resources

Required textbooks (curricular books, if any)	Lecture Notes for Chemical Reactor Design
Main references (sources)	H. Scott Fogler, 2008, "Elements Chemical Reaction Engineering".

Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

1. Course Name:	
Thermodynamics	
2. Course Code:	
Chem.E.502	
3. Semester / Year:	
First Semester / 2025-2026	
4. Description Preparation Date:	
01/09/2025	
5. Available Attendance Forms:	
Attendance	
6. Number of Credit Hours (Total) / Number of Units (Total)	
30 hrs. /2 Unit	
7. Course administrator's name (mention all, if more than one name)	
Name: Asst. Prof. Dr. Ghazi Faisal Naser Email: ghazi_faisal@mu.edu.iq	
8. Course Objectives	
Course Objectives	1-Explain the basic concepts of thermodynamics such as system, state, state postulate, equilibrium, process, and cycle 2- Define the concept of heat and the terminology associated with energy transfer by heat 3- Discuss the implications of energy conversion on the environment. 4- Examine the moving boundary work or P dV work commonly encountered in reciprocating devices such as automotive engines and compressors. 5- Solve energy balance problems for closed (fixed mass) systems that involve heat and work interactions for general pure substances, ideal gases, and incompressible substances. 6- Apply the energy balance to general unsteady-flow processes with particular emphasis on the uniform-flow process as the model for commonly encountered charging and discharging processes 7- Develop fundamental relations between commonly encountered thermodynamic properties and express the properties that cannot be measured directly in terms of easily measurable properties. 8- Develop the Maxwell relations, which form the basis for many thermodynamic relations. 9- Predict the P-v-T behavior of gas mixtures based on Dalton's law of additive pressures and Amagat's law of additive volumes. 10- Evaluate the entropy change of reacting systems. 11- Develop the equilibrium criterion for reacting systems based on the second law of thermodynamics 12- Establish the phase equilibrium for nonreacting systems in terms of the specific Gibbs function of the phases of a pure substance. 13- Develop the general relations for compressible flows encountered when gases flow at high speeds.

	14- Fundamental property relation, The chemical potential and phase equilibrium, Partial properties, Partial properties in binary solutions, Fugacity and fugacity coefficient, VLE for pure species, Chemical-reaction equilibrium.

9. Teaching and Learning Strategies

Strategy	• Developing comprehension and understanding skills. • Developing calculations and derivative skills. • Developing relationships with friends to solve problems collaboratively. •Encourage collaborative learning through group projects, research assignments, seminars preparing and peer discussions.

10. Course Structure

Week	*Hours*	*Required Learning Outcomes*	*Unit or subject name*	*Learning method*	*Evaluation method*
Week-1	*2*	*Studying the basics of thermodynamics*	**Thermodynamics laws**	Theoretical	*Discussion*
Week-2	*2*	*Explain analysis of multiple systems*	**analysis of open and dynamic systems**	Theoretical	*Discussion*
Week-3	*2*	*Study the phase rule*	**The phase rule**	Theoretical	*Discussion*
Week-4	*2*	*Explanation*	**State function versus path function, Internal energy, Equations of state for ideal and real gas**	Theoretical	*Discussion*
Week-5	*2*	*Understanding Fundamental equations, Mechanical energy balance*	**Fundamental equations, Mechanical energy balance for open systems,**	Theoretical	*Discussion*
Week-6	*2*	*Study Advance applications of fundamental equations*	**Advance applications of fundamental equations, Velocity of propagation of a pressure wave, Nozzles and diffusers, Convergent divergent nozzle**	Theoretical	*Discussion*
Week-7	*2*	*Understanding Pumps*	**Pumping devices (multistage), The Joule-Thomson coefficient**	Theoretical	*Discussion*
Week-8	*2*	*Explain Transient analysis*	**Transient analysis (unsteady states)**	Theoretical	*Discussion*
Week-9	*2*	*Study Maxwell relations*	**Maxwell relations, Mnemonic diagram**	Theoretical	Quiz
Week-10	*2*	*Understanding General relations*	**General relations for dU, dH, dS, CV, and CP**	Theoretical	*Discussion*
Week-11	*2*	*Study the the Gibbs energy as a generating function*	**The Gibbs energy as a generating function, General residual property relations.**	Theoretical	*Seminar*
Week-12	*2*	*Study The nature of equilibrium*	**The nature of equilibrium (multicomponent system), Fundamental property relation**	Theoretical	*Discussion*
Week-13	*2*	*Quiz*	=	Theoretical	Quiz
Week-14	*2*	*Report*	=	Theoretical	*Report*
Week-15	*2*	*Applications and understanding*	**The chemical potential and phase equilibrium, Partial properties, Partial properties in binary solutions, Fugacity and fugacity coefficient, VLE**	Theoretical	*Discussion*

