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

2026

Academic Program Description Form

University Name: Tikrit University

Faculty/Institute: Petroleum Process Engineering

Scientific Department: Petroleum and Gas Refining Engineering

Academic or Professional Program Name: Undergraduate - Bachelor of Science in Petroleum and Gas Refining Engineering

Final Certificate Name: Bachelor of Science in Petroleum and Gas Refining Engineering

Academic System: Annual

Description Preparation Date: 8/ 3 /2026

File Completion Date: 8 / 3 / 2026

Signature:

Head of Department name:

Asst. Prof. Qahtan Adnan Mahmood

Date: 11 / 3 / 2026

Signature:

Scientific Associate name:

lect. Hamad Khudhair Mohammed

Date: 11/ 3 / 2026

The file is checked by:

Department of Quality Assurance and University Performance

Director of the Quality Assurance and University Performance Department:

Lect. Adnan Ibrahim Ahmed

Date: 11 / 03 / 2026

Signature:

Asst. Prof. Ghassan H. Abdullah

Date: 11 / 3 / 2026

Approval of the Dean

1. Program Vision

Improving the department's educational level using the most recent ways.

2. Program Mission

Providing community service by developing the Petroleum sector in the governorate and across the nation.

3. Program Objectives

1- Providing students with the fundamentals of scientific knowledge in the field of Petroleum and gas refining engineering, as well as developing their professional skills in the areas of analytical and creative thinking through the use of information technologies, data analysis, and modern experimental methods in problem formulation and solution.

2- Preparing well-qualified engineers to enhance petroleum process engineering operations and handle dealings with them in all aspects of life, particularly in the petroleum industry.

3- Conducting academic research to stay up with the world scientific process, as well as applied research to turn engineering knowledge and ideas into practical reality by solving the country's challenges in all domains.

4- Contributing to the country's reconstruction in the petroleum and petrochemical industries sectors by providing engineering consultations, preparing economic feasibility studies, project designs, and technical services.

5- Implementing scientific sobriety as a characteristic of this department in line with international rules and standards.

4. Program Accreditation

N. A.

5. Other external influences
(Only different state institutions provide summer internship for third-year students.)

6 Program Structure				
Program Structure	Number of Courses	Credit hours	Percentage	Reviews•
Institution Requirements	7	18	11%	/
College Requirements	9	32	20%	/
College Requirements	22	112	69%	/
Summer internship	1	/	/	/
Others	/	/	/	/

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

7. Program Description

Year/Level	Course Code	Course Name	Credit Hours	
			theoretical	practical
Four years	BSc-PGR	Bachelor of Science in Petroleum and Gas Refining Engineering	176	56

8. Expected learning outcomes of the program

Knowledge

A1- Broad education to understand the impact of engineering solutions globally and economically.

A2: The ability to collaborate in interdisciplinary teams.

A3- The ability of applying cognitive sciences such as mathematics, as well as applied and pure sciences.

A4- The ability to use modern methods, skills, and engineering tools in the petroleum and petrochemical sectors.

A5- The ability to build petroleum and petrochemical facilities that satisfy the necessary requirements while remaining within realistic cost limits.

A6- The ability to develop and perform experiments, analyze data, and translate them practically.

Skills

B1- Developing and enhancing the student's ability to utilize design programs in their area of specialty.

B2- Developing and improving the student's ability to cope with new technology relevant to the course terminology.

B3- Improving the student's ability to face challenges and dilemmas and find acceptable answers to them.

B4- Developing and improving the student's ability to apply academic knowledge in real-world situations.

Ethics

C1- The ability to make decisions.
C2- Student-driven innovation methods.
C3: The student's ability to think.
C4- Collecting the necessary data to complete a certain subject.
C5. Encouraging students' creative thinking and keeping up with the most recent scientific approaches for teaching and learning.

9. Teaching and Learning Strategies

1. Introducing course syllabus to students (lectures).

2. Numerous examples are provided to demonstrate the basic principles.

3. A standardized problem-solving approach that can be applied to any problem.

4. Use figures, drawings, and graphs to offer extensive explanations and reinforce what the learner is reading.

5. At the conclusion of each chapter, self-assessment exams with answers are provided to measure learning progress.

6. Discussing and solving many problems in tutorial sessions, which enables collaboration with one or more colleagues to share ideas and debate the content.

7. Assigning activities, such as drafting research papers, to help students develop self-learning and presenting abilities.

8. Conducting quizzes.

9. Taking semester and final examinations on the designated dates.

10. Informing students about how grades are calculated for students during the semester and their exam results, and discussing failures and successes.

11. Informing students of the textbooks and reference books they need in the course and make a questionnaire for previous years in order to improve the curriculum, improve the performance of teaching staff, and raise the scientific level of the student.

12. Training students in various state institutions (third stage).

10. Evaluation methods

1. Monthly and final exams.

2. Short assessment and classroom involvement.

3. Submitting homework, research papers, and scientific reports.

4. Laboratory work.

11. Faculty						
Faculty Members						
Academic Rank	Specialization		Special Requirements/Skills (if applicable)		Number of the teaching staff	
	General	Special			Staff	**Lecturer**
Professor	1	2			1	2
Assistant Professor	1	5			6	-
Lecturer	-	10			8	2
Assistant Lecturer	4	4			8	-

Professional Development
Mentoring new faculty members
Preparation programs in the form of open lectures and seminars with training workshops that include: 1. Introducing new faculty members to the university's vision, mission, organizational structure, policies and procedures. 2. Enabling new faculty members to obtain a better understanding of their rights and obligations in addition to the rights and duties of students. 3. Providing new faculty members with detailed information about the facilities and services of the university, college, and department. 4. Introducing new faculty members to the quality of the academic program and program accreditation. 5. Introducing new faculty members to learning resources and scientific research programs.
Professional development of faculty members
1. Using current teaching methods and techniques. 2. Sharing experiences with academics from various institutions and universities. 3. Help evaluate, construct, and analyze the curriculum. 4. Continuous course assessment based on comments from instructors and students. 5. Be open to new experiences.

12. Acceptance Criterion
1. High school graduates (applied branch). 2. Admission is open to both male and female. 3. The Central Admissions Department of the Ministry of Higher Education and Scientific Research determines the minimal acceptance grades. 4. The desire of the student or guardian to study in the department.
13. The most important sources of information about the program
1. textbooks. 2. The teaching staff. 3. Workshops, seminars and conferences. 4. Websites and electronic library. 5. The local market and its needs.
14. Program Development Plan
1. Continuously updating the curriculum to keep pace with the curricula of international and established universities and the needs of the local market. 2. Increase interest in the practical aspect by providing modern educational laboratory equipment and opening new laboratories. 3. Providing modern textbooks and reference books from international publisher to the department's library. 4. Incorporating scientific and technological developments at the global level into school curricula and practical experiences. 5. Design and implement development programs in the form of open lectures and seminars with training workshops for teaching and professional staff. 6. Make memorandums of understanding with state institutions in the field of exchanging experiences and conducting scientific research and studies.

Program Skills Outline															
				Required program Learning outcomes											
Year/Level	Course Code	Course Name	Basic or optional	Knowledge				Skills				Ethics			
				A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4
4	PPE 405	Petroleum pollution and its control	basic	*	*	*	*	*	*	*	*	*	*	*	*

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

الوصف الاكاديمي
المرحلة الثالثة -الفصل الاول

Module Description Form

Module Information					
Module Title	Petrochemical Engineering I			Module Delivery	
Module Type	Core			☒ Theory ☐Lecture ☐ Lab ☒ Tutorial ☐ Practical ☐ Seminar	
Module Code	PGR316				
ECTS Credits	3				
SWL (hr/sem)	150				
Module Level	UGIII		Semester of Delivery	5	
Administering Department	PRG		College	PPE	
Module Leader	Dr. Omar Yasin Thayee		e-mail	omaroilgas@tu.edu.iq	
Module Leader's Acad. Title	Assistant professor		Module Leader's Qualification	PhD	
Module Tutor	N/A		e-mail	N/A	
Peer Reviewer Name			e-mail		
Scientific Committee Approval Date			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. **Introduction to petrochemical engineering.** 2. **Chemicals from direct conversion of methane.** 3. **Production of methanol & methanol to olefins MTO process.** 4. **Methanol to Gasoline MTG process.** 5. **Mobil olefin to gasoline & distillate (MOGD) process.** 6. **Production of iso-octane** 7. **GTL process.** 8. **Production of benzene and xylene** 9. **Production of linear alkyl-benzene** 10. **Production of linear alkyl-benzene sulphonic acid**
Module Learning Outcomes	1. **Knowing the fundamentals of petrochemical industry and petrochemical feedstock.** 2. **Knowing the fundamentals syngas process and chemicals from syngas.** 3. **Knowing the fundamentals of syngas to methanol process and production of olefins.** 4. **Knowing the fundamentals of methanol to gasoline process** 5. **Knowing the fundamentals of ethylene process.** 6. **Knowing the fundamentals of HF alkylation process of C4= and iC4 to produce iC8** 7. **Knowing the fundamentals of Fischer Tropsch technology.** 8. **Knowing the fundamentals of BTX production from LPG.** 9. **Knowing the fundamentals of linear alky benzene production.**
Indicative Contents	**Part A: Introduction to petrochemical engineering and petrochemical feedstock [4 hr.], Part B: The fundamentals of Syngas technology [20 hr.], Part C: GTL processes [8 hr.], Part D: Chemicals based on benzene [12 hr.], Part E: Production of LAB and LABS [12 hr.]**

Learning and Teaching Strategies	
Strategies	**The main strategy that will be adopted in delivering this module is to motivate students' participation in the class by raising questions and inquiries while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials, symposiums that are interesting to the students, and self-assessment tests.**

Student Workload (SWL)			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	**56**	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	**4**
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	**91**	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	**6.5**
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**150**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	**2**	**20% (20)**	**4 , 8, 12**	**#1 - #12**
	Assignments	**1**	**5% (5)**	**4 and 13**	**#1- #4 and #8 - #13**
	Report	**1**	**5% (5)**	**10**	**#1 - #10**
	Seminar	**2**	**5% (10)**	**13**	**All**
Summative assessment	**Midterm Exam**	**2hr**	**10% (10)**	**7**	**#1 - #7**
	Final Exam	**3hr**	**50% (50)**	**16**	**All**
Total assessment			**100% (100 Marks)**		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	**Introduction to petrochemical engineering**
Week 2	**Steam methane reforming**
Week 3	**Production of methanol from syngas**
Week 4	**Methanol to Gasoline MTG process**
Week 5	**Production of MTBU**
Week 6	**Production of syncrude by Fischer Tropsch process**
Week 7	**Production of syncrude by Fischer Tropsch process**
Week 8	**Ethylene process**
Week 9	**Ethylene process**
Week 10	**Production of Iso-octane**
Week 11	**Production of BTX from LPG**
Week 12	**Production of linear alkyl-benzene**
Week 13	**Production of linear alkyl-benzene**

