Ministry of Higher Education & Scientific Research
Supervision and scientific evaluation directorate
Quality assurance and academic accreditation

Academic Program Specification Form For The Academic Year (2024-2025)

University: Northern Technical University

College/Institute: College of Oil and Gas Techniques Engineering/Kirkuk

Scientific Department: Renewable Energy Techniques Engineering

Deans Name:	Deans Assistant for Scientific Affairs	Head of Department
Assist.Prof. Dr.Obid Majed Ali	Assist.Prof. Dr.Galawish Nouri Taher	Assist.Prof. Dr. Naseer Tawfeeq Alwan
Date:10/10/2024	Date:10/10/2024	Date:10/10/2024
Signature:	Signature:	Signature:

The College Quality Assurance

And University Performance

Manager

Maha adnan Dawood

Date:10/10/2024

Signature:

1. Program vision

Excellence in the field of engineering education, learning and scientific research in all cognitive fields of renewable energy engineering according to locally and internationally approved standards and building bridges with the local community and support the economy using alternative energy sources with economic returns high.

2. Program message

A. to divide engineering technology energy and the renewable seeks to achieve the mission of the Northern Technical University in building an educational institution capable of keeping pace with and absorbing the continuous and ongoing development of basic sciences and their various applications.:

B. Providing the local and international private sector and the government sector with generations of engineers and workers with knowledge of the latest green energy generation technologies and the possibility of enhancing their expertise in the centers. Scientific, And research, And educational, And industrial.

C. Providing the best educational services to students in the field of studying basic sciences for the bachelor's degree to provide them with the skills required in the specialization through educational programs in accordance with international standards..

D. Contribute to the continuous development and updating of educational and research programs..

E. Play an influential role in community development through training, awareness, consulting and interactive programs between the department and the community..

F. Working to create and develop academic relations between local and regional universities through scientific and cultural exchange..

G. Deepening national loyalty and preserving the principles of society and noble human valuesand Developing creative and ethical values.

3. Program objectives

The department seeks to achieve the following strategic objectives::

Firstly:General objectives:

A. Keeping pace with global developments in all scientific fields, especially in renewable energy engineering..

B. Providing society and state institutions with scientific and technical expertise in the field of renewable energy engineering.And developing its scientific, health and environmental institutions.

C. Raising the level of performance and quality to the level of advanced international universities..

secondly:Educational objectives:

أ. Developing and updating scientific curricula, both theoretical and practical..

ب. Developing scientific competencies and performance of teachers, researchers and students.

ت. The department aims to adopt modern technologies in practical laboratories..

Thirdly:Scientific research objectives:

H. Engage in graduate studies and engineering professional issues in the labor market at all levels with emphasis on continuous career development.

I. Finding solutions to contemporary environmental problems.

J. Understanding the study of the main causes of the negative aspects prevalent in our environment and society, studying them scientifically and finding successful treatment for them..

K. Investing in energy research and sustainable development to develop industry in its various fields such as medical, chemical, food, and other industries..

L. Contributing to addressing energy-related problems in Iraq(Contributing to entrepreneurial and creative projects and continuous professional development in the local community).

Fourth:Community service objectives:

A. Supporting community activities by holding scientific seminars, conferences and practical courses in various fields of energy sciences and renewable energies..

B. Cooperating with various government departments to advance the health, environmental, industrial and agricultural reality by providing scientific expertise and research results to transfer them to the ground..

C. Seeking to advance society by expanding the general horizons related to the importance of renewable energy engineering in solving many health, environmental and industrial problems..

Fifth:Student activity objectives:

أ. Supporting student activities, cultural, social, sports and arts.

ب. Knowledge, cultural and scientific exchange with other local and international universities.

ت. Training students in our scientific, health, industrial and environmental institutions during the summer vacation.

ث. Seeking to conclude agreements with universities and departments similar to our department inside and outside the country to send distinguished students for training and to view the scientific activity there during the summer vacation..

ج. Holding an annual scientific conference for research projects (graduation projects) and honoring the distinguished ones among them.

4. Programmatic accreditation

Nothing

5. Other external influences

Nothing

6. Program Structure

Comments *	Percentage	Study unit	Number of courses	Program Structure
Basic course	9.583%	23	9	**Institutional Requirements**
Basic course	21.25%	51	8	**College Requirements**
Basic course	69.166%	166	27	**Department Requirements**
			There is	**Summer training**
				Other

* Notes may include whether the course is basic or optional.

7. Program Description

Credit hours		Course name	Course code	Year/Level
	theoretical			2023-2024 /

Graduation Requirements										
Level 1:										
No.	Subject code	Subject	ECTS	Weekly hours						
				CL.	Lect.	Lab.	Pr.	Tut.	Semn.	
1	NTU 101	English Language	2.00	2						
2	RETE 100	Mechanics Engineering / Static	7.00	3				2		
3	COGTEK 100	Mathematics Principles	7.00	3				2		
4	RETE 102	Electrical Technology	6.00	2		2		1		
5	RETE 103	Workshop	6.00			6				
6	NTU 100	Human Rights & Democracy	2:00	2						
7	RETE 104	Thermodynamics' Principles	9.00	3		2		2		
8	NTU 102	Computer	3.00	1		1				
9	RETE 101	Eng. Mechanics/ Dynamics	8.00	3				2		
10	COGTEK 101	Engineering Drawing	8.00	1		3				
11	NTU 103	Arabic Language	2.00	2						

Graduation Requirements									
Level 2									
No.	Subject code	Subject	ECTS	Weekly hours					
				CL.	Lect.	Lab.	Pr.	Tut.	Semn.
1	COGTEK 200	Fluid Mechanics	7.00	3		2		1	
2	COGTEK 201	Mathematics	7.00	3				2	
3	RETE 200	Electronics	7.00	3		2		1	
4	RETE 201	Mechanical Drawing	5.00	1		3			

5	NTU 200	Baath Crimes	2.00	2					
6	NTU 201	English Language	2.00	2					
7	RETE 202	Strength of Materials	6.00	3		2		1	
8	RETE 203	Electronics circuits	6.00	3		2		1	
9	RETE 204	Refrigeration & Air Conditioning Principles	5.00	2		2			
10	RETE 205	Electric machines	5.00	2		2		1	
11	NTU 202	Computer	2.00	1		1			
12	NTU 203	Arabic Language		2					

Graduation Requirements									
Level 3:									
No.	Subject code	Subject	ECTS	Weekly hours					
				CL.	Lect.	Lab.	Pr.	Tut.	Semn.
1	RETE 300	Conduction and radiation heat transfer	7.00	3		2		1	
2	COGTEK 300	Engineering Analysis	6.00	2		1		1	
3	RETE 302	Renewable Energy Systems	6.00	2		2			1
4	RETE 303	Power electronics	5.00	2		2			
5	RETE 304	Gas dynamics	6.00	2		2			
6	RETE 305	Solar Energy Engineering	6.00	2		2		1	
7	RETE 306	Biofuel	5.00	2		2			1
8	RETE 301	Convection heat transfer, and heat exchanger design	7.00	3		2		1	
9	RETE 307	Combustion and Pollution Engineering	6.00	2		1		1	
10	COGTEK 301	Numerical Analysis	6.00	2		2		1	

Graduation Requirements

Level 4:									
No.	Subject code	Subject	ECTS	Weekly hours					
				CL.	Lect.	Lab.	Pr.	Tut.	Semn.
1	RETE 400	Wind energy	5.00	2		2			1
2	RETE 401	Solar Photovoltaic Conversion	5.00	2		2			1
3	RETE 402	Simulation of renewable energy systems	6.00	2		2		1	
4	COGTEK 400	Engineering projects management and its risks	4.00	2				1	1
5	RETE 404	Power Plants	5.00	2		2			1
6	NTU 400	Methodology of Scientific Research	5.00	2					1
7	RETE 405	Design of solar renewable systems	6.00	2		2			1
8	RETE 406	Store and recover Energies	5.00	2		2			
9	RETE 407	Control systems	5.00	2		2			
10	RETE 403	Computer-based modeling and simulation of renewable energy systems	8.00	2		4			
11	COGTEK 401	Graduation Project	6.00	1			3		1

8. Expected learning outcomes of the program

Knowledge

A- Cognitive objectives.

1- Keeping pace with global developments in all scientific fields, especially in renewable energy engineering.

2- To provide students with an understanding of the engineering principles of renewable energy technology engineering.

3- Enabling students to gain knowledge and understanding in working on modern renewable energy systems and in analyzing programs related to those systems.

4- Enabling students to gain knowledge and understanding of troubleshooting and maintenance of various renewable energy devices.

	5- Enabling the student to analyze and design renewable energy systems.
Skills	
	for-Skill objectives of the program: 1 - Explaining the topics of the foundations of renewable energy engineering by specialists in the subject, with emphasis on using mathematics as a basis for understanding and learning. 2- Provide them with skills to solve practical problems related to power generation systems. 3- Introducing the student to the basics of renewable energy generation. 4- The focus is on the topics of designing, analyzing, developing and controlling industrial systems using control systems.
Values	
	C- Emotional and value-based goals: 1- Enabling students to think and analyze topics related to the engineering framework, such as various electrical circuits, electrical power transmission systems, and programmable control systems in the field of industrial application of renewable energy. 2- Enabling students to think and analyze topics related to computer systems related to the engineering framework. 3- Enable students to think and analyze topics related to solving practical problems related to renewable energy systems.

9. Teaching and learning strategies

1- Explaining engineering theories related to the field of generation and transmission of electrical power.

2- Forming discussion groups during or outside lectures to discuss scientific engineering topics that require thinking and analysis.

3- Providing students with the basics and additional topics related to the previous learning outcomes of skills to solve practical problems.

4- Solving a set of practical examples by academic staff specialized in the field of renewable energy engineering

5- Assigning students homework on complex problems in preparation for moving on to the stage of solving practical problems.

6- During the lecture, students participate in solving some practical problems.

7- The department's scientific laboratories are supervised by academic staff specialized in renewable energy engineering.

10. Evaluation methods

1- Asking surprise questions to students in the classroom on topics that have been previously explained as a prelude to explaining advanced topics.
2- Daily exams with questions related to practical problems.
3- Participation scores for competitive questions among students.
4- Setting grades for scientific projects assigned to the student.
5- Grading homework and reports the student is responsible for it.
6- Semester exams for the curriculum in addition to the mid-year exam and the final exam.
7- Active participation in the classroom is evidence of the student's commitment and responsibility..
8- Commitment to the deadline for submitting the required assignments and reports from the student.
9- Midterm and final exams reflect the student's commitment, knowledge and skill achievement..

11. Faculty

Faculty members

Faculty preparation		Special requirements/skills (if any)		Specialization		Academic Rank
lecturer	angel			private	general	
	angel			Thermal energy/renewable energy	theengineering theMechanics And	assistant professor
	angel			Biochemistry	sciences	assistant professor
	angel			Thermals	Mechanical Engineering	Teacher
	angel			Electronics	Electrical and Electronic	Assistant Professor

					Engineering	
	angel			Thermals	Mechanical Engineering	Assistant Professor
	angel			Geometry Engineering	Geology	Assistant Professor
	angel			mathematics	Mathematics education	Assistant Professor
	angel			mathematics	sciencesmathematics	Assistant Professor
	angel			Thermals	Fuel and energy	Assistant Professor
	angel			Materials Physics	physics	Assistant Professor
	angel			law	law	Assistant Professor
	angel			Literature	Arabic	Assistant Professor

Professional development
Orientation of new faculty members
Through seminars, workshops and conference attendance
Professional development for faculty members
Through conferences, seminars, discussion groups and the attendance of faculty members at postgraduate discussions.

12. Acceptance Criteria

- AccreditationAdmission requirements for students according to the regulations of the Ministry of Higher Education and Scientific Research (Central Admission)
- passingPersonal interview for the department.
- thatBe fit for medical examination.
- an averageGraduation from middle school.
- EnergyDepartment capacity.

13. The most important sources of information about the program

- Needs the market.
- Trends local to the governorate.
- Studies and questionnaires.

14. Program development plan

- **In-country training courses**
- **Training courses outside Diameter**

Program Skills Chart															
Required learning outcomes of the program															
Values				**Skills**				**Knowledge**				**Basic or Selective**	**Course name**	**Course code**	Year/Level
A4	**A3**	**A2**	**A1**	**B4**	**B3**	**B2**	**B1**	**A4**	**A3**	**A2**	**A1**				
*	*	*	*	*	*	*	*	*	*	*	*	**Basic**	English language	NTU 101	2023-2024/ First
				*	*	*	*	*	*	*	*	**Basic**	Engineering/static mechanics	RETE 100	
				*	*	*	*	*	*	*	*	**Basic**	Principles of mathematics	COGTEK 100	
				*	*	*	*	*	*	*	*	**Basic**	Electrical Technology	RETE 102	
				*	*	*	*	*	*	*	*	**Basic**	Laboratories	RETE 103	
				*	*	*	*	*	*	*	*	**Basic**	Human rights and democracy	NTU 100	
				*	*	*	*	*	*	*	*	**Basic**	Thermodynamics	RETE 104	
*	*	*	*	*	*	*	*	*	*	*	*	**Basic**	Computer	NTU 102	
				*	*	*	*	*	*	*	*	**Basic**	Engineering Mechanics/Kinematics	RETE 101	
				*	*	*	*	*	*	*	*	**Basic**	Engineering drawing	COGTEK 101	
*	*	*	*	*	*	*	*	*	*	*	*	**Basic**	Arabic	NTU 103	

				*	*	*	*	*	*	*	*	**Basic**	Fluid mechanics	COGTEK 200	2024-2025/ Second
				*	*	*	*	*	*	*	*	**Basic**	mathematics	COGTEK 201	
				*	*	*	*	*	*	*	*	**Basic**	Electronics	RETE 200	
				*	*	*	*	*	*	*	*	**Basic**	mechanical drawing	RETE 201	
*	*	*	*	*	*	*	*	*	*	*	*	**Basic**	Baath Party Crimes	NTU 200	
*	*	*	*	*	*	*	*	*	*	*	*	**Basic**	English language	NTU 201	
				*	*	*	*	*	*	*	*	**Basic**	material resistance	RETE 202	
				*	*	*	*	*	*	*	*	**Basic**	Electronic circuits	RETE 203	
				*	*	*	*	*	*	*	*	**Basic**	Principles of refrigeration and air conditioning	RETE 204	
				*	*	*	*	*	*	*	*	**Basic**	Electrical machines	RETE 205	
*	*	*	*	*	*	*	*	*	*	*	*	**Basic**	Computer	NTU 202	
*	*	*	*	*	*	*	*	*	*	*	*	**Basic**	Arabic	NTU 203	
				*	*	*	*	*	*	*	*	**Basic**	Heat transfer by conduction and radiation	RETE 300	2025-

				*	*	*	*	*	*	*	*	**Basic**	Engineering analysis	COGTEK 300	2026/Third
				*	*	*	*	*	*	*	*	**Basic**	Renewable energy systems	RETE 302	
				*	*	*	*	*	*	*	*	**Basic**	Power electronics	RETE 303	
				*	*	*	*	*	*	*	*	**Basic**	Gas dynamics	RETE 304	
				*	*	*	*	*	*	*	*	**Basic**	Solar energy engineering	RETE 305	
				*	*	*	*	*	*	*	*	**Basic**	Biofuel	RETE 306	
				*	*	*	*	*	*	*	*	**Basic**	Convection heat transfer, heat exchanger design	RETE 301	
				*	*	*	*	*	*	*	*	**Basic**	Combustion and Pollution Engineering	RETE 307	
				*	*	*	*	*	*	*	*	**Basic**	Numerical analysis	COGTEK 301	
				*	*	*	*	*	*	*	*	**Basic**	Wind energy	RETE 400	2026-2027/ Fourth
				*	*	*	*	*	*	*	*	**Basic**	Photovoltaic energy conversion	RETE 401	
				*	*	*	*	*	*	*	*	**Basic**	Renewable energy systems simulation	RETE 402	
				*	*	*	*	*	*	*	*	**Basic**	Engineering Project Management and Risks	COGTEK 400	

				*	*	*	*	*	*	*	*	**Basic**	Power plants	RETE 404	
*	*	*	*	*	*	*	*	*	*	*	*	**Basic**	Scientific research methodology	NTU 400	
				*	*	*	*	*	*	*	*	**Basic**	Renewable energy systems design	RETE 405	
				*	*	*	*	*	*	*	*	**Basic**	Energy storage and recovery	RETE 406	
				*	*	*	*	*	*	*	*	**Basic**	Control systems	RETE 407	
				*	*	*	*	*	*	*	*	**Basic**	Modeling and simulation of renewable energy systems using computers	RETE 403	
				*	*	*	*	*	*	*	*	**Basic**	Graduation project	COGTEK 401	

- **Please tick the boxes corresponding to the individual learning outcomes of the programme being assessed.**

Course Description

Level 1

Module 1 Subject information					
Module Title	**English Language**			**Module Delivery**	
Module Type	**Basic**			☒**Theory** ☐**Lecture** ☐**Lab** ☐**Tutorial** ☐**Practical** ☐**Seminar**	
Module Code	**NTU 101**				
ECTS Credits	**2**				
SWL (hr/sem)	**50**				
Module Level		UGx11 1	**Semester of Delivery**		1
Administering Department		RETE	**College**	College of Oil & Gas Techniques Engineering/Kirkuk	
Module Leader	Noor Saad Abd aljaleel		e-mail	noor.saad23@ntu.edu.iq	
Module Leader's Acad. Title		Assist. Lecture	**Module Leader's Qualification**		MSc
Module Tutor			e-mail		
Peer Reviewer Name		Name	e-mail	Email	
Scientific Committee Approval Date		06/01/2023	**Version Number**	1.0	

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	1. To develop problem solving skills and understanding of circuit theory through the application of techniques. 2. Developing strategies to produce more coherent writing and to make clear appropriate, and relevant notes from academic texts. 3. Encouraging them to adopt diverse approaches for dealing with new unknown vocabulary by practicing effective use for dictionaries and through making effective vocabulary records. 4. Exploring and evaluating research technologies and resources and crediting source information. 5. Promoting learner independence by encouraging students to return to earlier study skills to refresh their memories or see how new skills build on and develop those previously presented.
Module Learning Outcomes	1. Students will identify topics and formulate questions. 2. Identify appropriate methods and sources for research 3. engage ethically with sources. 4. Oral Communication. 5. Identify literary techniques and creative uses of language in literary texts. 6. Adapt their texts to particular audiences and purposes 7. Apply relevant theoretical concepts to literary or other texts and practices 8. Describe their own writing practices and how they have evolved 9. Plan, structure and give a presentation in English using a stock of typical phrases and visuals effectively 10. Use appropriate strategies for asking and responding to questions, as well as summarizing speaker's ideas during the Q&A sessions 11. Use appropriate language for managing and participating in a round-table discussion 12. . Prepare for and take part in a panel discussion as a panelist
Indicative Contents	Indicative content includes the following. It is often seen as a relatively formal and complex English language that conveys ideas in an accurate and objective manner. It is generally known to include the basic skills of literary analysis, adherence to repositories, synthesis of associated scholars, and the ability to critically evaluate. Basic academic vocabulary, phrases, and grammatical

	complexity are often used in academic dialogue and texts. Specifically, academic English refers to words and practices that are not necessarily common or frequently encountered in informal conversations and circumstances. 1- **Student life Reading**: who to read ways of reading, methods reading, **punctuation**: capital letters, full stop, and question mark, **linking idea:** and but joints sentence, **Rules**: present simple, **checking your writing**, error in spelling, capital letters, punctuation and grammar. 2- **Daily routine, reading:** working and stress, **predicting content**: using picture in a text, Writing: routine and procedure, Hand writing: making hand written work clear and easy to read, **paragraph**: block and intended styles **linking idea**: sequencing word, first, after, then, finally. finally 3- **People and the environment, Reading:** weather, **Scanning**: using headings, **meaning from context**: guessing the meaning from the new word, **Writing**: describing our lives, **punctuation**: apostrophes, **rules**: talking about frequency, 4- **Architecture reading:** famous building, **making notes**: notes from study, intensive reading labeling diagram, **Research**: finding information, asking your self question**, linking idea**: expressing reason, because, express result, so, **word and phrases**: language to describe building 5- **Education, reading:** universities, **predicting content**: using the title and the first few sentences, linking ideas: expressing contrast – however, **writing**: formal letters and emails, **greetings and endings**: dear, yours, **word and phrases**: languages for letters and emails 6- **Technology, reading:** invention, **getting information from website**: skimming and scanning to find useful information, **using visual in web sites**: getting extra information from diagram and pictures, **Writing definition**: using which or that to describe things, giving examples: supporting definition with example. 7- **Food drink and culture**, **reading**: food from other countries, **topic sentence**: using topic sentence to help understanding, **writer opinion**: identifying writer opinion, **punctuation**: commas, linking ideas, in addition and, **using pronouns**: avoiding repetition. 8- **Cites of the world, reading:** city life, looking at data: table, chart, & graph, getting facts from text: using heading to help your information, **rules**: comparatives and superlatives, **linking ideas**: using relative pronouns which and where. 9- **Brain power, reading:** a healthy brain, in other word: using pronouns and synonyms to avoid repetition, **making notes**: organizing notes, **common mistake**: typical grammar rules, summaries: summarizing the main point of a text

	10- **Staying alive, reading: dangerous disease of our time, using what you know:** using your own knowledge to help you understand a text, using a reference to understand a text: pronouns .adjective ,adverb

Learning and Teaching Strategies	
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 types of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL) The student's academic load is calculated for 15 weeks.			
Structured SWL (h/sem) **Regular student load during the semester**	33	**Structured SWL (h/w)** **Regular weekly student load**	(33/15) =2.2
Unstructured SWL (h/sem) **Irregular student load during the semester**	17	**Unstructured SWL (h/w)** **Irregular student load per week**	(18/15)=1.13
Total SWL (h/sem) **The student's total academic load during the semester**	**50**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
	Quizzes	3	15% (15)	5, 8, and 10	LO #3 and #6, #13

Formative assessment	Assignments	3	15% (15)	4,6, 8,10, and 12	LO #5,7, 9, 11, and #13
	Projects				
	Seminar	1	10% (10)	13	LO #8
Summative assessment	**Midterm Exam**	1hr	10% (10)	7	LO #9
	Final Exam	3 hours	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction to the academic English
Week 2	Student life **Reading Skills**, way of reading.
Week 3	Student life **Writing skills** punctuation, linking idea. Checking your writing, Writing about people. **vocabulary development**., part of speech, A dictionary you're writing about people
Week 4	Daily Routine **Reading Skills** predicting content, skimming
Week 5	Daily Routine **Writing skill s**hand writing, paragraph .linking idea .writing about routine & procedure Vocabulary development, colocation jobs ending - in or er ist
Week 6	People & the environment Reading skills scanning using headings meaning from context

Week 7	People & the environment Writing skills punctuation talking about frequency of writing about study habits Research sources
Week 8	Architecture Reading skills making notes Research focusing your search
Week 9	Architecture Writing skills linking idea word & phrases writing about building Vocabulary development Dictionary entry countable and uncountable nouns
Week 10	Educations Reading skills predicting content linking idea Writing skills greeting and ending in formal letters word and phrases writing a letter or email Vocabulary developments plurals
Week 11	Technology Reading skills getting information from web site using visual in websites Writing skills writing definition giving example writing a description for a device Vocabulary development Homophones Research websites
Week 12	Food drink and culture Reading skills topic sentence writing opinion Writing skills punctuation linking ideas using pronouns writing about food and drink Vocabulary development prefixes
Week 13	Cites of the word

	Reading skills looking at data getting facts from text Writing skills comparatives and superlatives linking idea writing about cites Research finding facts and figure Vocabulary development word attack skills
Week 14	Brain power Reading skills in other words making notes Writing skills common mistake summaries writing a summary Research books
Week 15	Staying alive Reading skills using what you know using reference to understand text focusing on statics Writing skills linking ideas word and phrases writing about statics Vocabulary development word or figures learning a words synonyms and anatomy
Week 16	**Preparatory week before the final exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	[1] R. Harrison,academic skills Level 1 students books. UK: Oxford, 2011. [2] John and Liz Soar. (New Headway Beginner) 4th edition. Oxford: Oxford University Press.	Yes
Recommended Texts		
Websites		

Module 2
Subject information

Module Title	**Mechanics Engineering /static**	**Module Delivery**	
Module Type	**Core**		**☒Theory**
Module Code	**RETE 100**		**☐Lecture**
ECTS Credits	**7**		**☐ Lab**
SWL (hr/sem)	**175**		**☒Tutorial**
			☐Practical
			☐Seminar

Module Level	UGx11 1	**Semester of Delivery**	1
Administering Department	RETE	**College**	College of Oil & Gas Techniques Engineering/Kirkuk
Module Leader		e-mail	
Module Leader's Acad. Title		**Module Leader's Qualification**	
Module Tutor		e-mail	
Peer Reviewer Name	Name	e-mail	Email
Scientific Committee Approval Date	06/01/2023	**Version Number**	1.0

Relation with other Modules

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

Module Aims, Learning Outcomes and Indicative Contents

Course objectives, learning outcomes and guiding content

Module Aims **Subject objectives**	1. To develop problem solving skills and understanding of mechanics theory through the application of techniques. 2. To understand Force, Moment and Couple from a given machine. 3. Covers the fundamentals of mechanics and mechanical machine components.

	4. To understand friction and equilibrium problems. 5. To calculate centroids and moments of inertia.
Module Learning Outcomes	1. Explain the principles of static equilibrium. 2. Recognize how mechanics work in mechanical machines. 3. Describe force, moment, and couple. 4. Solve problems related to the forces in truss members using the method of joints and the method of sections. 5. Identify types of forces. 6. Define types of friction. 7. Use Free Body Diagrams to solve static problems involving components and pulley systems. 8. Explain the concept of equilibrium used in problem-solving. 9. Solve problems related to work and balance.
Indicative Contents	Indicative content includes the following. • Mechanics: is the physical science that deals with the effects of forces on objects. • Branches of Mechanics: Statics, Dynamics, Strength of Materials. • Statics: is the study of rigid bodies that are in equilibrium. • Two kinds of quantities are used in engineering mechanics: A scalar quantity has only magnitude (mass, time, temperature, etc.). A vector quantity has both magnitude and direction (force, velocity, etc.). • Rigid Body: a body is considered rigid when the changes in distance between any two of its points are negligible under any condition. • External Force: When a force is applied to a body, it is called an external force. • Internal Force: the resistance to deformation or change of shape exerted by the material of a body is called an internal force. • Collinear Forces: forces whose lines of action pass through a common point are called concurrent forces. • Concurrent Forces: forces whose lines of action pass through a common point are called concurrent forces. • Resultant: a single force that can replace two or more forces and produce the same effect on the body as all the forces combined. The results of these two forces can be determined analytically or graphically. • When a body moves or tends to move over another body, a force opposing the motion develops at the contact surfaces. This force, which opposes the movement or the tendency of movement, is called Frictional Force or Friction.

Learning and Teaching Strategies	
Strategies	• Clearly define the learning objectives for the unit. Students should understand what they are expected to learn and achieve by the end of the unit. • Promote active learning by engaging students in hands-on activities, problem-solving exercises, and group discussions. This helps students actively participate in the learning process and enhances their understanding of mathematical concepts. • Support Learning: Build the unit in a way that builds on previously learned concepts. Start with foundational topics and gradually progress to more complex ideas. Provide clear explanations and examples to support students' understanding at each stage. • Link mathematical concepts to real-life applications to demonstrate their relevance and practicality. Show students how mathematics is used in various fields and professions, which will enhance their appreciation of the subject. • Utilize technology tools and resources to enhance the teaching and learning experience. Interactive software, online simulations, graphing calculators, and educational apps can help students visualize and explore mathematical concepts.

Student Workload (SWL) The student's academic load is calculated for 15 weeks.			
Structured SWL (h/sem) **Regular student load during the semester**	78	**Structured SWL (h/w)** **Regular weekly student load**	5.3
Unstructured SWL (h/sem) **Irregular student load during the semester**	97	**Unstructured SWL (h/w)** **Irregular student load per week**	6.4
Total SWL (h/sem) **The student's total academic load during the semester**	175		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	5	20% (20)	2, 4, 7, 9, 11	LO # 3, 5, 7, 9, 11 and 13
	Assignments	5	10% (10)	5, 7,9,11,13	LO #4, 5,8,10, and 12
	Projects	2	10% (10)	6.11	LO #5, and 10
Summative assessment	**Midterm Exam**	2hr	10% (10)	11	LO #1-8
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Core concepts: Concepts of weight, force, moments, units, center of gravity, Vector Algebra
Week 2	Vector quantities and scalar quantities .2D resolve force
Week 3-4	Force Systems: Component forces and Resultant forces.
Week 5	Resultant Forces examples and Dot product
Week 5	Moment
Week 6	Couple
Week 7-8	Equilibrium: System Isolation, Free Body Diagram, 2-D and 3-D equilibrium equations
Week 9-10	Friction
Week 11	Exam
Week 12	Centers of Mass and Centroids: Center of Mass, Centroids of Lines, Areas and Volumes

Week 13	Area Centroid under curve
Week 14	Wight Centroid
Week 15	**Preparatory week before the final exam**
Week 16	**The week of final exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	ENGINEIRING MECHANICS STATICS, JL MERIAM, LG KRAIGE, JN BOLTON, SI Version	Yes
Recommended Texts	ENGINEERING MECHANICS STATICS, R. C. Hibbeler, Plarson	yes
Websites		

Module 3 **Subject information**				
Module Title	**Mathematics Principles**		**Module Delivery**	
Module Type	**Core**		☒**Theory**	
Module Code	**COGTEK 100**		☐**Lecture**	
ECTS Credits	**7**		☐**Lab**	
SWL (hr./sem.)	**175**		☒**Tutorial**	
			☐**Practical**	
			☐**Seminar**	
Module Level	UGx11 1	**Semester of Delivery**	1	
Administering Department	RETE	**College**	College of Oil & Gas Techniques Engineering/Kirkuk	
Module Leader	Ali Jasim Mohammed	e-mail	ali.jasim@ntu.edu.iq	

Module Leader's Acad. Title	Assist. Lecturer	**Module Leader's Qualification**	MSc
Module Tutor	Name (if available)	e-mail	Email
Peer Reviewer Name	Name	e-mail	Email
Scientific Committee Approval Date	06/01/2023	**Version Number**	1.0

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	1. To provide students with a foundation in basic mathematical concepts, this foundation is essential for further studies in advanced mathematics and its applications. 2. To develop a foundation in mathematical concepts, principles, and problem-solving techniques. 3. To enhance logical reasoning, critical thinking, and analytical skills. 4. To promote mathematical literacy and numeracy among students. 5. To develop students' ability to analyze problems and apply mathematical principles to solve complex problems in various contexts. 6. Mathematics is essential for developing numerical literacy, which involves understanding and working with numbers, data, measurements, and calculations.
Module Learning Outcomes	1. Determinants: • Understand the concept of determinants and their properties. • Calculate determinants of matrices of various sizes. Apply determinants in solving systems of linear equations. • Use determinants to find the inverse of a matrix. 2. Trigonometric Functions: • Understand and apply the definitions of trigonometric functions such as sine, cosine, tangent, cosecant, secant, and cotangent. • Solve trigonometric equations. Apply trigonometric identities and formulas to simplify expressions and solve problems involving angles and triangles.

	3. Vectors: • Define and understand vectors in two and three dimensions. • Perform vector operations such as addition, subtraction, scalar multiplication, and dot product. Calculate vector magnitudes and directions. Solve geometric and algebraic problems involving vectors. • Apply vector concepts to physical and engineering problems, including forces, velocity, and displacement. 4. Limits: • Understand the concept of a limit. Evaluate limits algebraically and graphically. Apply limit properties and theorems to find limits of functions. • Determine the continuity of a function at a point. Solve problems involving infinite limits and limits at infinity. 5. Derivatives: • Define the derivative as the instantaneous rate of change of a function. • Calculate derivatives using various differentiation rules, including the power rule, product rule, quotient rule, and chain rule. • Apply derivatives to analyze functions, Understand the relationship between the graph of a function and its derivative. • Solve related rates problems using derivatives. 6. Integration: • Understand the concept of integration. Calculate definite and indefinite integrals using various integration techniques, such as substitution, integration by parts, and trigonometric substitution. • Apply integration to find areas between curves, volumes of solids of revolution, and other applications in physics and engineering. • Use integration to solve differential equations and represent inverse derivatives.
Indicative Contents	Indicative content includes the following. • Determinants and their properties: This topic involves understanding determinants, their properties, and their applications, including solving linear equations using Cramer's method. • Trigonometric functions: This includes studying the properties and graphs of trigonometric functions, trigonometric relationships and identities, and their applications in solving equations and various other contexts. • Vectors: This topic focuses on vector arithmetic operations in two and three-dimensional spaces, vector projections, orthogonal components, and their applications in finding areas of shapes.

	• Limits: Understanding the concept of limits of functions, including algebraic and trigonometric functions, as well as limits at infinity. Applications of limits are also explored. • Derivatives: Studying derivatives of algebraic and trigonometric functions, implicit functions, and inverse functions. The chain rule and applications of derivatives, particularly in mechanical engineering, are covered. • Hyperbolic functions: This involves derivatives of hyperbolic functions and inverse hyperbolic functions, drawing graphs, and their applications in physical and mechanical contexts. • Integration: Integration theory, definite and indefinite integration, integration of various functions including trigonometric, logarithmic, exponential, and hyperbolic functions. Methods of integration, such as integration by parts, partial fractions, and substitution, are also explored. Applications of integration in physics, engineering, and finding areas under curves and volumes of revolution are covered. • Differential equations: Simplifying differential equations is discussed, along with numerical integration methods such as the Trapezoidal Rule and Simpson's Rule, and their applications.
Learning and Teaching Strategies	
Strategies	• Clearly define the learning objectives for the unit. Students should understand what they are expected to learn and achieve by the end of the unit. • Active learning by engaging students in hands-on activities, problem-solving exercises, and group discussions. This helps students to actively participate in the learning process and enhances their understanding of mathematical concepts. • Supported Learning: Build the unit in a way that builds on previously learned concepts. Start with foundational topics and gradually progress to more complex ideas. Provide clear explanations and examples to support students' understanding at each stage. • Link mathematical concepts to real-life applications to prove their relevance and practicality. Show students how mathematics is used in various fields and professions, which will enhance their appreciation of the subject. • Use technology tools and resources to enhance the teaching and learning experience. Interactive software, online simulations, graphing calculators, and

	educational apps can help students visualize and explore mathematical concepts.