			for pure species, Chemical-reaction equilibrium		

11.Course Structure/ Lab					
Week	*Hours*	*Required Learning Outcomes*	*Unit or subject name*	*Learning method*	*Evaluation method*
Week-1					
Week-2					
Week-3					
Week-4					
Week-5					
Week-6					
Week-7					
Week-8					
Week-9					
Week-10					
Week-11					
Week-12					
Week-13					
Week-14					
Week-15					

12.Course Evaluation	
Quiz; 15 Mark, Exam; 10 Mark, Seminar; 5 Marks Final Exam; 70 Mark	
13.Learning and Teaching Resources	
Required textbooks (curricular books, if any)	F U N D A M E N TA L S O F ENGINEERING THERMODYNAMICS ,7th edition
Main references (sources)	Introduction to chemical engineering Thermodynamics. J.M.Smith
Recommended books and references (scientific journals, reports...)	ENGINEERING THERMODYNAMICS ,3rd. edition
Electronic References, Websites	

Course Description Form

14.Course Name:
Separation Processes
15.Course Code:
Chem.E.504
16.Semester / Year:
1st Semester / 2025-2026
17.Description Preparation Date:
1/09/2025

18. Available Attendance Forms:
Attendance
19. Number of Credit Hours (Total) / Number of Units (Total)
30 hrs. /2 Unit
20. Course administrator's name (mention all, if more than one name)
Name: Prof. Dr. Ahmed H. Ali Email: dr.ahmedha@mu.edu.iq

21. Course Objectives	
Course Objectives	**To develop a thorough understanding of the fundamental principles and theories underlying various separation processes, including thermodynamics, kinetics, and transport phenomena. To learn how to design, analyze, and optimize separation processes, including equipment sizing, selection, and operation. To develop problem-solving skills, applying separation process principles to real-world problems, such as process intensification, energy efficiency, and sustainability. To introduce students to advanced separation techniques, such as membrane separation, adsorption, and chromatography, and their applications in various industries. To equip students with the skills to conduct research and development in separation processes, including experimental design, data analysis, and interpretation.**
22. Teaching and Learning Strategies	
Strategy	Interactive lectures with discussions to encourage critical thinking and problem-solving. Real-world examples to illustrate separation process principles and applications. Collaborative projects to develop teamwork, communication, and problem-solving skills. Use of software tools to simulate separation processes and analyze results. Industry experts sharing practical experiences and insights.

23. Course Structure

Week	*Hours*	*Required Learning Outcomes*	*Unit or subject name*	*Learning method*	*Evaluation method*
Week-1	*2*	Design of freedom analysis	Introduction to Formulation of mathematical models for lumped parameter systems	Attendance	Lecture
Week-2	*2*	Ultrafiltration	liquid storage tank, stirred tank heater, isothermal CSTR, non-isothermal CSTR	Attendance	Lecture
Week-3	*2*	Microfiltration, Nanofiltration.	Heat exchanger, heat exchanger with steam, single stage heterogeneous systems	Attendance	Lecture

Week-4	*2*	Pervaporation Membrane	Multi-component flash drum, multistage heterogeneous systems	Attendance	Lecture
Week-5	*2*	distillation hybrids	Multi-component distillation column, reactive distillation column credentials). Writing résumé for applicant with management experience.	Attendance	Lecture
Week-6	*2*	Gas separation	liquid flow in a pipe, velocity profile inside a pipe, diffusion with chemical reaction in a slab catalyst	Attendance	Lecture
Week-7	*2*	Pressure swing	Temperature profile in a heated cylindrical rod, isothermal plug-flow reactor, non-isothermal plug-flow reactor	Attendance	Lecture
Week-8	*2*	distillation. Extractive	Bisection method, secant method and Newton-Raphson method *and reactor volume isothermal and non isothermal*	Attendance	*Exam*
Week-9	*2*	distillation. Reactive	Typical series of isothermal, constant-holdup CSTR	Attendance	Lecture
Week-10	*2*	distillation. Homogeneous	A mixture of gases is fed into the reactor	Attendance	Lecture
Week-11	*2*	isotropic distillation	Boiling systems represent some of the most interesting and important operations in chemical engineering processing and are among the most difficult to model.	Attendance	Lecture
Week-12	*2*	Heterogeneous azeotropic distillation	Batch processes offer some of the most interesting and challenging problems in modeling and control because of their inherent dynamic nature	Attendance	Lecture
Week-13	*2*	Forward osmosis;	Chemical reactors sometimes have mass-transfer limitations as well as chemical reaction-rate limitations.	Attendance	Quiz
Week-14	*2*	Reverse osmosis;	The distillation column is probably the most popular and important process studied in the chemical engineering	Attendance	Lecture
Week-15	*2*	.Adsorption and ion exchange.	Final exam (date to be assigned later)	Attendance	*Seminar*