Week 14	**Production of linear alkyl-benzene sulphonic acid**
Week 15	**Preparatory week**
Week 16	**Final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	None

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	**Fundamentals of petroleum and petrochemical engineering by Ray**	**Yes**
Recommended	**Chemistry of petrochemical processes by Sami Matar**	**No**
Websites	https://www.google.iq/books/edition/_/k0RhuQEACAAJ?hl=en&sa=X&ved=2ahUKEwj6_tbDpL3_AhWhgP0HHWnSCiwQre8FegQIGxAG	

Grading Scheme				
Group	**Grade**	التقدير	**Marks %**	**Definition**
Success Group (50 - 100)	**A -** Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(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 University of Tikrit College of Petroleum Process Engineering Department of Petroleum and Gas Refining Engineering	

MODULE DESCRIPTOR FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	Engineering Analysis I			**Module Delivery**	
Module Type	**S**			**Theory**	
Module Code	PGR311			**Lecture**	
ECTS Credits				**Lab**	
SWL (hr/sem)	100			**Tutorial** **Practical** **Seminar**	
Module Level	3		**Semester of Delivery**	5	
Administering Department	PGR		**College**	PPE	
Module Leader	Amer Talal Nawaf		**e-mail**	amer.talal@tu.edu.iq	
Module Leader's Acad. Title	Asst. prof.		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Amer Talal Nawaf		**e-mail**	amer.talal@tu.edu.iq	
Peer Reviewer Name			**e-mail**		
Review Committee Approval			**Version Number**		

Relation With Other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	
Module Aims, Learning Outcomes and Indicative Contents **الإرشادية والمحتويات التعلم ونتائج الدراسية المادة أهداف**			
Module Aims **أهداف المادة الدراسية**	• Providing students with the foundations of scientific knowledge in the field of engineering and improving professional capabilities in the direction of analytical thinking. The use of modern technologies in the use of information technologies and modern experimental methods in formulating and solving problems • Providing well-qualified engineers to improve the activities of chemical engineering and the ability to manage dealing with it in all facilities life. • Procedure of scientific research of an academic nature to keep pace with the global scientific process and research of an applied nature to translate, Engineering knowledge and its theories into a work reality by addressing the problems that the country suffers from in all fields. • Discuss and understand first-order and second-order differential equations • Understanding higher order differential equations • Understanding Second Order Differential equations (Non linear, Linear) equations • Understanding Second Order Differential consider complex equation can solve by sepecial cases such as (Frobenius andBessel function)		
Module Learning Outcomes **مخرجات التعلم للمادة الدراسية**	• Education is a broad to understand the impact of engineering solutions globally and economically. • Ability to work in multi groups in engineering majors • The ability to use the techniques, skills and tools of contemporary engineering in the engineering field • The possibility of applying cognitive sciences such as mathematics, pure sciences and engineering. • The possibility of designing and implementing experiments, analyzing of the results and applications. • The ability to solve differential equations for any degree. • The ability to solve the second differential equation (Non linear, Linear by D-operator). • The ability to solve the complex equation by Frobenius method and		

	Bessel equations
Indicative Contents **المحتويات الإرشادية**	• First Order Differential equations (Separable, Homogenous, Exact, Linear, Bernoulli). 12 hrs • Second Order Differential equations (Non linear, Linear, solve by D operator). 16 hrs • Modified equations, Higher order equations, Euler's equation, Simultaneous equations. 12 hrs • Solve differential equations by series method (Frobenius). 8 hrs • Solve differential equations by series method (Bessel function). 8 hrs
Learning and Teaching Strategies **استراتيجيات التعلم والتعليم**	
Strategies	We worked in to divide the students into groups to encourage student's participation in the exercises and discussion during solving the problems. Make a homework concerning the subject of the lectures, and do seminars to present the work.

Student Workload (SWL) **الحمل الدراسي للطالب**			
Structured SWL (h/sem) **الفصل خلال للطالب المنتظم الدراسي الحمل**	59	**Structured SWL (h/w)** **أسبوعيا للطالب المنتظم الدراسي الحمل**	4
Unstructured SWL (h/sem) **الفصل خلال للطالب المنتظم غير الدراسي الحمل**	41	**Unstructured SWL (h/w)** **أسبوعيا للطالب المنتظم غير الدراسي الحمل**	2.92
Total SWL (h/sem) **الفصل خلال للطالب الكلي الدراسي الحمل**	100		

Module Evaluation **الدراسية المادة تقييم**					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	20	6, 14	Q1 for1-5, Q2 for 10-14
	Assignments	2	10	7, 9	Hw.1: 6-7and Hw.2: 8-9
	Projects / Lab.			continues	
	Report	1	10		
Summative assessment	**Midterm Exam**	1	10	9	M. E 1-10
	Final Exam	1	50	16	All
Total assessment					

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	First Order Differential equations (Separable, Homogenous, Exact, Linear, Bernoulli)
Week 2	First Order Differential equations (Separable, Homogenous, Exact, Linear, Bernoulli)
Week 3	First Order Differential equations (Separable, Homogenous, Exact, Linear, Bernoulli)
Week 4	Second Order Differential equations (Non linear, Linear, solve by D operator).
Week 5	Second Order Differential equations (Non linear, Linear, solve by D operator).
Week 6	Second Order Differential equations (Non linear, Linear, solve by D operator).
Week 7	Second Order Differential equations (Non linear, Linear, solve by D operator).
Week 8	Modified equations, Higher order equations, Euler's equation, Simultaneous equations
Week 9	Modified equations, Higher order equations, Euler's equation, Simultaneous equations
Week 10	Modified equations, Higher order equations, Euler's equation, Simultaneous equations
Week 11	Solve differential equations by series method (Frobenius).
Week 12	Solve differential equations by series method (Frobenius).
Week 13	Solve differential equations by series method (Frobenius).
Week 14	Formula of special function.
Week 15	**Preparatory Week**
Week 16	**Final Exam**

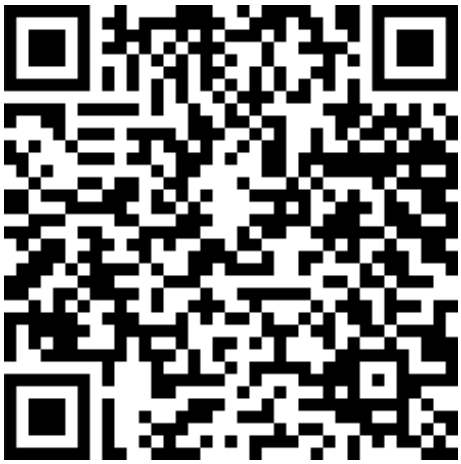
Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Advanced engineering mathematics, Erwin kreyszig	
Recommended Texts	Chemical Engineering mathematics by Jeffrey	
Websites		

APPENDIX:

GRADING SCHEME مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	بقرار مقبول	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required
Note:				

NB 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 University of Tikrit College of Petroleum Process Engineering Department of Petroleum and Gas Refining Engineering	

MODULE DESCRIPTOR FORM
نموذج وصف المادة الدراسية

Module Information
معلومات المادة الدراسية

Module Title	Mass Transfer 1	**Module Delivery**	
Module Type	Core	☒ **Theory** ☐ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	PGR312		
ECTS Credits	5		
SWL (hr/sem)	125		
Module Level	3	**Semester of Delivery**	5
Administering Department	PGR	**College**	PPE
Module Leader	Dr. Muayad A. Shihab	**e-mail**	muayad.abed@tu.edu.iq
Module Leader's Acad. Title	Asst. Prof.	**Module Leader's Qualification**	Ph.D.
Module Tutor	-	**e-mail**	-
Peer Reviewer Name	-	**e-mail**	-
Review Committee		**Version Number**	2

Approval			

Relation With Other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	PGR111	**Semester**	One
Co-requisites module	None	**Semester**	-
Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية			
Module Aims أهداف المادة الدراسية	1. To provide a detailed study of the main chemical separation units. 2. To enable students to select the appropriate technology for chemical separation processes based on correct criteria. 3. To study the design calculations for the equilibrium stages of various chemical separation processes, including diffusion, absorption, and distillation. 4. To familiarize students with mass transfer calculations. 5. To provide a deep understanding of the design calculations for absorption and distillation units. 6. To develop the ability to diagnose and analyze various chemical separation processes within industrial facilities, with a specific focus on oil and gas plants.		
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Upon successful completion of this module, students will be able to: 1. Explain and analyze gaseous and liquid diffusion processes. 2. Derive the laws that govern mass transfer processes. 3. Analyze and design gas absorption processes, including the selection of an appropriate solvent and the application of all relevant design equations and derivations. 4. Design packed absorption towers. 5. Analyze and perform design calculations for binary distillation processes, including the derivation of all fundamental design equations. 6. Design distillation towers.		
Indicative Contents	Part A: Diffusion (16 hrs.)		