Student Workload (SWL) The student's academic load is calculated for 15 weeks.			
Structured SWL (hr./sem.) **Regular student load during the semester**	78	**Structured SWL (hr./w)** **Regular weekly student load**	5.2
Unstructured SWL (hr./sem.) **Irregular student load during the semester**	97	**Unstructured SWL (h/w)** **Irregular student load per week**	6.46
Total SWL (hr./sem.) **The student's total academic load during the semester**	175		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	5	20% (20)	3, 5, 7, 10 and 13	LO #1, #3, #8, #12, #14
	Assignments	5	15% (15)	3, 4, 7,12 and 14	LO #2, #4, #6, #8, #10
	Projects /Lab.				
	Report	1	5%(5)	10	LO 7#
Summative assessment	**Midterm Exam**	2 hrs.	10% (10)	7	LO #1 - 2
	Final Exam	3hr.	50% (50)	16	All

Total assessment	100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Determinants and their properties - Determinants of n degree - Solving Linear Equations by Cramer's Method - Applications to Determinants.
Week 2	Trigonometric functions - Graph of Trigonometric Functions- Trig. relationships and identities - Trigonometric applications and equations - various applications on trigonometric functions.
Week 3	Vectors - vector arithmetic operations in two and three-dimensional spaces - Vector Projections & Orthogonal Components - orthogonal vectors and unit vectors - Calculate vector scales, scalar and vector projections - Application of vectors to find area of shapes.
Week 4	limits - Limit of a Function -The limits of algebraic and trigonometric functions and the limits of functions At Infinity (∞) - Applications on limits The Limit
Week 5	derivatives- Composite Functions - Derivatives of algebraic and trigonometric functions - Derivatives of Implicit Functions - chain rule - Applications of Derivatives (Mechanical Engineering)
Week 6	Derivative of inverse functions - Derivative of Inverse Trigonometric Functions - Various applications. Derivatives of Logarithmic and Exponential Functions.
Week 7	Hyperbolic functions - Derivatives of Hyperbolic Functions - The derivative of Inverse Hyperbolic Functions - Drawing and Graphs of Hyperbolic Functions and their Inverses relations - Physical and Mechanical applications.
Week 8	Integration - Integration Theory - Definite and Indefinite Integration - Integration of Trigonometric and Inverse Functions.
Week 9	Integration of Logarithmic and Exponential Functions - Integration of Hyperbolic and Inverse Functions - Improper Integral and Hospital's Rule.
Week 10	Methods of integration: Integration by parts - Integration by Partial Fractions -
Week 11	Integration by substituting the trigonometric function - Integration by completing the square...etc. -

Week 12	Physical and engineering Applications of Integration - The area is under a curve and between two curves.
Week 13	Volume of Revolution - Arc Length of a Curve (Integration Application)
Week 14	simplify differential equations
Week 15	Numerical Integration - Trapezoidal Rule & Simpson's Rule - Numerical Integration Method - Applications.

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Thomas' Calculus" by George B. Thomas Jr., Maurice D. Weir, and Joel Hass	Yes
Recommended Texts	Advanced Engineering Mathematics" by Erwin Kreyszig	No
	"Calculus" by Michael Spivak	No
Websites	https://www.khanacademy.org	

Module 4 **Subject information**			
Module Title	**Electrical technology**	**Module Delivery**	
Module Type	**Core**	☒**Theory**	
Module Code	**RETE 102**	☐**Lecture**	
ECTS Credits	**6**	☒**Lab**	
SWL (hr/sem)	**150**	☒**Tutorial** ☐**Practical** ☐**Seminar**	
Module Level	1	**Semester of Delivery**	1
Administering Department	RETE	**College**	College of Oil & Gas Techniques Engineering/Kirkuk

Module Leader	Naseer Tawfeeq Alwan	e-mail	naseer.t.alwan@ntu.edu.iq
Module Leader's Acad. Title	Lecturer	Module Leader's Qualification	PhD
Module Tutor	Naseer Tawfeeq Alwan	e-mail	naseer.t.alwan@ntu.edu.iq
Peer Reviewer Name	Name	e-mail	Email
Scientific Committee Approval Date	06/01/2023	**Version Number**	1.0

Relation with other Modules

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

Module Aims, Learning Outcomes and Indicative Contents

Module Aims	1- Connect electrical circuits and compare theoretical results with practical 2- Introduce the student to understand electrical theories and prove them in practice
Module Learning Outcomes	1. To familiarize the student with the importance of the most important electrical principles 2. Learning Outcomes, Teaching, Learning and Assessment Methods 3. To distinguish the electrical components and parts and their working principle.
Indicative Contents	Indicative content includes the following. Part A -Principles of circuits To develop the student's mental ability to connect simple and complex circuits. The student learns how to develop a strategy to change a complex circuit to a simple circuit with the same results. Part B –Principles to connect circuits. The student learns to connect circuits according to the circuit diagram.

Learning and Teaching Strategies

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)

The student's academic load is calculated for 15A week

Structured SWL (h/sem) **Regular student load during the semester**	78	**Structured SWL (h/w)** **Regular weekly student load**	5.2
Unstructured SWL (h/sem) **Irregular student load during the semester**	72	**Unstructured SWL (h/w)** **Irregular student load per week**	4.8
Total SWL (h/sem) **The student's total academic load during the semester**	150		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	10% (10)	5, 10	LO#7and #11
	Assignments	4	10% (10)	2,4,7, and 12	LO #3, #5, #9 and #12
	Projects /Lab.	2	10% (10)	Continuous	LO #3 and #6
	Report	10	10% (10)	Continuous	LO#3,#5,#6,#7,#8#,#9 ,#10,#11,#13
Summative assessment	**Midterm Exam**	2 hours	10% (10)	7	LO #1 - #2
	Final Exam	3 hours	50% (50)	16	All

Total assessment	100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	How to use measuring devices for the purpose of measuring (R, I, V)
Week 2	Ohm's law Connecting resistors to mixed parallel
Week 3	Kirchhoff's law for voltage and current
Week 4	Applications of Kirchhoff's law
Week 5	Thevenin Theory
Week 6	Norton Theory
Week 7	Tractorism Theory
Week 8	Nodal theory
Week 9	Series circuits consisting of a coil
Week 10	Parallel circuits consisting of a coil
Week 11	Series circuits consisting of a capacitor
Week 12	Parallel circuits consisting of a capacitor
Week 13	Resonant circuit
Week 14	Applications of series circuits
Week 15	Applications of parallel circuits
Week 16	Preparatory week before the final exam
Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered

Week 1	Connecting avow-meter with resistance
Week 2	Connecting resistance with power supply
Week 3	Applications
Week 4	Connecting two circuits and measuring the voltage for each resistance
Week 5	Applications
Week 6	Connecting two circuits and measuring the current at each resistance
Week 7	Applications
Week 8	Resonance theory for electrical circuits
Week 9	Resonance circuits and their applications
Week 10	Make a simple equivalent circuit equivalent to the original circuit
Week 11	Applications
Week 12	Making half and full rectifier wave circuits
Week 13	Applications
Week14	Find a load that draws a voltage equal to the source voltage
Week 15	Applications
Week16	Preparatory week before the final exam

Learning and Teaching Resources

	Text	**Available in the Library?**
Required Texts	"Basic Electrical Engineering", THERAJA.	Yes
Recommended Texts	"Electrical and Electronic Principles and Technology", John Bird	Yes
Websites	Basic Electrical Circuits website tutorials	

Module 5
Subject information

Module Title	**Workshop**	**Module Delivery**	
Module Type	**Core**		☐**Theory**
Module Code	**RETE 103**		☐**Lecture**
ECTS Credits	**6**		☒**Lab**
SWL (hr/sem)	**150**		☐**Tutorial**
			☐**Practical**
			☐**Seminar**

Module Level	1	**Semester of Delivery**	1
Administration Department	RETE	College	College of Oil & Gas Techniques Engineering/Kirkuk
Module Leader	Naseer Tawfeeq Alwan	e-mail	naseer.t.alwan@ntu.edu.iq
Module Leader's Acad. Title	Lecturer	Module Leader's Qualification	PhD
Module Tutor	Name (if available)	e-mail	
Peer Reviewer Name		e-mail	
Scientific Committee Approval Date	06/01/2023	Version Number	

Relation with other Modules

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

Module Aims, Learning Outcomes and Indicative Contents

Module Aims	1. The student is able to acquire manual skills by carrying out the operation and manufacturing processes using various hand tools and measuring tools. 2. Introducing the student to gain the manual skill by implementing the operations and connection of the manual tools and measuring tools for the household refrigeration and air conditioning equipment.

	3. The laboratory material consists of laboratory workshops and refrigeration workshop.
Module Learning Outcomes	4. To familiarize the student with the importance of workshops. 5. To teach the student how to acquire the manual skill by carrying out the operation and manufacturing processes using various hand tools and measuring tools. 6. To distinguish the manual tools and measuring tools for the household refrigeration and air conditioning equipment.
Indicative Contents	Indicative content includes the following. Part A -Tools Include recognition of different tools. Employed for surface preparation and methods of application correctly, Devices of measuring dimensions, Calipers, types and uses, drill types and dimensions Part B - Measuring tools T Steel miller, Veneer, Micrometer, Height & height gauge hand tools, Saws, Hammers, Files, Scriber, Chisels, Taps and dies, Surface plate, Bench working. Part C –Welding Workshop Include recognition of tools and materials employed – Gas cylinder of oxy – Acetylene welding of surface – Electrical are welding exercise – Welding spot. Part D –**Lathing Workshop** lathe machine – Parts – Operation – Practice on longitudinal lathing – Making center – Puncturing – Making external teeth – Practice – Employing measuring tools – internal & external lath machining.

Learning and Teaching Strategies	
Strategies	Teaching Method 1 - Asynchronous on-line course materials Description: Podcasts, videos and articles in workshop Attendance Recorded: yes Unscheduled Directed Student Hours (time spent away from the timetabled sessions but directed by the teaching staff). Teaching Method 2 - Practical

	Description: Practical homework assignments Attendance Recorded: Yes Unscheduled Directed Student Hours (time spent away from the timetabled sessions but directed by the teaching staff).

Student Workload (SWL) The student's academic load is calculated for 15 weeks.			
Structured SWL (h/sem) **Regular student load during the semester**	90	**Structured SWL (h/w)** **Regular weekly student load**	6
Unstructured SWL (h/sem) **Irregular student load during the semester**	60	**Unstructured SWL (h/w)** **Irregular student load per week**	4
Total SWL (h/sem) **The student's total academic load during the semester**	150		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	No	No	No	No
	Assignments	4	10% (10)	Continuous	All
	Projects /Lab.	10	40% (40)	Continuous	All
	Report	10	50% (50)	Continuous	All
Summative assessment	**Midterm Exam**	No	No	No	No
	Final Exam	No	No	No	No
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
1	**Tools** Include recognition of different tools. Employed for surface preparation and methods of application correctly, Devices of measuring dimensions, Calipers, types and uses, drill types and dimensions
2-3	**Measuring tools** Steel miller, Veneer, Micrometer, Height & height gauge hand tools, Saws, Hammers, Files, Scriber, Chisels, Taps and dies, Surface plate, Bench working.
4-6	**Welding Workshop** Include recognition of tools and materials employed – Gas cylinder of oxy – Acetylene welding of surface – Electrical are welding exercise – Welding spot.
7-9	**Lathing Workshop** lathe machine – Parts – Operation – Practice on longitudinal lathing – Making center – Puncturing – Making external teeth – Practice – Employing measuring tools – internal & external lath machining.
10-11	**Alloying Workshop** Contents of alloying workshops – Alloying sands and characteristics – Additives for improvement – Metals melts – Method of casting – Sand mold shaping – Heat treatment.
12-13	**Carpentry Workshop** Tools, machinery in the carpentry workshop, Fundamental principles – types of wood – application samples preparation
14-15	**Cars Workshop** Modes of car motor operation - Fuel feed pump - Electrical spark transfer device - Pistons in cylinder as motion transfer device to the front, back wheels.
16	**Preparatory week before the final exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Workshop	Yes

Module 6
Subject information

Module Title	**HUMAN RIGHTS AND DEMOCRACY**	**Module Delivery**	
Module Type	BASIC		**☒Theory**
Module Code	NTU100		**☐Lecture**
ECTS Credits	2		**☐Lab**
SWL (hr/sem)	50		**☐Tutorial**
			☐Practical
			☐Seminar

Module Level	1	**Semester of Delivery**	1
Administering Department	RETE	**College**	Type College Code
Module Leader	Dr. Osama	e-mail	Osama@ntu.edu.iq
Module Leader's Acad. Title	Lecturer	**Module Leader's Qualification**	Ph.D.
Module Tutor	None	e-mail	None
Peer Reviewer Name		e-mail	
Review Committee Approval	06/01/2023	**Version Number**	1.0

Relation with Other Modules

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

Module Aims, Learning Outcomes and Indicative Contents

Module Aims	1. Increase the student's knowledge of the theoretical and historical development of human rights and democracy. 2. Develop the student's analytical and critical skills regarding the current and future aspects of human rights and democracy. 3. Train the student on the importance of active participation in public life as a means to promote respect for human rights and engage in political and cultural activities. 4. Empower students to understand the importance of education and

	its role in promoting a culture of human rights and democracy, contributing to the building of a civilized society based on good governance, faith in human rights, education about them, and active participation in governance through free and fair elections.
Module Learning Outcomes	1. Understand the historical development of human rights in ancient civilizations and their relevance to contemporary societies. 2. Analyze the positions of divine laws and religious texts on human rights and evaluate their impact on different societies. 3. Critically examine international constitutions and treaties related to human rights and assess their effectiveness in promoting and protecting human rights. 4. Evaluate the role and significance of the United Nations Charter in establishing a framework for the protection of human rights at the international level. 5. Assess the functions and contributions of international organizations in promoting and safeguarding human rights globally. 6. Explore the role of non-governmental organizations (NGOs) in advocating for and protecting human rights in different contexts. 7. Identify and explain the key safeguards and mechanisms in place to ensure the protection of human rights at the national and international levels. 8. Understand the concept of international humanitarian law and its historical evolution, and its significance in times of armed conflict. 9. Analyze the concept, origin, and evolution of democracy, and understand its principles and values. 10. Examine the relationship between Islam and democracy and evaluate different perspectives on the compatibility of these concepts. 11. Identify and describe the characteristics and features of a democratic system. 12. Differentiate between various forms and types of democracy and assess their strengths and weaknesses. 13. Analyze the political components of democracy, including the role of political parties and their influence on the democratic process. 14. Understand the relationship between democracy, education, and the role of education in promoting democratic values and citizenship. 15. Evaluate the role of media in a democratic system, including its influence on public opinion and the functioning of democratic

	institutions.
Indicative Contents	1. Human Rights in Ancient Civilizations: o Overview of human rights in ancient Greek civilization o Exploration of human rights in ancient Roman civilization 2. Divine Laws and Human Rights: o Examination of the positions of divine laws and religious texts on human rights o Analysis of the impact of divine laws on human rights in different societies 3. Human Rights in International Constitutions: o Study of human rights provisions in international constitutions and charters o Comparison of the approaches taken by different countries in guaranteeing human rights in their constitutions 4. The United Nations Charter and Human Rights: o Overview of the United Nations Charter and its significance in promoting and protecting human rights o Analysis of specific articles and provisions related to human rights in the UN Charter 5. Human Rights in International Organizations: o Examination of the role and functions of international organizations in promoting and safeguarding human rights o Case studies on the work of specific international organizations in advancing human rights agendas 6. Human Rights in Non-Governmental Organizations: o Exploration of the role and contributions of non-governmental organizations (NGOs) in the field of human rights o Analysis of the challenges and opportunities faced by NGOs in advocating for human rights 7. Safeguards for Human Rights: o Study of legal and institutional safeguards for the protection of human rights at national and international levels o Examination of mechanisms such as national human rights institutions, ombudsman offices, and international human rights tribunals 8. International Humanitarian Law: o Introduction to the concept of international humanitarian law and its historical development o Analysis of the legal framework governing the conduct of armed conflicts and the protection of civilians 9. The Concept and Evolution of Democracy: o Understanding the concept, origin, and historical evolution of democracy o Exploration of different theoretical perspectives on democracy and its core principles 10. Islam and Democracy:

	○ Examination of the relationship between Islam and democracy ○ Analysis of different interpretations and debates surrounding the compatibility of Islamic principles and democratic values 11. Characteristics of Democracy: ○ Identification and explanation of the key characteristics and features of a democratic system ○ Analysis of the importance of democratic principles such as popular autonomy, rule of law, and political participation 12. Forms and Types of Democracy: ○ Exploration of different forms and types of democracy, including direct democracy, representative democracy, and hybrid systems ○ Assessment of the strengths and weaknesses of each form of democracy 13. Political Components of Democracy: ○ Study of the role of political parties and electoral systems in a democratic system ○ Analysis of the influence of interest groups, civil society organizations, and media on democratic processes 14. Democracy, Education, and Citizenship: ○ Examination of the relationship between democracy, education, and the role of education in promoting democratic values and active citizenship ○ Analysis of the importance of civic education and the development of critical thinking skills in a democratic society 15. Media and Democracy: ○ Evaluation of the role of media in a democratic system, including the freedom of the press, media ethics, and media's role in shaping public opinion ○ Analysis of the challenges and opportunities posed by digital media in the context of democratic societies
Learning and Teaching Strategies	
Strategies	1. Lectures: Traditional lectures delivered by the instructor can provide an overview of key concepts, theories, and historical developments in the field. Lectures can help students build foundational knowledge and understand the broader context of the subject matter. 2. Discussions and Debates: Facilitating class discussions and debates allows students to actively engage with the course material, share their perspectives, and critically analyze different viewpoints. This can promote critical thinking, enhance communication skills, and encourage students to explore the complexities of human rights and democracy. 3. Case Studies: Using real-life case studies and examples can help students apply theoretical knowledge to practical situations. Analyzing specific

	cases can deepen understanding, highlight challenges, and stimulate discussions on the implementation of human rights and democratic principles in different contexts. 4. Group Projects and Presentations: Assigning group projects or presentations on specific topics within the course can encourage collaboration, research skills, and in-depth understanding. Working in groups allows students to explore different aspects of the subject matter and present their findings to the class. 5. Guest Speakers: Inviting guest speakers who are experts in the field of human rights, democracy, or international law can provide students with practical insights, real-world experiences, and diverse perspectives. Guest speakers can also share their expertise on specific topics or case studies related to the course. 6. Interactive Workshops and Simulations: Conducting interactive workshops or simulations can provide students with hands-on experiences related to human rights and democracy. This can include activities such as role-playing exercises, mock trials, or model United Nations sessions, allowing students to understand the practical application of concepts and engage in problem-solving. 7. Multimedia Resources: Incorporating multimedia resources such as videos, documents, and online platforms can enhance students' understanding and engagement with the course material. Multimedia resources can provide visual and audio representations of complex topics, showcase real-world examples, and stimulate discussions. 8. Independent Research and Critical Analysis: Assigning research projects or essays that require independent research and critical analysis can foster self-directed learning, research skills, and the ability to critically evaluate sources of information. This can deepen students' understanding of specific topics and encourage them to develop their own arguments and perspectives. 9. Assessments and Feedback: Providing regular assessments, such as quizzes, exams, or essays, can help students gauge their understanding of the material and receive feedback on their progress. Constructive feedback can guide students in improving their knowledge and skills throughout the course.

Student Workload (SWL)			
Structured SWL (h/sem) **Regular student load during the semester**	33	**Structured SWL (h/w)** **Regular weekly student load**	(32/15)=2.2
Unstructured SWL (h/sem)	17	**Unstructured SWL (h/w)** **Irregular student load per week**	(18/15)=1.13

Irregular student load during the semester			
Total SWL (h/sem) **The student's total academic load during the semester**	50		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	20% (20)	5 and10	LO #2, and #6
	Assignments	2	10% (10)	6and 12	LO#3 and #8
	Projects /Lab.	0	0		
	Report	1	10% (10)	14	LO #5
Summative assessment	**Midterm Exam**	1 hour	10% (10)	7	LO #1 - #3
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Human rights in ancient civilizations (Greek and Roman civilizations)
Week 2	The position of divine laws on human rights.
Week 3	Human rights in international constitutions.
Week 4	The United Nations Charter and its stance on human rights.
Week 5	Human rights in international organizations.
Week 6	Human rights in non-governmental organizations.
Week 7	Safeguards for human rights.
Week 8	The concept of international humanitarian law and its historical development.
Week 9	The concept, origin, and evolution of democracy.
Week 10	The relationship between Islam and democracy.
Week 11	Characteristics of democracy.
Week 12	Forms and types of democracy.
Week 13	Political components of democracy.
Week 14	Democracy and education.
Week 15	**Preparatory week before the final exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Dr. Abed Al-Jabri Muhammad Human Rights and Democracy 2006	Yes
Recommended Texts	rights man And democracy numbers A. M. D. Ghassan generous Attractive and A. M. Amjad beautiful The worshippers Taste For the year2018	No
Websites	”Ways And education And culture rights man”, publication on network Information International)The Internet(on the site Electronic**http://ghrorg-learning.blogspot.com**	

Module 7
Subject information

Module Title	**Thermodynamics**		
Module Type	**Core**	☒Theory ☐ Lecture ☒ Lab ☒ Tutorial ☐ Practical ☐ Seminar	
Module Code	**RETE 104**		
ECTS Credits	**9**		
SWL (hr/sem)	**225**		
Module Level	1	Semester of Delivery	2
Administration Department	RETE	College	College of Oil & Gas Techniques Engineering/Kirkuk
Module Leader	Naseer Tawfeeq Alwan	e-mail	naseer.t.alwan@ntu.edu.iq
Module Leader's Acad. Title	Lecturer	Module Leader's Qualification	PhD
Module Tutor	Name (if available)	e-mail	
Peer Reviewer Name		e-mail	
Scientific Committee Approval Date	09/14/2023	Version Number	1

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	1. Understanding energy and its transformation: Thermodynamics deals with the study of energy and its conversion from one form to another. By studying thermodynamics, engineers gain a fundamental understanding of how energy behaves and can be manipulated. 2. Analyzing and optimizing energy systems: Engineers use thermodynamics to analyze and optimize the performance of energy systems, such as power plants, engines, refrigeration systems, and HVAC systems. They can determine the efficiency, energy transfer rates, and overall performance of these systems, leading to improvements in design and operation. 3. Designing and improving energy-related devices: Thermodynamics provides engineers with the knowledge necessary to design and improve energy-related devices, including combustion engines, turbines, heat exchangers, and renewable energy systems. By understanding the principles of thermodynamics, engineers can enhance the efficiency, reliability, and sustainability of these devices.
Module Learning Outcomes	(LO1) Describe basic concepts of Thermodynamics • restate definition of system, surrounding, closed and open system, extensive and intensive properties. • Calculate absolute and gage pressure, and absolute temperature. • Calculate changes in kinetic, potential, enthalpy and internal energy. (LO2) arrange the ideal and real gas equations of state. (LO3) Formulate the first law of thermodynamics for a closed systems and arrange the change in energy in the closed systems via heat and work transfer. (LO4) Apply first law of thermodynamics for closed systems and construct conservation of mass and energy equations. (LO5) Formulate the first law of thermodynamics for a closed systems and arrange the change in energy in the closed systems via heat and work transfer. (LO6) Apply the first law of thermodynamics to the open systems. • describe steady-flow open system. • Apply the first law of thermodynamics to the nozzles, diffusers, turbines, compressors, throttling valves, mixing chambers, heat exchangers, pipe and duct flow.

	(LO7) judge the properties of pure substances • judge the state of the pure substances such as compressed liquid, saturated liquid-vapor mixture and superheated vapor using property diagrams and tables. (LO7) assess thermodynamic applications using second law of thermodynamics. • Calculate thermal efficiency and coefficient of performance for heat engines, refrigerators and heat pumps. • restate perpetual-motion machines, reversible and irreversible processes. (LO8) On successful completion of the module, students should be able to show experience and enhance discipline-specific practical skills in carrying out Level 1 practical exercises in Thermodynamics following instruction, using test and measurement equipment and techniques, collecting and recording data, Estimating accuracy, assessing errors, and using safe work systems. (LO9) Problem solving skills (LO10) Numeracy (LO11) Communication skills (LO12) IT skills
Indicative Contents	Indicative content includes the following. • Conservation of Energy: The total energy of an isolated system remains constant over time. The energy may change its form or be transferred between different components of the system, but the total energy within the system remains constant. • The ideal gas is a theoretical model that simplifies the behavior of gases under certain conditions. While real gases deviate from ideal behavior at high pressures and low temperatures, the ideal gas concept provides a useful framework for understanding gas properties • Ideal Gas Law: The ideal gas law is an equation that relates the pressure (P), volume (V), temperature (T), and number of moles (n) of an ideal gas. It can be expressed as PV = nRT, where R is the ideal gas constant. This equation shows that, at a constant temperature, the product of pressure and volume is proportional to the number of moles of gas. • Boyle's Law: Boyle's law describes the relationship between the pressure and volume of an ideal gas at constant temperature. It states that the pressure of an ideal gas is inversely proportional to its volume: P1V1 = P2V2. • Charles's Law: Charles's law relates the volume and temperature of an ideal gas at constant pressure. It states that the volume of an ideal gas is directly proportional to its absolute temperature: V1/T1 = V2/T2. • Avogadro's Law: Avogadro's law states that equal volumes of different gases, at the same temperature and pressure, contain an equal number of

	molecules. It is that the volume of an ideal gas is directly proportional to the number of moles of the gas: V1/n1 = V2/n2. • Energy Conservation Equation: The first law can be mathematically expressed using the energy conservation equation. It states that the change in internal energy of a system is equal to the heat added to the system minus the work done by the system: ΔU = Q - W, where ΔU represents the change in internal energy, Q represents the heat added to the system, and W represents the work done by the system. • The second law of thermodynamics is a fundamental principle in thermodynamics that governs the direction and limitations of energy transfer and conversion. • The second law sets an upper limit on the efficiency of heat engines, which are devices that convert heat energy into mechanical work. The Carnot efficiency represents the maximum efficiency that can be achieved by an ideal heat engine operating between two temperature extremes. It depends only on the temperatures of the heat source and heat sink and is given by (T1 - T2) / T1, where T1 is the temperature of the heat source and T2 is the temperature of the heat sink.

Learning and Teaching Strategies

Strategies	Teaching Method 1 - Lectures Description: Attendance Recorded: Yes Teaching Method 2 - Asynchronous on-line course materials Description: Podcasts, videos and articles in thermodynamics Attendance Recorded: No Unscheduled Directed Student Hours (time spent away from the timetabled sessions but directed by the teaching staff). Teaching Method 3 - Tutorials Description: Attendance Recorded: Yes Teaching Method 4 - Practical Description: Practical homework assignments Attendance Recorded: No Unscheduled Directed Student Hours (time spent away from the timetabled sessions but directed by the teaching staff).

Student Workload (SWL)

Structured SWL (h/sem) Regular student load during the semester	108	Structured SWL (h/w) Regular weekly student load	7.2
Unstructured SWL (h/sem)	117	Unstructured SWL (h/w)	7.8

Irregular student load during the semester		Irregular student load per week	
Total SWL (h/sem) The student's total academic load during the semester	225		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	5	10% (10)	3,5,7,9,11 and 15	LO #2, #3,#5,#7,#9 and #11
	Assignments	5	10% (10)	2,6,8 and 12	LO #1, #4, #6and #10
	Projects / Lab.	4	20% (10)	Continuous	All
	Report				
Summative assessment	Midterm Exam	2 hours	10%(10)	7	LO #1 - #5
	Final Exam	3 hours	50%(50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

Week 1	Definition of energy – kinetic & potential energies –work – power flow & internal energy – enthalpy-energy diagram
Week2	Definition of state – property, process – property diagrams -1st law of thermodynamic, (P- V) diagram.
Week3	Ideal gases – ideal gasses laws (boyle, Charles, Gaylosic), gas constant – Avogadro law specific heat at constant volume & pressure
Week4	Energy analysis of closed system, particular closed system processes – constant volume, constant pressure and constant temperature process.
Week5	Particular closed system processes – adiabatic and polytrophic processes
Week6	Mass and energy analysis of control systems
Week7	Properties of pure substances and Phase change process of pure substances
Week8	Steam formation process, Dryness fraction, Liquid line, Steam line and Wet steam
Week9	Calculation of steam, steam table
Week 10	Steam process with drawing each processes on (PV)diagram
Week 11	Second law of thermodynamic Statement of (Kelvin, Planck & Clausius statement)
Week 12	Heat engine, refrigerator and heat pump

Week 13	Carnot and reverse Carnot cycle
Week 14	Entropy, Entropy change of ideal gases and isentropic process
Week 15	Entropy change of pure substances and Isentropic efficiencies of steady-flow devices

Learning and Teaching Resources

	Text	Available in the Library?
Required Texts	Applied Thermodynamics for engineering technology By TD EASTOP	Yes
Recommended Texts	Thermodynamics An engineering approach By Yunus A. Cengel	Yes
	Fundamentals of engineering thermodynamics By Michael J. Moran	No

Module8
Subject information

Module Title	**Computer**	**Module Delivery**	
Module Type	**Basic**		**☒Theory**
Module Code	**NTU 102**		**☐Lecture**
ECTS Credits	**3**		**☒Lab**
SWL (hr/sem)	**75**		**☐Tutorial**
			☐Practical
			☐Seminar
Module Level	1	**Semester of Delivery**	2
Administering Department	RETE	**College**	College of Oil & Gas Techniques Engineering/Kirkuk
Module Leader		e-mail	Email
Module Leader's Acad. Title		**Module Leader's Qualification**	
Module Tutor		e-mail	
Peer Reviewer Name	Name	e-mail	Email
Scientific Committee Approval Date	06/01/2023	**Version Number**	1.0

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims **Subject objectives**	1. To develop problem solving skills and understanding of computer skills through the application of techniques. 2. Acquire the ideas of how computer works by understanding the basic functions of input, output and storage devices 3. This program is meant for those students who have low-level literacy in computer use and only partial understanding of the functions of a computer. And so the students are introduced to this program to improve computer literacy
Module Learning Outcomes	Students completing this module will be able to: – Understand basic computer terminology;– Identify components of a computer and peripheral devices;– Perform the basic computer functions by using a desktop or a laptop;– Develop an understanding of word processing capabilities of a computer;– Understand the concept and usage of the Internet and e-mails;– Use the acquired skills to pursue employment opportunities;– Enhance their computer literacy.
Indicative Contents	Indicative content includes the following. • **MS Office** Word, Excel, Outlook, Power point, Access • **Google Drive** Docs, Drive, Forms, Gmail, Sheets • **Spreadsheets** Excel, Google Drive, Open Office, pivot tables, vertical lookups, macros • **Email** Outlook, Gmail, mail merge, filters, folders • **Presentations** PowerPoint, Google slides, Tableau, Keynote • **Operating systems** MacOS, Microsoft Windows,

Learning and Teaching Strategies	
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) The student's academic load is calculated for 15A week			
Structured SWL (h/sem) **Regular student load during the semester**	33	**Structured SWL (h/w)** **Regular weekly student load**	2.2
Unstructured SWL (h/sem) **Irregular student load during the semester**	42	**Unstructured SWL (h/w)** **Irregular student load per week**	2.8
Total SWL (h/sem) **The student's total academic load during the semester**	75		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment 40%	**Quizzes**	5	10%(10)	3,6, 8,12 and 14	LO #1, #2,#4,#5 and #6
	Assignments	4	10%(10)	2,5,10 and 13	LO #2, #4,#5 and #7
	projects/Lab.	4	20%(20)	Continuous	All

	Report				
Summative assessment 60%	**Midterm Exam**	2hr	10%(10)	7	LO #1 - #3
	Final Exam	3hr	5%(50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction - What is Computer,
Week 2	Basic applications of Computer
Week 3	Components of Computer System,
Week 4	Central Processing Unit (CPU),
Week 5	Concepts of Hardware and Software
Week 6	Introduction to Internet, WWW and web browsers
Week 7	Operating Computer using GUI Based Operating System
Week 8	Basics of Popular Operating Systems; The User Interface
Week 9	Using right Button of the Mouse and Moving Icons on the screen, Use of Common Icons, Status Bar, Using Menu and Menu-selection, Running an Application
Week 10	Viewing of File, Folders and Directories, Creating and Renaming of files and folders,
Week 11	Opening and closing of different Windows; Using help; Creating Short cuts,
Week 12	Basics of OS Setup
Week 13	Common utilities
Week 14	Understanding Word Processing:
Week 15	Using Spread Sheet

Week 16	Making small presentation

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Knowing computer
Week 2	Operating Computer using GUI Based Operating System
Week 3	Understanding Word Processing
Week 4	Using Spread Sheet
Week 5	Introduction to Internet, WWW and web browsers
Week 6	Making small presentation
Week 7	Basics of OS Setup

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts		
Recommended Texts	Beginning Programming All-in-One For Dummies Author: Wallace Wang	No
Websites	https://www.w3schools.in/computer-fundamentals/output-devices	

Module9 Subject information		
Module Title	**Mechanics Engineering /Dynamic's**	**Module Delivery**
Module Type	**Core**	

Module Code	RETE 101			☒**Theory** ☐**Lecture** ☐ **Lab** ☒**Tutorial** ☐**Practical** ☐**Seminar**
ECTS Credits	**8**			
SWL (hr/sem)	**200**			
Module Level	1	**Semester of Delivery**	2	
Administering Department	RETE	**College**	College of Oil & Gas Techniques Engineering/Kirkuk	
Module Leader		e-mail		
Module Leader's Acad. Title	Lecturer	**Module Leader's Qualification**	PhD	
Module Tutor		e-mail		
Peer Reviewer Name	Name	e-mail	Email	
Scientific Committee Approval Date	06/01/2023	**Version Number**	1.0	

Relation with other Modules

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

Module Aims, Learning Outcomes and Indicative Contents

Module Aims	This module is designed to impart essential mechanical science knowledge applicable to all engineering disciplines. It also serves as a foundational steppingstone for advanced studies in mechanical engineering, with a particular emphasis on dynamics. The course equips students with the fundamental knowledge and understanding of mechanical and physics principles and methodologies necessary to support their education in various mechanical and related engineering fields. Topics covered in the course encompass a wide range of dynamics mechanics topics, including various types of motion (linear, circular, and projectile), as well as concepts related to force, momentum, impulse, rotational motion, work, power, torque, angular momentum, and energy. Throughout

	the course, students will learn and apply various analytical and numerical methods for addressing typical mechanical structures and problems.
Module Learning Outcomes	1. Grasp and employ fundamental terminology for describing the motion of particles, vector functions, and the fundamental principles of Newtonian mechanics. 2. Resolve mechanical problems in one dimension involving forces such as gravity, friction, and air resistance. 3. Comprehend the concept of terminal velocity and utilize it to solve one-dimensional mechanics problems. 4. Apply Newton's second law in vector form to address problems in multiple dimensions. 5. Resolve problems concerning the motion of a projectile in the absence of air resistance. 6. Explore how displacement, velocity, and acceleration vary with time in linear motion. 7. Examine how displacement, velocity, and acceleration change with time in curvilinear motion. 8. Provide a concise summary of key dynamics components. 9. Elaborate on the concepts of work and energy. 10. Identify power and efficiency considerations for mechanical components and their practical applications.
Indicative Contents	Indicative content includes the following: • Its objective is to familiarize students with the analysis of moving mechanical bodies by imparting an understanding of the theories and laws governing mechanical systems. • Introducing students to this curriculum complements the field of engineering mechanics. • It serves as an introductory foundation for materials engineering, equipping students with essential knowledge required to achieve optimal design for engineering structures and materials capable of withstanding various loads and environmental conditions.