24.Course Structure/ Lab					
Week	*Hours*	*Required Learning Outcomes*	*Unit or subject name*	*Learning method*	*Evaluation method*
Week-1	Nill				
Week-2					
Week-3					
Week-4					
Week-5					
Week-6					

Week-7	
Week-8	
Week-9	
Week-10	
Week-11	
Week-12	
Week-13	
Week-14	
Week-15	

25.Course Evaluation

1st Exam; 10 Marks
2nd Exam 10 Marks
Seminar; 10Marks
Final Exam; 70 Marks

26.Learning and Teaching Resources

Required textbooks (curricular books, if any)	
Main references (sources)	1. Separation Process Principles Chemical And Biochemical Operations, Third Edition J. D. Seader, Ernest J. Henley , D. Keith Roper. 1. Mechanical–Physical Separation Processes. Transport Processes and Separation Process Principles (Includes Unit Operations) Fourth edition . Wastewater Treatment and Reuse Theory and De Examples Volume 2: Post-Treatment, Reuse, and Dispo Syed R. Qasim. The University of Texas at Arlington, Gu Zhu, CP&Y, Inc.In Cooperation with,CP&Y, Inc. Consul Engineers · Planners · Project Managers Dallas, Texas
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Curriculum Skills Map																			
Required learning outcomes of the program																			
General, transferable skills other skills related to employability and personal development				Affective and value-based goals				Program skill objectives				Cognitive objectives				essential Cr ny choice	Course name	Course code	Year/ Level
D ٤	D ٣	D ٢	D ١	A ٤	Part ٣	Part ٢	Part ١	B ٤	B ٣	B ٢	B ١	A ٤	A ٣	A ٢	A ١				
✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	essential	Technical English Language I	MS-101	First

First Year
Second Semester

No	Subject Title	Weekly hours			Units/ ECTS
		Th.	Tut.	Lab./Pr.	
1	Heat Transfer	2	--	--	2
2	Catalysts	2	--	--	2
3	Research Methodology	2	--	--	2
4	Mathematical Modeling	2	--	--	2
5	Technical English Language (II)	2	--	--	١
6	Renewable Energy	2	--	--	2
Total		١٢			١١

Course Description Form

27.Course Name:
Heat Transfer
28.Course Code:
Chem.E.507
29.Semester / Year:
Second Semester / 2025-2026
30.Description Preparation Date:
01/09/2025
31.Available Attendance Forms:
Attendance
32.Number of Credit Hours (Total) / Number of Units (Total)
30 hrs. /2 Unit
33.Course administrator's name (mention all, if more than one name)

Name: Assist. Prof. Ali Samir Aneed
Email: ali.samir@mu.edu.iq

34.Course Objectives

Course Objectives	**This course aims to develop a comprehensive understanding of fundamental and advanced heat transfer mechanisms, including conduction, convection, and transient heat transfer. Students will be able to analyze thermal systems, derive temperature distributions, and apply numerical methods to solve complex engineering problems. The course emphasizes practical applications in chemical engineering systems, enhancing students' analytical, computational, and problem-solving skills in line with Bologna Process learning outcomes.**

35.Teaching and Learning Strategies

Strategy	Interactive lectures with problem-solving sessions Use of real engineering case studies Numerical simulations using MATLAB or similar tools Group discussions and seminars Assignments focused on applied heat transfer problems Encouraging student-centered and outcome-based learning