المحتويات الإرشادية	• Study of the diffusion process, including Fick's Law and its governing equations. • Exploration of gaseous diffusion processes and their associated equations. • Analysis of the diffusion coefficient, its determination, and related rates. • Distinction between diffusion processes in gases and liquids. Part B: Absorption (20 hrs.) • Learning about two-film theory and its fundamental equations and derivations. • Study of gaseous absorption processes and their related equations. • Introduction to the design methods for gas absorption columns. • Analysis of tray columns and their design equations. • Identification of wetted-wall columns and columns involving chemical reactions. • Understanding of stripping columns. Part C: Distillation (20 hrs.) • Study of distillation processes and the concept of equilibrium state. • Analysis of fractional distillation columns for binary systems. • Calculations for determining the number of stages in distillation columns. • Understanding the q-line equation and its use in calculations. • Learning how to perform calculations for multi-feed and side-stream systems.
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Students will be actively engaged in tasks designed to help them develop and hone their critical thinking abilities. This will be achieved through a combination of lectures, interactive tutorials, and assignments that include engaging and challenging tasks. The course will incorporate the following strategies to facilitate learning: • Detailed Examples: Numerous examples will be worked through in

	detail to illustrate the fundamental principles. • Consistent Problem-Solving Strategy: A consistent strategy for problem-solving will be taught, which can be applied to a wide range of problems. • Visual Reinforcement: Figures, sketches, and diagrams will be used to provide a detailed description and reinforce the concepts being taught. • Self-Assessment: Self-assessment tests with answers will be provided at the end of each section to allow students to evaluate their progress. • Collaborative Learning: Many problems will be discussed and solved during tutorial classes, providing opportunities for students to work with classmates to exchange ideas and discuss the material.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	59	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	66	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation
تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	20% (20)	5, 12	LO 1, 2, 3 and 4, 5
	Online Assignments	1	5% (5)	8	LO 1, 2, 3 and 4
	Onsite Assignments	2	10% (10)	4, 10	LO 1, 2 and 3, 4
	Report	1	5% (5)	13	LO 1, 2, 3, 4, and 5
Summative	**Midterm Exam**	2 hr.	10% (10)	7	LO 1, 2, 3, and 4

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

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction to Diffusion
Week 2	Fick's Law and Gaseous Diffusion
Week 3	Diffusion in the Liquid Phase
Week 4	Measurement of Diffusivity
Week 5	Two-Film Theory
Week 6	Rate of Absorption
Week 7	Design of Packed Absorption Towers
Week 8	Wetted-Wall Absorption Columns and Chemical Reaction
Week 9	Tray Absorption Towers and Stripping Towers
Week 10	Distillation and Vapor-Liquid Equilibrium
Week 11	Fractional Distillation for Binary Systems
Week 12	Number of Stages: Calculation and Graphical Methods
Week 13	q-Line Equation
Week 14	Multi-Feed and Side-Stream Operations
Week 15	**Preparatory Week**
Week 16	**Final Exam**

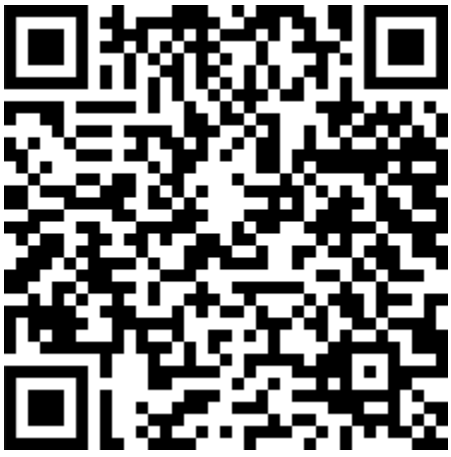
Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	**Text book:** Coulson and Richardson's Chemical Engineering: • Volume 1: Fluid Flow, Heat Transfer and Mass Transfer • Volume 2: Particle Technology and Separation Processes • Volume 6: An Introduction to Chemical Engineering	Yes

	Design	
Recommended Texts	Ludwig, E. E. (1995, 2000). *Applied Process Design for Chemical and Petrochemical Plants* (Volumes 1, 2, and 3). Peters, M. S., & Timmerhaus, K. D. (2000). *Plant Design and Economics for Chemical Engineers.*	Yes
Websites	-	

APPENDIX:

GRADING SCHEME مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	مقبول بقرار	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required
Note:				

NB 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 University of Tikrit College of Petroleum Process Engineering Department of Petroleum and Gas Refining Engineering	

MODULE DESCRIPTOR FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	PETROLEUM REFINING PROCESS I			**Module Delivery**	
Module Type	CORE			☒ **Theory** ☐ **Lecture** ☒ **Lab** ☒ **Tutorial** ☐ **Practical** ☒ **Seminar**	
Module Code	PGR313				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level	C		**Semester of Delivery**		
Administering Department	PGR		**College**	PPE	
Module Leader	Jasim Ibrahim Humadi		**e-mail**	Jasim_alhashimi_ppe@ tu.edu.iq	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	M. Sc.	
Module Tutor	Jasim Ibrahim Humadi		**e-mail**	Jasim Ibrahim @ tu.edu.iq	
Peer Reviewer Name	Mouyed Abid		**e-mail**	Moayed Abid@tu.edu.iq	
Review Committee Approval			**Version Number**	1	

Relation With Other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	
Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية			
Module Aims أهداف المادة الدراسية	7. **Providing students with the basics of scientific knowledge in the field of petroleum refining technology and improving their professional abilities in the direction of analytical and creative thinking through the use of information technologies, data analysis and modern experimental methods in formulating and solving problems.** 8. **Preparing well-qualified engineers to advance the activities of Petroleum and Gas Refining Engineering and the ability to manage dealing with them in all aspects of life, especially in the field of petroleum refining industry.** 9. **Conducting scientific research of an academic nature to keep pace with the global scientific march and research of an applied nature to translate engineering knowledge and its theories into action by addressing the problems that the country suffers from in the field of gas industry.** 10. **Contribute in one way or another in terms of design, supervision, follow-up and advice for the reconstruction of the country in the petroleum refining industry, with the provision of engineering consultancy, the preparation of economic feasibility studies, project designs and the provision of technical services.** 11. **Rooting scientific sobriety and making it a feature of this department in accordance with international controls and standards.** 12. **Providing students with the basics of scientific knowledge about crude oil treating processes, pipelines, pumping, and fuel storage** 13. **Providing students with the basics of scientific knowledge about different units of crude oil treating processes like gas/oil separation, de-emulsification, dehydration, stabilization and**		

	conditioning of crude oil **14. Preparing well-qualified engineers to understand, operate, and develop of different units in crude oil processing operations.**
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	**1. Broad-based education to understand the impact of engineering solutions globally and economically in the petroleum refining industry.** **2. Ability to work in multidisciplinary teams in petroleum refining industry.** **3. The possibility of applying cognitive sciences such as mathematics and pure petroleum sciences in the field of petroleum refining technology.** **4. The ability to use the techniques, skills and tools of contemporary engineering in the engineering field of the petroleum refining industry.** **5. The ability to design, operates, and develop crude oil treating units to meet the required needs within realistic economic determinants.** **6. The possibility of designing and implementing experiments, analyzing the results and translating them into reality in the field of petroleum refining industry**
Indicative Contents المحتويات الإرشادية	**Indicative content includes the following.** **Part A – Crude oil treating processes (27 h)** **Principal field processing operations (3 h), Oil and gas separation and flashing (6 h), emulsion treatment and dehydration of crude oil (6 h), desalting (6 h), and stabilization and sweetening of crude oil (6 h)** **Part B – Surface production facilities (9 h)** **Produced water management and disposal (3 h), field storage tanks, vapor recovery system (VRS), and tank blanketing (3 h), and Oil field chemicals (3 h)** **Part C – Storage and Transport of NG (6 h)** **Pipelines and pumping of crude oil (3 h), and oil spill-treating agents (3 h)**
Learning and Teaching Strategies	

استراتيجيات التعلم والتعليم	
Strategies	**The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes and interactive tutorials. The following steps will be applied to enhance the learning strategies :** **1. Using appropriate teaching methods in line with the level of students and allowing students to discuss.** **2. Using modern and advanced means to deliver the largest amount of knowledge to the student.** **3. Presenting the course vocabulary to the students (lectures).** **4. Assigning students assignments, such as writing research papers, so that students acquire skills for self-learning and presentation.** **5. Conducting sudden exams.** **6. Oral exams via e-learning platforms.** **7. Conducting the quarterly and final exams on the specified dates.** **8. Informing students of how students' grades are calculated during the semester, their exam results, and discussing failures and successes.** **9. Informing students of the curriculum books and auxiliary books that they need in the course vocabulary**

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	150	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	7
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	77	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	6.5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	200		

Module Evaluation
تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	**20**	6, 11	1 -5, 6 - 10
	Assignments	1	**5**	12	1-11
	Projects / Lab.	Continue	**10**	1-14	1 - 14
	Homework	2	**5**	4, 8	1-4, 5-8
Summative assessment	Midterm Exam	1	**10**	14	1-12
	Final Exam	1	**50**	16	1-14
Total assessment			**100**		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	**Introduction about principal field processing operations**
Week 2	**Separation of produced fluids from petroleum well**
Week 3	**Flash process technology**
Week 4	**Emulsion treatment and dehydration of crude oil I**
Week 5	**Emulsion treatment and dehydration of crude oil II**
Week 6	**Desalting of crude oil I**
Week 7	**Desalting of crude oil II**
Week 8	**Stabilization processes of crude oil**
Week 9	**Crude Oil Sweetening**
Week 10	**Surface production facilities: produced water management and disposal**
Week 11	**Field storage tanks, vapor recovery system (VRS), and tank blanketing**
Week 12	**Oil field chemicals (OFC)**
Week 13	**Pipelines and pumping of crude oil**
Week 14	**Oil spill-treating agents**
Week 15	**Preparatory Week**
Week 16	**Final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	**Oil-gas separation**
Week 2	**Emulsification**
Week 3	**De-Emulsification I**
Week 4	**De-Emulsification II**
Week 5	**Desalting**
Week 6	**Stabilization process of crude oil**
Week 7	**Sweetening process of crude oil**

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	**1- Petroleum and Gas Field Processing, Second Edition, H. K. Abdel-Aal, M. A. Aggour, and M. A. Fahim** **2- Fundamentals of petroleum refining, M. A. Fahim, T. A. Al-Sahhaf, and A. S. Elkian1**	**yes**
Recommended Texts	**1- Petroleum refining engineering by Nelson.** **2- Petroleum refining by Parakash**	yes
Websites	**https://www.arab-oil-naturalgas.com/?amp=1, https://www.elsevier.com/, School of mine in Colorado Website**	

APPENDIX:

GRADING SCHEME مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
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	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
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	F – Fail	راسب	(0-44)	Considerable amount of work required
Note:				

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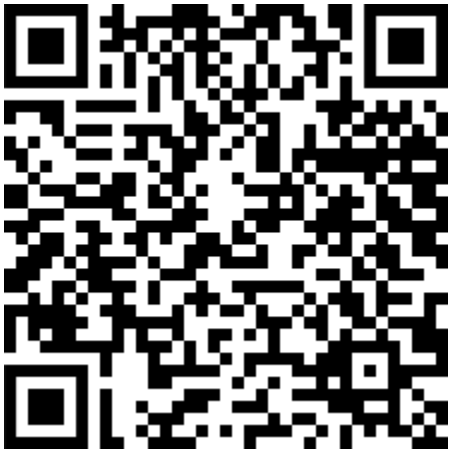