Learning and Teaching Strategies	
Strategies	Teaching and learning strategies for a Dynamics module in engineering are designed to help students grasp complex concepts related to motion, forces, and mechanical systems effectively. Here are the common strategies used in this module: • **Lectures:** Traditional lectures provide an overview of key concepts and theories in dynamics. Instructors use visual aids, examples, and real-world applications to explain complex topics.

	• **Tutorials and Workshops:** Small group tutorials or workshops allow students to work on problem-solving exercises and engage in discussions. Tutors can provide guidance and clarification on challenging concepts. • **Computer Simulations:** Simulation software and tools help students visualize and analyze dynamic systems. They can explore how different variables impact the behavior of mechanical systems. • **Case Studies:** Analyzing real-world case studies involving dynamic systems and structures helps students see the practical applications of the concepts they learn in class. • **Group Projects:** Collaborative projects encourage teamwork and problem-solving. Students may work together to design, analyze, and present solutions for complex engineering problems. • **Homework Assignments:** Regular assignments challenge students to practice problem-solving and reinforce their understanding of course materials. Instructors can provide feedback and discuss solutions in class. • **Peer Teaching and Learning:** Encouraging students to explain concepts to their peers can deepen their understanding and enhance communication skills. • **Self-Study and Reading:** Students are encouraged to read textbooks, research papers, and additional materials to supplement their understanding of course topics. • **Assessment:** Regular quizzes, tests, and examinations assess students' understanding and mastery of course content. These assessments help identify areas where additional support may be needed. • **Online Resources:** Course materials, lecture notes, and additional resources are often made available online, allowing students to review and reinforce their learning independently. • **Problem-Solving Sessions:** Dedicated problem-solving sessions focus on challenging tackling exercises and developing problem-solving skills.

Student Workload (SWL)

The student's academic load is calculated for 15 weeks.

Structured SWL (h/sem) **Regular student load during the semester**	78	**Structured SWL (h/w)** **Regular weekly student load**	5.2

Unstructured SWL (h/sem) **Irregular student load during the semester**	122	**Unstructured SWL (h/w)** **Irregular student load per week**	8.13
Total SWL (h/sem) **The student's total academic load during the semester**	200		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	5	20% (20)	2, 4, 8,12	LO #1, 2, 10 and 11
	Assignments	2	20% (20)	3, 5, 7, 9, 13	LO # 3, 4, 6 and 7
Summative assessment	**Midterm Exam**	2hr	10% (10)	10	LO #1-9
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1-2	Introduction of Dynamic Rectilinear Motion Plane curvilinear motion Rectangular Coordinates Normal and tangential coordinates Polar coordinates.
Week 3	Space curvilinear motion Space motion Relative motion Constrained motion
Week 4	Generalized Newton's Second
Week 5-7	Force, Mass, Acceleration Newton's second law Equation of motion and solution problem
Week 8-9	Work and kinetic energy Potential energy
Week 10	Mid-term exam

Week 11	Linear Impulse and Linear momentum
Week 12	Work-Energy Impulse- Momentum
Week 13	Conservation of Energy and Momentum
Week 14	Rotation Absolute motion Relative velocity
Week 15	Preparatory week before the final exam
Week 16	The final exam week

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	1. Engineering Mechanics Dynamics, JL Meriam, LG Kraige, Sixth Edition	Yes
Recommended Texts	. 2. Engineering Mechanics Dynamics, R. C. Hibbeler, Twelfth Edition	yes
Websites	https://www.noor-book.com/en/ebook-Engineering-Mechanics-Dynamics-14th-pdf	

Module10 **Subject information**		
Module Title	**Engineering Drawing**	**Module Delivery**
Module Type	**Core**	☒**Theory**
Module Code	**COGTEK 101**	☐**Lecture**
ECTS Credits	**8**	☒**Lab**
SWL (hr/sem)	**200**	☐**Tutorial** ☐**Practical** ☐**Seminar**

Module Level		1	**Semester of Delivery**		2
Administration Department		RETE	College	College of Oil & Gas Techniques Engineering/Kirkuk	
Module Leader	Naseer Tawfeeq Alwan		e-mail	naseer.t.alwan@ntu.edu.iq	
Module Leader's Acad. Title		Lecturer	Module Leader's Qualification		PhD
Module Tutor	Name (if available)		e-mail		
Peer Reviewer Name			e-mail		
Scientific Committee Approval Date		06/01/2023	Version Number	1.0	

Relation with other Modules

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

Module Aims, Learning Outcomes and Indicative Contents

Module Aims	4. Introducing the student to the importance of engineering drawing and its relationship to other engineering subjects. 5. Develop the student's mental abilities in drawing simple and complex shapes. 6. Expanding the horizons of the student's imagination of geometric shapes and identifying their components, parts, mechanics, and their working principles
Module Learning Outcomes	7. To familiarize the student with the importance of engineering drawing 8. To teach the student how to imagine geometric shapes. 9. To distinguish the mechanical components and parts and their working principle.
Indicative Contents	Indicative content includes the following. <u>Part A -Principles of drawing</u> To develop the student's mental ability to draw simple and complex shapes.

	The student learns how to develop a strategy and sequence for drawing, assembling and deconstructing geometric shapes. Part B -Orthographic Projections The student learns to draw geometric projections and set geometric dimensions. Part C -Cutting theory. To develop the student's mental ability to draw simple and complex shapes Cutting theory- Shapes and lines of cuts by type of material. Part D -Drawing stereoscopic shapes using 3D graphics Instructions. Prepare to use instructions in drawing three-dimensional geometric shapes and modifications of three-dimensional graphics.

Learning and Teaching Strategies	
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) The student's academic load is calculated for 15A week			
Structured SWL (h/sem) **Regular student load during the semester**	63	**Structured SWL (h/w)** **Regular weekly student load**	4.2
Unstructured SWL (h/sem) **Irregular student load during the semester**	137	**Unstructured SWL (h/w)** **Irregular student load per week**	9.13

Total SWL (h/sem) **The student's total academic load during the semester**	200

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	5	10% (10)	2,5,7,9.and 13	LO #1, #5, #6, #11, and #13
	Assignments	5	10% (10)	3, 5, 8,10 and 14	LO #3, 4, 6, 7, and 10
	Projects /Lab.	10	20% (20)	Continuous	All
	Report				
Summative assessment	**Midterm Exam**	2 hours	10% (10)	7	LO #1 - #4
	Final Exam	3 hours	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Principles of drawing
Week 2	Title Block
Week 3	Drawing geometric shapes, the basic
Week 4	Graphic Adjustments - Computer Graphics Aids
Week 5	Geometric line- Types of engineering drawing lines- Geometric operations- Dimensional placement.
Week 6	Orthographic Projections
Week 7	Mid-term Exam

Week 8	Principle of First Angle Projection
Week 9	Principle of Third Angle Projection
Week 10	The conclusion of a third projection from two known locations.
Week 11	Cutting theory- Shapes and lines of cuts by type of material.
Week 12	Drawing of projections cut from a specific site
Week 13	Drawing of partially cut elevations. Drawing of semi-cut elevations.
Week 14	3D Coordinates Drawing Using AutoCAD
Week 15	3D Solid Primitive Drawing Using AutoCAD
Week 16	**Preparatory week before the final exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Lab 1: Introduction to principles of drawing Using AutoCAD
Week 2	Lab 2: drawing Title Block Using AutoCAD
Week 3	Lab 3: Drawing Commands with Exercise
Week 4	Lab 4: Drawing Aids Commands with Exercise
Week 5	Lab 5: Introduction to Edit Commands with Exercise
Week 6	Lab 6: Dimensions, Layers, Line types, Colors with Exercise
Week 7	Lab7:Orthographic Projections Using AutoCAD with Exercise
Week 8	Lab 8: First angle projection Using AutoCAD with Exercise
Week 9	Lab 9: Third angle projection Using AutoCAD with Exercise
Week 10	Lab 10: Construct the view, from the two given views Using AutoCAD with Exercise
Week 11	Lab11: Principles of sectioning Using AutoCAD with Exercise

Week 12	Lab 12: Full Section Drawing Using AutoCAD with Exercise
Week 13	Lab 13: Half Section Drawing Using AutoCAD with Exercise
Week14	Lab 14: 3D Coordinates Drawing Using AutoCAD with Exercise
Week 15	Lab 15: 3D Solid Primitive Drawing Using AutoCAD with Exercise
Week16	Preparatory week before the final exam

Learning and Teaching Resources

	Text	Available in the Library?
Required Texts	Engineering Drawing Using AutoCAD	Yes
Recommended Texts	Ashleigh Fuller, Antonio Ramirez, Douglas Smith - Technical Drawing with AutoCAD 2017-SDC Publications (2017)	No
Websites	Basic Mechanical Drawing website tutorials	

Module11
Subject information

Module Title	ARABIC LANGUAGE	**Module Delivery**	
Module Type	SUPPORT		☒Theory ☐Lecture ☐Lab ☐Tutorial ☐Practical ☐Seminar
Module Code	NTU 103		
ECTS Credits	2		
SWL (hr/sem)	50		
Module Level	1	**Semester of Delivery**	2
Administering Department	RETE	**College**	College of Oil & Gas Techniques Engineering/Kirkuk
Module Leader	Dr. Jamal Fateh Ali	e-mail	jamal1978@ntu.edu.iq
Module Leader's Acad. Title	Lecturer	**Module Leader's Qualification**	Ph.D.
Module Tutor	None	e-mail	None

Peer Reviewer Name		e-mail	
Review Committee Approval	06/01/2023	**Version Number**	1.0

Relation with Other Modules			
Prerequisitemodule	None	**Semester**	
Co-requisites module	None	**Semester**	
Module Aims, Learning Outcomes and Indicative Contents			
Module Aims	1. Enhance communication Effective: Aims to learn the language Arabic to Empowerment Students from communication In a way effective in the environment Arabic, whether He was that in life Daily or in Context Academic And practical. 2. to understand Culture Arabic: It is considered to learn the language Arabic key To understand Culture Arabic And its values, And helps students on Recognition on Heritage Arabic The rich And understand Multiple Cultures in the world Arabic 3. Enhance Capabilities Research And the Academy: To learn the language Arabic Contributes in development skills Research and writing academy For students, Which They can from Participation Effectively in Discussions Academy and Production Knowledge. 4. .to provide Opportunities Functional: It is considered Mastery the language Arabic skill value in market the job, where Students can Arabic the job in Areas Multiple like Translation, Media, Relationships General, And education. 1.Enhancing effective communication: Teaching Arabic aims to enable students to communicate effectively in the Arab environment, both in daily life and in academic and professional contexts. ***2.***Understanding Arab culture: Learning Arabic is a key to understanding Arab culture and its values, helping students to explore the rich Arab heritage and comprehend the cultural diversity within the Arab world. ***3.***Enhancing research and academic skills: Learning Arabic contributes to developing research and academic writing skills for students, enabling them to actively participate in academic discussions and contribute to knowledge production. ***4.***Providing job opportunities: Proficiency in Arabic is a valuable skill in the job market, allowing students to		

Module Learning Outcomes	**1.**ability on communication Effective: Acquire Students skills Listening And talk And reading And writing in the language Arabic, Which They can from communication Fluently And understand Content In a way correct.**2** **2.** ability on to understand Texts And culture: Learn Students reading And understand Texts Literary And cultural In the language Arabic, Which Contributes in development understand them For heritage Arabic And analysis Cash For business Literary. **3.**ability on Search And writing academy: Learn Students How to procedure Research And writing academy In the language Arabic, And they can from presentation papers Research And reports Academy In a way distinct. **4.** Interaction Cultural And social: Can Students from Participation in the society Arabic In a way Deeper And understand Traditions and values And customs Local, Which enhances Understanding Cultural And coexistence Peaceful. 1. Effective communication skills: Students acquire listening, speaking, reading, and writing skills in Arabic, enabling them to communicate fluently and understand content accurately. 2. Understanding texts and culture: Students learn to read and comprehend literary and cultural texts in Arabic, enhancing their understanding of Arab heritage and developing critical analysis of literary works. 3. Research and academic writing abilities: Students learn how to conduct research and engage in academic writing in Arabic, enabling them to present research papers and academic reports effectively. 4. Cultural and social interaction: Students are able to actively participate in the Arab community, gaining a deeper understanding of local traditions, values, and customs, fostering cultural understanding and peaceful coexistence.
Indicative Contents	***1.***introduction in Contents Indicative: Identification Contents Indicative And its importance, And its role in Areas And specializations Miscellaneous. ***2.*** Types And formulas Contents Indicative: Exploration various Types And formulas Contents Indicative, like Tables and fees The statement And points Prominent And summaries. ***3.***construction Contents Indicative: Techniques and strategies construction Contents Indicative effective, With what in that to choose Information Home, And simplify Concepts complex, And organizing Content For ease Understanding. ***4.***representation Visual For contents Indicative: Use Media Visual, like Fees The statement and plans and drawings, To submit Contents Indicative In a way attractive And useful Visually.

	5. Examples And studies the condition: Analysis Examples And studies condition Real To understand How to Use Reference Content in Contexts different, like Reports Research And materials Marketing and resources Educational. 1. Introduction to Indicative Contents: Defining indicative contents and understanding their significance in various fields and disciplines. 2. Types and Formats of Indicative Contents: Exploring different types and formats of indicative contents, such as tables, charts, bullet points, and summaries. 3. Creating Indicative Contents: Techniques and strategies for effectively creating indicative contents, including selecting key information, simplifying complex concepts, and organizing content for easy comprehension. 4. Visual Representation of Indicative Contents: Utilizing visual aids, such as infographics, diagrams, and illustrations, to present indicative contents in an engaging and informative manner. 5. Examples and Case Studies: Analyzing real-life examples and case studies to understand how indicative contents are used in various contexts, such as research reports, marketing materials, and educational resources.
Learning and Teaching Strategies	
Strategies	1. Interactive Language Activities: Engaging students in interactive activities such as role-plays, group discussions, and language games to practice and reinforce language skills. 2. Communicative Approach: Emphasizing real-life communication and providing opportunities for students to actively engage in speaking, listening, reading, and writing tasks to develop their language proficiency. 3. Authentic Materials: Incorporating authentic materials such as newspaper articles, songs, videos, and literature to expose students to real-world language usage and cultural contexts

Student Workload (SWL)			
StructuredSWL(h/same) **Regular student load during the semester**	33	**Structured SWL (h/w)** **Regular weekly student load**	(32/15)= 2.2
UnstructuredSWL(h/same) **Irregular student load during the semester**	17	**Unstructured SWL (h/w)** **Irregular student load per week**	(18/15)= 1.13
TotalSWL(h/same) **The student's total academic load during the semester**	50		

Module Evaluation					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	4	30% (30)	3,6,10 and 14	LO #1, #2, #3, and #4
	Assignments	2	10% (10)	4 and 12	LO #1and #4
	Projects /Lab.		0% (0)	0	0
	Report		0% (0)	0	0
Summative assessment	Midterm Exam	1hr	10% (10)	7	LO #1 - #2
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction to Language Errors:
Week 2	Taa Marbuta and Taa Marbuta (Bound and Open Taa): Understanding the rules and usage of the Taa Marbuta and Open Taa in Arabic language.
Week 3	Hamzat Al-Wasl and Al-Qat' (Hamza of Connection and Hamza of Disconnection): Differentiating between Hamzat Al-Wasl and Al-Qat' and their respective roles in pronunciation.
Week 4	Alif Al-Maddooda and Alif Al-Muqassara Writing Rules: Exploring the rules for writing Alif Al-Maddooda (elongated Alif) and Alif Al-Muqassara (shortened Alif).
Week 5	Solar and Lunar Letters: Identifying the distinction between solar and lunar letters in Arabic pronunciation.
Week 6	Adad (Numbers): Learning about the numerical system in Arabic and its usage.
Week 7	Verbs: Understanding verb conjugation and the different verb forms in Arabic.
Week 8	Parts of Speech: Exploring the different parts of speech, including nouns, verbs, adjectives, adverbs, etc.
Week 9	Meanings of Prepositions: Examining the meanings and usage of prepositions in Arabic.
Week 10	Common Language Errors: Analyzing common language errors and their applications in practical contexts.
Week 11	Noon and Tanween: Understanding the usage and pronunciation of Noon and Tanween in Arabic.
Week 12	Taa Marbuta and Taa Marbuta (Bound and Open Taa): Understanding the rules and usage of the Taa Marbuta and Open Taa in Arabic language.
Week 13	Hamzat Al-Wasl and Al-Qat' (Hamza of Connection and Hamza of Disconnection): Differentiating between Hamzat Al-Wasl and Al-Qat' and their respective roles in pronunciation.
Week 14	Alif Al-Maddooda and Alif Al-Muqassara Writing Rules: Exploring the rules for writing Alif Al-Maddooda (elongated Alif) and Alif Al-Muqassara (shortened Alif).
Week 15	Solar and Lunar Letters: Identifying the distinction between solar and lunar letters in Arabic pronunciation.

Week 16	Preparatory week before the final exam

Learning and Teaching Resources **Learning and teaching resources**		
	Text	**Available in the Library?**
Required Texts	1. Sufficient" For Canadian: It is considered from Most important Books in science Grammar, where Explains . Rules And the structures Grammar In style simplified And comprehensive.**2** **2.**Exchange"For son What is with you:book famous It deals with rules Discharge Actions And the names in the language Arabic, And it is considered from works Grammar Classic. **3.**joint in science Arabic"For son reaped:book comprehensive Covers group Wide from Topics Grammar And exchange And eloquence And literature	Yes
Recommended Texts	**1.**Millennium"For son What is with you: Book famous in science Grammar And exchange, It is considered from Most important the reviewer Classic in study the language Arabic. **2.**The Extremist in all art Funny" For son Anbari: Book Includes Many from Words and expressions Arabic used in Literature And the hair. 3. Statement And clarification" For son to forbid Ashkelonian: Book It deals with Topics Grammar And exchange And eloquence, It is considered Reference Values in study the language Arabic.	No
Websites		

Level 2

Module 12 Subject information				
Module Title	Fluid Mechanics		Module Delivery	
Module Type	**Core**		☒Theory ☐ Lecture ☒ Lab ☒ Tutorial ☐ Practical ☐ Seminar	
Module Code	**COGTEK 200**			
ECTS Credits	**8**			
SWL (hr/sem)	**200**			
Module Level	2	Semester of Delivery	3	
Administration Department	RETE	College	College of Oil and Gas Techniques Engineering - Kirkuk, Northern Technical University, Iraq	
Module Leader	Obed Majeed Ali	e-mail	obedmajeed@ntu.edu.iq	
Module Leader's Acad. Title	Assistant lecturer	Module Leader's Qualification	M.Sc.	
Module Tutor		e-mail		
Peer Reviewer Name		e-mail		
Scientific Committee Approval Date		Version Number		

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	This module will give students a thorough introduction to the fundamental principles of fluid mechanics and deal with engineering applications of inviscid and viscous flow. On completion of this module, students should be able to: 1. Understand the fundamental principles of fluid statics and fluid flow, with consideration of both ideal (inviscid) and real (viscous) flow. 2. Compute basic parameters for hydrostatic fluid problems, including forces on submerged bodies. 3. Analyze ideal fluid flow in one- and two-dimensions using the continuum concepts of conservation of mass, momentum and energy. 4. Knowledge and understanding of viscous flow with application to boundary layers, pipe flow, flow around bodies, lubrication and other application areas. 5. Identify appropriate methodologies for modeling flows using non-dimensional parameters. 6. Describe the operation of turbomachinery for incompressible flow, including the dynamics of centrifugal pumps. 7. Recognise and simply describe the complex nature of turbulent flow.
Module Learning Outcomes	1. Understand how to convert the unit system from British to SI. unit or vice versa. 2. Training the students how to solve the problems associated with fluid mechanics. 3. Measure the fluid flow of liquids by different types of flow meters. 4. Analyze the magnitude of the horizontal and vertical components of the force of the water on the gate. 5. Determine the reading on the pressure gauge by the different types of manometers. 6. Draw simple hydraulic and energy gradient lines. 7. Solve the formulas of open channel flow. Skills outcomes - Analysis - synthesis - interpretation, - report writing - laboratory - computational.
Indicative Contents	Indicative content includes the following. Part A- Introduction: Basic concepts of fluid mechanics. Fundamental terms. Physical values. Fluids and their properties. Forces inside fluid. Measurement of pressure. Relative statistics of fluid – constant acceleration, rotation. Forces of hydrostatic pressure. Buoyancy. Streamlines. Stream surface. Stream tube. Mass/volume flow. Control volume. Fluid Dynamics: Continuity equation. Basic laws of fluid dynamics – conservation of mass, conservation of linear momentum, conservation of energy. Ideal fluid flow. Application of Bernoulli's equation. Real fluid flow. Viscosity. Determination

	of losses. Reynolds experiment. Laminar and turbulent flow. Boundary layer. Velocity profile. Losses in pipes. Frictional losses. Moody's diagram. Local losses. Pumps, types. Turbines and the working principle of the turbine. **Part B-**● Analyze characteristics of a particular flow. ● Formulate the governing equations and boundary conditions. ● Solve these equations analytically in simple cases. Revision problem classes and quiz [6 hrs]

Learning and Teaching Strategies

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 types of simple experiments involving some sampling activities that are interesting to the students

Student Workload (SWL)

Structured SWL (h/sem) Regular student load during the semester	93	Structured SWL (h/w) Regular weekly student load	6.2
Unstructured SWL (h/sem) Irregular student load during the semester	107	Unstructured SWL (h/w) Irregular student load per week	7.13
Total SWL (h/sem) The student's total academic load during the semester	200		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	5	10% (10)	3,5,7,9, and 11	LO #4,6,8,10 and #12
	Assignments	5	10% (10)	2, 6,9, 11,13	LO #3, #5, #8, #10 and #13
	Lab Report	10	20% (20)	All	2,4,6,7,8,9,10,11,12,13
Summative assessment	Mid Term exam	2 hours	10% (10)	7	LO #1-7
	Final Exam	3hr	50% (50)	16	All
100% (100 Marks)					

Delivery Plan (Weekly Syllabus)

Week 1	Introduction - Units system
Week 2	Physical properties of fluids.
Week 3	Physical properties of fluids
Week 4	Fluid pressure at static.
Week 5	Fluid pressure instruments
Week 6	Hydrostatic force on a plane surface.
Weeks 7	Mid-Term Exam
Weeks 8	Hydrostatic force on an inclined surface
Week 9	Hydrostatic force on a curved surface.
Week 10	Fluid dynamics/classifications of fluids.
Week 11	Conservation of mass
Week 12	Conservation of momentum and its application.
Week 13	Conservation of energy-Bernoulli equation.
Week 14	Viscous flow in pipes.
Week 15	Preparing for the final exam

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Lab 1: Density and Specific Gravity
Week 2	Lab 2: DETERMINATION OF LIQUID VISCOSITY USING STOCK`S METHOD.
Week 3	Lab 3: Determination of Center of Pressure and Hydro-static Force on Plane surface (Part One).
Week 4	Lab 4: Determination of Center of Pressure and Hydro-static Force on Plane surface (Part Two).
Week 5	Lab 5: Reynolds Number Investigation.

Week 6	Lab 6: Estimation of the Volume Flow Rate Using Orifice Meter Apparatus.
Week 7	Lab 7: IMPACT OF WATER JET ON VANES.

Learning and Teaching Resources		
	Text	Available in the Library?
Required Texts	FLUID MECHANICS	Yes
Recommended Texts	1- A TEXTBOOK OF FLUID MECHANICS AND HYDRAULIC MACHINES BY RAJPUT. 2- Fluid Mechanics by Yunus A. Cengel, John M.Cimbala. 3- Fluid_mechanics_frank_m._white_4th_ed.	No

Module 13
Subject information

Module Title	**Mathematics**	Module Delivery	
Module Type	**Core**	☒Theory ☐ Lecture ☐ Lab ☒ Tutorial ☐ Practical ☐ Seminar	
Module Code	**COGTEK 201**		
ECTS Credits	**7**		
SWL (hr/sem)	**175**		
Module Level	2	Semester of Delivery	3
Administration Department	RETE	College	College of Oil and Gas Techniques Engineering - Kirkuk, Northern Technical University, Iraq
Module Leader		e-mail	
Module Leader's Acad. Title	Assistant lecturer	Module Leader's Qualification	
Module Tutor		e-mail	
Peer Reviewer Name		e-mail	
Scientific Committee Approval Date		Version Number	

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	• To equip students with the knowledge and understanding of mathematical concepts, notation and techniques relevant to mechanical engineering. • To develop skills and confidence in mathematical modeling and problem solving. • To support students in understanding mathematical aspects of other modules.
Module Learning Outcomes	On successful completion of this module, students should be able to: 1. Use vectors to represent three-dimensional space, including points, lines and planes and find intersections among these. 2. Differentiate and integrate vectors in the context of dynamics problems and understand scalar and vector products and their use in mechanics and dynamics. 3. Integrate and differentiate functions using a range of techniques and relate derivatives and integrals to engineering applications such as rates of change, maxima and minima, areas, volumes, averages, flow rates, work, centers of mass, etc. 4. Sketch (freehand) basic and composite functions, recognizing limiting behaviors and discontinuities. 5. Create mathematical models of engineering systems described by first order ordinary differential equations, and solve the equations analytically and via Euler's method. 6. Differentiate and integrate functions of more than one variable. 7. Understand the formation of matrices, their associated algebra, their use in the solution of simultaneous equations and in graphical transformations, and the concepts of eigenvalues and eigenvectors. 8. Understand, manipulate and plot complex numbers and functions in various forms, find complex solutions of equations, and appreciate the links between exponential, trigonometric and hyperbolic functions. 9. Present data effectively using a variety of techniques.

	10. Calculate important statistical measures of central tendency and dispersion. 11. Understand the concept of correlation and regression, calculate the regression coefficient and determine regression lines via the least squares technique. 12. Understand the basic concepts of probability, including conditional probability and independence. Skills outcomes • Mathematical modeling and problem solving skills • Ability to apply mathematics to represent, analyze and design engineering systems.
Indicative Contents	Definitions and use of vectors in 3D space; vector algebra; the scalar and vector products and their uses. Functions and graphs; limits of functions. Techniques for differentiation: product rule; quotient rule; chain rule; implicit differentiation; logarithmic differentiation; differentiating parametric equations; Differentiating vectors in Cartesian and polar coordinate systems. Techniques for integration: substitution; integration by parts; partial fractions; integration of vectors; numerical integration. Engineering applications of integration and differentiation. Functions of more than one variable: partial differentiation; multiple integrals. First order differential equations; Mathematical modeling and problem solving. Vector equations of lines and planes. Matrix algebra; transformation matrices; eigenvalues and eigenvectors. Complex numbers; hyperbolic functions. Statistics, regression and elementary probability.

Learning and Teaching Strategies	
Strategies	Implementing active learning in a class room requires preparation and some changes to the lecture. However, the lecture content is not changed or replaced with new material. The same lecture content is delivered to the students in a better way and the lecture time is used more effectively. The following are some of the techniques of active learning and cooperative learning I personally use in my engineering classes to enhance student's understanding and retention of the material:

	○ **One Minute Paper**: Students are asked to write a one-minute note (about the previous lecture, the homework or the material in general) to the instructor on a piece of paper. This provides a fast way for the teacher to have a quick feedback on students' understanding of what was previously covered. ○ **Muddiest Point**: When there is a long lecture with multiple topics covered, the students are given the opportunity to discuss the material covered in the lecture and list the most difficult parts of the lecture. ○ **Clarification Pause**: During the lecture, the students are given the time to go over the material written on the board, think about it and ask if they have any questions. Then, the lecturer answers the different questions raised before resuming the next part of the lecture. ○ **Questions and answers**: Usually during the lecture, questions are raised about the new material presented and questions are solved on the board. A sample of the questions asked include "Why do you think this topic is important?" or "what is the relationship between what we were talking about and this technique?" or "which technique is best?" ○ **Critical Thinking, Group Discussion**: Students are given a handout with multiple problems and they are asked to apply what they learned in the lecture to solve the problems in groups. They are asked to discuss it together and come up with a single solution that all members agree on. ○ **Critical Thinking, Think-pair-share:** Students are asked to work individually on a problem for a short time; Then students pair up to compare their answers. Then they have to explain their answer and share it with the rest of the class. ○ **Peer Teaching:**If one member of the team solves the problem correctly, he will explain it to the rest of the group and discuss with them why his/her answer is correct and their answer is not. This allows the students to find out what went wrong and the mistake they made in solving the problem. This technique will help the student to avoid these mistakes when doing the homework or the exams. ○ **Active Review Sessions**: For each exam, students are given a practice test with a set of problems a week in advance. They are encouraged to work on the practice test individually first and then in groups to discuss the answers. During the review session, the students are asked questions about the problems in the practice test and they are given the choice to decide which problems they want the professor to focus on.

Student Workload (SWL)			
Structured SWL (h/sem) Regular student load during the semester	78	Structured SWL (h/w) Regular weekly student load	5.2
Unstructured SWL (h/sem) Irregular student load during the semester	97	Unstructured SWL (h/w) Irregular student load per week	6.46
Total SWL (h/sem) The student's total academic load during the semester	150		

Module Evaluation					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	5	15% (15)	5,7, 9,10 and 12	LO #1, #3, #5, #6,and #7
	Assignments	10	20% (20)	Continuous	LO#3,4,5,6,7,8,9,10,11, and 12
	Seminar	1	5% (5)	7	LO #6
Summative assessment	Mid Term exam	2 hours	10% (10)	8	LO #1-4
	Final Exam	3hr	50% (50)	16	All
100% (100 Marks)					

Delivery Plan (Weekly Syllabus)	
Week 1	Review in differentiation and integration
Week 2	Vectors: general introduction to vectors in space – equation of straight line and an equation for a plane in space – plane, tangent and perpendicular line – vector function
Week 3	Complex numbers – polar form – Euler equation – exponential and roots of complex numbers – composite functions
Week 4	Tow and more variable equations – partial derivative
Week 5	Chain rule for partial derivative – gradient and directional derivative – maximum and minimum values for tow variable functions
Week 6	Double integral, areas and volumes – physical applications
Weeks 7	Triple integral
Weeks 8	Mid-Term Exam
Week 9	Polar coordinates – cylindrical and spherical coordinates – curve drawing in polar coordinates

Week 10	Green's theorem - divergence theorem
Week 11	The linear integration
Week 12	The Series: sequences of numbers - limits - infinite series - limit by definition - alternating series test - power series - converges interva
Week 13	Taylor/Maclaurin series for a function – general applications
Week 14	Matrices: introduction and Basic Operations
Week 15	Preparing for the final exam

Learning and Teaching Resources		
	Text	Available in the Library?
Required Texts	"Calculus", Ford, S.R. and Ford, J.R., (1963) Mc Graw Hill	Yes
Recommended Texts	"Advanced Engineering Mathematics", Erwin Kreyszig et al., (2006) George B. Thomas, Jr., "Thomas' Calculus	No

Module 14

Subject information

Module Title	ELECTRONICS		**Module Delivery**	
Module Type	CORE		☒**Theory** ☐**Lecture** ☒**Lab** ☒ **Tutorial** ☐**Practical** ☐**Seminar**	
Module Code	RETE 200			
ECTS Credits	7			
SWL (hr/sem)	175			
Module Level	2		**Semester of Delivery**	3
Administering Department	Electronics and Control Eng.		**College**	Technical Engineering College - Kirkuk
Module Leader			e-mail	
Module Leader's Acad. Title	Asst. lecture		**Module Leader's Qualification**	M.Sc.
Module Tutor	None		e-mail	None
Peer Reviewer Name	Asst. Lect.		e-mail	@ntu.edu.iq
Review Committee Approval	06/01/2023		**Version Number**	1.0

Relation with Other Modules Relationship with other subjects			
Prerequisitemodule	None	**Semester**	
Co-requisites module	None	**Semester**	
Module Aims, Learning Outcomes and Indicative Contents Course objectives, learning outcomes and guiding content			
Module Aims	1. Providing a clear explanation about the operation of basic semiconductor devices available today. 2. To show how each device and its characteristics is used in an appropriate circuit 3. Understanding the fundamentals of circuit analysis and analogue electronics and it is a basic introduction to electronic theory for a group of electronics-based programmers. 4. Understanding the basic concepts that are used and built upon in future years. 5. Recognize the fundamentals of basic electrical components and circuits and analyzes simple electrical circuits. 6. Explain basic input and output electronics for the electrical circuits. 7. Introduces resources to support learning and their use to develop a resilient approach to learning. 8. Introducing students to the language and methodologies that engineers use to solve problems. 9. Teaching the ability to analyze any DC circuit, and simple electronic circuits containing diodes and transistors.		
Module Learning Outcomes	16. Students will be able to understand the operation of simple power supply circuits and specify components for a given performance and be able to discuss and explain them. 17. Students will be able to understand the electrical characteristics of diodes and analyzes simple analogue circuits containing these elements and be able to discuss and explain them. 18. Students will be able to analyze the diode characteristics and equations, ideal vs real. Signal conditioning, clamping and clipping, Zener diodes and power supplies. 19. Students will be able to demonstrate broad knowledge of electronic components: their construction, function and application in an electronic circuit, and have the ability to build a working electronic circuit using these components, from a given design. 20. Students will be able to demonstrate the ability to design, build and test a printed circuit board based on knowledge of component function and competent use of CAD software and established design rules. 21. Students will be able to demonstrate the ability to accurately present		

	the outcomes of an experiment using a laboratory logbook

Indicative Contents	Indicative content includes the following.
	
	1. Introduction to Semiconductors
	  ○ The Atom
	  ○ Materials Used in Electronic Devices
	  ○ Current in Semiconductors
	  ○ N-Type and P-Type Semiconductors
	  ○ The PN Junction
	2. Diodes and Applications
	  ○ Diode Operation
	  ○ Voltage-Current (VI) Characteristic of a Diode
	  ○ Diode Approximations
	  ○ Half-Wave Rectifiers
	  ○ Full-Wave Rectifiers
	  ○ Power Supply Filters and Regulators
	  ○ Diode Limiters and Clampers
	  ○ Voltage Multipliers
	  ○ The Diode Datasheet
	3. Special-Purpose Diodes
	  ○ The Zener Diode
	  ○ Zener Diode Applications
	  ○ Device Application
	4. Bipolar Junction Transistors
	  ○ Bipolar Junction Transistor (BJT) Structure
	  ○ Basic BJT Operation
	  ○ BJT Characteristics and Parameters.

Learning and Teaching Strategies	
Strategies	**The learning and teaching strategy**is designed to achieve the following aims: 1. communicate knowledge and information on basic electronic circuits 2. Engage students in the analysis and understanding of basic electronic circuits through a combination of theory lectures, tutorials and problem sheets. 3. communicate knowledge on ethical behavior in work environment through lectures. 4. communicate information on opportunities in electronic engineering paths through lectures.