36. Course Structure

Week	*Hours*	*Required Learning Outcomes*	*Unit or subject name*	*Learning method*	*Evaluation method*
Week-1	*2*	Understand basic heat transfer modes	Introduction to Heat Transfer	Lecture	Quiz
Week-2	*2*	Analyze boundary layer concepts	Hydrodynamic Boundary Layer	Lecture	Assignment
Week-3	*2*	Evaluate thermal boundary layers	Thermal Boundary Layer	Lecture + Problem Solving	Quiz
Week-4	*2*	Apply governing equations	Laminar Flow Heat Transfer Fundamentals	Lecture	Report
Week-5	*2*	Solve heat transfer in pipes	Laminar Tube Flow Analysis	Lecture + Tutorial	Exam
Week-6	*2*	Understand developing flow	Thermal Entry Region in Tubes	Lecture	Assignment
Week-7	*2*	Analyze transient systems	Unsteady-State Heat Transfer (Lumped System)	Lecture	Quiz
Week-8	*2*	Solve transient conduction	Transient Heat Conduction	Lecture + Numerical Examples	Exam
Week-9	*2*	Understand turbulent flow behavior	Introduction to Turbulent Flow	Lecture	Assignment
Week-10	*2*	Analyze temperature distribution	Temperature Profile in Turbulent Flow	Lecture + Discussion	Quiz
Week-11	*2*	Apply empirical correlations	Turbulent Heat Transfer Correlations	Lecture	Report

Week-12	*2*	Apply numerical methods	Finite Difference Method	Lecture + Lab	Assignment
Week-13	*2*	Solve engineering problems numerically	Numerical Solution of Heat Transfer Problems	Simulation	Quiz
Week-14	*2*	Integrate concepts	Comprehensive Problem Solving	Discussion	Report
Week-15	*2*	*Ideal binary distillation column, Reactor with mass transfer and Batch reactor system*	Final exam (date to be assigned later)		*Exam*

37.Course Structure/ Lab					
Week	*Hours*	*Required Learning Outcomes*	*Unit or subject name*	*Learning method*	*Evaluation method*
Week-1					
Week-2					
Week-3					
Week-4					
Week-5					
Week-6					
Week-7					
Week-8					
Week-9					
Week-10					
Week-11					
Week-12					
Week-13					
Week-14					
Week-15					

38.Course Evaluation	
Quiz; 15 Mark, Exam; 10 Mark, Seminar; 5 Marks Final Exam; 70 Mark	
39.Learning and Teaching Resources	
Required textbooks (curricular books, if any)	Bird, R. B., Stewart, W. E., & Lightfoot, E. N. (2007). *Transport Phenomena* (2nd ed.). John Wiley & Sons.
Main references (sources)	Bejan, A. (2013). *Convection Heat Transfer* (4th ed.). John Wiley & Sons.
Recommended books and references (scientific journals, reports...)	CONDUCTION HEAT TRANSFER by Vedat S Arpacz , University of Michigan,
Electronic References, Websites	

Course Description Form

40.Course Name:
Catalysts
41.Course Code:
Chem.E.508
42.Semester / Year:
Second Semester / 2025-2026
43.Description Preparation Date:
01/09/2025
44.Available Attendance Forms:
Attendance
45.Number of Credit Hours (Total) / Number of Units (Total)
30 hrs. /٢ Unit
46.Course administrator's name (mention all, if more than one name)
Name: Prof. Raid Tariq Hade ALkateeb Email: dr.raidt@mu.edu.iq

47.Course Objectives

Course Objectives	**Develop advanced understanding of Catalysts techniques by enabling students to formulate, analyze, and solve complex chemical engineering systems using differential equations, linear algebra, and numerical methods, while critically evaluating model assumptions, limitations, and real-world applicability in industrial and research contexts.**

48.Teaching and Learning Strategies

Strategy	Encourage collaborative learning through group projects, research assignments, and peer discussions, supported by the use of simulation software and analytical tools, to develop critical thinking, independent inquiry, and the ability to design, analyze, and present complex mathematical models effectively.