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Reactor Design I**			**Module Delivery**	
Module Type	**Core**			☒ **Theory** ☒ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**PGR314**				
ECTS Credits	**5**				
SWL (hr/sem)	**125**				
Module Level	1		**Semester of Delivery**	1	
Administering Department	Type Dept. Code		**College**	Type College Code	
Module Leader	Dr. Ghassan H. Abdulrazzaq		**e-mail**	ghassanaldoori@tu.edu.iq	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Dr. Ghassan H. Abdulrazzaq		**e-mail**	ghassanaldoori@tu.edu.iq	
Peer Reviewer Name	Name		**e-mail**	E-mail	
Scientific Committee Approval Date	01/06/2023		**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite	None	**Semester**	

module			
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	The major aim of this course is to give the student the required knowledge for design and operation of chemical reactors including single and multiple-reactors system. it will cover concepts ranging from basics such as the kinetics of homogeneous reactions, rate equation, searching for a mechanism, to the reactor design including batch reactor, mixed flow reactors, plug flow reactors, and other design parameters like size comparison of single reactors, pressure drop in packed bed reactor.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Identify the principles of chemical engineering, including material balance with chemical reaction and chemical reaction equilibrium. 2. Able to design a chemical reactor that need it in petroleum refinery . 3. Ability to deal with rate equation. 4. Ability to deal with all reactor types and their design for single or multiple. 5.Ability to deal with reactions (reversible, irreversible, series, parallel, etc.). • The skills goals special to the course. This course will provide students with sufficient understanding to convert the informati obtained by laboratory into information useful in designing chemical reactors, which w make the most of them in the next phase of designing the reactors for the engineering project and thus provide a graduate who is able to design reactors. • C. Affective and value goals At the end of the course presented, the student will possess all the necessary skills to c with problems in designing or operating reactors.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following: 1. Kinetics of Homogeneous Reactions: Concentration dependent term of a rate equation in single and multiple reactions, elementary and nonelementary reactions, molecularity and order of reaction, rate constant k, testing kinetic models, temperature dependency from Arrhenius' Law, Activation energy and temperature dependency. [8 hrs] Predictability of reaction rate from theory. Concentration-Dependent Term, Temperature-Dependent Term, Use of Predicted Values in Design. [2 hrs] 2. Interpretation of batch reactor data: Constant-volume batch reactor, analysis of total pressure data obtained in a constant-volume system, the conversion, integral method of analysis of data, irreversible unimolecular-type first-order reactions, irreversible bimolecular-type second-order reactions, empirical rate equations of nth order, zero-order reactions, overall order of irreversible reactions from the half-life $t_{1/2}$, Irreversible reactions in parallel, Varying- volume batch reactor, **nth-**order and other reactions. for all rate forms other than zero-, first-, and second-order the integral method of analysis. [12hrs]

	3. Temperature and reaction rate, the search for a rate equation, Calculation of k from Individual data points, calculation of k from pairs of data points, graphical method of fitting data. [4 hrs] 4. Introduction to reactor design, general discussion, symbols and relationship between CA and XA, constant density batch and flow systems, batch and flow systems of gases of changing density but with T and π constant, batch and flow systems for gases in general (varying p, T,π). [4 hrs] 5. Ideal reactors for a single reaction: Ideal batch reactor, space-time and space-velocity, steady-state mixed flow, steady-state plug flow reactor, holding time and space time for flow reactors. [8 hrs] 6. Design for single reactions: Size comparison of single reactors (batch reactor, mixed versus plug flow reactors, first- and second-order reactions, variation of reactant ratio for second-order reactions, general graphical comparison [2 hrs]. 7. Multiple-reactor systems: Plug flow reactors in series and/or in parallel, equal-size mixed flow reactors in series, mixed flow reactors of different sizes in series, finding the conversion in a given system, determining the best system for a given conversion, reactors of different types in series, recycle reactor, autocatalytic reactions, plug flow versus mixed flow reactor, no recycle, optimum recycle operations, reactor combinations, [12 hrs]. 8. Design for parallel reactions: Introduction to multiple reactions, the selectivity, the side entry reactor [2 hrs]. 9. Potpourri of multiple reactions: irreversible first-order reactions in series, first-order followed by zero-order reaction, zero-order followed by first-order reaction, successive irreversible reactions of different orders, reversible reactions, irreversible series-parallel reactions, two- step irreversible series-parallel reactions, the Denbigh reactions and their special cases.[4 hrs] 10. Temperature and pressure effects: Single reactions, heats of reaction from thermodynamics, exothermic reactions in mixed flow reactors-a special problem, adiabatic plug flow reactor performance. 11. Pressure drop in packed bed reactor, pseudo - order reactions [4 hrs]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	This document provides the academic description of the reactor design course, which includes introducing the skills of the third stage students in the department of petroleum refinery engineering to understand what chemical reactions are from an engineering point of view. This course will provide students with sufficient understanding to convert the information obtained by laboratory into information useful in designing chemical reactors, which will make the most of them in the next phase of designing the reactors for the engineering project and thus provide a

	graduate who is able to design reactors.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	59	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	66	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**125**		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	20% (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.				
	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) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Kinetics of Homogeneous Reactions: Concentration-Dependent Term of a Rate Equation
Week 2	Temperature-Dependent Term of a Rate Equation
Week 3	Searching for a Mechanism

Week 4	Predictability of Reaction Rate from Theory
Week 5	Interpretation of Batch Reactor Data: Constant-volume Batch Reactor
Week 6	Ideal Batch Reactors
Week 7	Mid-term Exam + Temperature and Reaction Rate
Week 8	Size Comparison of Single Reactors
Week 9	Multiple-Reactor Systems
Week 10	Design for Parallel Reactions
Week 11	Irreversible First-Order Reactions in Series
Week 12	Pressure Drop in Packed Bed Reactor
Week 13	Pseudo - Order Reactions
Week 14	Reversible Reactions
Week 15	Irreversible Series-Parallel Reactions
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Chemical reactors design by Fogler	Yes
Recommended Texts	Chemical Reaction Engineering Third Edition Octave Levenspiel	Yes
Websites	https://sites.tufts.edu/andrewrosen/files/2013/09/reactor_design_guide1.pdf	

Grading Scheme
مخطط الدرجات

Group	Grade	التقدير	Marks %	Definition
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
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	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(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 University of Tikrit College of Petroleum Process Engineering Department of Petroleum and Gas Refining Engineering	

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information معلومات المادة الدراسية		
Module Title	HEAT TRANSFER I	**Module Delivery**
Module Type	CORE	☒ **Theory** ☐ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**
Module Code	PGR315	
ECTS Credits	4	
SWL (hr/sem)	100	

Module Level	UGIII	**Semester of Delivery**	5
Administering Department	PGR	**College**	PPE
Module Leader	Dr. Maha Ibrahim Salih	**e-mail**	
Module Leader's Acad. Title	Asst. Prof.	**Module Leader's Qualification**	PhD
Module Tutor	None	**e-mail**	None
Peer Reviewer Name	-	**e-mail**	-
Review Committee Approval		**Version Number**	1.0

Relation With Other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Mathematics I and II, Thermodynamic I	**Semester**	1 and 2
Co-requisites module	-	**Semester**	-

Module Aims, Learning Outcomes, Indicative Contents and Brief Description أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر	
Module Aims أهداف المادة الدراسية	This course provides a comprehensive introduction to heat transfer fundamentals and their applications. The course introduces students to the analysis of steady-state and transient one-multi dimensional heat conduction.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of this course students will be able to: **Heat Conduction Equation (Heat Diffusion Equation)** 1. **Apply** Fourier's law to calculate heat transfer rates in Cartesian, cylindrical, and spherical coordinates. 2. **Analyze** steady-state conduction through composite walls, cylindrical bodies, and spherical bodies. 3. **Evaluate** heat transfer performance in a double-pipe heat exchanger by integrating conduction and convection principles. 4. **Calculate** heat transfer through extended surfaces (fins) and **assess** fin

	efficiency and effectiveness. 5. **Solve** problems involving unsteady (transient) heat conduction in solids. 6. **Apply** lumped system analysis to predict temperature variation in small bodies with negligible internal resistance. **Principles of Convection** 7. **Explain** the role of viscous flow in convective heat transfer. 8. **Describe** the formation of laminar boundary layers on flat plates. 9. **Interpret** the temperature profile within the thermal boundary layer and its effect on the heat transfer coefficient. 10. **Analyze** heat transfer in turbulent flow through tubes using empirical correlations. 11. **Evaluate** laminar heat transfer in tubes using analytical and empirical solutions.
Indicative Contents المحتويات الإرشادية	• **Introduction to Modes of Heat Transfer**: conduction, convection, and an overview of applications. **Heat Conduction Equation (Heat Diffusion Equation)** • Fourier's law of heat conduction in Cartesian, cylindrical, and spherical coordinates. • One-dimensional steady-state conduction through a composite wall. • Radial conduction through cylindrical bodies. • Radial conduction through spherical bodies. • Heat transfer in double-pipe heat exchangers. • Heat transfer through extended surfaces (fins): fin efficiency and effectiveness. • Unsteady (transient) conduction in solids. • Lumped system analysis for small bodies. **Principles of Convection** • Fundamentals of viscous flow and its role in convection. • Development of the laminar boundary layer on a flat plate. • Temperature profile within the thermal boundary layer. • Heat transfer in turbulent tube flow. • Heat transfer in laminar tube flow.
Course Description	This course introduces the fundamental mechanisms of heat transfer with emphasis on conduction and convection. It covers the derivation and application of the heat conduction (diffusion) equation in Cartesian, cylindrical, and spherical coordinates, including steady-state and transient conduction in solids, conduction through composite walls, cylindrical and spherical bodies, as well as the use of extended surfaces (fins) to enhance heat transfer. The course also examines heat transfer in practical systems such as double-pipe heat exchangers. Principles of convection are explored through the study of viscous flow, the development of laminar and thermal boundary layers, and heat transfer correlations for both laminar and turbulent flows in tubes. The theoretical foundations are integrated with engineering applications to develop students' ability to analyze, model, and

	solve real-world heat transfer problems.
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	In this course, key concepts and methods are explained step by step in lectures, with plenty of examples to make ideas clear and practical. Students also get dedicated time to practice what they learn by working through a wide selection of guided tutorial problems.