Student Workload (SWL)			
Structured SWL(h/same) **Regular student load during the semester**	93	**Structured SWL (h/w)** **Regular weekly student load**	6.2
Unstructured SWL(h/same) **Irregular student load during the semester**	82	**Unstructured SWL (h/w)** **Irregular student load per week**	5.46
Total SWL(h/same) **The student's total academic load during the semester**	175		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	5	10% (10)	4,8,9,11,13	LO#3,6,8, 10 and 11
	Assignments	5	10% (10)	2, 4,6,10,12	LO # 3, 7, 9,12 and 14
	Report /Lab.	10	10% (10)	Continuous	2,4,6,7,8,9,10,11,12,13
	Projects	1	10% (10)	13	LO # 5, 8 and 10
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO #1-7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction to Atom, Material Used in Electronics, Current in Semiconductors.
Week 2	N-Type and P-Type Semiconductors, The PN Junction.
Week 3	Diode Operation, Voltage-Current (VI) Characteristics.
Week 4	Diode Models, Half-Wave Rectifiers.
Week 5	Full-Wave Rectifiers, Power Supply Filters and Regulators.
Week 6	Diode Limiters and Clampers, Voltage Multipliers.
Week 7	The Zener Diode, Zener Diode Applications.
Week 8	Mid-term Exam
Week 9	Bipolar Junction Transistor (BJT) Structure.
Week 10	Basic BJT Operation
Week 11	BJT Characteristics and Parameters

Week 12	Transistor Bias Circuits and the DC Operating Point
Week 13	Voltage-Divider Bias
Week 14	Other Bias Methods
Week 15	**Preparatory Week**
Week 16	**Final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1-2	Lab 1:The Diode Characteristic • Part 1: Characteristic of PN Junction Diode Curve (Forward Bise) • Part 2: Characteristic of PN Junction Diode Curve (Revers Bise)
Week 3-5	Lab 2:Diode Applications Part 1: Diode Rectifiers • Half-wave rectifier. • Center-tapped full-wave rectifier. • Full-wave rectifier circuit. Part 2: Diode Rectifiers with Filter. • Half-wave rectifier with Filter • Full-wave rectifier circuit with Filter.
Week 6	Lab 3:Diode Clipping Circuits
Week 7	Lab 4:Diode Clamping Circuits
Week 8	Lab 5: Voltage Doubler Circuit.
Week 9-12	Lab 6:Special-Purpose Diodes Part 1: Static Characteristic of Zener Diode. Part 2: The Zener Diode and Regulator • Out-Put Voltage Regulation by Zener Diode using Varying.V_{in} • Out-Put Voltage Regulation by Zener Diode using Varying.R_L Part 3: Diode Clipping Circuits using Zener Diode.

Week 13-14	Lab 7:Transistor Static Characteristic • Common-Base Transistor Connection • Common-Emitter Transistor Connection

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Electronic Devices' Conventional Current Version, by Thomas L. Floyd, Tenth Edition.	Yes
Recommended Texts	Electronic Devices and Circuit Theory' by Robert Boylestad Louis Nashelsk, Ninth Edition.	No
Websites		

Module 15
Subject information

Module Title	Mechanical Drawing	Module Delivery	
Module Type	**Core**	☒Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**RETE 201**		
ECTS Credits	**6**		
SWL (hr/sem)	**150**		
Module Level	2	Semester of Delivery	3
Administration Department	**RETE**	College	College of Oil and Gas Techniques Engineering – Kirkuk (COGTEK)
Module Leader		e-mail	
Module Leader's Acad. Title		Module Leader's Qualification	
Module Tutor		e-mail	
Peer Reviewer Name		e-mail	
Scientific Committee Approval Date		Version Number	

Relation with other Modules			
Prerequisite module	Engineering Drawing	Semester	2
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	1. to train students: to read the technical drawings through the application of techniques 2. Learn students to read symbols, technical terms, standard specifications. 3. To understand the basic principle for descriptive geometry. 4. This course deals with the basic concept of the computer in mechanical drawing. 5. To be able to communicate with manufacturers of mechanical systems. 6. To understand standard specifications, draw simple and complex assembly drawings. 7. To be able to communicate with other mechanical engineering professionals Regardless of their spoken language.
Module Learning Outcomes	Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks. 1. Capability to use AutoCAD for 2-D representations. 2. To make the students understand all about the screw threads and their Definitions also to teach the students all common types for screw threads and the common types for bolts and nuts with an overview in details. 3. To make the students understand all about the Keys, types of keys, spline shaft and hub concept, and the basic definitions for Keys also the correct manner for Keys drawing. 4. Enables the students to learn the techniques and standard practices of technical graphics. 5. To make the students understand all about the riveting and types of rivets. 6. Read a working or assembly drawing (blueprint) 7. Represent mechanical components in multi view orthographic representation 8. Understanding all about the welding, types of weld joints and the basic Definitions for welding also the correct manner for all types of welding symbol drawing 9. To help students understand all about the Gears classification, draw spur gear, definitions, formulas and calculations.

Indicative Contents	Indicative content includes the following. Part A - Introduction to (CAD), components of computer aided drawing (CAD), Exercises. [4 hrs] Screw threads, forms of screw thread, international metric threads (ISO screw), Common types of fasteners. [8hrs] Method of drawing (Hexagonal & Square headed bolts and nuts) Screw threads, Nuts, Forms and types of screw threads and types of nuts, ISO. Also method of drawing (Hexagonal & Square headed bolts and nuts), with an exercise for these objects. [8 hrs] general introduction for Keys, types of keys, spline shaft and hub Drawing, and the basic definitions for Keys also the correct manner for Keys drawing. The common types for Keys also an explanation in detail. Also the pin and cotter joint [12hrs] Revision and quiz [8hrs] Part B – Fundamentals of rivets and riveted joints, types of riveted joints, Conventional rivet symbol, and the basic definitions for riveting also the correct manner for all types of rivets drawing, also an explanation in details for all types. [10 hrs] general introduction for Welding, type of welding, welding symbols standard. [4 hrs] General introduction for Pulleys, types of pulleys. location and dimension of Pulleys, and the basic definitions for Pulleys also the correct manner for all types of Pulleys drawing, also an explanation in details for all types. [10 hrs] Gears classification of gears, Assembly and details of common mechanical unit [15 hrs] Pipes and pipe joints, piping fittings, pipe symbols standard. [10 hrs]

Learning and Teaching Strategies	
Strategies	The student work will be assessed according to the module tasks. The excises in the drawing hall will be marked weekly. And the homework will be assessed next lecture. During both assessments the student will give the oral and written feedback in order to improve their skills. The final exam will be done at the end of the semester. Note: the late work will not be marked.

Student Workload (SWL)			
Structured SWL (h/sem) Regular student load during the semester	63	Structured SWL (h/w) Regular weekly student load	4.2
Unstructured SWL (h/sem) Irregular student load during the semester	87	Unstructured SWL (h/w) Irregular student load per week	5.8
Total SWL (h/sem) The student's total academic load during the semester	150		

Module Evaluation					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	5	10% (10)	3,6,8,10,11 and12	LO #4, #7, #9, #11 and #13
	Assignments	5	10% (10)	2, 5,9, 11 and 14	LO #3, #5, #7 #8 and #9
	Lab Report	10	20% (20)	Continuous	LO #2,3,4,5,6,7,8,9,10,11,12
Summative assessment	Mid Term exam	2 hours	10% (10)	7	LO #1-7
	Final Exam	3hr	50% (50)	16	All
100% (100 Marks)					

Delivery Plan (Weekly Syllabus)	
Week 1	Introduction to (CAD), components of computer aided drawing (CAD), Exercises
Week 2	Screw threads, forms of screw thread, international metric threads (ISO screw), Common types of fasteners
Week 3	Method of drawing (Hexagonal & Square headed bolts and nuts)
Week 4	Keys, types of keys.
Week 5	Pins and Cotters.
Week 6	Rivets and riveted joints
Weeks 7	Mid-Term Exam
Weeks 8	Types of riveted joints, conventional rivet symbol, working drawing.
Week 9	Welding, type of weld joints, welding symbols standard, location and dimension of weld.
Week 10	Pulleys, types of pulleys.
Week 11	Gears classification of gears, spur gear, definitions, formulas and calculations.
Week 12	Assembly and details of common mechanical units. Screw Jack (assembly and details).
Week 13	Power screw (Assemble and details)
Week 14	Coupling, Types of coupling, Bearings, types of bearings.
Week 15	Preparatory week before the final exam

Learning and Teaching Resources		
	Text	Available in the Library?
Required Texts	kl Narayana p. kannaiah k. venketa reddy mechanical engineering.	Yes
Recommended Texts	Up. and. Running.with.AutoCAD.2012.2D.and.3D. Drawing. a nd. Modeling	No

Module 16 Subject information				
Module Title	BAATH CRIMES		**Module Delivery**	
Module Type	BASIC		☒Theory ☐Lecture ☐Lab ☐Tutorial ☐Practical ☐Seminar	
Module Code	NTU 200			
ECTS Credits	2			
SWL (hr/sem)	50			
Module Level	2	**Semester of Delivery**	3	
Administering Department	RETE	**College**	College of Oil and Gas Techniques Engineering - Kirkuk, Northern Technical University, Iraq	
Module Leader	Dr. Osama Ali Ibrahim	e-mail	Osama@ntu.edu.iq	
Module Leader's Acad. Title	Lecturer	**Module Leader's Qualification**	Ph.D.	
Module Tutor	None	e-mail		
Peer Reviewer Name		e-mail		
Review Committee Approval	06/01/2023	**Version Number**	1.0	

Relation With Other Modules			
Prerequisitemodule	None	**Semester**	
Co-requisites module	None	**Semester**	
Module Aims, Learning Outcomes and Indicative Contents			

Module Aims	The objectives of this course include: 1. **Understanding History:** Studying the crimes of the defunct Baath Party regime may be part of understanding the events of the modern history of the region and the countries affected by it. 2. **Event analysis:** Examining events and developments that occurred during the Baath Party rule, with a focus on events that constitute human rights violations and crimes. 3. **Justice and Human Rights:** Understand the concepts of human rights and justice, and how justice can be achieved in light of the crimes committed by the Baath Party regime. 4. **Legal Studies:** Focus on the legal aspects of these crimes, and how to address them through the national legal system or international law. 5. **Prevention and education:** Find ways to avoid the recurrence of such crimes in the future, and raise awareness of the importance of human rights.
Module Learning Outcomes	1. **Understanding history and context:** Students' ability to understand and analyze the historical context of Ba'ath Party rule and how crimes occurred during this period. 2. **Critical analysis:** The ability to critically analyze events and situations, and evaluate their impact on society and human rights. 3. **Legal knowledge:** Understand the laws and regulations relating to crimes associated with the Baath Party regime, and how they are applied to achieve justice. 4. **Critical thinking:** Developing critical thinking skills and deep analysis of events and phenomena related to the subject. 5. **Human rights awareness:** Raising awareness about human rights and emphasizing their importance in preventing the recurrence of such crimes in the future. 6. **Dealing with information sources:** Develop research and analysis skills in using reliable sources to understand history and evaluate events. 7. **Writing and Communication:** Improving writing and expression skills on topics related to the crimes of the defunct Baath Party regime. 8. **Ability to interact with sensitive content**: Develop the ability to interact with sensitive topics appropriately and professionally.

	This is amazing outcomes can contribute to qualifying students to have a deeper understanding of the subject and to apply the acquired knowledge in different contexts, whether in the academic field or in society in general.
Indicative Contents	**1. Crimes of the Baath regime according to the Iraqi Supreme Criminal Court Law of 2005:** This chapter deals with the concept of crimes and their types, the definition of crime in language and terminology, and also a detailed study of the types of existing crimes. After that, the crimes of the Baath regime are addressed according to the documentation of the Iraqi Supreme Criminal Court Law of 2005 AD. Finally, the types of international crimes and the decisions issued by the Supreme Criminal Court against the perpetrators of crimes are identified. **2. Psychological and social crimes and their effects, and the most prominent violations of the Baathist regime in Iraq:** This is related to studying the impact of psychological and social crimes committed by the Baath Party regime on the individual and society. It deals with the psychological effects of violations and dealing with them from a social perspective. Also, social crimes and the militarization of society. This chapter discusses the Baath regime's position on religion. It explains in detail the violations of Iraqi laws and the pictures and places of detention of the Baath regime. **3. Environmental crimes of the Baath regime in Iraq:** This content includes a study of the environmental impact of the crimes of the Baath Party regime, such as environmental pollution and environmental destruction resulting from the regime's actions, such as war pollution, radioactive contamination, and mine explosions. In addition to the destruction of cities and villages, the drying up of marshes, and the bulldozing of palm groves, trees, and crops. **4. Mass grave crimes:** This section deals with the legal and ethical aspects related to mass grave crimes, the events of the genocide graves committed by the Baathist regime in Iraq, and the chronological classification of the genocide graves in Iraq for the period 1963-2003. This content indicates the diversity and comprehensiveness of the subject, as the legal, social and environmental aspects of the crimes of the Baath Party regime are addressed. This study material also includes the research and analysis of specific case studies for a deep understanding of the context and impacts.
Learning and Teaching Strategies	
Strategies	**Active learning and active participation:** • Encourage students to actively participate in lessons through questions and group discussions.. • Organize educational activities that encourage thinking, discussion and

	problem solving.. Learning through technology: • Use e-learning platforms and educational applications to deliver content and enhance engagement and practice.. • Providing online resources and multimedia teaching materials to guide students in self-directed learning.. Continuous assessment and feedback: • Provide periodic assessment of student performance through tests and assignments.. • Providing immediate feedback and supervision to help students improve their skills and learn about the country's history and the suffering of the Iraqi people during the rule of the former regime..

Student Workload (SWL)

Structured SWL(h/same) **Regular student load during the semester**	33	**Structured SWL (h/w)** **Regular weekly student load**	2.2
Unstructured SWL(h/same) **Irregular student load during the semester**	17	**Unstructured SWL (h/w)** **Irregular student load per week**	1.13
Total SWL(h/same) **The student's total academic load during the semester**	50		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	5	20% (20)	2,4,6,8,10	LO #3, 6, 7,9, and 11
	Assignments	5	10% (10)	3,5,7,9,12	LO #2, 8, 10,12, and 13
	Report	2	10% (10)	6,10	LO # 4, 9
Summative assessment	**Midterm Exam**	1 hour	10% (10)	7	LO #1-6
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered

Week 1-2	• Crimes system Resurrection according to law The court Criminal Iraqi The High general 2005 M
	  • The concept of crimes and their types
	  • Crimes of the Baath regime according to the documentation of the Iraqi

	Supreme Criminal Court Law of 2005 AD

Week 3-4	• Crimes Psychology and social And its effects, And most prominently Violations order Baathist in Iraq
	  • Psychological crimes
	  • Mechanisms of psychological crimes
	  • Social crimes

Week5-6	• Crimes Psychology and social And its effects, And most prominently Violations order Baathist in Iraq
	  • The Baath regime's position on religion
	  • Violations of Iraqi laws
	  • Human rights violations
	  • Some political violations decisions

Week 7	• Mid-term exam

Week 8-9	• Environmental crimes of the Baath regime in Iraq
	  • War pollution, radioactivity and mine explosions
	  • Destruction of cities and villages (scorched earth policy)

Week 10-12	• Environmental crimes of the Baath regime in Iraq
	  • Drying the marshes
	  • Destruction of palm groves, trees and crops

Week 13-14	• Mass grave crimes
	  • Events of the genocidal graves committed by the Baathist regime in Iraq
	  • Chronological classification of genocide graves in Iraq for the period 1963 AD-2003 AD

Week 15	**Preparatory Week**
Week 16	**Final Exam**

Learning and Teaching Resources

	Text	**Available in the Library?**
Required Texts	• The Holy Quran • Ihsan Hindi, Laws of belligerent occupation, Rights of the civilian population in the occupied territories and their protection, Administration	No

	Politics, Damascus, 1972 • Archive of the Political Prisoners Foundation. • Martyrs Foundation Archive • Archive of the Iraqi Center for Documenting Extremist Crimes at the Holy Abbasid Shrine.	
Recommended Texts	• Ayman Abdel Aziz Salama, International Responsibility for the Crime of Genocide, 1st ed., Dar Al-Ulum for Publishing and Distribution, Cairo, 2006.	No
Websites		

Module 17

Subject information

Module Title	**English Language**	**Module Delivery**	
Module Type	Basic		☒**Theory** ☐**Lecture** ☐**Lab** ☐**Tutorial** ☐**Practical** ☒**Seminar**
Module Code	**NTU 201**		
ECTS Credits	**2**		
SWL (hr/sem)	50		
Module Level	2	**Semester of Delivery**	3
Administering Department	RETE	**College**	College of Oil and Gas Techniques Engineering – Kirkuk (COGTEK)
Module Leader		e-mail	
Module Leader's Acad. Title	Assistant lecturer	**Module Leader's Qualification**	Master
Module Tutor		e-mail	
Peer Reviewer Name	Name	e-mail	Email
Scientific Committee Approval Date	06/01/2023	**Version Number**	1.0

Relation with other Modules

Prerequisite module	English Language	**Semester**	1

Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	The aim of this English Language Lecture is to provide students with a comprehensive understanding of the English language, including its structure, usage, and various linguistic aspects. The lecture aims to enhance students' language skills and improve their overall proficiency in English.
Module Learning Outcomes	1. Demonstrate a solid understanding of the fundamental aspects of English grammar, vocabulary, and syntax. 2. Apply effective reading strategies to comprehend and analyze a variety of written texts. 3. Produce coherent and well-structured written pieces using appropriate grammar, vocabulary, and style. 4. Listen actively and understand spoken English in various contexts, including formal and informal situations. 5. Engage in meaningful conversations and deliver clear and organized oral presentations in English. 6. Critically evaluate and analyze linguistic elements in literature, media, and other forms of communication. 7. Recognize and appreciate the historical and cultural contexts that have shaped the English language.
Indicative Contents	Indicative content includes the following. 1. Introduction to the English language and its global significance. 2. Overview of English grammar, including parts of speech, sentence structure, and verb tenses. 3. Building vocabulary and word choice for effective communication. 4. Reading comprehension strategies and analysis of different types of texts. 5. Developing writing skills, including organization, coherence, and proper grammar usage.

	6. Listening comprehension and effective note-taking techniques. 7. Speaking skills development, including conversation, pronunciation, and presentation skills. 8. Literary analysis and interpretation of English language texts. 9. Historical and cultural influences on the English language. 10. Contemporary issues and challenges in the English language.

Learning and Teaching Strategies	
Strategies	1. Lecture delivery: The instructor will present concepts, explanations, and examples through interactive lectures, incorporating visual aids, multimedia resources, and real-life examples. 2. Group activities: Students will engage in group discussions, peer-to-peer interactions, and collaborative learning tasks to reinforce their understanding of concepts and develop their communication skills. 3. Practical exercises: Students will participate in individual and group exercises, such as grammar quizzes, writing assignments, and pronunciation drills, to apply their knowledge and receive feedback. 4. Multimedia resources: The lecture may incorporate audiovisual materials, online resources, and language learning software to provide a dynamic and interactive learning experience. 5. Assessments: Regular assessments, including quizzes, exams, and assignments, will be conducted to measure students' progress and provide constructive feedback for improvement. 6. Self-directed learning: Students will be encouraged to engage in independent learning outside of the lecture through recommended readings, online resources, and language practice exercises.

Student Workload (SWL) The student's academic load is calculated for 15 weeks.			
Structured SWL (h/sem)	33	**Structured SWL (h/w)**	2.2

Regular student load during the semester		**Regular weekly student load**	
Unstructured SWL (h/sem) **Irregular student load during the semester**	17	**Unstructured SWL (h/w)** **Irregular student load per week**	1.13
Total SWL (h/sem) **The student's total academic load during the semester**	50		

Module Evaluation

Course material evaluation

As		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	0	0	5, 12	LO #1, 3 and 7
	Assignments	0	30% (30)	4, 13	LO #2, 4 and 6
	Projects /Lab.	0	0%		
	Report	1	20% (10)	13	All
Summative assessment	**Midterm Exam**	2 hrs.	20% (30)	7	LO #1-6
	Final Exam	2 hrs.	30% (30)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	• Review of basic grammar: Verb tenses (present, past, future) • Words in English (Book 4)
Week 2	• Present perfect tense • Words in English (Book 4)

Week 3	• Modal verbs: Can, could, may, might, must, should • Words in English (Book 4)
Week 4	• writing letters and emails. • Words in English (Book 4)
Week 5	• Conditional sentences (Type 1) • Words in English (Book 4)
Week 6	• Reported speech (statements and questions) • Words in English (Book 4)
Week 7	• Mid-term Evaluation
Week 8	• Comparative and superlative adjectives and adverbs • Words in English (Book 4)
Week 9	• Passive voice • Words in English (Book 4)
Week 10	• Phrasal verbs • Words in English (Book 4)
Week 11	• Future forms: Going to, will, and present continuous. • Words in English (Book 4)
Week 12	• Prepositions: Time, place, and movement • Words in English (Book 4)
Week 13	• Reported speech (commands and requests) • Words in English (Book 4)
Week 14	• Relative clauses • Words in English (Book 4)
Week 15	• Review and reinforcement of previous topics before final term evaluation

Learning and Teaching Resources

	Text	**Available in the Library?**
Required Texts	English Grammar in Use by Raymond Murphy 5th edition	No
Recommended Texts	4000 Essential English words 2nd edition	No
Websites	http://www.duolingo.com/ http://www.bbc.co.uk/learningenglish	

Module 18
Subject information

Module Title	**Strength of Materials**		
Module Type	**Core**	☒ Theory ☐ Lecture ☒ Lab ☒ Tutorial ☐ Practical ☐ Seminar	
Module Code	**RETE 202**		
ECTS Credits	**6**		
SWL (hr/sem)	**150**		
Module Level	2	Semester of Delivery	4
Administration Department	RETE	College	College of Oil and Gas Techniques Engineering - Kirkuk, Northern Technical University, Iraq
Module Leader		e-mail	
Module Leader's Acad. Title	Assistant lecturer	Module Leader's Qualification	MSc
Module Tutor		e-mail	
Peer Reviewer Name		e-mail	
Scientific Committee Approval Date		Version Number	

Relation with other Modules

Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

Module Aims	• To know different types of stresses which may be subjected to the mechanical elements and their expected effects such as strain. • To study the shear forces and bending moment diagrams with essential stresses

Module Learning Outcomes	• Students who successfully complete this course will have demonstrated an ability to: ✓ Understand the concepts of stress and strain at a point as well as the stress-strain relationships for homogenous, isotropic materials. ✓ Calculate the stresses and strains in axially-loaded members, circular torsion members, and members subject to flexural loadings. ✓ Calculate the stresses and strains associated with thin-wall spherical and cylindrical pressure vessels. ✓ Determine the stresses and strains in members subjected to combined loading and apply the theories of failure for static loading. ✓ Determine and illustrate principal stresses, maximum shearing stress, and the stresses acting on a structural member. ✓ Determine the deflections and rotations produced by the three fundamental types of loads: axial, torsional, and flexural. ✓ Analyze slender, long columns subjected to axial loads. ✓ Design simple bars, beams, and circular shafts to allow stresses and loads.
Indicative Contents	1. Introduction to Strength of Materials A. Definition and Importance of Strength of Materials B. Historical Background C. Applications of Strength of Materials 2. Stress and Strain A. Basic Definitions B. Types of Stresses C. Types of Strains D. Hooke's Law 3. Axial Loading A. Normal Stress and Strain B. Deformation of Axially Loaded Members C. Stress-Strain Diagrams D. Elastic and Plastic Deformation E. Factor of Safety 4. Torsion A. Torque and Torsional Shear Stress B. Polar Moment of Inertia C. Torsional Deformation D. Power Transmission in Shafts 5. Bending

Learning and Teaching Strategies

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 types of simple experiments involving some sampling activities that are interesting to the students Unscheduled Directed Student Hours (time spent away from the timetabled sessions but directed by the teaching staff).

Student Workload (SWL)

Structured SWL (h/sem) Regular student load during the semester	93	Structured SWL (h/w) Regular weekly student load	6.2
Unstructured SWL (h/sem) Irregular student load during the semester	57	Unstructured SWL (h/w) Irregular student load per week	3.8
Total SWL (h/sem) The student's total academic load during the semester	150		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5, 7	LO #1, and #3
	Assignments	3	10% (10)	3,4,14	LO #2, #4 and #8
	Lab Report	20	20% (20)	Continuous	All
Summative assessment	Mid Term exam	2 hours	10% (10)	7	LO #1-4
	Final Exam	3hr	50% (50)	16	All
100% (100 Marks)					

Delivery Plan (Weekly Syllabus)

Week 1	simple stress
Week 2	Shearing stress, Bearing stress
Week 3	Thin wall cylinders
Week 4	Simple strain, stress-strain diagram, Hook's law
Week 5	Thermal stress
Week 6	Welded connection
Weeks 7	Riveted joints
Weeks 8	Torsion
Week 9	Spring
Week 10	Shear and moment in Beam
Week 11	Beam deflection
Week 12	Mid-Term Exam

Week 13	Combined stresses
Week 14	Stress at a point / Mohr circle
Week 15	Preparing for the final exam

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Lab 1:Introduction to Strength of materials
Week 2	Lab 2: Brinell Hardness Test
Week 3	Lab 3: Rockwell Hardness Test
Week 4	Lab 4: Vickers Hardness Test
Week 5	Lab 5: Tensile Test
Week 6	Lab 6: Compression Test
Week 7	Lab 7: Torsion Test
Week 8	Lab 8: Creep Test
Week 9	Lab 9: Spring Stiffness
Week 10	Lab 10: Deflection in Cantilever Beam Test

Learning and Teaching Resources		
	Text	Available in the Library?
Required Texts	Strength of Materials, Ferdinand L. Singer and Andrew Pytel.	Yes
Recommended Texts	Schaum's Outline of Strength of Materials	No

Module 19
Subject information

Module Title	ELECTRONIC CIRCUITS		**Module Delivery**	
Module Type	CORE		☒Theory ☐Lecture ☒Lab ☒Tutorial ☐Practical ☐Seminar	
Module Code	RETE 203			
ECTS Credits	7			
SWL (hr/sem)	175			
Module Level	2	**Semester of Delivery**	4	
Administering Department	RETE	**College**	College of Oil & Gas Techniques Engineering/Kirkuk	
Module Leader		e-mail	@ntu.edu.iq	
Module Leader's Acad. Title		**Module Leader's Qualification**		
Module Tutor	None	e-mail	None	
Peer Reviewer Name	Asst. Lect.	e-mail	@ntu.edu.iq	
Review Committee Approval	06/01/2023	**Version Number**	1.0	

Relation with Other Modules
Relationship with other subjects

Prerequisite module	Electronics ECE102	**Semester**	Level 1 Semester 2
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents

Module Aims	Basically, the module aims to establish a strong foundation in electronic circuits, enabling the students to analyze and design basic electronic circuits and understand their applications in various fields such as control systems, telecommunications and consumer electronics. The main module aims are: 1. Understanding fundamental concepts. 2. Developing electronic circuit analysis skills. 3. Family with electronic components. 4. Developing amplifier design skills. 5. Practical circuit design and analysis. 6. Introduction to integrated circuits.

Module Learning Outcomes	The module learning outcomes include the following: 22. **Knowledge and Understanding**: Students should demonstrate a solid knowledge and understanding of the fundamental concepts, principles, and theories related to electronic circuits. They should be able to explain the behavior and characteristics of electronic components and their applications in circuit design. 23. **Circuit Analysis Skills**: Students should be able to apply circuit analysis techniques, including Kirchhoff's laws, nodal analysis, and mesh analysis, to solve electronic circuit problems. They should be able to analyze and predict the behavior of circuits under different conditions. 24. **Design and Evaluation**: Students should be able to design and evaluate basic electronic circuits, including amplifiers, using appropriate design principles and techniques. They should understand the trade-offs and considerations involved in circuit design, such as gain, bandwidth, stability, and power efficiency. 25. **Practical Skills**: Students should possess practical skills in building, testing, and troubleshooting electronic circuits. They should be able to use laboratory equipment and tools effectively and safely. They should also demonstrate the ability to analyze and interpret experimental data and draw conclusions based on the results. 26. **Integration of Knowledge**: Students should be able to integrate their knowledge of electronic circuits with other relevant areas, such as mathematics, physics, and computer science. They should be able to apply their knowledge to solve interdisciplinary problems and understand the broader context of electronic circuits in various applications. 27. **Communication and Presentation Skills** Students should be able to communicate their ideas, analysis, and design concepts effectively, both orally and in written form. They should be able to present their work and findings in a clear and organized manner, using appropriate technical terminology.
Indicative Contents	1. Review of basic concepts: o Diode structure, operation, types and applications. 2. Bipolar Junction Transistors (BJTs): BJT structure, operation, characteristics and biasing techniques. o Field-Effect Transistors (FETs): (JFET and MOSFET) structure, operation, characteristics and biasing techniques. 3. Amplifier configurations: o BJT amplifiers: common emitter, common base, and common collector configurations.

	o FET amplifiers: common source, common gate, and common drain configurations 4. Amplifier circuits: o BJT small-signal amplifiers: voltage gain, current gain, and power gain. o FET small-signal amplifiers: voltage gain, current gain, and power gain. o Multistage amplifiers and cascaded amplifiers. o Differential amplifiers. 5. Power Amplifiers: o Class A, B, AB, and C power amplifiers Amplifier frequency response and bandwidth: o BJT and FET amplifiers. 6. Power supply basics: o rectification, filtering, and regulation.
Learning and Teaching Strategies	
Strategies	To effectively deliver the electronic circuits module, instructors may employ the following strategies: 1.**Lectures** Conducting lectures is a traditional method to deliver theoretical concepts and principles. Instructors can use multimedia resources, such as slides, visual aids, and demonstrations, to enhance understanding. They should focus on clear explanations, real-life examples, and engaging students through interactive discussions. 2.**Practical Sessions**: Practical sessions in a laboratory setting are essential for students to apply theoretical knowledge to hands-on circuit design, construction, and testing. Instructors can guide students through experiments and provide opportunities for them to troubleshoot and analyze circuit behavior. This approach reinforces understanding and builds practical skills. 3.**Problem-Solving Exercises** Assigning problem-solving exercises encourage students to practice circuit analysis techniques and apply theoretical concepts to solve complex problems. Instructors can provide a range of problems at different difficulty levels, offering opportunities for

	students to work individually or in groups. Feedback and discussions on problem-solving strategies further enhance learning. 4.**Design Projects**: Design projects allow students to integrate their knowledge and skills to design and implement electronic circuits to meet specific requirements. Instructors can assign individual or group projects that involve circuit design, simulation, prototyping, and testing. This approach fosters creativity, critical thinking, and problem-solving abilities. 5.**Simulation Tools**: Using circuit simulation software, such as SPICE (Simulation Program with Integrated Circuit Emphasis), instructors can provide virtual environments for students to design and analyze circuits. Simulations allow students to experiment with different circuit configurations, evaluate performance, and observe behavior in a controlled manner. It also facilitates rapid prototyping and exploration of complex circuits. 6.**Interactive Demonstrations**: Instructors can conduct interactive demonstrations to illustrate the behavior of electronic circuits in real-time. These demonstrations can involve circuit construction on a breadboard or using simulation software. By engaging students through live demonstrations, instructors can reinforce concepts and clarify difficult topics. 7.**Group Discussions and Peer Learning** Encouraging group discussions and peer learning can promote active engagement and knowledge sharing among students. Instructors can assign problem-solving tasks or case studies to group discussions, allowing students to collaborate, exchange ideas, and learn from each other's perspectives and approaches. 8.**Assessment and Feedback** Assessments, including quizzes, tests, and assignments, are essential for evaluating students' understanding and progress. Instructors should provide timely and constructive feedback to help students identify areas for improvement. Feedback can be provided through individualized comments, grading rubrics, or face-to-face discussions. 9.**Guest Speakers and Industry Visits**: Inviting guest speakers from industry or academia and organizing visits to relevant companies or research labs that can provide students with real-world insights and applications of electronic circuits. These opportunities allow students to connect theoretical knowledge with practical applications and gain exposure to industry practices.

	By incorporating a combination of these strategies, instructors can create an engaging and comprehensive learning experience for students in the electronic circuits module. It is important to adapt and modify these strategies based on the specific needs of the students and the available resources.

Student Workload (SWL)			
Structured SWL(h/same) **Regular student load during the semester**	93	**Structured SWL (h/w)** **Regular weekly student load**	6.2
Unstructured SWL(h/same) **Irregular student load during the semester**	82	**Unstructured SWL (h/w)** **Irregular student load per week**	5.46
Total SWL(h/same) **The student's total academic load during the semester**	175		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	5	10% (10)	1,3,5,8,11	LO #1, 2, 10,11and 13
	Assignments	5	10% (10)	2, 4,6,10,12	LO # 3, 4, 6,7 and 8
	Projects /Lab.	14	10% (10)	Continuous	
	Report	1	10% (10)	13	LO # 5, 8 and 10
Summative assessment	**Midterm Exam**	2 hours	10% (10)	7	LO #1-7
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Review of basic concepts: ○ Diode structure, operation, types and applications. ○ Bipolar Junction Transistors (BJTs): BJT structure, operation, characteristics and biasing techniques. ○ Field-Effect Transistors (FETs): (JFET and MOSFET) structure, operation, characteristics and biasing techniques.

Week 2-3	Amplifier configurations: ○ BJT amplifiers: common emitter, common base, and common collector configurations. ○ FET amplifiers: common source, common gate, and common drain configurations
Week 4-7	Amplifier circuits: ○ BJT small-signal amplifiers: voltage gain, current gain, and power gain. ○ FET small-signal amplifiers: voltage gain, current gain, and power gain. ○ Multistage amplifiers and cascaded amplifiers. ○ Differential amplifiers.
Week 8-10	Power Amplifiers: ○ Class A, B, AB, and C power amplifiers
Week 11-12	Amplifier frequency response and bandwidth: ○ BJT and FET amplifiers.
Week 13-14	Power supply basics: ○ rectification, filtering, and regulation.
Week 15	**Preparatory Week**
Week 16	**Final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	BJT amplifier DC biasing techniques.
Week 2	FET amplifier DC biasing techniques.
Week 3-4	BJT small signal amplifier configurations.
Week 5-6	FET small signal amplifier configurations.
Week 7-8	Multistage amplifiers and cascaded amplifiers.
Week 9	Differential amplifiers.
Week 10	Power Amplifiers: Class A, B, AB, and C power amplifiers
Week 11-12	Bandwidth and frequency response of BJT and FET amplifiers.

Week 13-14	Power supply circuits: rectification, filtering, and regulation.