49. Course Structure

Week	*Hours*	*Required Learning Outcomes*	*Unit or subject name*	*Learning method*	*Evaluation method*
Week-1	*2*	*Formulation* Catalyst functions	Catalyst functions		Lecture

Week-2	*2*	*Formulation* Organization of catalysis	Organization of catalysis		Lecture
Week-3	*2*	Organization of catalysis.	Catalyst functions. Organization of catalysis.		Quiz
Week-4	*2*	*Formulation* Steps in catalytic reaction	Steps in catalytic reaction		Lecture
Week-5	*2*	Steps in catalytic reaction.	Organization of catalysis. Steps in catalytic reaction.		*Discussion*
Week-6	*2*	*Formulation* Structures of catalysis	Structures of catalysis		Lecture
Week-7	*2*	Structures of catalysis	Steps in catalytic reaction. Structures of catalysis		Quiz
Week-8	*2*	*Formulation* Catalyst design	Catalyst design		Lecture
Week-9	*2*	*Formulation* Catalytic material	Catalytic material		Lecture
Week-10	*2*	Catalytic material	Catalyst design. Catalytic material.		Quiz
Week-11	*2*	*Formulation* Catalyst preparation	Catalyst preparation		Lecture
Week-12	*2*	*Formulation* Physical adsorption of solid material	Physical adsorption of solid material.		Lecture
Week-13	*2*	Catalyst preparation	Catalyst preparation. Physical adsorption of solid material.		Quiz
Week-14	*2*	*features of the catalyst*	*Engineering features of the catalyst*		*Report*
Week-15	*2*	Catalyst preparation	Catalyst preparation. Physical adsorption of solid material.		*Exam*

50.Course Structure/ Lab					
Week	*Hours*	*Required Learning Outcomes*	*Unit or subject name*	*Learning method*	*Evaluation method*
Week-1					
Week-2					
Week-3					
Week-4					
Week-5					
Week-6					
Week-7					
Week-8					
Week-9					
Week-10					
Week-11					

Week-12					
Week-13					
Week-14					
Week-15					

51.Course Evaluation	
Quiz; 15 Mark, Exam; 10 Mark, Seminar; 5 Marks Final Exam; 70 Mark	
52.Learning and Teaching Resources	
Required textbooks (curricular books, if any)	Lecture Notes for Computational Methods in Chemical Engineering (CL 701)
Main references (sources)	William L. Luyben (1996). Process modeling,simulation, and control for chemical engineers
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

53.Course Name:	
Research Methodology	
54.Course Code:	
Chem.E.506	
55.Semester / Year:	
Second Semester / 2025-2026	
56.Description Preparation Date:	
01/09/2025	
57.Available Attendance Forms:	
Attendance	
58.Number of Credit Hours (Total) / Number of Units (Total)	
30 hrs. /٢ Unit	
59.Course administrator's name (mention all, if more than one name)	
Name: Assist. Prof. Dr. Forat Yasir Sharrad Email: furatyasir@mu.edu.iq	
60.Course Objectives	
Course Objectives	Introducing students to the requirements of the scientific research methodology, starting from formulating the idea, implementing it, and classifying it according to the basics of scientific research, including designing experiments based on the ranges of operational variables, implementing them, analyzing their results, and then classifying them according to the requirements of theses, dissertations, and global publication.

61.Teaching and Learning Strategies	
Strategy	Enhancing collaborative learning through group reports, research tasks, and peer discussions, supported by the use of simulation software and analytical tools, to develop critical thinking, independent inquiry, and the ability to effectively design, analyze, and present complex mathematical models.

62. Course Structure

Week	*Hours*	*Required Learning Outcomes*	*Unit or subject name*	*Learning method*	*Evaluation method*
Week-1	*2*	Types of Statistics	descriptive statistics and inferential statistics		Lecture
Week-2	*2*	Types of Variables	Quantitative and Categorical Variable		Lecture
Week-3	*2*	Typical probability distributions	Organizing and Graphing Qualitative Data		Lecture
Week-4	*2*	Random samples	Frequency Distribution of a Qualitative Variable		*Exam*
Week-5	*2*	Writing a scientific paper	Essay writing process, Research paper abstract writing, Emphasizing Generalizing		Lecture
Week-6	*2*	Writing a scientific paper	Paraphrasing, Quoting, Text referencing, Unnecessary words, - Redundant words that can be omitted, Unnecessary Phrases		*Report*
Week-7	*2*	Factorial design of experiments	General issues		*Seminar*
Week-8	*2*	Orthogonal designs	Modeling, Simulation and Data analysis		*Exam*
Week-9	*2*	Central composite design	Modeling, Simulation and Data analysis		Quiz
Week-10	*2*	Box Behnken design	Modeling, Simulation and Data analysis		*Report*
Week-11	*2*	Linear regression	Modeling, Simulation and Data analysis		*Seminar*
Week-12	*2*	Response surface Methodology	Modeling, Simulation and Data analysis		*Discussion*
Week-13	*2*	Learning Minitab program	Modeling, Simulation and Data analysis		Quiz
Week-14	*2*	Learning Minitab program	Modeling, Simulation and Data analysis		*Report*
Week-15	*2*	*Final Exam*	Final Exam		*Exam*