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	59	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	41	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	2.7
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	20% (20)	5, 12	LO 1- 5 and -6 11
	Online Assignments	2	10% (10)	4,10	LO 1- 5 and -6 11
	Onsite Discussions	1	5% (5)	9	LO 6- 12
	Report	1	5% (5)	13	LO 1- 12
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	all
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction to Heat transfer
Week 2	Modes of Heat Transfer
Week 3	Steady state one dimension conduction without heat generation through a composite wall, cylindrical body and sphere body
Week 4	Steady state one dimension Convection and Conduction through a Composite Wall without heat generation
Week 5	The Overall Heat-Transfer Coefficient, U
Week 6	Critical Thickness of Insulation
Week 7	Unsteady or Transient Heat Conduction, Lumped System Analysis
Week 8	Applicability of Lumped-Capacity Analysis
Week 9	Principles of Convection: Laminar Boundary Layer on a Flat Plate
Week 10	The Thermal Boundary Layer
Week 11	Empirical Relations for Pipe and Tube Flow
Week 12	Empirical Correlations of Calculation Heat Transfer coefficient for Fully Developed Turbulent Flow in Tubes
Week 13	Constant Heat Flux
Week 14	Empirical Relation for Laminar Heat Transfer in Tubes
Week 15	**Preparatory Week**
Week 16	**Final Exam**

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Heat transfer by J.P. Holman, 10th Edition	Yes
Recommended Texts	1- Fundamentals of Heat and Mass Transfer - Incropera/DeWitt/others - Sixth Edition. 2- Mass Transfer: Fundamentals & Applications by Yunus Cengel and Afshin Ghajar.	No
Websites	-	

APPENDIX:

GRADING SCHEME مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	مقبول بقرار	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required
Note:				

NB 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 University of Tikrit College of Petroleum Process Engineering Department of Petroleum and Gas Refining Engineering	

MODULE DESCRIPTOR FORM

نموذج وصف المادة الدراسية

Module Information
المادة الدراسية معلومات

Module Title	Numerical method and optimizing	**Module Delivery**	
Module Type	**S**	• **Theory**	
Module Code	PGR326	• **Lecture**	
ECTS Credits		• **Lab**	
SWL (hr/sem)	100	• **Tutorial** • **Practical** • **Seminar**	
Module Level	3	**Semester of Delivery**	6
Administering Department	PGR	**College**	PPE
Module Leader	Yousif Saleh Issa	**e-mail**	yosif.eng.80@tu.edu.iq
Module Leader's Acad. Title	Asst. Lecturer.	**Module Leader's Qualification**	MSc.
Module Tutor	Yousif Saleh Issa	**e-mail**	yosif.eng.80@tu.edu.iq
Peer Reviewer Name		**e-mail**	
Review Committee Approval		**Version Number**	

Relation With Other Modules

العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents
الإرشادية والمحتويات التعلم ونتائج الدراسية المادة أهداف

Module Aims **أهداف المادة الدراسية**	Learn how to use the numerical methods to find the roots and finding the solutions of linear and non-linear algebraic equations and ordinary differential equations, integration, find the great endings and lesser critical points, interpolation and extrapolation, and finally to find the best values (optimization) as another methods beside analytical methods when uses them in petroleum processes.
Module Learning Outcomes **مخرجات التعلم للمادة الدراسية**	• Education is a broad to understand the impact of engineering solutions globally and economically. • Ability to work in multi groups in engineering majors • The ability to use the techniques, skills and tools of contemporary engineering in the engineering field • The possibility of applying cognitive sciences such as mathematics, pure sciences and engineering. • The possibility of designing and implementing experiments, analyzing of the results and applications. • The ability to solve differential equations for any degree. • The ability to solve the second differential equation (Non linear, Linear by D-operator). • The ability to solve the complex equation by Frobenius method and Bessel equations
Indicative Contents **المحتويات الإرشادية**	• First Order Differential equations (Separable, Homogenous, Exact, Linear, Bernoulli). 12 hrs • Second Order Differential equations (Non linear, Linear, solve by D operator). 16 hrs • Modified equations, Higher order equations, Euler's equation, Simultaneous equations. 12 hrs • Solve differential equations by series method (Frobenius). 8 hrs • Solve differential equations by series method (Bessel function). 8 hrs

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	We worked in to divide the students into groups to encourage student's participation in the exercises and discussion during solving the problems. Make

	a homework concerning the subject of the lectures, and do seminars to present the work.

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الفصل خلال للطالب المنتظم الدراسي الحمل	59	**Structured SWL (h/w)** أسبوعيا للطالب المنتظم الدراسي الحمل	4
Unstructured SWL (h/sem) الفصل خلال للطالب المنتظم غير الدراسي الحمل	41	**Unstructured SWL (h/w)** أسبوعيا للطالب المنتظم غير الدراسي الحمل	2.92
Total SWL (h/sem) الفصل خلال للطالب الكلي الدراسي الحمل	100		

Module Evaluation الدراسية المادة تقييم					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	20	6, 14	Q1 for1-5, Q2 for 10-14
	Assignments	2	10	7, 9	Hw.1: 6-7and Hw.2: 8-9
	Projects / Lab.	4	10	continues	
	Report				
Summative assessment	**Midterm Exam**	1	10	9	M. E 1-10
	Final Exam	1	50	16	All
Total assessment					

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Find the roots of equations (fixed point method, Newton-Raphson method, bisection method, secant method)
Week 2	Find the roots of equations (fixed point method, Newton-Raphson method, bisection method, secant method)
Week 3	Solution of set of linear equations by (Jacobi method, Gauss-siedel method)
Week 4	nonlinear set of equation (solve by Simple iteration or Gauss –seidel, Newton – Raphson method).
Week 5	Numerical solution of ordinary differential equation (1^{st} order &2^{nd} order, solve by Tayler series, Runge kutaa).

Week 6	Numerical solution of ordinary differential equation (1st order &2nd order, solve by Tayler series, Runge kutaa).
Week 7	interpolation (General Form of Newton's Interpolating Polynomials, Newton's Divided-Difference Interpolating Polynomials).
Week 8	Newton's Divided-Difference Interpolating Polynomials (Non linear, Linear, solve by D operator).
Week 9	Curve fitting (group average, least squar)
Week 10	Curve fitting (group average, least squar)
Week 11	Optimization Techniques (Optimization Terminologies: Objective Function, Decision Variable, Constraint).
Week 12	Mathematical Modelling of Optimization Problem (Linear Programing, nonlinear Programing).
Week 13	Multivariable Optimization with Inequality Constraints Optimization Techniques Introduction Numerical Optimization Techniques (Elimination Methods, Fibonacci method, Golden section method, Interpolation Methods, Newton Method).
Week 14	Multivariable Optimization with Inequality Constraints Optimization Techniques Introduction Numerical Optimization Techniques (Elimination Methods , Fibonacci method , Golden section method , Interpolation Methods , Newton Method).
Week 15	**Preparatory Week**
Week 16	**Final Exam**

Delivery Plan (Weekly Lab. Syllabus) **المنهاج الاسبوعي للمختبر**	
	Material Covered
Week 1	Find the roots of equations by Excel and Matlab
Week 2	Solution of set of linear equations by Excel and Matlab
Week 3	Numerical solution of ordinary differential equation by Excel and Matlab
Week 4	interpolation by Excel and Matlab
Week 5	Curve fitting by Excel and Matlab
Week 6	Find maximum and minimum of Linear Programing by Excel and Matlab
Week 7	Find maximum and minimum of Linear Programing by Excel and Matlab

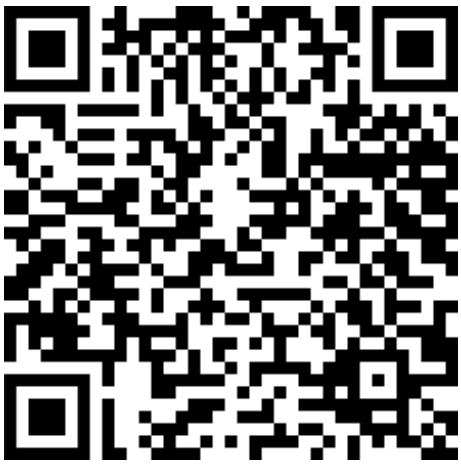
Learning and Teaching Resources **مصادر التعلم والتدريس**		
	Text	**Available in the Library?**
Required Texts	Numerical analysis using MATLAB and	- Numerical

	spreadsheets /Steven T.Karris.	method for scientists and engineering K. Sankara.Rao
Recommended Texts	- Numerical method in engineering practice, Al Khafaji.	
Websites		

APPENDIX:

GRADING SCHEME **مخطط الدرجات**				
Group	**Grade**	**التقدير**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A** - Excellent	**امتياز**	90 - 100	Outstanding Performance
	B - Very Good	**جيد جدا**	80 - 89	Above average with some errors
	C - Good	**جيد**	70 - 79	Sound work with notable errors
	D - Satisfactory	**متوسط**	60 - 69	Fair but with major shortcomings
	E - Sufficient	**مقبول**	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	**بقرار مقبول**	(45-49)	More work required but credit awarded
	F – Fail	**راسب**	(0-44)	Considerable amount of work required
Note:				

NB 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.



الوصف الاكاديمي
المرحلة الثالثة -الفصل الثاني

	Ministry of Higher Education and Scientific Research - Iraq University of Tikrit College of Petroleum Process Engineering Department of Petroleum and Gas Refining Engineering	

MODULE DESCRIPTOR FORM

نموذج وصف المادة الدراسية

Module Information

المادة الدراسية معلومات

Module Title	Engineering Analysis II	**Module Delivery**	
Module Type	**S**	• **Theory**	
Module Code	PGR321	• **Lecture**	
ECTS Credits		• **Lab**	
SWL (hr/sem)	100	• **Tutorial** • **Practical** • **Seminar**	
Module Level	3	**Semester of Delivery**	6
Administering Department	PGR	**College**	PPE
Module Leader	Amer Talal Nawaf	**e-mail**	amer.talal@tu.edu.iq
Module Leader's Acad. Title	Asst. prof.	**Module Leader's Qualification**	Ph.D
Module Tutor	Amer Talal Nawaf	**e-mail**	amer.talal@tu.edu.iq
Peer Reviewer Name		**e-mail**	
Review Committee Approval		**Version Number**	

Relation With Other Modules

العلاقة مع المواد الدراسية الأخرى

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

Module Aims, Learning Outcomes and Indicative Contents
الإرشادية والمحتويات التعلم ونتائج الدراسية المادة أهداف