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Thomas L. Floyd. 2006. Electric Circuit Fundamentals (7th Edition) (Floyd Electronics Fundamentals Series). Prentice-Hall, Inc., USA.	Yes
Recommended Texts	Adel S. Sedra and Kenneth C. Smith. 2007. Microelectronic Circuits Revised Edition (5th. ed.). Oxford University Press, Inc., USA.	No
Websites	https://www.coursera.org/	

Module 20
Subject information

Module Title	Refrigeration & Air Conditioning Principles		Module Delivery	
Module Type	**Core**		☒Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**RETE 204**			
ECTS Credits	**5**			
SWL (hr/sem)	**125**			
Module Level	2	Semester of Delivery	4	
Administration Department	RETE	College	College of Oil and Gas Techniques Engineering - Kirkuk, Northern Technical University, Iraq	
Module Leader	Marwa Khaleel Rashid	e-mail	marwa.khaleel23@ntu.edu.iq	
Module Leader's Acad. Title	Assistant lecturer	Module Leader's Qualification	M.Sc.	
Module Tutor		e-mail		
Peer Reviewer Name		e-mail		

Scientific Committee Approval Date		Version Number	

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	1. Understand the basic principles of refrigeration and air conditioning systems. 2. To understand the fundamental properties of Air and Water vapor mixture. 3. This course deals with the basic concept of air-conditioning processes. 4. Identify and describe the components of a typical refrigeration and air conditioning system. 5. To explain the thermodynamic principles involved in refrigeration and air conditioning processes. 6. Demonstrate knowledge of refrigerants and their properties, including safety considerations and environmental impacts.
Module Learning Outcomes	1. Define Refrigeration and Air conditioning and identify their applications. 2. Define and calculate moist air properties using related equations. 3. Recognize how to use a Psychrometric chart in solving various Air conditioning processes. 4. Analyze the simple vapor compression cycle. 5. Describe the factors affecting vapor compression cycle performance. 6. Identify the multi-pressure refrigeration systems. 7. Recognize the types of refrigerant and their effect on Ozone and How to Number it
Indicative Contents	Indicative content includes the following. Part A - Air conditioning Air conditioning definition, Air conditioning systems and applications, SI units, Fundamental properties of Air and Water vapor mixture; Definition of (moist air properties), Calculation of moist air properties using related equations. [14 hrs] Psychrometric chart and its construction, Air-conditioning processes, Air-conditioning processes (sensible cooling, and sensible heating). [14 hrs] Air-conditioning processes (Dehumidification, Humidification, Mixing of air streams, Cooling and dehumidification with reheat, and Pre-heating with humidification and reheat). [14 hrs] Summer and winter cycle. [4 hrs] Part B - Refrigeration

	Refrigeration definition, Refrigeration systems and applications, heat pump, reversed Carnot cycle, [7 hrs] Simple vapor compression cycle components and analysis, Ideal and actual vapor compression cycle, factors affecting vapor compression cycle performance, Multi Pressure systems. [30 hrs] Refrigerants. [14 hrs]

Learning and Teaching Strategies

Strategies	The Refrigeration and Air Conditioning module employs a range of effective learning and teaching strategies. Students engage in theoretical lectures, practical demonstrations, and hands-on laboratory sessions to grasp the underlying principles and gain practical skills. Case studies and real-world scenarios enhance problem-solving abilities, while group projects foster teamwork and communication skills. Continuous assessment methods, including assignments and practical assessments, ensure students' progress and understanding of the subject matter. The module promotes equipping students with the knowledge and skills necessary for success in the field of refrigeration and air conditioning.

Student Workload (SWL)

Structured SWL (h/sem) Regular student load during the semester	63	Structured SWL (h/w) Regular weekly student load	4.2
Unstructured SWL (h/sem) Irregular student load during the semester	62	Unstructured SWL (h/w) Irregular student load per week	4.13
Total SWL (h/sem) The student's total academic load during the semester	125		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	5	10% (10)	3,6,8 and 12,14	LO #1, #3 #6, #8, and 10
	Assignments	4	10% (10)	2,4,9,and 14	LO #2, #4, #5 and #7
	Lab Report	10	20% (20)	Continuous	All
Summative assessment	Mid Term exam	2 hours	10% (10)	7	LO #1-3
	Final Exam	3hr	50% (50)	16	All
100% (100 Marks)					

Delivery Plan (Weekly Syllabus)	
Week 1	Air conditioning, Air conditioning systems, SI units, Fundamental properties of Air and Water vapor mixture; definition of (moist air properties) , Dry bulb, wet bulb and Dew point temperatures, partial pressure, Relative humidity, moisture content, Specific volume and Enthalpy
Week 2	The General Gas Law, Dalton's law of partial pressure, Calculation of moist air properties using related equations.
Week 3	Psychrometric chart, Construction of psychrometric chart, Sensible Heat and Latent Heat.
Week 4	Air-conditioning processes, Adiabatic saturation process, sensible cooling, and sensible heating.
Week 5	Dehumidification; By pass factor, contact factor, Humidification – Humidification by water injection, steam injection.
Week 6	Mixing of air streams, Cooling and dehumidification with reheat
Weeks 7	Mid-Term Exam
Weeks 8	Preheating with humidification and reheat. Summer and winter cycle.
Week 9	Refrigeration application, refrigeration theory, heat pump, reversed Carnot cycle.
Week 10	Simple vapor compression cycle, vapor compression cycle components, Simple vapor compression cycle analysis
Week 11	Ideal and actual vapor compression cycle, factors affecting vapor compression cycle performance (effect of suction temperature, effect of condensing temperature, effect of sub cooling, effect of superheating, effect of pressure loss).
Week 12	Multi Pressure systems: Removing flash gas, inter-cooler
Week 13	Single evaporator and single compressor, single compressor and two evaporators.
Week 14	Two compressors and two evaporators, multi-stage compression cycle using, water intercooler, flash intercooler, liquid refrigerants intercooler
Week 15	Preparing for the final exam

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Lab 1: Measuring air velocity using Pitot tube and Manometer.
Week 2	Lab 2: Air Properties.
Week 3	Lab 3: Application on air Psychrometric chart.

Week 4	Lab 4: Sensible heating.
Week 5	Lab 5: Sensible cooling.
Week 6	Lab 6: Dehumidification of air
Week 7	Lab 7: Heating with humidification of air.
Week 8	Lab 8: Mixing of air.
Week 9	Lab 9: Refrigerator and heat pump.
Week 10	Lab 10: Calculation of the capacity and coefficient of performance of vapor compression unit.

Learning and Teaching Resources		
	Text	Available in the Library?
Required Texts	Refrigeration & Air Conditioning, W. F. Stoecker & J. W. Jones, Second Edition, McGraw-Hill, Inc.	NO
Recommended Texts	Air Conditioning Engineering, W. P. Jones, Fifth Edition Elsevier Butterworth-Heinemann	No
	https://www.ashrae.org/technical-resources/ashrae-handbook	

Module 21

Subject information

Module Title	Electrical machines	**Module Delivery**	
Module Type	**Core**		**☒Theory**
Module Code	RETE 205		**☐Lecture**
ECTS Credits	6		**☒Lab**
SWL (hr/sem)	150		**☒ Tutorial**
			☐Practical
			☐Seminar
Module Level	2	**Semester of Delivery**	4

Administering Department	RETE	**College**	College of Oil & Gas Techniques Engineering/Kirkuk
Module Leader	Saygin Siddiq Ahmed	e-mail	Saygin.ahmed@ntu.edu.iq
Module Leader's Acad. Title	Assistant lecturer	**Module Leader's Qualification**	M.Sc
Module Tutor		e-mail	
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 Aims	3- Connect electrical circuits and compare theoretical results with practical.1 4- Introduce the student to understand electrical theories and prove them in practice 5- The student can distinguish between direct current and alternating current
Module Learning Outcomes	10. To familiarize the student with the importance of The most important electrical principles 11. Learning Outcomes, Teaching, Learning and Assessment Methods 12. To distinguish the electrical components and parts and their working principle.
Indicative Contents	Indicative content includes the following. <u>Part A -Principles of circuits</u> To develop the student's mental ability to connect simple and complex circuits. The student learns how to develop a strategy to change a complex circuit to a simple circuit with the same results.

	Part B –Principles to connect circuits The student learns to connect circuits according to the circuit diagram.

Learning and Teaching Strategies	
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) The student's academic load is calculated for 15 weeks.			
Structured SWL (h/sem) **Regular student load during the semester**	78	**Structured SWL (h/w)** **Regular weekly student load**	5.2
Unstructured SWL (h/sem) **Irregular student load during the semester**	72	**Unstructured SWL (h/w)** **Irregular student load per week**	4.8
Total SWL (h/sem) **The student's total academic load during the semester**	150		

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

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

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	**Transformers:** Operating principle, classification, construction
Week 2	Emf equation, phasor diagrams, Equivalent circuit model, Losses & efficiency,
Week 3	Voltage regulation, frequency response, polarity test
Week 4	Autotransformers, Isolation & instrument transformers
Week 5	**DC Machines:** Operating principle, generator & motor action, construction,
Week 6	Types of excitation, EMF & torque equations, Power stages & efficiency
Week 7	Commutation, Armature Reaction, Characteristics & applications of dc generators
Week 8	Starting & speed control of dc motors, Characteristics & applications of dc motors
Week 9	Midterm Exam
Week 10	**Induction Machines:** Three-phase induction motors. Principle of operation, construction, types
Week 11	Rotating magnetic field, emf equation of an AC Machine, Torque developed in an induction motor
Week 12	Torque-speed characteristics, Starting & speed control, Single phase induction motors, Starting, application
Week 13	**Synchronous Machines:**

	Construction, types & operating principle of synchronous generator, AC armature windings, Equivalent circuit, Phasor diagrams
Week 14	Voltage regulation, parallel operation, synchronization
Week 15	Power Angle characteristics, effect of field excitation change
Week 16	Final Exam

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Applications DC motors acquired, installed and types
Week 2	Applications Electromotive force equalization velocity speed control
Week 3	Applications DC motor torque in the laboratory
Week 4	Torque and speed in the laboratory
Week 5	Applications Characteristics of all types of DC motors
Week 6	Applications ingle motors in the laboratory
Week 7	Applications Three-phase starter in the laboratory
Week 8	star and a triangle in single & three phase
Week 9	Midterm Exam
Week 10	Students watching the types of DC motors in the laboratory
Week 11	Students watching the shape of the transistor in the laboratory and how it works
Week 12	Electromotive force equalization velocity speed control
Week 13	Applications full wave uniform and see the wave on the OSC
Week14	Applications uniform half wave and see the wave on the OSC

Week 15	Preparatory week before the final exam
Week16	Final Exam

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	"Basic Electrical Engineering", THERAJA.	Yes
Recommended Texts	"Electrical and Electronic Principles and Technology", John Bird	Yes
Websites	Basic Electrical machines website tutorials	

Module 22 **Subject information**				
Module Title	Computer		**Module Delivery**	
Module Type	Basic		☒**Theory** ☐**Lecture** ☒**Lab** ☐**Tutorial** ☐**Practical** ☐**Seminar**	
Module Code	NTU 202			
ECTS Credits	3			
SWL (hr/sem)	75			
Module Level	2	**Semester of Delivery**	4	
Administering Department	RETE	**College**	College of Oil and Gas Techniques Engineering – Kirkuk (COGTEK)	
Module Leader		**e-mail**		
Module Leader's Acad. Title		**Module Leader's Qualification**		
Module Tutor		**e-mail**	Email	
Peer Reviewer Name		**e-mail**	Email	

Scientific Committee Approval Date		Version Number	

Relation with other Modules			
Prerequisite module	Computer	Semester	2
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	MATLAB is a widely used programming language and computational tool for numerical analysis, data visualization, and scientific computing. In undergraduate curricula, MATLAB teaching goals include developing students' skills in programming, data analysis, and problem solving, as well as providing them with a practical understanding of mathematical concepts and the analysis of complex computations and algorithms. The most crucial goals for teaching MATLAB include learning outcomes, which include: 1- Introduction to Programming: MATLAB is frequently used in academic curriculum as an introductory programming language. The main goal is to familiarize students with fundamental ideas in programming, including variables, data, control structures, functions, and types of algorithms. 2- Numerical Computation: MATLAB is frequently used for numerical computation, and one of the primary objectives of the MATLAB study program is to teach students how to conduct mathematical calculations, work with matrices, solve challenging equations, and put algorithms into practice for scientific, engineering, and mathematical applications. 3- Data Analysis and Visualization: MATLAB offers powerful tools for data analysis and visualization. The built-in functions, toolboxes, and simulations of MATLAB are used by students to construct plots and graphs, show data in various forms, and do statistical analysis. 4- Simulation and Modeling: Many simulation and modeling jobs are performed using MATLAB. Students will learn how to create mathematical models, simulate systems, and analyze their behavior by utilizing MATLAB's simulation features.

	5- Development of applications: MATLAB enables the creation of standalone programs and GUI-based user interfaces. For their projects and scientific research, students can learn how to write interactive programs, publish MATLAB code as standalone applications, and develop user-friendly interfaces. 6- Development of applications: MATLAB enables the creation of standalone programs and GUI-based user interfaces. For their projects and scientific research, students can learn how to write interactive programs, publish MATLAB code as standalone applications, and develop user-friendly interfaces. 7- Problem-solving abilities are a common topic of MATLAB study programs. Students are encouraged to use their MATLAB and programming expertise to address real-world issues, developing their analytical and critical thinking skills.
Module Learning Outcomes	MATLAB is a popular programming language and tool. It has many uses, including biology, engineering, economics, mathematics, data analysis, and complex mathematical equations. As a result, MATLAB learning objectives in undergraduate curricula can change based on the course and level of the student. In academic programs, MATLAB often produces the following learning outcomes: 1- Understanding and Application of Programming Concepts: Students learn the basic structure of the MATLAB programming language, including variables, loops, functions, and conditional statements. They also learn how to write efficient and effective code using best programming practices. 2- Data analysis and visualization using equation solving, engineering diagrams, and visualization are all possible with MATLAB. Students gain knowledge of how to use MATLAB functions to import, modify, and analyze data. In order to visualize outcomes, they also learn how to make plots, charts, and graphs. 3- Modeling and Simulation: MATLAB is often used to model and simulate complex systems in engineering, physics, applied science, and other scientific fields. Students learn how to create mathematical models and simulations using MATLAB functions and tools. 4- Solve complex problems: MATLAB is a useful tool for solving complex problems in many fields. Students learn how to use MATLAB to solve problems related to optimization, numerical analysis, and differential and integral equations in advanced mathematics. 5- Interdisciplinary: MATLAB has applications in a wide range of disciplines, including engineering, physics, biology, economics, and

	mathematics. Students gain knowledge of how to use MATLAB to tackle issues in their particular fields of study. 6- Programming for scientific computing: MATLAB is often used in scientific computing, where efficient and accurate numerical calculations are required. Students learn how to code scientific computing applications using MATLAB's built-in functions and tools to analyze their data. 7- Algorithm development: MATLAB is a useful tool for developing and testing algorithms. Students learn how to develop and test algorithms for various applications using MATLAB. 8- Digital Image and Signal Processing: MATLAB contains built-in functions for processing digital images and signals, which makes it a popular tool in these fields. Students learn how to use MATLAB to analyze and process images and digital signal processors. 9- Machine Learning and Data Science: MATLAB has a variety of tools for machine learning and data science applications, including neural networks, classification algorithms, and data visualization tools. Students learn how to use these tools to solve problems and analyze data in machine learning. 10- Communication and Collaboration: MATLAB is frequently used in joint research projects where a large number of researchers contribute to the same code base. The built-in version control and code sharing facilities in MATLAB help students learn how to cooperate productively. Additionally, they gain communication skills by using MATLAB's visualization and simulation tools to present their findings. 11- Control Systems Design: When it comes to planning and assessing control systems, MATLAB is employed in control systems engineering. Students gain knowledge of how to utilize MATLAB to simulate closed-loop systems, create controllers, and assess system stability. 12- Computational finance: MATLAB has built-in functions for financial modeling and analysis, making it a popular tool in computational finance. Students learn how to use MATLAB to model financial markets, analyze financial data, and develop trading strategies. 13- Numerical methods: MATLAB is a powerful tool for numerical methods, such as solving differential equations, performing numerical integration, and solving optimization problems. Students learn how to use MATLAB to apply numerical methods to solve problems in their respective fields of study.
Indicative Contents	**Indicative content includes the following.** **Part A -**

	Introduction to MATLAB environment & MATLAB windows, MATLAB commands & elementary mathematical functions[12 hours] Vectors and Matrices**[14 hours]** Solving basic algebraic equations & quadratic equations**[14 hours]** Create function in files – MATLAB Introduction to Plotting, Plotting multiple plots & Plotting 3D**[14 hours]** **Part B-** **For**-end loops, While- end loops &If statement**[14hrs]** Integration, differentiation and Fourier transform[12 hours] Introduction to Simulink and Modeling equations in Simulink**[14 hours]** Modeling electrical cct. in Simulink, Modeling electronic and communication cct. in Simulink**[14 hours]**

Learning and Teaching Strategies	
Strategies	Learning and teaching strategies are methods used to help learners acquire knowledge and skills, and for teachers to effectively deliver instruction. There are various types of learning and teaching strategies, including: 1- Active learning entails involving students in tasks that demand their participation, critical thinking, and application of what they have learned. Group discussions, practical exercises, and problem-based learning are a few examples. 2- Collaborative learning: This involves group work and collaboration among learners to achieve a common goal. Examples include group projects and peer learning. 3- Inquiry-based learning: This involves encouraging learners to ask questions, explore topics, and find answers through research and experimentation. Examples and reports include scientific investigations and case studies. 4- Direct instruction: This involves the teacher providing information to learners in a structured and organized manner. Examples include lectures, demonstrations, and tutorials. 5- Differentiated instruction: This involves tailoring instruction to meet the needs of individual learners, based on their learning style, abilities, and interests. 6- Technology-based resources instruction: This involves using technology tools and tools to enhance instruction and engage learners. Examples include online courses, interactive whiteboards, and educational apps. 7- Effective teaching and learning strategies often involve a combination of these approaches, tailored to the needs of the learners and the content being taught.

Student Workload (SWL) The student's academic load is calculated for 15 weeks.			
Structured SWL (h/sem) **Regular student load during the semester**	33	**Structured SWL (h/w)** **Regular weekly student load**	2.2
Unstructured SWL (h/sem) **Irregular student load during the semester**	42	**Unstructured SWL (h/w)** **Irregular student load per week**	2.8
Total SWL (h/sem) **The student's total academic load during the semester**	**75**		

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

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction to MATLAB environment & MATLAB windows
Week 2	MATLAB commands & elementary mathematical functions
Week 3	Vectors and Matrices
Week 4	Matrices
Week 5	Solving basic algebraic equations & quadratic equations

Week 6	Create function in files - MATLAB
Week 7	Introduction to Plotting, Plotting multiple plots & Plotting 3D
Week 8	Operational & logical statements
Week 9	**For**-end loops & While-end loops
Week 10	**If** statement
Week 11	Integration & differentiation
Week 12	Fourier transform
Week 13	Introduction to Simulink
Week 14	Modeling equations in Simulink
Week 15	Modeling electrical cct. in Simulink
Week 16	Modeling electronic cct. in Simulink

Delivery Plan (Weekly Lab. Syllabus) **Weekly lab schedule**	
	Material Covered
Week 1	Introduction to MATLAB environment
Week 2	MATLAB windows
Week 3	MATLAB commands & elementary mathematical functions
Week 4	Vectors
Week 5	Matrices
Week 6	Solving basic algebraic equations &quadratic equations
Week 7	Create function in files - MATLAB
Week 8	Introduction to Plotting, Plotting multiple plots & Plotting 3D
Week 9	Operational & logical statements
Week 10	**For**-end loops & While-end loops
Week 11	**If** statement
Week 12	Integration & differentiation
Week 13	Fourier transform
Week 14	Introduction to Simulink and Modeling equations in Simulink
Week 15	Modeling electrical cct. in Simulink

Week 16	Modeling electronic cct in Simulink

Learning and Teaching Resources		
	Text	Available in the Library?
Required Texts	MATLAB An Introduction with Applications.	
Recommended Texts	An Introduction to Programming and Numerical Methods in MATLAB	
Websites	https://www.mathworks.com	

Module 23 Subject information				
Module Title	Arabic Language		Module Delivery	
Module Type	Basic		☒Theory ☐Lecture ☐Lab ☐ Tutorial ☐Practical ☐Seminar	
Module Code	NTU 203			
ECTS Credits	3			
SWL (hr/sem)	50			
Module Level	2	Semester of Delivery	4	
Administering Department	RETE	College	College of Oil & Gas Techniques Engineering/Kirkuk	
Module Leader		e-mail		
Module Leader's Acad. Title		Module Leader's Qualification		
Module Tutor		e-mail		
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 Course objectives, learning outcomes and guiding content	
Module Aims	1. Enhance Effective Communication: Learning Arabic aims to enable students to communicate effectively in the Arabic environment, whether in daily life or in academic and practical contexts. 2. to understand Arabic Culture: Learning the Arabic language is key to understanding Arab culture and its values, and helps Students To learn about the rich Arab heritage and understand the multiculturalism of the Arab world. 3. Enhance Research and academic capabilities: Learning Arabic contributes to developing research skills. And writing Academic for students, enabling them to participate effectively in academic discussions. And production Knowledge. 4. to provide Job Opportunities: Proficiency in the Arabic language is a valuable skill in the job market, as it can... For students Working in various fields such as translation, media, public relations, and education.
Module Learning Outcomes	1. ability on communication Effective: Acquire Students skills Listening And talk And reading And writing In language Arabic, Which They can from communication Fluently And understand Content In a way correct. 2. ability on to understand Texts And culture: Learn Students reading And understand Texts Literary And cultural In Arabic, Which Contributes in development understand them For heritage Arabic And analysis Cash For business Literary. 3. ability on Search And writing academy: Learn Students How to procedure Research And writing Academy in language Arabic, And they can from presentation papers Research And reports Academy In a way distinct. 4. Interaction Cultural And social: Can Students from Participation in the society Arabic In a way Deeper and understanding Traditions and values And customs Local, Which enhances Understanding Cultural And coexistence Peaceful.
Indicative Contents	1. introduction in Contents Indicative: Identification Contents Indicative And its importance, And its role in Fields and specializations Miscellaneous. 2. Types And formulas Contents Indicative: Exploration various Types And formulas Contents Indicative, like tables and fees The statement And points Prominent And summaries. 3. construction Contents Indicative: Techniques and strategies construction Contents Indicative effective, With what In that to choose Information Home,

	And simplify Concepts complex, And organizing Content For ease Understanding. 4. representation Visual For contents Indicative: Use Media Visual, like Fees Charts and diagrams and drawings, To submit Contents Indicative In a way attractive And useful Visually. 5. Examples And studies the condition: Analysis Examples And studies condition Real To understand How to Use Reference Content in Contexts different, like Reports Research And materials Marketing and resources Educational.

Learning and Teaching Strategies	
Strategies	1. Interactive Language Activities: Engaging students in interactive activities such as role-plays, group discussions, and language games to practice and reinforce language skills. 2. Communicative Approach: Emphasizing real-life communication and providing opportunities for students to actively engage in speaking, listening, reading, and writing tasks to develop their language proficiency. 3. Authentic Materials: Incorporating authentic materials such as newspaper articles, songs, videos, and literature to expose students to real-world language usage and cultural contexts

Student Workload (SWL)			
Structured SWL (h/sem) **Regular student load during the semester**	33	**Structured SWL (h/w)** **Regular weekly student load**	2.2
Unstructured SWL (h/sem) **Irregular student load during the semester**	17	**Unstructured SWL (h/w)** **Irregular student load per week**	1.13
Total SWL (h/sem) **The student's total academic load during the semester**	50		

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

Formative assessment	**Quizzes**	4	15% (10)	2, 5, 10,12	LO #3, #6, #8, and #13
	Assignments	3	15% (10)	2, 7,12	LO #3, #5,and #7
	Report	10	10% (10)	Continuous	All
Summative assessment	**Midterm Exam**	1 hour	10% (10)	7	LO #1-7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Introduction to Language Errors
Week 2	Taa Marbuta and Taa Marbuta (Bound and Open Taa): Understanding the rules and usage of the Taa Marbuta and Open Taa in Arabic language.
Week 3	Hamzat Al-Wasl and Al-Qat' (Hamza of Connection and Hamza of Disconnection): Differentiating between Hamzat Al-Wasl and Al-Qat' and their respective roles in pronunciation.
Week 4	Alif Al-Maddooda and Alif Al-Muqassara Writing Rules: Exploring the rules for writing Alif Al-Maddooda (elongated Alif) and Alif Al-Muqassara (shortened Alif).
Week 5	Solar and Lunar Letters: Identifying the distinction between solar and lunar letters in Arabic pronunciation.
Week 6	Adad (Numbers): Learning about the numerical system in Arabic and its usage.
Week 7	Verbs: Understanding verb conjugation and the different verb forms in Arabic.
Week 8	Parts of Speech: Exploring the different parts of speech, including nouns, verbs, adjectives, adverbs, etc.
Week 9	Meanings of Prepositions: Examining the meanings and usage of prepositions in Arabic.
Week 10	Common Language Errors: Analyzing common language errors and their applications in practical contexts.
Week 11	Noon and Tanween: Understanding the usage and pronunciation of Noon and Tanween in Arabic.
Week 12	Taa Marbuta and Taa Marbuta (Bound and Open Taa): Understanding the rules and usage of the Taa Marbuta and Open Taa in Arabic language.
Week 13	Hamzat Al-Wasl and Al-Qat' (Hamza of Connection and Hamza of Disconnection): Differentiating between Hamzat Al-Wasl and Al-Qat' and their respective roles in pronunciation.
Week 14	Alif Al-Maddooda and Alif Al-Muqassara Writing Rules: Exploring the rules for writing Alif Al-Maddooda (elongated Alif) and Alif Al-Muqassara (shortened Alif).

Week 15	Solar and Lunar Letters: Identifying the distinction between solar and lunar letters in Arabic pronunciation.
Week 16	Final Exam

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	1. Enough Al-Kindi: It is considered one of the most important books in grammar, as it explains Rules Grammatical structures in a simplified and comprehensive style. 2. Exchange By Ibn Malik: A famous book that deals with the rules of conjugation. Actions And the names in the Arabic language, and it is considered one of the works of grammar Classic. 3. Joint In the Science of Arabic" by Ibn Jinni: A comprehensive book covering a group Wide From the topics of grammar, morphology, rhetoric and literature	Yes
Recommended Texts	***1.*** Millennium By Ibn Malik: A famous book on grammar and morphology, considered from The most important classical references in the study of the Arabic language. **2.** The Extremist In Every Charming Art by Ibn Al-Anbari: A comprehensive book Many Of the Arabic words and expressions used in literature and poetry. ***3.*** Statement Al-Tabyeen by Ibn Hajar al-Asqalani: A book that deals with topics Grammar Morphology and rhetoric, and is considered a valuable reference in the study of language. Arabic.	No
Websites		

Level 3

Module24 Subject information					
Module Title	**Conduction & Radiation Heat Transfer**			**Module Delivery**	
Module Type	**Core**			**☒Theory**	
Module Code	RETE 300			**☐Lecture**	
ECTS Credits	**7**			**☒Lab**	
SWL (hr/sem)	**175**			**☒Tutorial** **☐Practical** **☐Seminar**	
Module Level	UGx11 3		**Semester of Delivery**	5	
Administering Department	Type Dept. Code		**College**	Technical Eng. College/ Kirkuk	
Module Leader			e-mail	@ntu.edu.iq	
Module Leader's Acad. Title	Professor		**Module Leader's Qualification**	MSc	
Module Tutor	Name (if available)		e-mail	Email	
Peer Reviewer Name			e-mail	@ntu.edu.iq	
Scientific Committee Approval Date	06/01/2023		**Version Number**	1.0	

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	1. To develop problem solving skills and understanding of heat transfer through the application of techniques. 2. To understand the principle of heat transfer 3. This course deals with the basic concept of conduction and radiation heat transfer. 4. This is the basic subject for all conduction and radiation heat transfer 5. To understand the conduction heat transfer laws includes the one-dimensional steady state (cartesian, cylindrical, and spherical coordinates), the two-dimensional steady state (numerical solution), and the unsteady state (lumped analysis). 6. To understand the laws of radiation heat transfer, including properties, emissivity, shape factor, and heat exchange between non-black bodies.
Module Learning Outcomes	Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks. 1. Recognize the conduction heat transfer parameters. 2. Derived thermal conduction resistance for cartesian, cylindrical, and spherical geometries, and they represented with Ohm's law 3. Recognize the use of numerical analysis techniques to solve two-dimensional heat conduction problems. 4. Describe thermal resistance and overall heat transfer coefficient. 5. Discuss the unsteady state conduction heat transfer 6. Discuss important points in the conduction heat transfer part. 7. Identify the principle of radiation heat transfer. 8. Define Kirchhoff's identity, shape factors 9. Heat exchange between non-black bodies. 10. Representing black and non-black bodies' heat exchange by electrical circuits.
Indicative Contents	Indicative content includes the following. <u>Part A – Conduction heat transfer</u>

	Introduction to heat transfer, one-dimensional steady state heat transfer, overall heat transfer coefficient. [20 hrs] Heat source systems, fins theory. [15 hrs] Two-dimensional steady state conduction heat transfer. [10 hrs] Unsteady state heat transfer [5 hrs] Part B- Radiation heat transfer Introduction to Radiation heat transfer, basic concept, radiation properties, shape factors. [10 hrs] Heat exchanger between black bodies surface, heat exchange between non-black bodies surface [10 hrs]. Radiation heat exchange between parallel plate shield [5 hrs} Final examination [2 hrs Lab. Section and 3 hrs theory section] Revision problem classes [6 hrs]

Learning and Teaching Strategies	
Strategies	The primary strategy for delivering this module is to encourage students' participation in solving the exercises while at the same time developing their critical thinking skills. This will be accomplished through classes, interactive tutorials, and simple experiments involving enjoyable sampling activities for students.

Student Workload (SWL) The student's academic load is calculated for 15 weeks.			
Structured SWL (h/sem) **Regular student load during the semester**	93	**Structured SWL (h/w)** **Regular weekly student load**	6.2
Unstructured SWL (h/sem) **Irregular student load during the semester**	82	**Unstructured SWL (h/w)** **Irregular student load per week**	5.46
Total SWL (h/sem) **The student's total academic load during the semester**	**175**		

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

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	An introduction to the basic principles of heat transfer and methods of heat transfer
Week 2 & 3	Heat transfer by conduction in the steady state and one-dimensional in shapes (Cartesian, cylindrical, spherical) compound walls, compound cylinders, compound balls
Week 4	Overall heat transfer coefficient, critical thickness of insulating material, thermal contact resistance
Week 5	Heat source systems in walls and cylinders
Week 6 & 7	Types of fins, fin design, fin efficiency, fin efficiency, heat transfer from heat sinks
Week 8 & 9	Two-dimensional steady state conduction heat transfer (Numerical solution)
Week 10	Unsteady state heat transfer (Lumped heat capacity system)
Week 11 & 12	Introduction to heat by radiation, basic concepts, properties of radiation, shape factors
Week 13 & 14	Radiation Heat exchange between the surface of black objects and between the surface of non-black bodies
Week 15	Radiation heat exchange between parallel-plate shield
Week 16	Preparatory week before the final exam

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Lab 1: Recognize heat transfer lab apparatuses, and learn how the report is written
Week 2	Lab 2:**The heat transfer rate is directly proportional to the temperature difference between the two ends of the sample.**
Week 3	Lab 3: The heat transfer rate is inversely proportional to the cross-sectional area.
Week 4	Lab 4: Thermal contact resistance

Week 5	Lab 5: Determine the unknown material's thermal conductivity
Week 6	Lab 6: Materials emissivity evaluation
Week 7	Lab 7: Stefan-Boltzmann experiment

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Heat transfer, J.P. Holman, 13rd Edition, Mc Graw Hill companies, Inc., 1221	Yes
Recommended Texts	Heat transfer; A practical approach, Yunus A. Cengel, 2nd addition,	Yes
Websites		

Module25			
Subject information			
Module Title	**Engineering Analysis**	**Module Delivery**	
Module Type	**Core**	☒**Theory**	
Module Code	COGTEK 300	☐**Lecture**	
ECTS Credits	**6**	☐**Lab**	
SWL (hr/sem)	**150**	☒**Tutorial**	
		☐**Practical**	
		☐**Seminar**	
Module Level	3	**Semester of Delivery**	5
Administering Department	RETE	**College**	Oil and gas technical college/ Kirkuk
Module Leader		e-mail	
Module Leader's Acad. Title	Assist. Lecture	**Module Leader's Qualification**	MSc
Module Tutor	Ali Qani Mohammed Saleh	e-mail	ali.alkurdi23@ntu.edu.iq

Peer Reviewer Name	Name	e-mail	Email
Scientific Committee Approval Date	06/01/2023	**Version Number**	1.0

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	1. Develop a solid foundation in mathematical concepts and techniques used in engineering analysis. 2. Understand the principles and applications of numerical methods for solving engineering problems. 3. Gain proficiency in using software tools and programming languages for numerical analysis. 4. Acquire the skills to analyze and interpret numerical results to make informed engineering decisions. 5. Apply mathematical modeling techniques to solve real-world engineering problems.
Module Learning Outcomes	The subject intended specific learning outcomes. On successfully completing the module students will be able to: 1- Acquire a comprehensive understanding of the fundamental principles and concepts underlying a broad range of basic methods used in engineering analysis. 2- Demonstrate proficiency in applying a variety of established techniques and effectively utilizing computational tools to solve engineering problems. 3- Apply the acquired knowledge and skills in basic numerical approximation to address complex problems in diverse contexts, demonstrating the ability to critically assess and select appropriate tools and techniques. 4- Effectively employ MATLAB commands and functions to implement and execute engineering analysis tasks, demonstrating competence in utilizing

	computational tools for problem-solving.
Indicative Contents	Part A 1- Introduction, Mathematical Analysis, Function Analysis and Complex Function Analysis [20 hr.] 2- Mathematical Modeling, Logistic Regression Analysis, Probability and Statistics Analysis and Advanced Probability and Statistics Analysis [20 hr.] 3- Revision problem classes and quiz [3 hrs] Part B 4- Linear and Nonlinear Regression Analysis, Optimization Analysis and Optimal Control and Nonlinear Optimization Analysis [20 hr.]

Learning and Teaching Strategies	
Strategies	1. Establish a solid foundation: Start by thoroughly understanding the fundamental concepts and principles of engineering analysis. This includes understanding the mathematical techniques and numerical methods commonly used in the field. 2. Practice problem-solving: Engineering analysis involves solving complex problems. Regularly practice solving a variety of problems to enhance your problem-solving skills and develop a deeper understanding of the subject matter. 3. Utilize resources: Take advantage of textbooks, online resources, and reference materials specific to engineering analysis. These resources can provide additional explanations, examples, and practice problems to reinforce your understanding.