63.Course Structure/ Lab

Week	*Hours*	*Required Learning Outcomes*	*Unit or subject name*	*Learning method*	*Evaluation method*
Week-1					
Week-2					
Week-3					
Week-4					
Week-5					
Week-6					
Week-7					
Week-8					
Week-9					
Week-10					
Week-11					
Week-12					
Week-13					
Week-14					
Week-15					

64.Course Evaluation	
Quiz; 10 Mark, Exam; 10 Mark, Seminar; 10 Marks Final Exam; 70 Mark	
65.Learning and Teaching Resources	
Required textbooks (curricular books, if any)	Lecture Notes for Research methodology
Main references (sources)	PREM S. MANN and CHRISTOPHER J. LACKE (2013). Introductory Statistics
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

66.Course Name:
Mathematical Modeling
67.Course Code:
Chem.E.509
68.Semester / Year:
Second Semester / 2025-2026
69.Description Preparation Date:
01/09/2025
70.Available Attendance Forms:
Attendance
71.Number of Credit Hours (Total) / Number of Units (Total)
30 hrs. /٢ Unit
72.Course administrator's name (mention all, if more than one name)
Name: Assist. Prof. Ali A.Hassan

Email: ali.alkhafaji@mu.edu.iq	
73.Course Objectives	
Course Objectives	**Develop advanced understanding of mathematical modeling techniques by enabling students to formulate, analyze, and solve complex chemical engineering systems using differential equations, linear algebra, and numerical methods, while critically evaluating model assumptions, limitations, and real-world applicability in industrial and research contexts.**
74.Teaching and Learning Strategies	
Strategy	Encourage collaborative learning through group projects, research assignments, and peer discussions, supported by the use of simulation software and analytical tools, to develop critical thinking, independent inquiry, and the ability to design, analyze, and present complex mathematical models effectively.

75. Course Structure

Week	*Hours*	*Required Learning Outcomes*	*Unit or subject name*	*Learning method*	*Evaluation method*
Week-1	*2*	*Formulation of mathematical models*	Introduction to Formulation of mathematical models for lumped parameter systems		Lecture
Week-2	*2*	*Mass balance for rector*	liquid storage tank, stirred tank heater, isothermal CSTR, non-isothermal CSTR		*Report*
Week-3	*2*	*Energy balance*	Heat exchanger, heat exchanger with steam, single stage heterogeneous systems		*Seminar*
Week-4	*2*	*multi-component*	Multi-component flash drum, multistage heterogeneous systems		*Exam*
Week-5	*2*	*binary absorption column,*	Multi-component distillation column, reactive distillation column credentials). Writing résumé for applicant with management experience.		Lecture
Week-6	*2*	*Formulation of mathematical models for lumped distributed-parameter models*	liquid flow in a pipe, velocity profile inside a pipe, diffusion with chemical reaction in a slab catalyst		*Report*
Week-7	*2*	*Formulation of mathematical models for lumped distributed-parameter models*	Temperature profile in a heated cylindrical rod, isothermal plug-flow reactor, non-isothermal plug-flow reactor		*Seminar*
Week-8	*2*	*Solution of non-linear equations*	Bisection method, secant method and Newton-Raphson method *and reactor volume isothermal and non isothermal*		*Exam*
Week-9	*2*	*Series of isothermal*	Typical series of isothermal, constant-holdup CSTR		Quiz

Week-10	*2*	*Gas-phase, pressurized*	A mixture of gases is fed into the reactor		*Report*
Week-11	*2*	*Single-component vaporizer*	Boiling systems represent some of the most interesting and important operations in chemical engineering processing and are among the most difficult to model.		*Seminar*
Week-12	*2*	*Batch reactor system*	Batch processes offer some of the most interesting and challenging problems in modeling and control because of their inherent dynamic nature		*Discussion*
Week-13	*2*	*Reactor with mass transfer*	Chemical reactors sometimes have mass-transfer limitations as well as chemical reaction-rate limitations.		Quiz
Week-14	*2*	*Ideal binary distillation column*	The distillation column is probably the most popular and important process studied in the chemical engineering		*Report*
Week-15	*2*	*Ideal binary distillation column, Reactor with mass transfer and Batch reactor system*	Final exam (date to be assigned later)		*Exam*