Module Aims **أهداف المادة الدراسية**	• Providing students with the foundations of scientific knowledge in the field of engineering and improving professional capabilities in the direction of analytical thinking. The use of modern technologies in the use of information technologies and modern experimental methods in formulating and solving problems • Providing well-qualified engineers to improve the activities of chemical engineering and the ability to manage dealing with it in all facilities life. • Procedure of scientific research of an academic nature to keep pace with the global scientific process and research of an applied nature to translate, Engineering knowledge and its theories into a work reality by addressing the problems that the country suffers from in all fields. • Discuss and understand the laplace transformation • The ability to find the partial differential equation • Understanding mathematical modeling
Module Learning Outcomes **مخرجات التعلم للمادة الدراسية**	• Education is a broad to understand the impact of engineering solutions globally and economically. • Ability to work in multi groups in engineering majors • The ability to use the techniques, skills and tools of contemporary engineering in the engineering field • The possibility of applying cognitive sciences such as mathematics, pure sciences and engineering. • The possibility of designing and implementing experiments, analyzing of the results and applications. • The ability to solve the partial differential equation (two dimension or three). • The ability to find final solution by Laplace transforms for any (differential equation or partial differential equation). • Discuss mathematical modeling and applications to chemical engineering equipments in the steady state and unsteady state
Indicative Contents **المحتويات الإرشادية**	• Laplace transformation. 16 hrs • Partial differential equations (Separation of variables, change of

	variables, Laplace transforms). 12 hrs • Formula of special function. 6 hrs • Mathematical Modeling (Applications to chemical engineering equipments in the steady state and unsteady state). 22 hrs

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	We worked in to divide the students into groups to encourage student's participation in the exercises and discussion during solving the problems. Make a homwork concerning the subject of the lectures, and do seminars to present the work.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) **الفصل خلال للطالب المنتظم الدراسي الحمل**	59	**Structured SWL (h/w)** **أسبوعيا للطالب المنتظم الدراسي الحمل**	4
Unstructured SWL (h/sem) **الفصل خلال للطالب المنتظم غير الدراسي الحمل**	41	**Unstructured SWL (h/w)** **أسبوعيا للطالب المنتظم غير الدراسي الحمل**	2.92
Total SWL (h/sem) **الفصل خلال للطالب الكلي الدراسي الحمل**	100		

Module Evaluation
الدراسية المادة تقييم

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	20	6, 14	Q1 for1-5, Q2 for 10-14
	Assignments	2	10	7, 9	Hw.1: 6-7and Hw.2: 8-9
	Projects / Lab.			continues	
	Report	1	10		
Summative assessment	**Midterm Exam**	1	10	9	M. E 1-10
	Final Exam	1	50	16	All
Total assessment					

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered

Week 1	Laplace transformation
Week 2	Laplace transformation
Week 3	Laplace transformation
Week 4	Laplace transformation
Week 5	Partial differential equations (Separation of variables, change of variables, Laplace transforms).
Week 6	Partial differential equations (Separation of variables, change of variables, Laplace transforms).
Week 7	Partial differential equations (Separation of variables, change of variables, Laplace transforms).
Week 8	Partial differential equations (Separation of variables, change of variables, Laplace transforms).
Week 9	Mathematical Modeling (Applications to chemical engineering equipments in the steady state and unsteady state).
Week 10	Mathematical Modeling (Applications to chemical engineering equipments in the steady state and unsteady state).
Week 11	Mathematical Modeling (Applications to chemical engineering equipments in the steady state and unsteady state).
Week 12	Mathematical Modeling (Applications to chemical engineering equipments in the steady state and unsteady state).
Week 13	Mathematical Modeling (Applications to chemical engineering equipments in the steady state and unsteady state).
Week 14	Mathematical Modeling (Applications to chemical engineering equipments in the steady state and unsteady state).
Week 15	**Preparatory Week**
Week 16	**Final Exam**

Delivery Plan (Weekly Lab. Syllabus) **المنهاج الاسبوعي للمختبر**	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Advanced engineering mathematics, Erwin kreyszig	
Recommended Texts	Chemical Engineering mathematics by Jeffrey	
Websites		

APPENDIX:

GRADING SCHEME مخطط الدرجات				
Group	**Grade**	**التقدير**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A** - Excellent	**امتياز**	90 - 100	Outstanding Performance
	B - Very Good	**جيد جدا**	80 - 89	Above average with some errors
	C - Good	**جيد**	70 - 79	Sound work with notable errors
	D - Satisfactory	**متوسط**	60 - 69	Fair but with major shortcomings
	E - Sufficient	**مقبول**	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	**بقرار مقبول**	(45-49)	More work required but credit awarded
	F – Fail	**راسب**	(0-44)	Considerable amount of work required
Note:				

NB 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 Description Form

Module Information					
Module Title	Petrochemical Engineering II			Module Delivery	
Module Type	Core			☒ Theory ☐Lecture ☐ Lab ☒ Tutorial ☐ Practical ☐ Seminar	
Module Code	PGR316				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level		UGIII	Semester of Delivery		5
Administering Department		PRG	College	PPE	
Module Leader	Dr. Omar Yasin Thayee		e-mail	omaroilgas@tu.edu.iq	
Module Leader's Acad. Title		Assistant professor	Module Leader's Qualification		PhD
Module Tutor	N/A		e-mail	N/A	
Peer Reviewer Name			e-mail		
Scientific Committee Approval Date			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	11. **Introduction to petrochemical engineering.** 12. **Chemicals from direct conversion of methane.** 13. **Production of methanol & methanol to olefins MTO process.** 14. **Methanol to Gasoline MTG process.** 15. **Mobil olefin to gasoline & distillate (MOGD) process.** 16. **Production of iso-octane** 17. **GTL process.** 18. **Production of urea** 19. **Production of benzene and xylene** 20. **Production of linear alkyl-benzene** 21. **Production of linear alkyl-benzene sulphonic acid** 22. **Production of HDPE and LDPE** 23. **Production of PVC** 24. **Production of polystyrene and DVPS**
Module Learning Outcomes	10. **Knowing the fundamentals of petrochemical industry and petrochemical feedstock.** 11. **Knowing the fundamentals syngas process and chemicals from syngas.** 12. **Knowing the fundamentals of syngas to methanol process and production of olefins.** 13. **Knowing the fundamentals of methanol to gasoline process** 14. **Knowing the fundamentals of olefins oligomerization process to gasoline and distillates.** 15. **Knowing the fundamentals of HF alkylation process of C4= and iC4 to produce iC8** 16. **Knowing the fundamentals of Fischer Tropsch technology.** 17. **Knowing the fundamentals of ammonia and nitrogenic fertilizers process .** 18. **Knowing the fundamentals of thermal hydrodealkylation process THDA.** 19. **Knowing the fundamentals of PACOL & HF detergent Processes.** 20. **Knowing the fundamentals of sulphonation process.** 21. **Knowing the fundamentals of HDPL & LDPE manufacturing.** 22. **Knowing the fundamentals of PVC manufacturing.** 23. **Knowing the fundamentals of ion-exchangers manufacturing.**
Indicative Contents	**Part A: Introduction to petrochemical engineering and petrochemical feedstock [4 hr.], Part B: The fundamentals of Syngas technology [20 hr.], Part C: GTL processes [8 hr.], Part D: Chemicals based on benzene [12 hr.], Part E: Polymer engineering and manufacturing of HDPE, LDPE, PS, and DVPS [12 hr.]**

Learning and Teaching Strategies	
Strategies	**The main strategy that will be adopted in delivering this module is to motivate students' participation in the class by raising questions and inquiries while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials, symposiums that are interesting to the students, and self-assessment tests.**

Student Workload (SWL)			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	**56**	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	**4**
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	**91**	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	**6.5**
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**150**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	**2**	**20% (20)**	**4 , 8, 12**	**#1 - #12**
	Assignments	**2**	**10% (10)**	**4 and 13**	**#1- #4 and #8 - #13**
	Report	**1**	**5% (5)**	**10**	**#1 - #10**
	Seminar	**1**	**5% (5)**	**13**	**All**
Summative assessment	**Midterm Exam**	**2hr**	**10% (10)**	**7**	**#1 - #7**
	Final Exam	**3hr**	**50% (50)**	**16**	**All**
Total assessment			**100% (100 Marks)**		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	**Introduction to petrochemical engineering.**
Week 2	**Chemicals from direct conversion of methane.**
Week 3	**Production of methanol & methanol to olefins MTO process.**
Week 4	**Methanol to Gasoline MTG process.**
Week 5	**Mobil olefin to gasoline & distillate (MOGD) process.**
Week 6	**Production of iso-octane**
Week 7	**GTL process.**
Week 8	**Production of urea**
Week 9	**Production of benzene and xylene**
Week 10	**Production of linear alkyl-benzene**
Week 11	**Production of linear alkyl-benzene sulphonic acid**
Week 12	**Production of HDPE and LDPE**
Week 13	**Production of PVC**
Week 14	**Production of polystyrene and DVPS**
Week 15	**Preparatory week**
Week 16	**Final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	None

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	**Fundamentals of petroleum and petrochemical engineering by Ray**	**Yes**
Recommended	**Chemistry of petrochemical processes by Sami Matar**	**No**
Websites	https://www.google.iq/books/edition/_/k0RhuQEACAAJ?hl=en&sa=X&ved=2ahUKEwj6_tbDpL3_AhWhgP0HHWnSCiwQre8FegQIGxAG	

Grading Scheme				
Group	**Grade**	التقدير	**Marks %**	**Definition**
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(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 University of Tikrit College of Petroleum Process Engineering Department of Petroleum and Gas Refining Engineering	

MODULE DESCRIPTOR FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية		
Module Title	PETROLEUM REFINING PROCESS II	**Module Delivery**
Module Type	CORE	☒ **Theory** ☐ **Lecture** ☒ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**
Module Code	PGR323	
ECTS Credits	8	

SWL (hr/sem)	150			
Module Level	C	**Semester of Delivery**		
Administering Department	PGR	**College**	PPE	
Module Leader	Jasim Ibrahim homadi	**e-mail**		
Module Leader's Acad. Title	Professor	**Module Leader's Qualification**	PhD	
Module Tutor		**e-mail**		
Peer Reviewer Name	MoayedAbid	**e-mail**	Moayedabid@tu.edu.iq	
Review Committee Approval		**Version Number**	1	

Relation With Other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	**15. Ability to dehydrate and desalting crude oils.** **16. Ability to heat and distillate crude oils to its products at atmospheric and vacuum pressures.** **17. Ability to produce high octane number gasoline by different processes.** **18. Ability to produce lubricating oils by many processes.** **19. Ability to decrease sulfur content by hydrogenation processes** **20. Ability to find the best processes and operating conditions to produce petroleum products.**
Module Learning Outcomes مخرجات التعلم للمادة	**1. Recognize how Petroleum Refinery works .** **2. List the various terms associated with Refinery Equipments.**

الدراسية	**3. Summarize what is meant by a basic Refinery Units** **4. Discuss the reaction and involvement of atoms in Petroleum Industry** **5. Describe Petroleum Fields Processes** **6. Define Processes in Petroleum Industry** **7. Identify the basic elements and their applications.** **8. Discuss the operations of Atmospheric Distillation process.** **9. Discuss the Vacuum Distillation Process** **10. Explain the two main Towers in Petroleum Industry**
Indicative Contents المحتويات الإرشادية	2.