Student Workload (SWL) **The student's academic load is calculated for 15 weeks.**			
Structured SWL (h/sem) **Regular student load during the semester**	63	**Structured SWL (h/w)** **Regular weekly student load**	4.2
Unstructured SWL (h/sem) **Irregular student load during the semester**	87	**Unstructured SWL (h/w)** **Irregular student load per week**	5.8
Total SWL (h/sem)	**150**		

The student's total academic load during the semester	

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

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction to Engineering Analysis; Fundamental concepts in engineering analysis Tools and techniques of engineering analysis
Week 2	Mathematical Analysis; Differential equations and their applications in engineering, differentiation and integration
Week 3	Function Analysis; Algebraic and transcendental functions, trigonometric and exponential functions
Week 4	Complex Function Analysis; Complex numbers and operations, analysis of complex functions
Week 5	Mathematical Modeling; Mathematical models of growth, Mathematical models of regression
Week 6	Logistic Regression Analysis; Logistic regression analysis, Applications in engineering

Week 7	Probability and Statistics Analysis; Probability and statistics concepts, data analysis and probability distributions
Week 8	Advanced Probability and Statistics Analysis; Joint and conditional probability analysis, advanced statistics analysis and non-normal distributions
Week 9	Linear Regression Analysis; Simple linear regression analysis, Multiple linear regression analysis
Week 10	Nonlinear Regression Analysis; Nonlinear regression analysis, Applications in engineering
Week 11	Optimization Analysis and Optimal Control; Optimization analysis and optimal control problems, Applications in engineering
Week 12	Nonlinear Optimization Analysis; Nonlinear optimization analysis, Applications in engineering
Week 13	Review 1
Week 14	Review 2
Week 15	Review 3
Week 16	Preparatory week before the final exam

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Lab 1: Introduction to Engineering Analysis and MATLAB.
Week 2	Lab 2: Numerical Methods for Root Finding
Week 3	Lab 3: Interpolation and Curve Fitting
Week 4	Lab 4: Numerical Integration
Week 5	Lab 5: Numerical Solutions of Ordinary Differential Equations (ODEs)
Week 6	Lab 6: Systems of Linear Equations
Week 7	Lab 7: Partial Differential Equations (PDEs)

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	1. "Numerical Methods for Engineers" by Steven C. Chapra and Raymond P. Canale 2. "Numerical Analysis" by Timothy Sauer 3. "Numerical Methods in Engineering with MATLAB" by Jaan Kiusalaas	No
Recommended Texts	1. "Applied Numerical Methods with MATLAB for Engineers and Scientists" by Steven C. Chapra 2. "Numerical Methods: Design, Analysis, and Computer Implementation of Algorithms" by Anne Greenbaum and Timothy P. Chartier	No
Websites	3. (https://www.mathworks.com/) 4. (http://www.numericalmethods.eng.usf.edu/) 5. (https://www.engineering.com/)	

Module 26
Subject information

Module Title	**Renewable Energy Systems**		
Module Type	**Core**	☒Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☒ Seminar	
Module Code	**RETE 302**		
ECTS Credits	**6**		
SWL (hr/sem)	**150**		
Module Level	3	Semester of Delivery	5
Administration Department	RETE	College	College of Oil & Gas Techniques Engineering/Kirkuk

Module Leader	Ali Qani Mohammed Saleh	e-mail	ali.alkurdi23@ntu.edu.iq
Module Leader's Acad. Title	Lecturer	Module Leader's Qualification	MSc.
Module Tutor	Name (if available)	e-mail	
Peer Reviewer Name		e-mail	
Scientific Committee Approval Date		Version Number	1

Relation with other Modules

Prerequisite module	RETE 207	Semester	Four
Co-requisites module	None	Semester	--

Module Aims, Learning Outcomes and Indicative Contents

Module Aims	4. Comprehensive Understanding: The aim of this module is to provide students with a comprehensive understanding of various renewable energy systems, including solar, wind, hydropower, and biomass, enabling them to grasp the design, components, and operational principles of these systems. 5. Technical Proficiency: This module aims to equip students with the technical knowledge and skills necessary to analyse, evaluate, and design renewable energy systems. By the end of the module, students should be proficient in assessing the technical feasibility and performance of these systems. 6. Integration and Sustainability: Students will learn how to integrate renewable energy systems into the broader energy infrastructure and gain an appreciation for the role of these systems in achieving sustainability goals. They should be able to critically evaluate the environmental, economic, and social aspects of renewable energy technologies.
Module Learning Outcomes	(LO1). In-Depth Knowledge: Students will acquire in-depth knowledge of various renewable energy systems, including solar photovoltaic, wind, hydropower, and biomass, and understand their principles, components, and applications. (LO2). Technical Analysis: By the end of the course, students should be able to analyze the technical aspects of renewable energy systems, including system design, energy conversion processes, and efficiency considerations.

	(LO3). System Integration: Students will develop the skills to integrate renewable energy systems into existing energy infrastructures, including grid integration, storage solutions, and backup systems. (LO4). Performance Assessment: Students will be capable of assessing the performance and reliability of renewable energy systems, using key performance indicators and data analysis to evaluate their efficiency. (LO5). Environmental Impact Evaluation: Understanding the environmental implications of renewable energy technologies, students will be able to assess their positive and negative environmental impacts, contributing to more informed decision-making. (LO6). Economic Feasibility: Students will be able to conduct economic assessments of renewable energy projects, considering factors such as return on investment, cost-benefit analysis, and financial modeling. (LO7). Policy and Regulatory Awareness: Students should gain an understanding of the policy and regulatory frameworks related to renewable energy, allowing them to navigate the legal and administrative aspects of these technologies. (LO8). Innovation and Future Trends: Students will be aware of current innovations and emerging trends in renewable energy, preparing them for a dynamic and evolving field as they consider future opportunities and challenges.

Indicative Contents	Indicative content includes the following.
	• Introduction to Renewable Energy
	  • Definition and importance of renewable energy
	  • Environmental and economic drivers for renewable energy
	• Solar Energy Systems
	  • Solar photovoltaic (PV) technology
	  • Solar thermal systems
	  • Concentrated solar power (CSP)
	• Wind Energy Systems
	  • Wind turbine technology
	  • Wind resource assessment
	  • Offshore wind energy
	• Hydropower Systems
	  • Principles of hydropower generation
	  • Types of hydropower systems (dam, run-of-river, tidal)
	  • Environmental and social considerations
	• Biomass Energy Systems
	  • Types of biomass sources (wood, crops, waste)
	  • Biomass conversion processes (biogas, biofuels)
	  • Cogeneration and combined heat and power (CHP)
	• Geothermal Energy Systems
	  • Geothermal heat pumps
	  • Geothermal power plants (flash, binary, dry steam)
	  • Resource assessment and exploration
	• Integration and Grid Connection
	  • Grid integration of renewable energy

	• Energy storage systems (batteries, pumped storage, etc.) • Backup power systems and grid stability • Energy Efficiency in Renewable Systems • Energy-efficient components and designs • Smart grids and demand-side management • Energy conservation measures • Environmental Impact and Sustainability • Life cycle assessment of renewable energy systems • Environmental benefits and challenges • Sustainability Considerations • Economic Analysis and Financing • Economic evaluation of renewable energy projects • Financial modeling and cost-benefit analysis • Financing options and incentives • Regulation and Policy Framework • Regulatory challenges and incentives • Government policies and support mechanisms • International agreements and targets • Emerging Technologies and Trends • Exploration of cutting-edge renewable energy technologies • Market trends, innovation, and future prospects • The role of research and development • Practical Applications and Case Studies • Real-world case studies of successful renewable energy projects • Hands-on experience with renewable energy systems • Field trips and site visits (if applicable) • Group Projects and Student Presentations • Collaborative projects on renewable energy system design or analysis • Student presentations and discussions • Examinations and Assessment • Final examinations or assessments • Evaluation of student understanding and application of course content

Learning and Teaching Strategies	
Strategies	Teaching Method 1 - Lectures Description: Attendance Recorded: Yes Teaching Method 2 - Asynchronous on-line course materials Description: Podcasts, videos and articles in thermodynamics Attendance Recorded: No

	Unscheduled Directed Student Hours (time spent away from the timetabled sessions but directed by the teaching staff). Teaching Method 3 - Tutorials Description: Attendance Recorded: Yes Teaching Method 4 - Practical Description: Practical homework assignments Attendance Recorded: No Unscheduled Directed Student Hours (time spent away from the timetabled sessions but directed by the teaching staff).

Student Workload (SWL)

Structured SWL (h/sem) Regular student load during the semester	63	Structured SWL (h/w) Regular weekly student load	4.2
Unstructured SWL (h/sem) Irregular student load during the semester	87	Unstructured SWL (h/w) Irregular student load per week	5.8
Total SWL (h/sem) The student's total academic load during the semester	150		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	5	10% (10)	3,5,7,9,11 and 15	LO #2, #3,#5,#7,#9 and #11
	Assignments	5	10% (10)	2,6,8 and 12	LO #1, #4, #6and #10
	Projects / Lab.	4	20% (10)	Continuous	All
	Report				
Summative assessment	Midterm Exam	2 hours	10%(10)	7	LO #1 - #5
	Final Exam	3 hours	50%(50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

Week 1	Introduction to Renewable Energy - Overview of the course, Importance of renewable energy, environmental and economic drivers
Week2	Solar Energy Systems - Solar photovoltaic (PV) technology, Solar thermal systems, Solar resource assessment
Week3	Wind Energy Systems - Wind turbine technology, Wind resource assessment, Offshore wind energy

Week4	Hydropower Systems - Principles of hydropower generation, Types of hydropower systems, Environmental and social considerations
Week5	Biomass Energy Systems - Types of biomass sources, Biomass conversion processes, Cogeneration and combined heat and power (CHP)
Week6	Geothermal Energy Systems - Geothermal heat pumps, Geothermal power plants, Resource assessment and exploration
Week7	Integration and Grid Connection - Grid integration of renewable energy, energy storage systems, Backup power systems and grid stability
Week8	Energy Efficiency in Renewable Systems - Energy-efficient components and designs, Smart grids and demand-side management, Energy conservation measures
Week9	Environmental Impact and Sustainability - Life cycle assessment of renewable energy systems, Environmental benefits and challenges, Sustainability considerations
Week 10	Economic Analysis and Financing - Economic evaluation of renewable energy projects, Financial modeling and cost-benefit analysis, Financing options and incentives
Week 11	Regulation and Policy Framework - Regulatory challenges and incentives, Government policies and support mechanisms, International agreements and targets
Week 12	Emerging Technologies and Trends - Cutting-edge renewable energy technologies, Market trends, innovation, and future prospects, The role of research and development
Week 13	Practical Applications and Case Studies - Real-world case studies of successful renewable energy projects, Hands-on experience with renewable energy systems, Field trips and site visits (if applicable)
Week 14	Group Projects and Student Presentations - Collaborative projects on renewable energy system design or analysis, Student presentations and discussions
Week 15	Final Examinations and Assessment - Final examinations or assessments, Evaluation of student understanding and application of course content

Learning and Teaching Resources

	Text	Available in the Library?
Required Texts	Renewable Energy: Technology, Economics, and Environment by Martin Kaltschmitt, Wolfgang Streicher, and Andreas Wiese	No
Recommended Texts	Sustainable Energy: Choosing Among Options by Jefferson W. Tester, Elisabeth M. Drake, Michael J. Driscoll, et al.	No
	Renewable Energy: Power for a Sustainable Future by Godfrey Boyle	No

Module27

Subject information

Module Title	**Power electronics**	**Module Delivery**

Module Type	**Core**			**☒Theory**	
Module Code	RETE 303			**☐Lecture**	
ECTS Credits	**5**			**☒Lab**	
SWL (hr/sem)	**125**			**☐Tutorial**	
				☐Practical	
				☐Seminar	
Module Level	3	**Semester of Delivery**		5	
Administering Department	RETE	**College**	College of Oil & Gas Techniques Engineering/Kirkuk		
Module Leader		e-mail			
Module Leader's Acad. Title		**Module Leader's Qualification**		M.Sc.	
Module Tutor	None	e-mail	None		
Peer Reviewer Name		e-mail	@ntu.edu.iq		
Scientific Committee Approval Date	06/01/2023	**Version Number**	1.0		

Relation with other Modules

Prerequisite module	AC Electrical Circuits	**Semester**	1
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents

Module Aims	The aims of this module are: 1. To introduce students to the basic theory of power semiconductor devices and passive components, their practical applications in power electronics.

	2. Toize students familiar with the principle of operation, design and synthesis of different power conversion circuits and their applications. 3. To give students the ability to practice problem solving and design skills individually and in small groups, reflecting the requirements of the engineering profession. 4. To further develop student's awareness of the multifaceted and often conflicting dimensions of electronics design including performance, cost and energy efficiency. 5. To inform and to allow students to question the practices of modern power electronics engineering via discussions, interactions and case studies led by leading industry professionals. 6. To provide strong foundation for further study of power electronic circuits and systems.
Module Learning Outcomes	On successful completion of this module a student will be able to: 1. Relate basic semiconductor physics to properties of power devices, and combine circuit mathematics and characteristics of linear and non-linear devices. 2. Describe basic operation and compare performance of various power semiconductor devices, passive components and switching circuits. 3. Design and Analyze power converter circuits and learn to select suitable power electronic devices by assessing the requirements of application fields. 4. Formulate and analyze a power electronic design at the system level and assess the performance. 5. Identify the critical areas in application levels and derive typical alternative solutions, select suitable power converters to control Electrical Motors and other industry grade apparatus.

	6. Recognize the role power electronics play in the improvement of energy usage efficiency and the applications of power electronics in emerging areas.
Indicative Contents	• Concept of power electronics, application of power electronics, advantages and disadvantages of power electronics converters, power electronics systems. • Power diodes, its characteristics, types. • Brief Discussion about uncontrolled converters (Diode rectifiers). • Power transistors, Steady state characteristics, switching performance, safe operating area. • Power mosfets, characteristics, comparison with BJT. • IGBT, characteristics. • Thyristors, V-I characteristics and applications. SCR turn on methods. • Switching characteristics of thyristor, Two transistor model of SCR • Gate characteristics, ratings. • Thyristor protection • Series and parallel operation of thyristor, Gate triggering circuits of thyristor. • Different commutation techniques of SCR. • Brief description of members of thyristor family with symbol, GTO. • Principle of operation of single-phase half wave-controlled rectifiers with R, RL and RLE load, effects of freewheeling diodes. Calculation of performance parameters • Principle of operation of single-phase full wave controlled and half controlled rectifiers with R, RL and RLE loads, effects of freewheeling diodes. Calculation of performance parameters • Three phase half wave and full wave controlled and half wave controlled rectifiers with different loads. Effects of source inductance on the performance of converters • Techniques of power factor improvement, single phase and three phase dual converters. • DC-DC converters: Principle of operation, control strategies • Step-down chopper, performance parameters. • Step-up chopper, performance parameters. • Step-down/ step-up chopper, performance parameters. • Types of chopper circuits based on quadrant of operation.

	• Multiphase choppers and switching mode regulators. • Inverters: Definition, classification of inverters based on nature of input source, wave shape of output voltage, method of communication & connections. • Principle of operation of single-phase bridge inverter with R and R-L loads, performance parameters. • Principle of operation of three phase bridge inverter with R and R-L loads, performance parameters • Methods of voltage control and harmonic reduction of inverters • Brief idea of Resonant Pulse inverters. • AC controllers: Principle of on-off and phase control • Single phase and three phase controllers with R and R-L loads, performance parameters.

Learning and Teaching Strategies	
Strategies	• series of lectures. The lectures contain numerous practical design examples. Circuit simulation models of all of the circuits analyzed are provided and students are encouraged to use these to gain a better understanding. • Laboratory sessions are arranged in the form of a mini-project which is conducted over several sessions where students get the opportunity to design, simulate, build and test a DC-DC converter circuit and hence put into practice the theory covered in the lectures. • Bite-sized pre-recorded content and detailed lecture notes aimed at independent learning. • Guest lectures and discussion sessions from industry. • Visualization and sensory experience to correlate electronic circuit mathematical analysis and physical behavior. • person tutorials to focused on problem solving, case studies and

	discussion of engineering challenges. • In-class review of taught material during revision week • in-class tests where one or more of these are an assessment on the module.

Student Workload (SWL) The student's academic load is calculated for 15A week			
Structured SWL (h/sem) **Regular student load during the semester**	63	**Structured SWL (h/w)** **Regular weekly student load**	4.2
Unstructured SWL (h/sem) **Irregular student load during the semester**	62	**Unstructured SWL (h/w)** **Irregular student load per week**	4.13
Total SWL (h/sem) **The student's total academic load during the semester**	125		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	5	10% (10)	1,4,6,8,11	LO #1, 2 and 3
	Assignments	5	10% (10)	3, 5,7,9,12	LO # 3,4,5 and 6
	Projects /Lab.	14	10% (10)	Continuous	
	Report	1	10% (10)	13	LO # 5, 8 and 10
Summative assessment	**Midterm Exam**	2 hours	10% (10)	7	LO #1-7
	Final Exam	2hr	50% (50)	16	All

Total assessment	100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material to be Covered
Week 1-2	• Introduction to power electronics
Week 3	• Switching devices, power and control devices
Week 4	• Type and characteristic, rating (diode, transistor, …)
Week 5	• Methods of turning – ON and turning – OFF
Week 6	• Protection of power devices
Week 7	Triggering and base drive circuits
Week 8	• Controlled rectifiers, 1-phase and 3-phase circuits
Week 9	• Half-wave and full-wave circuits
Week 10	• DC choppers, step-up and step-down choppers
Week 11	• AC phase controller
Week 12	• Inverters, 1-phase and 3-phase bridges
Week 13	• Some applications, a uninterrup table power supply.
Week 14	• (UPS) b-switched mode power supply (SMP)
Week 15	**Review for final exam**
Week 16	**Final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material to be Covered
Week 1-2	Thyristor trigger angle & conduction angle

Week 3-4	SCR half-wave rectifier with load resistance.
Week 5-6	SCR half wave rectifier with inductive load
Week 7-8	SCR Full-wave Rectifier with load resistance.
Week 9-11	light dimmer circuit by using one scr
Week 12-14	AC voltage controlled
Week 15	**Review for final exam**
Week 16	**Final exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	1. Power Electronics by MH Rashid, PHI. 2. 2. Power Electronics by PS Bhimra, Khanna Publishers. 3. 3. Power Electronics by MD Singh and KB Khanchandani, TMH.	Yes
Recommended Texts		Yes
Websites		

Module 28 **Subject information**		
Module Title	**Gas Dynamics**	**Module Delivery**
Module Type	**Core**	☒**Theory**
Module Code	RETE 304	☐**Lecture**

ECTS Credits	**6**		☒**Lab** ☐**Tutorial** ☐**Practical** ☐**Seminar**	
SWL (hr/sem)	**150**			
Module Level	3	**Semester of Delivery**	5	
Administering Department	RETE	**College**	College of Oil and Gas Techniques Engineering - Kirkuk, Northern Technical University, Iraq	
Module Leader	Marwa Khaleel Rashid	e-mail	marwa.khaleel23@ntu.edu.iq	
Module Leader's Acad. Title	Assistant lecturer	**Module Leader's Qualification**	MSc	
Module Tutor	Name (if available)	e-mail	Email	
Peer Reviewer Name	Name	e-mail	Email	
Scientific Committee Approval Date	06/01/2023	**Version Number**	1.0	

Relation with other Modules

Relationship with other subjects

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

Module Aims, Learning Outcomes and Indicative Contents

Module Objectives	1. Understand the compressible flow fundamentals. 2. Study the compressible flow with friction and heat transfer. 3. Know the application of normal shock in compressible flow. 4. Study the aircraft propulsion systems and rocket propulsion and its applications.

	5. Recognize the working principles and characteristics of steam and gas turbines. 6. Recognize the working principles and characteristics of compressors.
Module Learning Outcomes	By the end of successful completion of this course, the student will be able to: 1. Ability to solve the properties of compressible fluid flow, one Dimensional isentropic flow 2. Ability to solve and analyze of Normal and Oblique shock waves. 3. The ability to determine the properties of the flow in constant area duct with friction (fanon flow) and its applications 4. The ability to determine the properties of the flow in constant area duct with heat transfer (Rayleigh flow) and its applications
Indicative Contents	Indicative content includes the following. Part A - Introduction to gas dynamics, Isentropic flow, Bryton cycle ideal and actual. [15hrs] Shock waves in supersonic flow, normal shock and oblique shock waves[15 hrs] Introduction to gas turbine power plant, [10 hrs] Introduction to rockets thrust equations, [15hrs] Part B Fundamentals. To understand the charts of oblique shock waves, [15 hrs] Types of pumps, pumps Characteristics, [7 hrs] Introduction to jet propulsion, The Kinds, Impulse Turbine, Blades Efficiency. [15 hrs]

Learning and Teaching Strategies	
Strategies	Implementing active learning in a class room requires preparation and some changes to the lecture. However, the lecture content is not changed or replaced with new material. The same lecture content is delivered to the students in a

	better way and the lecture time is used more effectively. The following are some of the techniques of active learning and cooperative learning I personally use in my engineering classes to enhance student's understanding and retention of the material: ○ **One Minute Paper**: Students are asked to write a one-minute note (about the previous lecture, the homework or the material in general) to the instructor on a piece of paper. This provides a fast way for the teacher to have a quick feedback on students' understanding of what was previously covered. ○ **Muddiest Point**: When there is a long lecture with multiple topics covered, the students are given the opportunity to discuss the material covered in the lecture and list the most difficult parts of the lecture. ○ **Clarification Pause**: During the lecture, the students are given the time to go over the material written on the board, think about it and ask if they have any questions. Then, the lecturer answers the different questions raised before resuming the next part of the lecture. ○ **Questions and answers**: Usually during the lecture, questions are raised about the new material presented and questions are solved on the board. A sample of the questions asked include "Why do you think this topic is important?" or "what is the relationship between what we were talking about and this technique?" or "which technique is best?" ○ **Critical Thinking, Group Discussion**: Students are given a handout with multiple problems and they are asked to apply what they learned in the lecture to solve the problems in groups. They are asked to discuss it together and come up with a single solution that all members agree on. ○ **Critical Thinking, Think-pair-share:** Students are asked to work individually on a problem for a short time; Then students pair up to compare their answers. Then they have to explain their answer and share it with the rest of the class. ○ **Peer Teaching:** If one member of the team solves the problem correctly, he will explain it to the rest of the group and discuss with them why his/her answer is correct and their answer is not. This allows the students to find out what went wrong and the mistake they made in solving the problem. This technique will help the student to avoid these mistakes when doing the homework or the exams. ○ **Active Review Sessions**: For each exam, students are given a practice test with a set of problems a week in advance. They are encouraged to work on the practice test individually first and then in groups to discuss the answers. During the review session, the students are asked

	questions about the problems in the practice test and they are given the choice to decide which problems they want the professor to focus on. ○ **Active presentations**: Students are asked to do projects and then to submit reports and give presentations. Each member of the group is required to give part of the presentation and during the presentation, the students are given the opportunity to have an open discussion and answer questions about their projects.

Student Workload (SWL) **The student's academic load is calculated for 15 weeks.**			
Structured SWL (h/sem) **Regular student load during the semester**	63	**Structured SWL (h/w)** **Regular weekly student load**	4.2
Unstructured SWL (h/sem) **Irregular student load during the semester**	87	**Unstructured SWL (h/w)** **Irregular student load per week**	5.8
Total SWL (h/sem) **The student's total academic load during the semester**	**150**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	5	10% (10)	3,6,8,10	LO 1-LO3
	Assignments	5	10% (10)	2, 5,9, 12	LO #3, #4

	Projects /Lab.(report)	10	20% (20)	Continuous	All
Summative assessment					
	Mid Term exam	2 hours	10% (10)	7	LO #1-4
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction
Week 2	Basic principles for compressible fluid flow
Week 3	Isentropic flow with variable area.
Week 4	Isentropic flow with variable area.
Week 5	The Isotropic
Week 6	Stationary Normal shock wave.
Week 7	**Mid Term exam**
Week 8	nozzle and diffusers
Week 9	Constant area adiabatic flow (Fanno flow)
Week 10	Constant area flow with heat transfer (Rayleigh flow).
Week 11	Oblique shock wave.
Week 12	Introduction to pumps, pumps classifications
Week 13	Introduction to Compressors, types of compressors
Week 14	Introduction to Compressors, types of compressors

Week 15	**Preparatory week before the final exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Lab 1: To study sound velocity in different solids and fluids
Week 2	Lab 2: To study various gas properties for different altitudes in the atmosphere.
Week 3	Lab 3: To study the wave propagation at different Mach numbers.
Week 4	Lab 4: To study the isentropic flow from variable area duct.
Week 5	Lab 5: To study the flow through constant area duct with friction. (Fanno flow).
Week 6	Lab 6: To study the shock waves generated in the flow field.
Week 7	Lab 7: To study different types of aerospace vehicles.

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	James EA John, Theo G, Keith, "Gas Dynamics" 3rd Edition, John-Wiely, 2006.	Yes
Recommended Texts	1. The Dynamics and Thermodynamics of Compressible Fluid Flow (Vol,1) by A.H. Shapiro 2. Power plant Technology, by MMMel-Wakil 3. Steam Turbines Theory and Practice by WJ Keartin.	No

Module 29
Subject information

Module Title	**Solar Energy Engineering**	

Module Type	**Core**		☒Theory ☐ Lecture ☒ Lab ☒ Tutorial ☐ Practical ☐ Seminar	
Module Code	**RETE 305**			
ECTS Credits	**6**			
SWL (hr/sem)	**150**			
Module Level	3	Semester of Delivery	6	
Administration Department	RETE	College	College of Oil and Gas Techniques Engineering - Kirkuk	
Module Leader	Afrah Turki Awad	e-mail	afrah.turki@ntu.edu.iq	
Module Leader's Acad. Title	Lecturer	Module Leader's Qualification	PhD	
Module Tutor		e-mail		
Peer Reviewer Name		e-mail		
Scientific Committee Approval Date		Version Number		

Relation with other Modules

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

Module Aims, Learning Outcomes and Indicative Contents

Module Aims	The course content is designed to provide comprehensive knowledge on solar radiation, analysis of solar radiation data, fundamentals of the solar thermal and photovoltaic system along with storage of energy required for effective design of efficient solar energy conversion devices. The concepts will be illustrated with practical examples, schematics and block diagrams wherever required. A sufficient number of numerical problems with solutions will be discussed in the course. This course is specifically designed for undergraduate and postgraduate students of Energy Engineering and Technology. Further, the course will be very much useful for students and researchers from varied academic backgrounds for the synthesis of novel energy conversion devices and processes.
Module Learning Outcomes	• Basic principles of Solar Power (Solar Photovoltaic, Solar Thermal, Dish Type, Solar Tower) • Design features of Solar Photovoltaic and Solar thermal equipment • Manufacturing process for Solar Photovoltaic and Solar thermal equipment

	• Quality assurance aspects of Solar Photovoltaic and Solar thermal equipment • Erection, Commissioning and Testing aspects of Solar Photovoltaic and Solar thermal equipment • Operation & Maintenance aspects of Solar Photovoltaic and Solar thermal equipment • Feasibility study & Economics of Solar Photovoltaic and Solar thermal power project, • How to prepare Feasibility Report / Detailed Project Report for Solar Photovoltaic and Solar thermal power project • Techno-Commercial appraisal of Solar Photovoltaic and Solar thermal power project from lenders perspective • Salient features of various Financing / Loan Agreements. • Financing options in the development of Solar Photovoltaic and Solar thermal power project • Tariff calculation of Solar Photovoltaic and Solar thermal power project and calculation of IRR, Payback period, etc. • Regulatory aspects/provisions in development of Solar Photovoltaic and thermal power project.
Indicative Contents	The undergraduate Solar Energy course covers a comprehensive range of topics to equip students with a fundamental understanding of renewable energy principles and solar technology applications. The course begins with an introduction to renewable energy sources, emphasizing the significance of solar energy in the global energy landscape. Students delve into the fundamentals of solar radiation, learning about solar geometry, radiation measurement, and influencing factors. The curriculum includes in-depth explorations of solar photovoltaic (PV) technology, covering semiconductor physics, various types of solar cells, module construction, and electrical basics for PV systems. Solar thermal systems, including solar water heating and concentrating solar power, are studied extensively, with a focus on system components and thermal energy storage methods. Practical aspects of PV system design, such as sizing, layout, and efficiency analysis, are explored, preparing students to design both grid-connected and off-grid solar installations. Additionally, the course delves into the economic aspects of solar energy projects, including policy analysis, incentives, and financial evaluations. Environmental sustainability, project development, and emerging solar technologies are also integral components, allowing students to grasp the holistic aspects of solar energy engineering. Laboratory sessions and hands-on projects complement theoretical learning, providing students with practical skills and insights into solar energy applications. This comprehensive approach enables students to develop a strong foundation in solar energy, fostering their ability to

	contribute effectively to the renewable energy sector and sustainable development initiatives.

Learning and Teaching Strategies

Strategies	Teaching Method 1 - Lectures Description: Attendance Recorded: Yes Teaching Method 2 - Asynchronous online course materials Description: Podcasts, videos, and articles on Renewable Energy Attendance Recorded: No Unscheduled Directed Student Hours (time spent away from the timetabled sessions but directed by the teaching staff). Teaching Method 3 - Tutorials Description: Attendance Recorded: Yes Teaching Method 4 - Practical Description: Practical homework assignments Attendance Recorded: No Unscheduled Directed Student Hours (time spent away from the timetabled sessions but directed by the teaching staff).

Student Workload (SWL)

Structured SWL (h/sem) Regular student load during the semester	78	Structured SWL (h/w) Regular weekly student load	5.2
Unstructured SWL (h/sem) Irregular student load during the semester	72	Unstructured SWL (h/w) Irregular student load per week	4.8
Total SWL (h/sem) The student's total academic load during the semester	150		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5, 10	LO #5 and 8
	Seminar	2	10% (10)	Continuous	All
	Lab Report	2	20% (20)	6, 13	LO # 2, 9
	Mid Term exam	2 hours	10% (10)	10	LO #1-11

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

Delivery Plan (Weekly Syllabus)	
Week 1	Energy Scenario, overview of solar energy conversion devices and applications, physics of propagation of solar radiation from the sun to earth
Weeks 2	Sun-Earth Geometry, Extra-Terrestrial and Terrestrial Radiation, Solar energy measuring instruments
Weeks 3	Estimation of solar radiation under different climatic conditions, Estimation of total radiation
Week 4	Fundamentals of solar PV cells, principles and performance analysis, modules, arrays, theoretical maximum power generation from PV cells.
Week 5	PV standalone system components, Standalone PV-system design.
Week 6	Components of grid-connected PV system, solar power plant design and performance analysis.
Week 7	Fundamentals of solar collectors, Snails law, Bougers law, Physical significance of Transmissivity – absorptivity product.
Week 8	Performance anlaysis of liquid flat plate collectors and testing
Week 9	Performance analysis of Solar Air heaters and testing
Week 10	Mid-Term Exam
Week 11	Solar thermal power generation (Solar concentrators).
Week 12	Thermal Energy Storage (sensible, latent and thermochemical) and solar pond
Weeks (13-14)	Applications: Solar Refrigeration, Passive architecture, solar distillation, and ermeging technologies.
Week 15	Preparing for the final exam

Learning and Teaching Resources		
	Text	Available in the Library?
Required Texts	GN Tiwari, Solar Energy, Fundamentals, Design, Modeling and Applications, Narosa, 2002.	No

	SP Sukhatme and JK Nayak, Solar Energy: Principles of Thermal Collection and Storage, Tata McGraw Hill, 2006.	No

Module 30 Subject information			
Module Title	**Biofuel**		
Module Type	**Core**		☒Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☒ Seminar
Module Code	**RETE 306**		
ECTS Credits	**5**		
SWL (hr/sem)	**125**		
Module Level	3	Semester of Delivery	6
Administration Department	RETE	College	College of Oil and Gas Techniques Engineering - Kirkuk
Module Leader		e-mail	@ntu.edu.iq
Module Leader's Acad. Title	Lecturer	Module Leader's Qualification	PhD
Module Tutor		e-mail	
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 Aims	1. Provide an overview of existing energy utilization, production and infrastructure. 2. Cover the consequences of our energy choices on the environment. 3. Introduce the impact of energy on food production and delivery. 4. Examine the growing field of biofuels by introducing the basics of renewable biofuel production.
Module Learning Outcomes	1. Define Biofuel and identify their applications. 2. Define the food which is used in preparing biofuel. 3. Preparation of bio hydrogen. 4. Preparation of biogas. 5. Preparation of biodiesel. 6. Preparation of bioethanol. 7. Preparation of biobutanol.
Indicative Contents	After studying this chapter, the student is expected to master the following knowledge and skills: 1. Biofuel production, microorganisms, biochemical pathway, and biological approaches [10 hrs]. 2. Biohydrogen and biomethanation production [20 hrs]. 3. Biodiesel, bioethanol, and biobutanol [15]. 4. Reactor configuration [5 hrs]. 5. Microbial Electrochemical Technologies [5 hrs]. 6. Energy analysis [5 hrs].

Learning and Teaching Strategies	
Strategies	The biofuel module employs a range of effective learning and teaching strategies. Students engage in theoretical lectures, practical demonstrations, and hands-on laboratory sessions to grasp the underlying principles and gain practical skills. Case studies and real-world scenarios enhance problem-solving abilities, while group projects foster teamwork and communication skills. Continuous assessment methods, including assignments and practical assessments, ensure students' progress and understanding of the subject matter. The module promotes equipping students with the knowledge and skills necessary for success in the field of biofuel.

Student Workload (SWL)			
Structured SWL (h/sem) Regular student load during the semester	63	Structured SWL (h/w) Regular weekly student load	4.2
Unstructured SWL (h/sem) Irregular student load during the semester	62	Unstructured SWL (h/w) Irregular student load per week	4.13
Total SWL (h/sem) The student's total academic load during the semester	125		

Module Evaluation					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	4	10% (10)	3,6,8, and 14	LO #1,#2,#3, and#7
	Seminar	2	10% (10)	7 and 13	LO 4 and #6
	Projects /Lab.	10	20% (20)	Contentious	All
Summative assessment	Mid Term exam	2 hours	10% (10)	7	LO #1-11
	Final Exam	3hr	50% (50)	16	All
100% (100 Marks)					

Delivery Plan (Weekly Syllabus)	
Week 1	Introduction to Biofuels
Weeks 2	Biofuels Production from Renewable Energy Sources
Weeks 3	Microorganisms Involved in Biofuel Production Processes
Week 4	Biochemical Pathways for the Biofuel Production
Week 5	Molecular Biological Approaches for the Improvement of Biofuels Production
Week 6	Biohydrogen Production by the Dark Fermentation Process
Week 7	Biohydrogen Production by Photobiological Processes
Week 8	Biomethanation.
Week 9	Bioethanol
Week 10	Bioethanol
Week 11	Biodiesel
Week 12	Microbial Electrochemical Technologies and Their Applications
Weeks 13	Effect of Reactor Configurations on Gaseous Biofuel Production
Weeks 14	Scale-up and Case Studies of Biofuel Production Processes
Week 15	Preparing for the final exam

Delivery Plan (Weekly Syllabus)	
Week 1	Lab 1: Fermentation experiment.
Weeks 2	Lab 2: Anaerobic digestion experiment.
Weeks 3	Lab 3: Stem Distillation experiment.
Week 4	Lab 4: Adsorption experiment.
Week 5	Lab 5: Gasification experiment.
Week 6	Lab 6: Liquefaction experiment.
Week 7	Lab 7: Trans esterification experiment.