76.Course Structure/ Lab

Week	*Hours*	*Required Learning Outcomes*	*Unit or subject name*	*Learning method*	*Evaluation method*
Week-1					
Week-2					
Week-3					
Week-4					
Week-5					
Week-6					
Week-7					
Week-8					
Week-9					
Week-10					
Week-11					
Week-12					
Week-13					
Week-14					
Week-15					

77.Course Evaluation

Quiz; 15 Mark, Exam; 10 Mark, Seminar; 5 Marks Final Exam; 70 Mark

78.Learning and Teaching Resources

Required textbooks (curricular books, if any)	Lecture Notes for Computational Methods in Chemical Engineering (CL 701)
Main references (sources)	William L. Luyben (1996). Process modeling,simulation, and control for chemical engineers

Curriculum Skills Map																		
Required learning outcomes of the program																		
General and transferable) e skills other skills related to employability and personal development (t				Affective and value-based goals				Program skill objectives				Cognitive objectives				essential Or my choice	Course name	Course code	Year Lev/ el
D ٤	D ٣	D ٢	D ١	A ٤	Part ٣	Part ٢	Part ١	B ٤	B ٣	B ٢	B ١	A ٤	A ٣	A ٢	A ١				
✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	essential	English Language I	MS - 203	

Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

79. Course Name:
Technical English Language (II)
80. Course Code:

MS−203	
81. Semester / Year:	
Second Semester / 2025−2026	
82. Description Preparation Date:	
01/09/2025	
83.Available Attendance Forms:	
Attendance	
84.Number of Credit Hours (Total) / Number of Units (Total)	
30 hrs. /١ Unit	
85. Course administrator's name (mention all, if more than one name)	
Name: Assist. Prof. Munthir Shakir Jokey, Ph.D. Email: munthirshakir@mu.edu.iq	
86. Course Objectives	
Course Objectives	**(a) Understand the five steps for successful reading and writing in English.** **(b) Understand how to use abbreviations in the engineering field and writing resume, progress report, activity report, test report, special purpose internal proposal, and questionnaire.** **(c) Increase skills in reading and writing memos and bar graphs, and use headings in a document.** **(d) Increase the ability to provide professional presentations and meetings.** **(e) Increase ability to write abstracts and use citation.**
87. Teaching and Learning Strategies	
Strategy	**An ability to apply knowledge of English Language; Reading, Writing, Speaking and Listening**

88. Course Structure

Week	*Hours*	*Required Learning Outcomes*	*Unit or subject name*	*Learning method*	*Evaluation method*
Week-1	*2*	*D4, D3, D2, D1*	Introduction to the steps for technical reading and writing in English.		Quiz

Week-2	*2*	*D4, D3, D2, D1*	Establishing purpose, identifying audience or readers, considering a context for writing, determining scope and coverage, and selecting the medium.		*Report*
Week-3	*2*	*D4, D3, D2, D1*	Brainstorm to determine what you already know and conduct research. Take note, interview for information, create and use questionnaires, avoid plagiarism, and document sources		*Seminar*
Week-4	*2*	*D4, D3, D2, D1*	Checking your writing: error correction – punctuate on and spelling. Writing an informal email		*Exam*
Week-5	*2*	*D4, D3, D2, D1*	Student Résumé for an entry level position (highlighting professional credentials). Writing résumé for applicant with management experience.		Quiz
Week-6	*2*	*D4, D3, D2, D1*	Advanced Résumé: Showing promotion within a single company, and combining functional and chronological elements.		*Report*
Week-7	*2*	*D4, D3, D2, D1*	Progress reports, activity reports, test reports, special purpose internal proposals, and questionnaires.		*Seminar*
Week-8	*2*	*D4, D3, D2, D1*	Writing a progress report, activity report, test report, special purpose internal proposal, and questionnaire. (continue)		*Exam*
Week-9	*2*	*D4, D3, D2, D1*	Typical Memo Format (Printed with Sender's Handwritten Initials)		Quiz
Week-10	*2*	*D4, D3, D2, D1*	Bar graph (quantities of different items during a fixed period). Bar (column) graph (showing the parts that make up the whole)		*Report*
Week-11	*2*	*D4, D3, D2, D1*	Headings used in a document.		*Seminar*
Week-12	*2*	*D4, D3, D2, D1*	Presentations and Meetings. Meeting agenda, e-mail to accompany an agenda, minutes of a meeting, slides for a presentation.		*Exam*
Week-13	*2*	*D4, D3, D2, D1*	Informative abstract		Quiz
Week-14	*2*	*D4, D3, D2, D1*	Documenting sources (e.g. APA, IEEE, MLA, etc.)		*Report*
Week-15	*2*	*D4, D3, D2, D1*	Final exam (date to be assigned later)		*Seminar*