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	Type something like: The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	150	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	7
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	102	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	6.5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	200		

Module Evaluation
تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes		10		
	Assignments		5		
	Projects / Lab.		10		
	Report		5		
Summative assessment	Midterm Exam		20		
	Final Exam		50		
Total assessment			100		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Product treatment
Week 2	Merox Process treatment
Week 3	Sulfur production by Claus process
Week 4	Adsorpants used in Refineries
Week 5	Mimic Diagram
Week 6	Asphalt production
Week 7	Aromatic production by solvent Extraction
Week 8	Refinery Water systems
Week 9	Steam water system
Week 10	Cooling Water production
Week 11	Wastewater Treatment in Refineries
Week 12	Storage Tanks in Refineries
Week 13	Product Blending
Week 14	Emergency Shut Down
Week 15	Preparatory Week
Week 16	Final Exam

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	**Merox Treatment process**
Week 2	**Aromatic Removal by sovent Extraction**
Week 3	**Adsorption process**
Week 4	**Desulfurization process**
Week 5	**Oil Skimmer**
Week 6	**H2S Removal by Amine Solvents Scrubbing**
Week 7	**Merciptanes Removal from gasoline**

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	**Fundamentals of petroleum refining by Fahim.**	**yes**
Recommended Texts	**1- Petroleum refining engineering by Nelson.** **2-Petroleum refining by Parakash**	yes
Websites	**School of mine in Colorado Website**	

APPENDIX:

GRADING SCHEME مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	مقبول بقرار	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required
Note:				

NB 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 University of Tikrit College of Petroleum Process Engineering Department of Petroleum and Gas Refining Engineering	

MODULE DESCRIPTOR FORM
نموذج وصف المادة الدراسية

Module Information
معلومات المادة الدراسية

Module Title	MASS TRANSFER II	**Module Delivery**	
Module Type	CORE	☒ **Theory** ☐ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	PGR322		
ECTS Credits	5		
SWL (hr/sem)	125		

Module Level	3	**Semester of Delivery**	5
Administering Department	PGR	**College**	PPE
Module Leader	Dr. muayad A. shihap	**e-mail**	muayad.abed@tu.edu.iq
Module Leader's Acad. Title	professor	**Module Leader's Qualification**	Ph.D.
Module Tutor		**e-mail**	
Peer Reviewer Name		**e-mail**	

Review Committee Approval		**Version Number**	1

Relation With Other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	
Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية			
Module Aims أهداف المادة الدراسية	21. A detailed study of the main chemical separation units. 22. Using the correct criteria to select the appropriate technology for chemical separation processes. 23. Studying the design calculations for the equilibrium stages of chemical separation processes (, , distillation, extraction, evaporation and humidification). 24. Familiarity with material transfer calculations. 25. Familiarity with the design calculations of extraction. 26. Diagnosis and analysis of various chemical separation processes in industrial facilities, especially oil ones.		
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	7. Studying the processes of enthalpy- composition diagram (H_X diagram) and multi-compound distillation with the derivation of all the basic design equations. 8. Studying solvent extraction processes using an appropriate solvent and the conditions for using it with all design equations. 9. Studying the evaporation processes for the concentration of aqueous solutions and the derivation of the basic equations for the balance of matter and energy. 10. Studying air humidification and cooling towers and design calculations of cooling tower.		
Indicative Contents المحتويات الإرشادية	Part A: Distillation. - Learn about enthalpy composition diagram. - Learn about multi-component distillation and the equations used in its calculations. (16 hr.)		

	Part B: Extraction. - Learn about solvent extraction and equilibrium equations. - Recognize the number of stages of a complete immiscible solvent. - Recognize the partial separation using triangle curves and methods of their calculations. - Learn about solvent extraction devices and how they work. (20 hr.) Part C: Evaporation. - Identify the methods of evaporation and the differences between them and the equations used in their calculation. - Learn about counter-directional evaporation and the equations used in its calculations. - Learn about co-current directional evaporation and the equations used in its calculations. (12 hr.). Part D: Humidification. - Identify humidity and relative humidity in the case of constant temperature. - Understand the processes of hydration, phase balance, graphics and equations. – Equation and calculation of cooling tower design. (12 hr.).
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The students will be actively engaged in the tasks, which will help them develop and hone their critical thinking abilities. This will be accomplished. Via lectures, interactive tutorials, and assignments incorporating fascinating tasks. The course includes: 1- Numerous examples worked out in detail to illustrate the basic principles. 2- A consistent strategy for problem solving that can be applied to any problem. 3- Figures, sketches, and diagrams to provide a detailed description and reinforcement of what you read. 4- Self-Assessment Tests at the end of each section, with answers so that you can evaluate your progress in learning.

	5- Many problems will be discussed and solved in the tutorial classes, which offer working with one or more classmates to exchange ideas and discuss the material.

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	59	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	66	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation
تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	20% (20)	5,10	LO # 1, 2. and 3
	Assignments	2	20%(20)	continuous	
	Seminar				
	Report				
Summative assessment	**Midterm Exam**	2 hr.	10%(10)	7	LO 1,2
	Final Exam	3 hr.	50%(50)	16	All
Total assessment			100%(100)marks		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	Enthalpy composition diagram.
Week 2	Enthalpy composition diagram.
Week 3	Multi component distillation.

Week 4	Multi component distillation.
Week 5	Extraction, equilibrium data.
Week 6	Number of stages of immiscible solvent extraction.
Week 7	Partially immiscible solvent for triangle diagram.
Week 8	Equipment of solvent extraction.
Week 9	Evaporation, principles.
Week 10	Evaporation theory and calculation.
Week 11	Multi stages Evaporation.
Week 12	Humidification phase equilibrium.
Week 13	Adiabatic saturation, humidity.
Week 14	Cooling tower design and calculation.
Week 15	**Preparatory Week**
Week 16	**Final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	**Text book:** 1- Chemical Engineering Vol.1, Coulson and Richards. **2-** Chemical Engineering Vol.2, Coulson and Richards	yes

Recommended Texts	Treybol, Mass Transfer Operation, 2010	yes
Websites		

APPENDIX:

GRADING SCHEME مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	مقبول بقرار	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required
Note:				

NB 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 DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information
معلومات المادة الدراسية

Module Title	**REACTOR DESIGN II**	**Module Delivery**	
Module Type	**Core**	☒ **Theory** ☒ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**PGR324**		
ECTS Credits	**5**		
SWL (hr/sem)	**125**		

Module Level	1	**Semester of Delivery**	1
Administering Department	Type Dept. Code	**College**	Type College Code
Module Leader	Dr. Ghassan H. Abdulrazzaq	**e-mail**	ghassanaldoori@tu.edu.iq
Module Leader's Acad. Title	Lecturer	**Module Leader's Qualification**	Ph.D.
Module Tutor	Dr. Ghassan H. Abdulrazzaq	**e-mail**	ghassanaldoori@tu.edu.iq
Peer Reviewer Name	Name	**e-mail**	E-mail
Scientific Committee Approval Date	01/06/2023	**Version Number**	1.0

Relation with other Modules
العلاقة مع المواد الدراسية الأخرى

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

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	Giving the student the necessary information about the reactor design and operation of chemical reactors, Symbols and Relationship between CA and X, Special Case 1. Constant Density Batch and Flow Systems, Special Case 2. Batch and Flow Systems of Gases of Changing Density but with T and. π Constant, Autocatalytic reactions, recycle reactor. The Denbigh reactions and their special cases. Study the Temperature and Pressure Effects in Single reactions and Heats of Reaction from Thermodynamics, and Steady-State Mixed Flow Reactors, Steady-State Plug Flow Reactors .
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Identify the principles of Reactor Design, including the reaction with the chemical reaction equilibrium. 2. Ability to deal with rate equation. 3. Ability to deal with all reactions types and their design for single or multiple. 4.Ability to deal with reactions (reversible, irreversible, series, parallel, etc.). • The skills goals special to the course. This course will provide students with sufficient understanding to convert the information obtained by laboratory into information useful in designing chemical reactors with catalyst that use it in chemical reaction, which will make the most of them in the next phase of designing the reactors for the engineering project and thus provide a graduate who is able to design reactors. • Affective and value goals At the end of the course presented, the student will possess all the necessary skills to deal with problems in catalyst .
Indicative Contents المحتويات الإرشادية	1. Heterogeneous Reactions, the Complications of the Rate Equation, contacting patterns for two-phase systems, final thoughts on flow modeling. [12 hrs] 2. Introduction to Reactor Design**:** General discussion, Symbols and Relationship between CA and X, Special Case 1. Constant Density Batch and Flow Systems, Special Case 2. Batch and Flow Systems of Gases of Changing Density but with T and. π Constant [12 hrs]. 3. Autocatalytic reactions, recycle reactor, [8 hrs]. 4 The Denbigh reactions and their special cases, [8 hrs] 5. Temperature and Pressure Effects: Single reactions, Heats of Reaction from Thermodynamics, [12 hrs] 6. Steady-State Mixed Flow Reactors, Steady-State Plug Flow Reactors [8 hrs].

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Presenting the course vocabulary to the students (lectures). 2. Assigning students assignments, such as writing research papers, so that students acquire skills for self-learning and presentation. 3. Conducting sudden exams. 4. Oral exams via e-learning platforms. 5. Conducting the semester and final exams on the specified dates.