Learning and Teaching Resources		
	Text	Available in the Library?
Required Texts	Fundamental of biofuel production processes, Debabrata Das and Jhansi L. Varanasi Taylor & Francis Group, LLC	Yes
	Biofuel Technology Handbook, Dominik Rutz & Rainer Janssen WIP Renewable Energies	No
	https://www.aiche.org/topics/energy/biofuels-energy	

Module31 Subject information			
Module Title	**Convection heat transfer, and heat exchanger design**	**Module Delivery**	
Module Type	**Core**	☒**Theory**	
Module Code	RETE 301	☐**Lecture**	
ECTS Credits	**7**	☒**Lab**	
SWL (hr/sem)	**175**	☒**Tutorial** ☐**Practical** ☐**Seminar**	
Module Level	3	**Semester of Delivery**	6
Administering Department	RETE	**College**	Oil and gas technical college/ Kirkuk

Module Leader		e-mail	
Module Leader's Acad. Title	Assist. Lecture	**Module Leader's Qualification**	MSc
Module Tutor	Ali Qani Mohammed Saleh	e-mail	ali.alkurdi23@ntu.edu.iq
Peer Reviewer Name	Name	e-mail	Email
Scientific Committee Approval Date	06/01/2023	**Version Number**	1.0

Relation with other Modules

Prerequisite module	RETE 300	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents

Module Objectives	1. Introduce the student to the groups used in heat transfer and to know their composition and how they work. 2. Introduce the student Basic Concepts of Heat Transfer, Heat Transfer Mechanisms, Thermal conductivity -convection heat transfer -Radiation heat transfer 3. Introducing the student the main scientific principle in the field of heat transfer and its application in the Refrigeration, Cooling, and air conditioning fields, power plants. 4. Introducing students how to calculate Overall Heat Transfer Coefficient 5. Introducing students study the heat conduction through a large plane wall cylinder and sphere as one dimensional steady state case and a multilayer plane walls, cylinders, and spheres medium under steady conditions and unsteady conditions. 6. Providing the student with practical and technical experience in calculating the heat transfer from finned surfaces.

	7. Introducing the student to Investigate the steady state one dimensional heat conduction in a cylinder and sphere, and estimate the critical radius of insulation for them 8 Introduce the student Basic Concepts convection heat transfer, viscous flow, inviscid flow, laminar boundary layer on flat plate. 9. Introducing students study Forced convection -Empirical relations for pipe and flow over flat plate and across tube banks, Empirical relation for free convection on a vertical and horizontal flat plate, vertical and horizontal cylinders. 10. Introduce the student Type of heat exchanger, The log mean temperature difference Heat exchangers-The overall heat transfer coefficient. 11. Introduce the student Basic Concepts Radiation heat transfer, physical mechanism, Radiation shape factor, relationship between shape factors, heat exchange between non-black bodies, Infinite parallel planes – radiation shields.
Module Learning Outcomes	5- Show the student's ability to use knowledge to prepare scientific and applied research. 6- The ability to use electronic programs to solve the problems of heat transfer. 7- The ability to think to extract engineering solutions to problems related to heat transfer. 8- The ability to keep pace with scientific and technical modernity. 9- Teaching leadership skills, the value of commitment, love of work and devotion to it. 10- The ability to calculate the rate of heat transfer. 11- The ability to calculate the heat transfer from finned surfaces. 12- The ability to design heat exchangers.
Indicative Contents	After studying this chapter, the student is expected to master the following knowledge and skills: . 1-Basic Concepts of Heat Transfer, and Heat Transfer Mechanisms [10 hrs] 2-Steady State One Dimensional Heat Conduction in a Large Plane Wall, and in a Cylinder [15 hrs] 3-Conduction through Multilayer Plane Wall Overall Heat Transfer Coefficient, Critical Radius of Insulation [15 hrs] 4-Unsteady State One Dimensional heat transfer. [5 hrs] 5-Studying the heat transfer from finned surfaces [10 hrs] 6-force and free convection [20 hrs]. 7- Design heat exchangers [15 hrs]. 8- Solve the problem of radiation heat transfer [20 hrs]

Learning and Teaching Strategies	
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 types of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL) The student's academic load is calculated for 15 weeks.			
Structured SWL (h/sem) **Regular student load during the semester**	93	**Structured SWL (h/w)** **Regular weekly student load**	6.2
Unstructured SWL (h/sem) **Irregular student load during the semester**	82	**Unstructured SWL (h/w)** **Irregular student load per week**	5.4
Total SWL (h/sem) **The student's total academic load during the semester**	**175**		

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

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

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction, Basic Concepts of Heat Transfer, Heat Transfer Mechanisms
Week 2	Steady State One Dimensional Heat Conduction in a Large Plane Wall, and in a Cylinder. Conduction through Multilayer Plane Wall, and Cylinder.
Week 3	Overall Heat Transfer Coefficient, Critical Radius of Insulation, Thermal Contact Resistance.
Week 4	Heat transfer from finned surfaces.
Week 5	Transient Heat Conduction, (Lumped System Analysis), Two-Dimensional Steady Heat Conduction
Week 6	Fundamentals of convection –viscous flow –inviscid flow –laminar boundary layer on flat plate, The thermal boundary layer –turbulent flow in the tube.
Week 7	Empirical Equations of Forced convection for Laminar and Turbulent Flow on Flat Plate, across cylinders and sphere
Week 8	Empirical Equations of Forced convection for Laminar and Turbulent Flow across cylinders and sphere
Week 9	Empirical Equations of Forced convection for Laminar and Turbulent Flow inside pipes and ducts
Week 10	Empirical relation for free convection on a vertical and horizontal flat plate, vertical and horizontal cylinders
Week 11	Introduction to Heat Exchangers, Kinds of Heat Exchangers, The Overall Heat Transfer Coefficient
Week 12	Fouling Factor, The Log Mean Temperature Difference Method

Week 13	The Effectiveness of the heat exchangers, The Performances for Difference Kinds of the Heat Exchangers
Week 14	Heat Radiation, Introduction, Basic Concepts, Characteristics of Radiation, The View Factor Radiation Heat Transfer Between Two Black Surfaces
Week 15	Radiation Heat Transfer Between Two Gray Surfaces, Radiation Shields and The Radiation Effect
Week 16	Preparatory week before the final exam

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

Week 14	Lab 14: Thermal Conductivity of Metal Rod
Week 15	Lab 15: Emissivity Measurement Apparatus

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	. Heat transfer By: JP Holman, Heat and mass transfer By: YunusA. Gengel,	Yes
Recommended Texts	. Fundamentals of heat and mass transfer By: Incropera	Yes
Websites	https://www. Heat transfer handbook By: Bijan	

Module32				
Subject information				
Module Title	**Combustion & Pollution Engineering**		**Module Delivery**	
Module Type	**Core**		☒**Theory**	
Module Code	RETE 307		☐**Lecture**	
ECTS Credits	**6**		☒**Lab**	
SWL (hr/sem)	**150**		☒**Tutorial**	
			☐**Practical**	
			☐**Seminar**	
Module Level	3	**Semester of Delivery**	6	
Administering Department	RETE	**College**	Oil and gas technical college/ Kirkuk	
Module Leader		e-mail		
Module Leader's Acad. Title		**Module Leader's Qualification**		
Module Tutor		e-mail	@ntu.edu.iq	
Peer Reviewer Name	Name	e-mail	Email	

Scientific Committee Approval Date	06/01/2023	**Version Number**	1.0

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	1. Introduce the student to the types of Fuel & combustion process. 2. Introduce the student Basic Concepts of Thermodynamics of combustion, stoichiometric combustion, incomplete combustion, complete combustion, Air fuel ratio*(A/F)*, 3.Introducing students how to calculate adiabatic flame temperature, constant pressure adiabatic flame temperature, constant volume adiabatic flame temperature. 4.Introducing students to study Classifications of engines and engine performance. 5.Introducing the student to Air-Standard cycles. 6. Introduce the student types Hydrocarbon fuels, Hydrocarbon fuels, gasoline, Diesel fuel, Alternate fuels. 7.Introducing students to study octane Number & Catane Number, Self-Ignition Characteristics of Fuels, Octane Number and Engine Knock 8. Introduce the student Basic Concepts of air pollution, physical and chemical fundamentals. 9. Introduce the student Ambient air quality standards for criteria pollutants, Air pollution standards, Air pollution regulation. 10.To understand Air pollutants classification, Transport and air pollution, Causes of air pollution from Transportation. 11. Introducing students study the strategies for control of emissions in SI engines; Add on systems to control emissions inside the engine: EGR, crankcase and evaporative emission control
Module Learning Outcomes	Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks. 1. Show the student's ability to use knowledge to prepare scientific and applied research. 2. The ability to use electronic programs to solve the problems of the

	combustion process. 3. The ability to think to extract engineering solutions to problems related to combustion and pollution. 4. The ability to keep pace with scientific and technical modernity. 5. Teaching leadership skills, the value of commitment, love of work and devotion to it. 6. The ability to calculate the rate of adiabatic flame temperature. 7. The ability to calculate the Calculation of concentrations of air pollutants in the atmosphere. 8. The ability to control emissions in SI engines.
Indicative Contents	After studying this chapter, the student is expected to master the following knowledge and skills: 1-Basic Concepts of combustion, and types of combustion [15 hrs] 2- Calculations of adiabatic flame temperature [10 hrs] 3- Classifications of engines and engine performance. [15 hrs] 4- Types of hydrocarbon fuels, Hydrocarbon fuels gasoline, Diesel fuel, Alternate fuels. [15 hrs] 5-Studying Octane Number & Cetane Number [10 hrs] 6- Air pollution and Air pollution regulation [20 hrs]. 7- Strategies for controlling emissions in SI engines [15 hrs].

Learning and Teaching Strategies	
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 types of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL) **The student's academic load is calculated for 15 weeks.**			
Structured SWL (h/sem) **Regular student load during the semester**	63	**Structured SWL (h/w)** **Regular weekly student load**	4.2
Unstructured SWL (h/sem) **Irregular student load during the semester**	87	**Unstructured SWL (h/w)** **Irregular student load per week**	5.8

Total SWL (h/sem) **The student's total academic load during the semester**	**150**

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	4	20% (20)	2, 6 and 9, 12	LO #1, #5 and #6, #8
	Assignments	3	15% (15)	4, 8 and 14	LO #2, #3 and #7
	Projects /Lab.				
	Report	1	5% (5)	13	LO #4
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO #1 - #7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Thermodynamics of combustion, . Review of property relations, letant heat of vaporization, Ideal gas mixtures, Fuel & combustion, stoichiometric combustion, incomplete combustion, complete combustion, Air fuel ratio (A/F)
Week 2	Excess of air, less of air, theoretical of air, Equivalence ratio.
Week 3	Application of 1st law of thermodynamic on combustion process, Closed system (non-flow process), Open system (steady-flow process)
Week 4	adiabatic flame temperature, constant pressure adiabatic flame temperature, constant volume adiabatic flame temperature

Week 5	Classifications of engines, Types of Ignition, Engine Cycle, Basic Design, Air Intake Process, Method of Fuel Input for SI Engines, Fuel Used, Application, Type of Cooling
Week 6	Engine performance, brake power, brake thermal efficiency, brake mean effective pressure, Specific fuel consumption, Mechanical efficiency, Volumetric efficiency
Week 7	Air-Standard cycle, Air-Standard Assumptions, pressure volume diagram, Mean process on pv diagram, Otto Cycle, Thermal efficiency of the ideal Otto cycle, diesel cycle, Thermal efficiency of the ideal diesel cycle
Week 8	Air-fuel cycle, Air-fuel cycle assumption, constant volume cycle (gasoline engine cycle), constant pressure cycle (Diesel engine cycle)
Week 9	Hydrocarbon fuels, Hydrocarbon fuels, gasoline, Diesel fuel, Alternate fuels
Week 10	Octane Number & Cetane Number, Self-Ignition Characteristics of Fuels, Octane Number and Engine Knock
Week 11	Introduction to pollution, Ecological Systems and pollution, Toxic pollutants, Environmental factors affecting toxicity, Ambient air quality standards for criteria pollutants, Air pollution standards, Air pollution regulation
Week 12	Air pollutants classification, Transport and air pollution, Causes of air pollution from Transportation
Week 13	Calculation of concentrations of air pollutants in atmosphere , Description of air pollutants , A-Criteria Pollutants , Carbon Monoxide (CO) , Nitrogen Oxides (NO2) , Sulfur Oxides (SOx) , Particulate Matter (PM-10) , Organic air pollutants (VOCS)), Hydrocarbons (HC), Ozone (O3), Lead (Pb)
Week 14	Calculation of concentrations of air pollutants in the atmosphere,
Week 15	Global Climate Change - Greenhouse Gases Toxic Pollutants, Radioactive pollutants, indoor pollutants and Non-Criteria pollutants
Week 16	Preparatory week before the final exam

Learning and Teaching Resources

	Text	**Available in the Library?**

Required Texts	. Engineering Fundamentals of the Internal Combustion Engine .By Willard W. Pulkrabek	Yes
Recommended Texts	AN INTRODUCTION TO COMBUSTION Concepts and Application.BY Stephen R. Turns	Yes
Websites		

Module33

Subject information

Module Title	**Numerical Analysis**	**Module Delivery**	
Module Type	**Core**	☒**Theory** ☐**Lecture** ☒**Lab** ☒**Tutorial** ☐**Practical** ☐**Seminar**	
Module Code	COGTEK 301		
ECTS Credits	**6**		
SWL (hr/sem)	**150**		

Module Level	3	**Semester of Delivery**	6
Administering Department	RETE	**College**	Oil and gas technical college/ Kirkuk
Module Leader		**e-mail**	
Module Leader's Acad. Title	Assist. Lecture	**Module Leader's Qualification**	MSc
Module Tutor	Ali Qani Mohammed Saleh	e-mail	ali.alkurdi23@ntu.edu.iq
Peer Reviewer Name	Name	e-mail	Email
Scientific Committee Approval Date	06/01/2023	**Version Number**	1.0

Relation with other Modules

Prerequisite module	None	**Semester**	

Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	1. Develop a solid foundation in numerical concepts and techniques used in numerical analysis. 2. Understand the principles and applications of numerical methods for solving engineering problems. 3. Gain proficiency in using software tools and programming languages for numerical analysis. 4. Acquire the skills to analyze and interpret numerical results to make informed engineering decisions. 5. Apply mathematical modeling techniques to solve real-world engineering problems.
Module Learning Outcomes	The subject intended specific learning outcomes. On successfully completing the module students will be able to: 1. Acquire a comprehensive understanding of the fundamental principles and concepts underlying a broad range of basic methods used in Numerical Analysis. 2. Demonstrate proficiency in applying a variety of established techniques and effectively utilizing computational tools to solve engineering problems. 3. Apply the acquired knowledge and skills in basic numerical approximation to address complex problems in diverse contexts, demonstrating the ability to critically assess and select appropriate tools and techniques. 4. Effectively employ MATLAB commands and functions to implement and execute Numerical Analysis tasks, demonstrating competence in utilizing computational tools for problem-solving.
Indicative Contents	Part A Introduction, Mathematical Analysis, Numerical Differentiation and Integration [20 hr.] Numerical Solutions of Ordinary Differential Equations, Systems of Linear Equations [20 hr.] Revision problem classes and quiz [3 hrs]

	Part B Eigenvalues and Eigenvectors, Numerical Methods in Probability and Statistics, Numerical Methods for Control Systems [20 hr.]

Learning and Teaching Strategies Learning and teaching strategies	
Strategies	1. Establish a solid foundation: Start by thoroughly understanding the fundamental concepts and principles of Numerical Analysis. This includes grasping the Numerical techniques and numerical methods commonly used in the field. 2. Practice problem-solving: Numerical Analysis involves solving complex problems. Regularly practice solving a variety of problems to enhance your problem-solving skills and develop a deeper understanding of the subject matter. 3. Utilize resources: Take advantage of textbooks, online resources, and reference materials specific to Numerical Analysis. These resources can provide additional explanations, examples, and practice problems to reinforce your understanding.

Student Workload (SWL) The student's academic load is calculated for 15 weeks.			
Structured SWL (h/sem) **Regular student load during the semester**	78	**Structured SWL (h/w)** **Regular weekly student load**	5.2
Unstructured SWL (h/sem) **Irregular student load during the semester**	72	**Unstructured SWL (h/w)** **Irregular student load per week**	4.8
Total SWL (h/sem) **The student's total academic load during the semester**	**150**		

Module Evaluation

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

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Introduction to Numerical Analysis; Numerical analysis and its applications in engineering, Sources of error in numerical calculations
Week 2	Numerical Methods for Solving Equations; Bisection method, Newton-Raphson method, Secant method
Week 3	Interpolation and Approximation; Polynomial interpolation, Lagrange interpolation, Least squares approximation
Week 4	Numerical Differentiation and Integration; Forward, backward, and central difference approximations, Trapezoidal rule, Simpson's rule
Week 5	Numerical Solutions of Ordinary Differential Equations; Euler's method, Runge-Kutta methods, Multistep methods
Week 6	Systems of Linear Equations; Direct methods: Gaussian elimination, LU decomposition, Iterative methods: Jacobi method, Gauss-Seidel method

Week 7	Eigenvalues and Eigenvectors; Power method, QR method
Week 8	Numerical Solutions of Partial Differential Equations; Finite difference methods, Finite element methods
Week 9	Numerical Optimization; Unconstrained optimization: Golden section search, Newton's method, Constrained optimization: Linear programming, quadratic programming
Week 10	Numerical Methods for Data Analysis; Curve fitting, statistical regression
Week 11	Numerical Methods in Probability and Statistics; Monte Carlo simulation, Numerical integration of probability density functions
Week 12	Numerical Methods for Signal Processing; Discrete Fourier transform, Fast Fourier transform
Week 13	Numerical Methods for Image Processing; Image enhancement techniques, Image restoration methods
Week 14	Numerical Methods for Control Systems; Numerical simulation of control, systems, model predictive control
Week 15	Review and Project Presentations
Week 16	Preparatory week before the final exam

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Lab 1: Introduction to Numerical Analysis and MATLAB.
Week 2	Lab 2: Numerical Methods
Week 3	Lab 3: Interpolation and Curve Fitting
Week 4	Lab 4: Numerical Integration
Week 5	Lab 5: Numerical Solutions of Ordinary Differential Equations

Week 6	Lab 6: Systems of Linear Equations
Week 7	Lab 7: Numerical Solutions of Partial Differential Equations; Finite difference methods,

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	1. "Numerical Analysis" by R.L. Burden and J.D. Faires: This book covers fundamental numerical methods and their applications in a concise and accessible manner. 2. "Numerical Methods for Engineers" by SC Chapra and RP Canale: This textbook focuses on the practical aspects of numerical analysis and provides a wide range of examples and exercises.	No
Recommended Texts	1. "Numerical Analysis: Mathematics of Scientific Computing" by D. Kincaid and W. Cheney: This book emphasizes the mathematical foundations of numerical methods and includes rigorous analysis of algorithms. 2. "Numerical Recipes: The Art of Scientific Computing" by WH Press et al.: This popular book provides a comprehensive collection of numerical algorithms, along with code implementation in various programming languages.	No
Websites	1. (https://www.mathworks.com/) 2. (http://www.numericalmethods.eng.usf.edu/) 3. (https://www.engineering.com/)	

Level 4

Module 34 Subject information				
Module Title	**Wind Energy**			
Module Type	**Core**		☒Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☒ Seminar	
Module Code	**RETE 400**			
ECTS Credits	**5**			
SWL (hr/sem)	**125**			
Module Level	4	Semester of Delivery	7	
Administration Department	RETE	College	College of Oil and Gas Techniques Engineering - Kirkuk, Northern Technical University, Iraq	
Module Leader	Afrah Turki Awad	e-mail	afrah.turki@ntu.edu.iq	
Module Leader's Acad. Title	Lecturer	Module Leader's Qualification	PhD	
Module Tutor		e-mail		
Peer Reviewer Name		e-mail		
Scientific Committee Approval Date		Version Number		

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	Wind energy is the fast growing renewable source for electricity generation. The objective of this course is to present a broad overview of the technology covering aspects such as the history of wind turbine development, the characteristics of the wind and its impact on site selection, and the design, manufacture, and operation

	of modern wind turbines. The course has a practical flavour, drawing on examples from the wind turbine engineering and development sectors. The political and economic implications of wind energy are explored in the final lecture.
Module Learning Outcomes	On completion of this module the student will: • i) be capable of conducting a basic wind resource estimation and site assessment. • ii) Understand the fundamentals of wind turbine design and operation • iii) understand issues related to integrating wind energy into an electricity distribution network • iv) appreciate the strengths and limitations of wind energy in an economic and political context
Indicative Contents	A wind turbine module typically focuses on a specific aspect or subset of topics related to wind energy systems. Modules are usually part of a larger course or program and provide in-depth knowledge and skills in a particular area. Here are some indicative contents that might be included in a wind turbine module: 1. Introduction to Wind Turbine Technology. 2. Wind Turbine Aerodynamics. 3. Wind Energy Conversion Systems. 4. Wind Resource Assessment. 5. Structural Analysis and Design. 6. Operation and Maintenance. 7. Grid Integration and Electrical Systems. 8. Environmental Impact and Regulations. 10. Emerging Technologies and Innovations.

Learning and Teaching Strategies	
Strategies	Teaching Method 1 - Lectures Description: Attendance Recorded: Yes Teaching Method 2 - Asynchronous online course materials

	Description: Podcasts, videos, and articles on Renewable Energy Attendance Recorded: No Unscheduled Directed Student Hours (time spent away from the timetabled sessions but directed by the teaching staff). Teaching Method 3 - Tutorials Description: Attendance Recorded: Yes Teaching Method 4 - Practical Description: Practical homework assignments Attendance Recorded: No Unscheduled Directed Student Hours (time spent away from the timetabled sessions but directed by the teaching staff).

Student Workload (SWL)

Structured SWL (h/sem) Regular student load during the semester	63	Structured SWL (h/w) Regular weekly student load	4.2
Unstructured SWL (h/sem) Irregular student load during the semester	62	Unstructured SWL (h/w) Irregular student load per week	4.13
Total SWL (h/sem) The student's total academic load during the semester	125		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	4	10% (10)	5, 10	LO #1 and 2
	Seminar	2	10% (10)	Continuous	All
	Lab Report	5	20% (20)	2,6,12,14	LO # 3,4,8,12
Summative assessment	Mid Term exam	2 hours	10% (10)	11	LO #1-3
	Final Exam	3hr	50% (50)	16	All
100% (100 Marks)					

Delivery Plan (Weekly Syllabus)

Week 1	Background of wind turbines
Weeks (2 - 3)	Evolution of modern wind turbines
Weeks (4 - 5)	The wind and its characteristics

Week 6	Wind Turbine Aerodynamics
Week 7	Structural design and analysis
Week 8	Electrical Aspects
Week 9	Wind turbine control and operation
Week 10	materials and manufacture
Week 11	Mid-Term Exam
Week 12	Planning and Siting
Week 13	Construction and offshore wind
Week 14	Politics, economics and case studies
Week 15	Preparing for the final exam

Learning and Teaching Resources		
	Text	Available in the Library?
Required Texts	Wind Energy Explained, Manwell, McGowan and Rogers, Wiley 2002, ISBN 0 471 49972 2	No
	Wind Energy Handbook, Burton, Sharpe, Jenkins and Bossanyi; Wiley, 2001, ISBN 0 471 48997 2	No
	Renewable Energy in Power Systems, Freris & Infield; Wiley, 2008, ISBN 978 0 471 01749 4	No

Module 35 Subject information			
Module Title	**Photovoltaic Energy Conversion**		
Module Type	**Core**	☒Theory ☐ Lecture ☐ Lab ☒ Tutorial ☐ Practical ☒ Seminar	
Module Code	**RETE 401**		
ECTS Credits	**5**		
SWL (hr/sem)	**125**		
Module Level	4	Semester of Delivery	7

Administration Department	RETE	College	College of Oil and Gas Techniques Engineering - Kirkuk, Northern Technical University, Iraq
Module Leader	Afrah Turki Awad	e-mail	afrah.turki@ntu.edu.iq
Module Leader's Acad. Title	Lecturer	Module Leader's Qualification	PhD
Module Tutor		e-mail	
Peer Reviewer Name		e-mail	
Scientific Committee Approval Date		Version Number	

Relation with other Modules

Prerequisite module	RETE 305	Semester	6
Co-requisites module	None	Semester	--

Module Aims, Learning Outcomes and Indicative Contents

Module Aims	The module "Photovoltaic Energy Conversion" is designed with several key aims to provide students with a comprehensive understanding of the principles and applications of photovoltaic technology. Firstly, the module aims to establish a strong foundation in the fundamental principles of photovoltaic energy conversion, including semiconductor physics and the photovoltaic effect. Students will explore various photovoltaic technologies, delving into the intricacies of different types of solar cells and understanding their specific applications and limitations. Moreover, the module aims to equip students with practical skills in designing and evaluating photovoltaic systems for diverse purposes, such as residential, commercial, and utility-scale applications. Emphasis is placed on integrating energy storage solutions to enhance the reliability of photovoltaic systems and promote grid stability. Additionally, the module aims to foster an understanding of the economic and environmental aspects of photovoltaic energy, encouraging students to analyze the cost-effectiveness of solar energy solutions and consider sustainable practices in the industry. By promoting problem-solving skills, encouraging research endeavors, and emphasizing the significance of grid integration and societal impact, this module aims to prepare students for careers in the rapidly evolving field of photovoltaic energy conversion, equipping them to contribute

	meaningfully to the renewable energy sector and address the challenges of a sustainable energy future.
Module Learning Outcomes	Upon completing the course, students should be able to: 1. Understand Photovoltaic Principles: Demonstrate a deep understanding of the underlying principles photovoltaic energy conversion, including semiconductor physics, the photovoltaic effect, and the operation of solar cells. 2. Evaluate Solar Cell Technologies: Analyze and compare various types of solar cells, including monocrystalline, polycrystalline, and thin-film technologies, considering their efficiency, materials, and applications. 3. Assess Solar Radiation: Evaluate solar radiation data and understand its significance in photovoltaic system design, including site-specific considerations, shading analysis, and tilt optimization. 4. Design Photovoltaic Systems: Design photovoltaic systems for different scales of applications, considering energy demands, system sizing, orientation, and integration techniques such as inverters and charge controllers. 5. Integrate Energy Storage Solutions: Integrate energy storage solutions, including batteries, into photovoltaic systems, ensuring effective energy management, load balancing, and grid stability. 6. Analyze Balance of System Components: Understand and analyze balance of system components such as wiring, fuses, and grounding systems, ensuring the safe and efficient operation of photovoltaic installations. 7. Perform System Simulation: Utilize software tools for system simulation, analyze the performance of photovoltaic systems under various conditions, and optimize for maximum efficiency and reliability. 8. Evaluate Environmental and Economic Aspects: Assess the environmental impact of photovoltaic technologies, considering life cycle analysis and carbon footprint. Conduct economic evaluations, including cost-benefit analysis, payback periods, and return on investment calculations. 9. Troubleshoot and Maintain Systems: Develop skills in diagnosing and troubleshooting common issues in photovoltaic systems. Understand maintenance practices, ensuring the long-term sustainability and efficiency of installations. 10. Apply Regulatory and Safety Standards: Apply knowledge of national and international regulatory standards, codes, and relevant safety practices to photovoltaic energy systems, ensuring compliance and safe operation.

	11. Communicate Effectively: Present technical information related to photovoltaic energy conversion clearly and effectively, both in written reports and oral presentations, demonstrating effective communication skills. 12. Work in Interdisciplinary Teams: Collaborate effectively in interdisciplinary teams, integrating knowledge from engineering, environmental science, and economics to address complex challenges in photovoltaic energy conversion. 13. These Module Learning Outcomes are designed to equip students with a comprehensive skill set and knowledge base, enabling them to excel in the design, implementation, and evaluation of photovoltaic energy systems.
Indicative Contents	This module encompasses a wide range of indicative contents designed to provide students with a deep understanding of solar energy technology and its practical applications. The curriculum begins with fundamental concepts in semiconductor physics, elucidating the principles underlying the photovoltaic effect. Students delve into the study of various types of solar cells, including monocrystalline, polycrystalline, and thin-film technologies, understanding their structures, materials, and efficiency factors. The module covers solar radiation analysis, emphasizing the importance of understanding the local solar resource for effective system design. Additionally, students explore the intricacies of solar module construction and characterization, gaining insights into the manufacturing processes and quality control standards. A significant portion of the module is dedicated to photovoltaic system design and integration. Students learn the art of sizing photovoltaic systems based on energy demands, considering factors like shading, tilt, and orientation. Grid integration techniques, including inverters and energy storage solutions, are thoroughly explored to ensure seamless integration into existing electrical systems. The curriculum also includes an in-depth analysis of the balance of system components such as charge controllers, batteries, and wiring, ensuring students grasp the holistic view of photovoltaic installations. Moreover, the module delves into practical aspects of photovoltaic energy conversion, including hands-on lab sessions for solar cell efficiency measurements, system simulation exercises, and troubleshooting scenarios. Environmental and economic considerations are incorporated, encouraging students to evaluate the life cycle analysis, carbon footprint, and cost-benefit aspects of photovoltaic projects. Case studies and real-world applications supplement theoretical knowledge, providing students with valuable insights into successful photovoltaic installations across various contexts. Overall, the indicative contents of the module offer a well-rounded education in photovoltaic energy conversion,

	preparing students for careers in solar energy research, design, and implementation.

Learning and Teaching Strategies

Strategies	Teaching Method 1 - Lectures Description: Attendance Recorded: Yes Teaching Method 2 - Asynchronous online module materials Description: Podcasts, videos, and articles on Renewable Energy Attendance Recorded: No Unscheduled Directed Student Hours (time spent away from the timetabled sessions but directed by the teaching staff). Teaching Method 3 - Tutorials Description: Attendance Recorded: Yes Teaching Method 4 - Practical Description: Practical homework assignments Attendance Recorded: No Unscheduled Directed Student Hours (time spent away from the timetabled sessions but directed by the teaching staff).

Student Workload (SWL)

Structured SWL (h/sem) Regular student load during the semester	63	Structured SWL (h/w) Regular weekly student load	4.2
Unstructured SWL (h/sem) Irregular student load during the semester	62	Unstructured SWL (h/w) Irregular student load per week	4.13
Total SWL (h/sem) The student's total academic load during the semester	125		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	4	20% (20)	2, 5, 8, 10	LO #1, 4, 9 and 13
	Seminar	2	10% (10)	Continuous	All

	Lab Report	5	10% (10)	2,6,12,14	LO # 3,4,8,12
Summative assessment	Mid Term exam	2 hours	10% (10)	9	LO #1-11
	Final Exam	3hr	50% (50)	16	All
100% (100 Marks)					

Delivery Plan (Weekly Syllabus)	
Weeks (1-2)	**Introduction to Photovoltaic Energy** • Overview of renewable energy sources • Importance and applications of photovoltaic energy • Historical development of photovoltaic technology • Basic concepts of semiconductor physics relevant to solar cells
Week 3	**Solar Radiation and Solar Cells** • Solar radiation: measurement and data analysis • Solar cell structure and operation • Different types of solar cells: monocrystalline, polycrystalline, thin-film, and emerging technologies • Efficiency factors and characteristics of solar cells
Week 4	**Photovoltaic System Components** • PV modules: construction, characterization, and testing • Inverters, charge controllers, and batteries in PV systems • Balance of system components: wiring, fuses, and grounding • Energy storage solutions: types and integration techniques
Weeks (5-6)	**Photovoltaic System Design** • Site assessment and solar resource analysis • System sizing: load estimation, energy production calculation • System configuration and layout for different applications • Grid-connected vs. off-grid PV systems: design considerations
Weeks (7-8)	**Grid Integration and Power Electronics** • Grid-tied PV systems: net metering, grid integration standards • Power electronics in PV systems: DC-DC converters, inverters, and maximum power point tracking (MPPT)

	• Microgrid and smart grid technologies in solar energy integration
Week 9	Mid-Term Exam
Weeks (10-11)	**Energy Storage and System Simulation** • Energy storage technologies: batteries, thermal storage • System simulation tools: modeling and performance prediction • Hands-on simulation exercises: analyzing PV system performance under various conditions
Weeks (12-14)	**Economic and Environmental Aspects** • Economic analysis of PV systems: cost-benefit analysis, payback periods, return on investment • Environmental impact assessment: life cycle analysis, carbon footprint • Case studies of successful PV installations • Future trends and emerging technologies in photovoltaic energy conversion
Week 15	Preparing for the final exam

Learning and Teaching Resources		
	Text	Available in the Library?
Required Texts	Reinders, A., Verlinden, P., Van Sark, W. and Freundlich, A., 2017. Photovoltaic solar energy: from fundamentals to applications. John Wiley & Sons.	No
	Lasnier, F., 2017. Photovoltaic engineering handbook. Routledge.	No

Module 36 Subject information		
Module Title	**Simulation of renewable energy systems**	
Module Type	**Core**	☒Theory ☐ Lecture ☒ Lab ☒ Tutorial
Module Code	**RETE 402**	
ECTS Credits	**6**	

SWL (hr/sem)	**150**	☐ Practical ☐ Seminar	
Module Level	4	Semester of Delivery	7
Administration Department	RETE	College	College of Oil & Gas Techniques Engineering/Kirkuk
Module Leader	Ali Qani Mohammed Saleh	e-mail	ali.alkurdi23@ntu.edu.iq
Module Leader's Acad. Title	Lecturer	Module Leader's Qualification	MSc.
Module Tutor	Name (if available)	e-mail	
Peer Reviewer Name		e-mail	
Scientific Committee Approval Date		Version Number	1

Relation with other Modules

Prerequisite module	RETE 302	Semester	5
Co-requisites module	None	Semester	--

Module Aims, Learning Outcomes and Indicative Contents

Module Aims	7. Simulation Proficiency: The aim of this module is to equip students with the knowledge and skills required to proficiently simulate and model the behavior of renewable energy systems. Students should be able to create accurate mathematical models of these systems and use simulation techniques to analyze their performance effectively. 8. Assessment and Optimization: The module aims to enable students to assess the efficiency and reliability of renewable energy systems through simulations. Students should gain the ability to identify opportunities for optimization and make informed decisions to enhance the performance of these systems. 9. Real-World Application: By the end of the module, students should be capable of applying simulation techniques to practical scenarios in the renewable energy sector. They will gain the competence to address real-world challenges and evaluate the impact of different factors on system behavior, making them valuable contributors to the renewable energy industry.
Module Learning Outcomes	(LO9). Model Development: Students will be able to develop mathematical models that accurately represent the behavior and

	components of various renewable energy systems, including solar, wind, and hydropower. (LO10). Simulation Proficiency: Upon completion of the module, students will possess the skills to use simulation software and tools to create detailed and dynamic models of renewable energy systems. (LO11). Data Collection and Analysis: Students will learn to gather relevant data, perform data analysis, and integrate data into their simulation models to ensure realistic system behavior. (LO12). Performance Evaluation: The module will equip students to assess the performance of renewable energy systems under various conditions and scenarios, enabling them to identify areas for improvement. (LO13). Optimization Techniques: Students will gain knowledge of optimization methods and strategies to enhance the efficiency and reliability of renewable energy systems, considering factors such as resource availability and load demand. (LO14). System Integration: Students will understand how to simulate the integration of renewable energy systems into the wider energy infrastructure, taking into account grid compatibility and energy storage solutions. (LO15). Sensitivity Analysis: Graduates of the module will be proficient in conducting sensitivity analyzes to evaluate the impact of different variables and parameters on system performance and behavior. (LO16). Scenario Planning: Students will be capable of using simulation to explore various scenarios, allowing them to assess the resilience and adaptability of renewable energy systems in different conditions, including extreme weather events or changing energy demands. (LO17). Reporting and Communication: Students will be able to effectively communicate their simulation results and findings to various stakeholders, such as project managers, policymakers, and investors. (LO18). Practical Applications: Upon completion, students should be able to apply their simulation skills to practical situations in the renewable energy sector, contributing to the design, analysis, and optimization of real-world renewable energy projects.