89. Course Structure/ Lab					
Week	*Hours*	*Required Learning Outcomes*	*Unit or subject name*	*Learning method*	*Evaluation method*
Week-1					
Week-2					
Week-3					
Week-4					
Week-5					
Week-6					
Week-7					
Week-8					

Week-9					
Week-10					
Week-11					
Week-12					
Week-13					
Week-14					
Week-15					

90. Course Evaluation	
Quiz; 15 Mark, Exam; 10 Mark, Seminar; 5 Marks Final Exam; 70 Mark	
91. Learning and Teaching Resources	
Required textbooks (curricular books, if any)	Philpot, S., & Curnick, L. (2013). Headway Academic Skills: Reading, Writing, and Study Skills: Level 2: Student's Book. Oxford University Press.
Main references (sources)	
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	

Course Description Form

92.Course Name:
Renewable Energy
93.Course Code:
Chem.E.510
94.Semester / Year:
Second Semester / 2025-2026
95.Description Preparation Date:
01/09/2025
96.Available Attendance Forms:
Attendance
97.Number of Credit Hours (Total) / Number of Units (Total)
30 hrs. /2 Unit
98.Course administrator's name (mention all, if more than one name)
Name: Assist. Prof. Dr. Adil Hatem Rashid Email: adil.hatem@mu.edu.iq
99.Course Objectives

Course Objectives	Develop advanced understanding of the fundamental concept of energy sources. World energy demand. Present and future contributions of the various energy kinds. Energy conservation

	and renewable energy. Technical ways of converting available energy into work. Various fields of energy saving in insulating buildings, pipes, tanks, and equipment.

100.	Teaching and Learning Strategies
Strategy	Encourage collaborative learning through group projects, research assignments, and peer discussions.

101.		Course Structure			
Week	*Hours*	*Required Learning Outcomes*	*Unit or subject name*	*Learning method*	*Evaluation method*
Week-1	*2*	*Introduction*	*Introduction to Renewable Energy*	*Lecture*	Monthly Exam, Quizzes, Home works, Class Discussions.
Week-2	*2*	*Renewable Energy Sources*	Solar Thermal Energy	*Lecture*	
Week-3	*2*	Renewable Energy Sources	Photovoltaic or Solar Cell	*Lecture*	
Week-4	*2*	*Renewable Energy Sources*	Hydropower & Geothermal Energy	*Lecture*	
Week-5	*2*	Renewable Energy Sources	Wind Power	*Lecture*	
Week-6	*2*	Renewable Energy Sources	Marine Energy Technologies		
Week-7	*2*	***First Month Exam***			
Week-8	*2*	*Biomass as Alternative Energy*	*Introduction*	*Lecture*	
Week-9	*2*	Biomass as Alternative Energy	*Biomass Resources*	*Lecture*	
Week 10	*2*	*General Classification of Fuels*		*Lecture*	
Week-11	*2*	*Thermal design of a biomass utilization system*		*Lecture*	
Week-12	*2*	*Technologies for converting biomass to useful energy*	*Biochemical*	*Lecture*	
Week-13	*2*	*Technologies for converting biomass to useful energy*	*Thermal conversion technologies-1*	*Lecture*	
Week-14	*2*	*Technologies for converting biomass to useful energy*	*Thermal conversion technologies-2*	*Lecture*	
Week-15	*2*	***Second Month Exam***			

102.	Course Structure/ Lab				
Week	*Hours*	*Required Learning Outcomes*	*Unit or subject name*	*Learning method*	*Evaluation method*

Week-1					
Week-2					
Week-3					
Week-4					
Week-5					
Week-6					
Week-7					
Week-8					
Week-9					
Week-10					
Week-11					
Week-12					
Week-13					
Week-14					
Week-15					

12- Course Evaluation:

1- Final grade: 30%, including:

Monthly exams: 20%, Final assessment: 10%

2- Final exam: 70%