	6. Informing students of how students' grades are calculated during the semester, their exam results, and discussing failures and successes. 7. Informing students of the curriculum books and auxiliary books that they need in the course vocabulary during a questionnaire for the previous years to improve the curriculum, improve the performance of the teachers, and raise the level of the student.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	59	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	66	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**125**		

Module Evaluation تقييم المادة الدراسية					
		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)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Heterogeneous Reactions, the Complications of the Rate Equation
Week 2	Contacting patterns for two-phase systems
Week 3	Final thoughts on flow modeling
Week 4	Introduction to Reactor Design**:** General discussion,
Week 5	Symbols and Relationship between CA and X: Special Case 1. Constant Density Batch and Flow Systems.
Week 6	Special Case 2. Batch and Flow Systems of Gases of Changing Density but with T and .π Constant
Week 7	Autocatalytic reactions
Week 8	Recycle reactor
Week 9	Mid-term Exam + The Denbigh reactions and their special cases
Week 10	The Denbigh reactions and their special cases
Week 11	Temperature and Pressure Effects: Single reactions
Week 12	Heats of Reaction from Thermodynamics
Week 13	Heats of Reaction from Thermodynamics
Week 14	Steady-State Mixed Flow Reactors
Week 15	Steady-State Plug Flow Reactors
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Chemical Reaction Engineering Third Edition Octave Levenspiel	Yes
Recommended Texts	Chemical reactors design by Fogler	Yes
Websites	https://sites.tufts.edu/andrewrosen/files/2013/09/reactor_design_guide1.pdf	

Grading Scheme
مخطط الدرجات

Group	Grade	التقدير	Marks %	Definition
Success Group	**A -** Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors

(50 - 100)	**C** - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(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
University of Tikrit
College of Petroleum Process Engineering
Department of Petroleum and Gas Refining Engineering

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information معلومات المادة الدراسية		
Module Title	HEAT TRANSFER II	**Module Delivery**
Module Type	CORE	☒ **Theory** ☐ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**
Module Code	PGR315	
ECTS Credits	4	
SWL (hr/sem	100	

)			
Module Level	UGIII	**Semester of Delivery**	5
Administering Department	PGR	**College**	PPE
Module Leader	Dr. Maha Ibrahim Salih	**e-mail**	
Module Leader's Acad. Title	Asst. Prof.	**Module Leader's Qualification**	PhD
Module Tutor	None	**e-mail**	None
Peer Reviewer Name	-	**e-mail**	-
Review Committee Approval		**Version Number**	1.0

Relation With Other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Mathematics I and II, Thermodynamic I	**Semester**	1 and 2
Co-requisites module	-	**Semester**	-
Module Aims, Learning Outcomes, Indicative Contents and Brief Description أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر			
Module Aims أهداف المادة الدراسية	This course provides a comprehensive introduction to heat transfer fundamentals and their applications. The course introduces students to the analysis of steady-state and transient one-multi dimensional heat conduction.		
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of this course students will be able to: 1. Understand a thermal system, develop the schematic diagram for the system, and apply energy balance and heat transfer models to develop governing equations. 2. Set up and solve for heat transfer rates as a function of geometry and materials in 1-D conduction using various tools: i.Material properties ii. Fourier's Law iii. Circuit Analogy		

	3. Estimate heat transfer from Extended Surfaces, Radial Geometry, and involving Energy Generation. 4. Construct a transient heat transfer analysis, testing for the lumped capacitance approximation, semi-infinite, infinite solids and understanding the assumptions. 5. Understand the approach for setting up numerical analysis for 2-D conduction heat transfer.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. 1. Introduction to heat transfer (4hrs) 2. One-dimension steady state conduction without heat generation (4hrs) 3. One-dimension steady state conduction with heat generation (4hrs) 4. Heat transfer from extended surfaces (6hrs) 5. Transient one-dimension conduction(6hrs)
Course Description	This is the first course in heat transfer, with an emphasis on understanding the fundamental physics underlying different heat transfer processes, making proper approximations for analytical heat transfer calculations and numerical methods for engineering heat transfer analysis. Topics include: introduction to three modes of heat transfer, thermal resistance network analysis, steady-state conduction, transient conduction, analytical methods for heat conduction
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The learning and teaching **strategy** is designed to: Carefully cover in lectures the necessary fundamental material and analytical techniques, and demonstrate concepts with appropriate (and where possible practical) examples Allow students adequate time to practice the techniques using a large number of carefully selected tutorial problems.

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	59	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	41	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	2.7
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

Module Evaluation
تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	20% (20)	4, 11	LO #1-4
	Assignments	4	20% (20)	Continues	All
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO # 1-4
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	Introduction to Heat transfer
Week 2	Introduction to Heat transfer
Week 3	Steady state one dimension conduction in plane wall without heat generation
Week 4	Steady state one dimension conduction in cylinder and sphere without heat generation
Week 5	Steady state one dimension conduction in plane wall with heat generation
Week 6	Steady state one dimension conduction in cylinder and sphere with heat generation
Week 7	Midterm exam
Week 8	Extended surfaces (Fins), fin general conduction analysis
Week 9	Fin efficiency
Week 10	Fin effectiveness
Week 11	Critical thickness of insulation
Week 12	lumped heat capacity system
Week 13	Unsteady state conduction in convection boundary conditions
Week 14	Transient heat flow in a semi-infinite solid
Week 15	**Preparatory Week**
Week 16	**Final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Temperature measuring instruments calibration
Week 2	Temperature measuring instruments calibration
Week 3	Temperature measuring instruments calibration
Week 4	Thermal conductivity
Week 5	Thermal conductivity
Week 6	Contact resistanc
Week 7	Contact resistanc

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Heat transfer by J.P. Holman, 10th Edition	Yes
Recommended Texts	3- Fundamentals of Heat and Mass Transfer - Incropera/DeWitt/others - Sixth Edition. 4- Mass Transfer: Fundamentals & Applications by Yunus Cengel and Afshin Ghajar.	No
Websites	-	

APPENDIX:

GRADING SCHEME مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	مقبول بقرار	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required
Note:				

NB 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 University of Tikrit College of Petroleum Process Engineering Department of Petroleum and Gas Refining Engineering	

MODULE DESCRIPTOR FORM

نموذج وصف المادة الدراسية

Module Information

معلومات المادة الدراسية

Module Title	Statistics and design of experiments	**Module Delivery**	
Module Type	Basic	☒ **Theory** ☐ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	PGR226		
ECTS Credits	3		
SWL (hr/sem)	75		
Module Level	UGII	**Semester of Delivery**	4
Administering Department	PGR	**College**	PPE

Module Leader	Raghad adnan mahdi	**e-mail**	
Module Leader's Acad. Title	lect	**Module Leader's Qualification**	MSc
Module Tutor		**e-mail**	
Peer Reviewer Name	-	**e-mail**	-
Review Committee Approval		**Version Number**	1.0

Relation With Other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	-
Co-requisites module	None	**Semester**	-
Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية			
Module Aims أهداف المادة الدراسية	Introduce students to the fundamentals of statistics, correlation, regression, and experimental design. The course covers descriptive and inferential statistics, correlation and regression coefficients, identifying the fundamental concepts of designing and analyzing experiments, learning about the various hypothesis tests and their application, addressing the analysis of variance, introducing the various designs for designing of experiments, and the method of imitating data.		
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	11. Learn the fundamentals and concepts of statistics. 12. Understand the concepts of descriptive and inferential statistics, as well as their respective measures. 13. Collect data and perform central tendency measurements and dispersion measurements. 14. Comprehend the correlation and regression. 15. Understand the fundamentals of experimental design and analysis. 16. Learn about the hypothesis tests and their applications. 17. Learn one-way and two-way analysis of variance. 18. Learn various experimental designs, their implementation, and data analysis, including the completely randomized design and the		

	randomized complete block design.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following: 1. Introduction: Statistical data, classification and tabulation of data, frequency distribution tables, cumulative frequency tables (ascending and descending), and graphical representation of data and frequency distributions [6 hrs]. 2. Measures of central tendency: Arithmetic, geometric, and harmonic means, median, upper and lower quartiles, mode, relation between means [6 hrs]. 3. Measures of dispersion: Range, quartile deviation, mean deviation, standard deviation, coefficient of variations, symmetric distribution, skewness, oblation [6 hrs]. 4. Correlation and regression: Coefficient of correlation, calculation of correlation factor, Spearman's order correlation factor, association coefficient, harmonic coefficient, regression, relation between correlation and regression coefficients [6 hrs]. 5. Fundamental principles of counting: Permutation, arrangements, and combinations, binomial theorem [3 hrs]. 6. Design of experiments: Introduction, terminology, statistical method [3 hrs]. 7. Comparison between groups: Comparison between two population means with equal and unequal variances, comparison between two population variances [3 hrs]. 8. Analysis of variance: One-way and two-way ANOVA [3 hrs]. 9. Randomized design of experiments: Completely Randomized Design and Completely Randomized Block Design [6 hrs].
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The students will be actively engaged in the tasks, which will help them develop and hone their critical thinking abilities. This will be accomplished via lectures, interactive tutorials, and assignments incorporating fascinating tasks. The course includes: 1- Numerous examples worked out in detail to illustrate the basic principles. 2- A consistent strategy for problem solving that can be applied to any problem. 3- Figures, sketches, and diagrams to provide a detailed description and reinforcement of what you read. 4- Self-Assessment Tests at the end of each section, with answers so that you can evaluate your progress in learning.

	5- Many problems will be discussed and solved in the classes and tutorials, which offer working with one or more classmates to exchange ideas and discuss the material.

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	45	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	30	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	2.1
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	75		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	20% (20)	5, 12	LO #1-3, and 7
	Assignments	4	10% (10)	Continuous	
	Case study	1	10% (10)	14	LO #8
	Report	-	-	-	-
Summative assessment	**Midterm Exam**	3 hr	10% (10)	7	LO #1-4
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري والعملي	
	Material Covered
Week 1	Introduction to statistics
Week 2	Introduction to statistics

Week 3	Measures of central tendency
Week 4	Measures of central tendency
Week 5	Measures of dispersion
Week 6	Measures of dispersion
Week 7	Correlation and regression
Week 8	Correlation and regression
Week 9	Fundamental principles of counting
Week 10	Introduction to design of experiments
Week 11	Comparison between groups
Week 12	Analysis of variance
Week 13	Randomized design of experiments
Week 14	Randomized design of experiments
Week 15	**Preparatory Week**
Week 16	**Final Exam**

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	1. Statistics and Probability in Engineering Application, Amjad I. S., Ali I. S., Mohammed R. A., 2005. 2. Design and Analyze of Experiments, Mohammed M. A., 1994. 3. Design of experiments in chemical engineering, Zivorad R. L., 2004.	No
Recommended Texts	Introduction to probability and statistics for engineers and scientists, 3rd Ed., Sheldon M. Ross.	No
Websites	www.mathway.com www.coursera.org www.stattrek.com	

APPENDIX:

GRADING SCHEME مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors

(50 - 100)	**C** - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	مقبول بقرار	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note:

NB 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.