Indicative Contents	Indicative content includes the following.
	• Introduction to Simulation
	  • Definition and importance of simulation
	  • Role of simulation in renewable energy systems
	• Mathematical Modeling
	  • Basics of mathematical modeling
	  • Differential equations and system representation
	  • Energy balance equations for renewable systems
	• Simulation Software and Tools
	  • Introduction to simulation software (eg, Python, MATLAB/Simulink, RET Screen)
	  • Hands-on training with simulation tools
	• Solar Energy System Simulation
	  • Solar PV system modeling
	  • Solar thermal system modeling

	• Impact of solar irradiance and weather conditions
	• Wind Energy System Simulation
	  • Wind turbine modeling
	  • Wind farm modeling
	  • Wind resource assessment and simulation
	• Hydropower System Simulation
	  • Hydroelectric power plant modeling
	  • Run-of-river and dam-based systems
	  • Impact of water flow and reservoir levels
	• Biomass Energy System Simulation
	  • Biomass combustion and gasification modeling
	  • Biogas and biofuel production simulation
	  • Resource availability and feedstock analysis
	• Geothermal Energy System Simulation
	  • Geothermal power plant modeling
	  • Geothermal heat pump modeling
	  • Ground heat exchanger simulations
	• Data Collection and Integration
	  • Gathering data for simulation
	  • Data analysis and validation
	  • Integrating real data into simulations
	• Performance Assessment
	  • Evaluating the performance of renewable energy systems using simulation
	  • Performance indicators and metrics
	• Optimization Techniques
	  • Strategies for optimizing renewable energy system performance
	  • Sensitivity analysis and scenario planning
	• Grid Integration and Energy Storage
	  • Simulation of grid-connected renewable energy systems
	  • Battery energy storage and load balancing
	• Case Studies and Projects
	  • Analysis of real-world renewable energy projects using simulation
	  • Group projects and hands-on simulation exercises
	• Sustainability and Environmental Impact Assessment
	  • Incorporating sustainability aspects into simulation
	  • Environmental impact assessments
	• Report Writing and Communication
	  • Communicating simulation results effectively
	  • Presentation of findings to stakeholders
	• Emerging Technologies and Future Trends
	  • Exploration of innovative simulation tools and techniques
	  • Future trends in renewable energy system simulation

Learning and Teaching Strategies	
Strategies	Teaching Method 1 - Lectures Description: Attendance Recorded: Yes Teaching Method 2 - Asynchronous on-line course materials Description: Podcasts, videos and articles in thermodynamics Attendance Recorded: No Unscheduled Directed Student Hours (time spent away from the timetabled sessions but directed by the teaching staff). Teaching Method 3 - Tutorials Description: Attendance Recorded: Yes Teaching Method 4 - Practical Description: Practical homework assignments Attendance Recorded: No Unscheduled Directed Student Hours (time spent away from the timetabled sessions but directed by the teaching staff).

Student Workload (SWL)			
Structured SWL (h/sem) Regular student load during the semester	78	Structured SWL (h/w) Regular weekly student load	5.2
Unstructured SWL (h/sem) Irregular student load during the semester	72	Unstructured SWL (h/w) Irregular student load per week	4.8
Total SWL (h/sem) The student's total academic load during the semester	150		

Module Evaluation					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	5	10% (10)	4,6,8,10,12 and 14	LO #2, #3,#5,#7,#9 and #11
	Assignments	5	10% (10)	2,6,8 and 12	LO #1, #4, #6and #10
	Projects / Lab.	4	20% (20)	Continuous	All
	Report				
Summative assessment	Midterm Exam	2 hours	10%(10)	7	LO #1 - #5
	Final Exam	3 hours	50%(50)	16	All

Total assessment	100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
Week 1	Introduction to Simulation - Overview of the course, Importance of simulation in renewable energy, Introduction to mathematical modeling
Week2	Mathematical Modeling - Basics of mathematical modeling, Differential equations and system representation, Energy balance equations for renewable systems
Week3	Simulation Software and Tools - Introduction to simulation software (eg, Python, MATLAB/Simulink, RETScreen), Hands-on training with simulation tools, Creating simple simulations
Week4	Solar Energy System Simulation - Modeling of solar PV systems, Modeling of solar thermal systems, Impact of solar irradiance and weather conditions on simulations
Week5	Wind Energy System Simulation - Wind turbine modeling, Wind farm modeling, Wind resource assessment and simulation
Week6	Hydropower System Simulation - Hydroelectric power plant modeling, Run-of-river and dam-based systems, Impact of water flow and reservoir levels
Week7	Biomass Energy System Simulation - Biomass combustion and gasification modeling, Biogas and biofuel production simulation, Resource availability and feedstock analysis
Week8	Geothermal Energy System Simulation - Geothermal power plant modeling, Geothermal heat pump modeling, Ground heat exchanger simulations
Week9	Data Collection and Integration - Gathering data for simulations, Data analysis and validation, Integrating real data into simulations
Week 10	Performance Assessment - Evaluating the performance of renewable energy systems using simulation, performance indicators and metrics
Week 11	Optimization Techniques - Strategies for optimizing renewable energy system performance, Sensitivity analysis and scenario planning
Week 12	Grid Integration and Energy Storage - Simulation of grid-connected renewable energy systems, Battery energy storage and load balancing simulations
Week 13	Case Studies and Projects - Analysis of real-world renewable energy projects using simulation, Group projects and hands-on simulation exercises
Week 14	Sustainability and Environmental Impact Assessment - Incorporating sustainability aspects into simulation, Environmental impact assessments in renewable energy projects
Week 15	Report Writing and Communication - Communicating simulation results effectively, presenting findings to stakeholders

Learning and Teaching Resources		
	Text	Available in the Library?
Required Texts	Solar PV and Wind Energy Conversion Systems: An Introduction to Theory, Modeling with MATLAB/Simulink, and the Role of Soft Computing Techniques by S. Sumathi and L. Ashok Kumar	No
Recommended Texts	Modeling and Simulation of Green Energy Technologies by Michael M. Ohadi and S. Javad Ahmadi	No

	Simulation-Based Analysis of Energy and Carbon Emission Impacts by Yi-Ming Wei and Dabo Guan	No

Module 37

Subject information

Module Title	Engineering projects management	**Module Delivery**	
Module Type	**Support**		**☒Theory**
Module Code	COGTEK 400		**☐Lecture**
ECTS Credits	**4**		**☐Lab**
SWL (hr/sem)	**100**		**☒Tutorial**
			☐Practical
			☒Seminar
Module Level	4	**Semester of Delivery**	7
Administering Department	RETE	**College**	College of Oil & Gas Techniques Engineering/Kirkuk
Module Leader		e-mail	
Module Leader's Acad. Title	Assist. Lecture	**Module Leader's Qualification**	MSc
Module Tutor		e-mail	@ntu.edu.iq
Peer Reviewer Name	Name	e-mail	Email
Scientific Committee Approval Date	06/01/2023	**Version Number**	1.0

Relation with other Modules

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	1. Introduce the student to the methods of management and the appropriation of each of them in different fields of work. 2. Introduce the student to exercise the different methods of management in the mini groups to elevate his ability in management. 3. Enhance the student skills in management by giving the typical solution on the assumed Problem. 4. Introducing students to different types of feasibility studies and how to assess each of them. 5. Introducing students to make the network planning for the different engineering Processes. 6. Introducing the student to the administrative and production organization of industrial enterprises. 7. Introducing the student to Break-Even Analysis.
Module Learning Outcomes	1. Enable the student to use knowledge to manage the different purposes of organizations. 2. Enable engineers to use modern programs to solve the technical problems in Organizations where they managed. 3. Enable engineers to plan the administrative and production organization of industrial enterprises. 4. Enable engineers to plan the network planning for the different engineering processes and find the typical path of the minimum duration that offers the best quality of the production. 5. Enable engineers to study the feasibility of the industrial processes which leads to Successful of the production.6. Enable engineers to calculate the Break-Even of any production or trading process and calculate the duration of that case. 7. Enhance the student's skills in management by giving the typical solution to the assumed problem
Indicative Contents	Indicative content includes the following. ● BUILDING SURVEY Introduction to the management [10 hrs]

	Modern methods of the management [15 hrs] Feasibility study [15 hrs] ● BREAK-EVEN ESTIMATION The necessity of calculations of the break-even point and its duration. [15 hrs] ● FEASIBILITY STUDY The necessity of the different field feasibility study [15 hrs] ● Administrative and production organization of industrial enterprises The meaning of the administrative and production organization of industrial enterprises and how can make the most appropriate administrative layout [15 hrs

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

Student Workload (SWL) The student's academic load is calculated for 15 weeks.			
Structured SWL (h/sem) **Regular student load during the semester**	47	**Structured SWL (h/w)** **Regular weekly student load**	3.1
Unstructured SWL (h/sem)	53	**Unstructured SWL (h/w)** **Irregular student load per week**	3.5

Irregular student load during the semester			
Total SWL (h/sem) **The student's total academic load during the semester**	**100**		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	5	20% (20)	3.5 and 10	LO #1, #2 and #5
	Assignments	5	20% (20)	4,8 and 12	LO #3, #4, #6 and #7
	Report				
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO #1 - #7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Introduction – definition and examples related to the industrial engineering management - Functions of management
Week 2	Establish Goals and Objectives
Week 3	Feasibility Study, Technical feasibility, Economic feasibility
Week 4	Feasibility Study, Schedule feasibility, Operational feasibility

Week 5	Analyzing Costs vs. Benefits, Calculating Present Value, Net Present Value (NPV), Internal Rate of Return (IRR).
Week 6	Administrative and production organization of industrial enterprises, Linear structure, Consulting structure, Functional structure.
Week 7	Break-Even Analysis, Break-point calculations
Week 8	Introduction in Network planning
Week 9	Network planning, calculation of the critical path, float time, meaning of the early start, early finish, late start and late finish.
Week 10	Network planning, Program Evaluation and Review Technique (PERT).
Week 11	Cold Thermal Energy Storage
Week 12	Quality Control and production inspection method
Week 13	Industrial costs and controllable cost techniques
Week 14	Maintenance
Week 15	Replacement
Week 16	Self-assessment control

Learning and Teaching Resources

	Text	**Available in the Library?**
Required Texts		Yes
Recommended Texts	Dr. Khalil Al-Ani, Dr. Ismail Ibrahim Al-Qazzaz, Dr. Adel Abdul Malik Awlair "Administration Total Quality and ISO 9001:2000 Requirements, First Edition 2001, Al-Ashqar Press, Baghdad	
Websites	1. https://www.workamajig.com/blog/critical-path-method	

	2. https://www.editorialmanager.com/cherd/default2.aspx?pg=AuthorshipVerification.aspx&d ocid=50317&authorID=%7b0854344E-1B2D-43DE-9697-4095BA17131E%7d&msid=%7bC7C1D8B5-7EF8-4FDD-B449 -5CE3CD0A947A %7d 3. https://www.investopedia.com/terms/q/quality-control.asp

Module 38
Subject information

Module Title	Power Plants	Module Delivery	
Module Type	**Core**	☒Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☒ Seminar	
Module Code	**RETE 404**		
ECTS Credits	**5**		
SWL (hr/sem)	**125**		
Module Level	4	Semester of Delivery	7
Administration Department	RETE	College	College of Oil and Gas Techniques Engineering - Kirkuk, Northern Technical University, Iraq
Module Leader	Marwa Khaleel Rashid	e-mail	marwa.khaleel23@ntu.edu.iq
Module Leader's Acad. Title	Assistant lecturer	Module Leader's Qualification	M.Sc.
Module Tutor		e-mail	
Peer Reviewer Name		e-mail	
Scientific Committee Approval Date		Version Number	

Relation with other Modules

Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	1. Power plant engineering deals with the study of energy, its sources and 1. Utilization of energy for power generation. 2. The power is generated by prime movers (example Hydraulic turbines, steam 3. turbines, diesel engines) 4. Large amount of power is generated using prime movers in a site or layout 5. called power plants, where all the equipment and machinery required for 6. power generation is located 7. 4. Energy may be defined as the capacity to do work. Energy exists in various 8. forms, such as Mechanical Energy, thermal energy, electrical energy, solar 9. energy etc 10. 5. Energy may be defined as the capacity to do work. Energy exists in various 11. forms, such as Mechanical Energy, thermal energy, electrical energy, solar 12. energy etc
Module Learning Outcomes	1. Explain about the plant steam cycles 2. To make the students understanding Binary cycle working on mercury and 3. steam, combine condenser 4. To make the students understanding Combustion and Fuels 5. Enables the students to learn Steam Condensers, Kinds, Direct Contact 6. Condensers, Surface Condenser 7. To make the students understand all about the Steam Nozzles, Applications 8. To explain the Pumps, Kinds of Pumps 9. Explain the operation of Pumps in series and Parallel, Centrifugal pumps 10. To help student how to calculate Steam Turbines, The Kinds, Impulse Turbine, 11. Blades Efficiency 12. To help students understand how to solve the water treatment and testing 13. in boiler Skills outcomes - Analysis - synthesis - interpretation, - report writing - laboratory - computational.

Indicative Contents	Indicative content includes the following. Part A - Introduction to power cycle, Carnot cycle, Rankin cycle ideal and actual, Rankin cycle with reheat. [15 hrs] Open feed water heater and close feed water heaters, binary cycle, combine cycle[15 hrs] Steam condenser are direct and indirect contact, the efficiency of steam condenser [10 hrs] Fuel and combustion, and how to calculate the air to fuel ratio [15 hrs] Calculate the heat of combustion [6hrs] Part B – Fundamentals . To understand the diagram of nozzle converge-divergence nozzles, Applications [15 hrs] System Characteristics, Pumps Characteristics, Matching Pumps to System Characteristics. [7 hrs] Steam Turbines, The Kinds, Impulse Turbine, Blades Efficiency. Water Treatment and Testing [15 hrs]

Learning and Teaching Strategies

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 types of simple experiments involving some sampling activities that are interesting to the students

Student Workload (SWL)

Structured SWL (h/sem) Regular student load during the semester	63	Structured SWL (h/w) Regular weekly student load	4.2
Unstructured SWL (h/sem) Irregular student load during the semester	62	Unstructured SWL (h/w) Irregular student load per week	4.13
Total SWL (h/sem) The student's total academic load during the semester	125		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	5	10% (10)	3,6,10,12	LO #2, #3 and #7
	Assignments	5	10% (10)	2, 5,9, 11	LO #1, #4, #6 and #8
	Lab Report	10	20% (20)	Continuous	All
Summative assessment	Mid Term exam	2 hours	10% (10)	7	LO #1-4
	Final Exam	3hr	50% (50)	16	All
100% (100 Marks)					

Delivery Plan (Weekly Syllabus)	
Week 1	Introductions, Plant steam cycles, main cycles
Week 2	Reheat cycle, regenerative cycle, open feed water heater
Week 3	closed feed water heaters, combine cycles
Week 4	Binary cycle working on mercury and steam, combine condenser
Week 5	Combustion and Fuels
Week 6	Correct Air/Fuel Ratio
Weeks 7	Mid-Term Exam
Weeks 8	Steam Condensers, Kinds
Week 9	Direct Contact Condensers, Surface Condenser
Week 10	Steam Nozzles, Applications
Week 11	The Pumps, Kinds of Pumps,
Week 12	System Characteristics, Pumps Characteristics, Matching Pumps to System Characteristics
Week 13	Operation of Pumps in series and Parallel, Centrifugal pumps
Week 14	Steam Turbines, The Kinds, Impulse Turbine, Blades Efficiency
Week 15	Preparing for the final exam

Delivery Plan (Weekly Lab. Syllabus)

	Material Covered
Week 1	Lab 1: Introduction to boiler
Week 2	Lab 2: Boiler feed water repeated for times with variable inputs
Week 3	Lab 3: To calculate the efficiency of steam condenser
Week 4	Lab 4: Air to fuel ratio of combustion
Week 5	Lab 5: To calculate the power of pumps kinds
Week 6	Lab 6: The steam nozzle repeated for times with variable inputs
Week 7	Lab 7: Water treatment in boiler

Learning and Teaching Resources		
	Text	Available in the Library?
Required Texts	Thermal engineering (eighth edition) RK RAJPUT	No
Recommended Texts	Fundamentals 0f engineering thermodynamics, Michael J. Moran and Howard N. Shapiro, Fifth edition	No

Module 39 Subject information			
Module Title	Methodology of Scientific Research	Module Delivery	
Module Type	**Basic**	☒Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☒ Seminar	
Module Code	**NTU 400**		
ECTS Credits	**5**		
SWL (hr/sem)	**125**		
Module Level	4	Semester of Delivery	7

Administration Department	RETE	College	College of Oil and Gas Techniques Engineering - Kirkuk, Northern Technical University, Iraq
Module Leader	Marwa Khaleel Rashid	e-mail	marwa.khaleel23@ntu.edu.iq
Module Leader's Acad. Title	Assistant lecturer	Module Leader's Qualification	M.Sc.
Module Tutor		e-mail	
Peer Reviewer Name		e-mail	
Scientific Committee Approval Date		Version Number	

Relation with other Modules

Prerequisite module	None	Semester	
Co-requisites module	COGTEK 401	Semester	8

Module Aims, Learning Outcomes and Indicative Contents

Module Aims	1. To Understand the significance of scientific research and its role in advancing knowledge. 2. To Identify the key characteristics of scientific research. 3. This course deals with the basic concept of Formulate research questions and objectives. 4. This is the basic subject for all ethical considerations in scientific research 5. Recognize the importance of conducting a literature review in research. 6. Familiarize with quantitative and qualitative data collection methods. 7. Understand the principles of experimental design.
Module Learning Outcomes	***1.*** Understand the nature and significance of scientific research. Identify the characteristics and principles of scientific research. Demonstrate an awareness of ethical considerations in scientific research. ***2.*** Recognize between various research designs. ***3.*** List the various formulate clear research questions and objectives ***4.*** Summarize what is literature review to identify relevant research articles. ***5.*** Discuss and evaluate the credibility and relevance of research articles.

	6. Design experiments that maximize internal and external validity. 7. Determine the appropriate sample size for a survey based on research objectives. 8. Demonstrate proficiency in employing different approaches to qualitative research. 9. Recognize and apply ethical principles and guidelines in research involving human subjects 10. Communicate research results in a clear and concise manner to different audiences. 11. Formulate a clear and concise research problem statement.
Indicative Contents	Indicative content includes the following. Part A - Definition and significance of scientific research [5 hrs.] Part B- Research Problem Formulation [5 hrs.] Part C- Research Design and Methodology [5 hrs.] Part D- Literature Review [5 hrs.] Part E- Data Collection and Measurement [5 hrs.] Part F- Homework and Discussion [7 hrs.]

Learning and Teaching Strategies

Strategies	Studying the Methodology of Scientific Research requires a combination of active learning strategies and focused study techniques, such as; **Read the Course Materials, Engage in Discussions, Take Detailed Notes, Practice with Examples, Review and Summarize, Create Visual Aids, and Work on Exercises and Assignments**

Student Workload (SWL)

Structured SWL (h/sem) Regular student load during the semester	32	Structured SWL (h/w) Regular weekly student load	2.13
Unstructured SWL (h/sem) Irregular student load during the semester	93	Unstructured SWL (h/w) Irregular student load per week	6.2
Total SWL (h/sem) The student's total academic load during the semester	125		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	3,5,8 and 10	LO #1, #2 and #9 #10, #11
	Assignments	2	10% (10)	2,4,6 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	10% (10)	Continuous	All

	Lab Report	5	10% (10)	3,7,13,14	LO #5,#8,11,13
Summative assessment	Mid Term exam	2 hours	10% (10)	7	LO #1 - #7
	Final Exam	3hr	50% (50)	16	All
100% (100 Marks)					

Delivery Plan (Weekly Syllabus)	
Week 1	Introduction to Scientific Research
Week 2	Research Design
Week 3	Literature Review
Week 4	Data Collection Methods
Week 5	Data Analysis
Week 6	Experimental Design
Weeks 7	Survey Design and Sampling
Weeks 8	Qualitative Research Methods
Week 9	Ethics in Scientific Research
Week 10	Data Interpretation and Presentation
Week 11	Peer Review and Publication Process
Week 12	Research Proposal Writing
Week 13	Project Management and Time Planning
Week 14	Presentations and Research Conferences
Week 15	Research Ethics Review and Course Wrap-up

Learning and Teaching Resources		
	Text	Available in the Library?
Required Texts	1. “Research Design: Qualitative, Quantitative, and Mixed Methods Approaches” by John W. Creswell and J. David Creswell	Yes

	2. “The Craft of Research” by Wayne C. Booth, Gregory G. Colomb, and Joseph M. Williams 3. “Research Methodology: A Step-by-Step Guide for Beginners” by Ranjit Kumar	
Recommended Texts	Academic Databases: Utilize academic databases such as PubMed, Google Scholar, JSTOR, and IEEE Xplore to search for research papers in the methodology of scientific research. Use relevant keywords such as “research methodology,” “scientific research design,” or specific methodologies you are interested in (eg, “qualitative research methods,” “experimental design”).	No
	(www.socialresearchmethods.net) (www.researchmethodology.org) (www.qualres.org)	

Module 40
Subject information

Module Title	**Renewable Energy design**			
Module Type	**Core**		☒Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☒ Seminar	
Module Code	**RETE 405**			
ECTS Credits	**6**			
SWL (hr/sem)	**150**			
Module Level	4		Semester of Delivery	8
Administration Department	RETE		College	College of Oil and Gas Techniques Engineering - Kirkuk
Module Leader	Afrah Turki Awad		e-mail	afrah.turki@ntu.edu.iq
Module Leader's Acad. Title	Lecturer		Module Leader's Qualification	PhD
Module Tutor			e-mail	
Peer Reviewer Name			e-mail	
Scientific Committee Approval Date			Version Number	

Relation with other Modules

Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	• The module is intended to present and assess some of the important renewable energy technologies and give some sense of the engineering design and development of some of these technologies. Starting with a brief outline of existing and proposed renewable energy systems, the module adopts an active solution-seeking approach, assessing these technologies against economic, engineering and other criteria. • Two of the most promising technologies, wind power, and solar energy are treated in some depth as an example of optimization in mechanical and electrical engineering design. Other technologies studied include geothermal, biomass, ocean and hydro power.
Module Learning Outcomes	By the end of the module, students should be able to: • Interpret, apply and resolve the scientific concepts and principles underpinning renewable energy technologies. • Evaluate design processes and methodologies for renewable energy systems and apply them to new situations. • Autonomously apply mathematical models for solving problems in renewable energy systems, criticizing these methods and advance independent hypotheses for the scope of their applicability and the limitations of these models for practical application. • Discuss current practice and its limitations as well as potential new and advanced developments at the forefront of renewable energy technology.
Indicative Contents	The module on Renewable Energy Design encompasses a diverse array of indicative contents aimed at equipping students with the knowledge and skills necessary to navigate the complexities of designing sustainable energy systems. Beginning with an introduction to renewable energy sources, students delve into the principles and applications of solar, wind, hydro, biomass, and geothermal energy. Site assessment and resource mapping techniques are explored, allowing students to identify optimal locations for renewable energy installations. The curriculum delves into the intricacies of various renewable energy technologies, such as solar photovoltaic systems, wind turbines, and biomass conversion methods, emphasizing system components, design considerations, and integration techniques. Students learn to optimize renewable energy systems by studying system sizing, load matching, and energy storage solutions,

	ensuring reliable and efficient energy supply. Economic and financial aspects are covered comprehensively, including cost-benefit analysis, financing options, and incentive programs. Environmental impact assessment and adherence to regulatory frameworks are emphasized, instilling an understanding of the environmental and legal considerations in renewable energy projects. The module also incorporates practical elements, including hands-on exercises, case studies of successful projects, and site visits, allowing students to apply theoretical knowledge to real-world scenarios. By exploring emerging technologies and innovations, students are encouraged to think critically and creatively, preparing them to contribute meaningfully to the ongoing global transition towards sustainable energy renewable solutions.

Learning and Teaching Strategies	
Strategies	Teaching Method 1 - Lectures Description: Attendance Recorded: Yes Teaching Method 2 - Asynchronous online module materials Description: Podcasts, videos, and articles on Renewable Energy Attendance Recorded: No Unscheduled Directed Student Hours (time spent away from the timetabled sessions but directed by the teaching staff). Teaching Method 3 - Tutorials Description: Attendance Recorded: Yes Teaching Method 4 - Practical Description: Practical homework assignments Attendance Recorded: No Unscheduled Directed Student Hours (time spent away from the timetabled sessions but directed by the teaching staff).

Student Workload (SWL)			
Structured SWL (h/sem) Regular student load during the semester	63	Structured SWL (h/w) Regular weekly student load	4.2
Unstructured SWL (h/sem) Irregular student load during the semester	87	Unstructured SWL (h/w) Irregular student load per week	5.8
Total SWL (h/sem) The student's total academic load during the semester	150		

Module 41 Course material evaluation					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5, 10	LO # 2,6
	Assignments	5	10% (10)	5,7,12 and 14	LO# 1,2, 3 and 5
	Seminar	2	10% (10)	Continuous	All
	Lab Report	2	10% (20)	4.11	LO # 3, 9
Summative assessment	Mid Term exam	2 hours	10% (10)	7	LO #1-7
	Final Exam	3hr	50% (50)	16	All
100% (100 Marks)					

Delivery Plan (Weekly Syllabus)	
Week (1-3)	General introduction to renewable energy - renewable energy sources and applications - renewable energy and environmental problems (acid rain, ozone layer depletion, climate change, nuclear risks).
Weeks (4 - 5)	Resource scale and availability.
Weeks (6 - 7)	Available technologies and challenges. Technical and economical assessment of renewable technologies.
Week (8-9)	Detailed technical study of two major renewable energy technologies: Solar energy: solar thermal & solar PV, current technology and future potential. Wind energy: wind turbine configurations and power generating technologies.
Week (10-11)	Broad study of technologies with less potential: Hydro power energy: Principles of hydro power technology. Ocean current, tidal & wave energy: technology, economics, challenges and R&D.
Week 12	Mid-Term Exam
Week 13	Ground source and geothermal energy: principles, operation, future scope.
Week 14	Biomass and Bioenergy: resources, sustainability, processing, combustion, scope.
Week 15	Preparing for the final exam

Learning and Teaching Resources		
	Text	Available in the Library?
Required Texts	Solar Energy Engineering, Kalogirou, SA, 2nd Edition, Academic Press, 2013. E-book ISBN 9780123972569.	No
	Boyle, G., 1996. Renewable energy: power for a sustainable future. (No Title).	No

Module Information					
Module Title	**Store and recover energy**			**Module Delivery**	
Module Type	**Core**			☒**Theory**	
Module Code	RETE 406			☒**Lecture**	
ECTS Credits	**5**			☒**Lab**	
SWL (hr/sem)	**125**			☐**Tutorial** ☒**Practical** ☒**Seminar**	
Module Level	4		**Semester of Delivery**	8	
Administering Department	RETE		**College**	College of Oil & Gas Techniques Engineering/Kirkuk	
Module Leader			e-mail		
Module Leader's Acad. Title	Assist. Lecture		**Module Leader's Qualification**	MSc	
Module Tutor			e-mail	@ntu.edu.iq	
Peer Reviewer Name	Name		e-mail	Email	
Scientific Committee Approval Date	06/01/2023		**Version Number**	1.0	

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

Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	-Advanced energy technology driving growing interest in thermal applications such as space and water heating -types of energy storage technologies available -TES systems have a huge potential to facilitate the most efficient use of thermal equipment and economical large-scale energy alternatives. -energy storage Enables electricity to be saved for a later, when and where it is most needed -Energy storage can reduce operating costs related to grid power
Module Learning Outcomes	-Able to recognize the energy storage types -Able to know thermal energy storage methods and their application. -identify the waste energy recovery
Indicative Contents	-understanding the fundamentals of energy storage -able to know the types of energy storage Mechanical Energy Storage, Chemical Energy Storage, Biological Storage, Magnetic Storage -Identify the application of energy thermal storage

Learning and Teaching Strategies	
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 types of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL) The student's academic load is calculated for 15 weeks.			
Structured SWL (h/sem) **Regular student load during the semester**	63	**Structured SWL (h/w)** **Regular weekly student load**	4.2
Unstructured SWL (h/sem) **Irregular student load during the semester**	62	**Unstructured SWL (h/w)** **Irregular student load per week**	4.1
Total SWL (h/sem) **The student's total academic load during the semester**	**125**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO#2 and 3
	Assignments	2	10% (10)	2 and 12	LO#4and6
	Projects /Lab.	1	10% (10)	6	LO#8
	Report	1	10% (10)	13	LO#11
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO#1-7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction ,Fundamental Properties and Quantities
Week 2	Mechanical Energy Storage, Chemical Energy Storage
Week 3	Biological Storage, Magnetic Storage
Week 4	Hydrogen for Energy Storage
Week 5	Thermal energy storage method
Week 6	Criteria for Thermal energy storage Evaluation
Week 7	Thermal energy storage Heating and Cooling Applications
Week 8	Thermal energy storage Heating and Cooling Applications
Week 9	Types and Features of Various Stratified Thermal energy storage Tanks
Week 10	Phase Change Materials (PCMs)
Week 11	Cold Thermal Energy Storage
Week 12	Environmental Impact and Thermal energy storage Systems and Applications
Week 13	Thermal energy storage and Energy Savings
Week 14	Energy Savings by Cold TES
Week 15	WASTE ENERGY RECOVERY
Week 16	**Preparatory week before the final exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered

Week 1	Lab 1: Introduction to laboratory & safety
Week 2	Lab 2: flat plate solar collector
Week 3	Lab 3: parabolic concentrating collector
Week 4	Lab 4: Rock storage
Week 5	Lab 5: ice storage
Week 6	Lab 6: water storage
Week 7	Lab 7: Evacuated Solar Collector

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Ibrahim DMARosen, thermal energy storage and application, Second. united kingdom: Wiley, 2011.	Yes
Recommended Texts		
Websites		

Module 42 **Subject information**		
Module Title	**Control systems**	**Module Delivery**
Module Type	**Core**	**☒Theory**
Module Code	RETE 407	**☒Lecture**
ECTS Credits	**5**	**☒Lab**
SWL (hr/sem)	**125**	**☐Tutorial** **☒Practical** **☒Seminar**

Module Level	4	**Semester of Delivery**	8
Administering Department	RETE	**College**	College of Oil & Gas Techniques Engineering/Kirkuk
Module Leader		e-mail	
Module Leader's Acad. Title	Assist. Lecture	**Module Leader's Qualification**	
Module Tutor		e-mail	@ntu.edu.iq
Peer Reviewer Name	Name	e-mail	Email
Scientific Committee Approval Date	06/01/2023	**Version Number**	1.0

Relation with other Modules

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

Module Aims, Learning Outcomes and Indicative Contents

Module Objectives **Subject objectives**	1. Understanding Measurement Principles: Gain knowledge of measurement principles, including device selection, calibration, and measurement limitations. 2. Familiarity with Control Systems: Learn the basics of control systems, including feedback, closed-loop control, and the role of sensors, actuators, and controllers. 3. Application of Measurement Techniques: Develop practical skills in using measurement techniques and instruments to collect and analyze data in engineering systems. 4. System Analysis and Optimization: Acquire the ability to analyze measurement and control systems, identify performance issues, and implement optimization strategies for enhanced system performance.
Module Learning Outcomes	1. Understand Measurement Principles: Develop a solid understanding of the fundamental principles of measurement, including accuracy, precision, and uncertainty. Gain the ability to choose appropriate measurement devices and methods for different engineering applications. 2. Analyze and Design Control Systems: Acquire the skills to analyze and design control systems, including feedback loops, controllers, and actuators. Grasp

	concepts such as stability, transient response, and steady-state error in control systems. 3. Apply Measurement Techniques: Gain practical expertise in applying measurement techniques and instruments to collect and analyze data in engineering systems. Utilize statistical methods to effectively analyze and interpret measurement data. 4. Troubleshoot and Optimize Systems: Develop the ability to troubleshoot and optimize engineering systems by identifying and rectifying measurement and control issues. Learn techniques for
Indicative Contents	Part A: Fundamentals of measurement systems, General Measurement System, Error and uncertainty analysis and Static characteristics of measurement system elements [25 hours] Introduction to control system, Power circuit elements, Principles of electric control and Plc basics [25 hours] Revision Session and Quiz [2 hours] Part B: tutorial of symbols, equipment's and Counters, timers, introduction to inverter [25 hours] PLC system structure, Basic ladder logic Timers, Counters & Comparators [25 hours] Up Counter (CTU), Down Counter (CTD), Latch and Unlatch Logic Memory Concept in Allen Bradley PLC, and Hardware of PLC circuit, review of PLC ladder. [25 hours] Revision Session and Quiz [2 hours] Revised Description: Part A of the Engineering Measurement and Control Systems course provides students with a solid understanding of the fundamental principles in this field. The module begins by covering the basics of measurement, including different measurement techniques and the use of instruments. Students will then delve into the topic of control systems and explore considerations related to Programmable Logic Controllers (PLCs). To reinforce the concepts learned, a revision session and quiz will be conducted, allowing students to review and assess their understanding. This module serves as a crucial foundation for further studies in the field of Engineering Measurement and Control Systems.

Learning and Teaching Strategies	
Strategies	1. Active Participation: Actively engage in class discussions, ask questions, and contribute to group activities. This will help you better understand the concepts and reinforce your learning. 2. Practical Application: Apply the theoretical knowledge to real-world examples and projects. Participate in laboratory sessions and hands-on activities to gain practical experience in measurement and control systems. 3. Problem-Solving Approach: Develop strong problem-solving skills by practicing solving different types of measurement and control problems. Work on assignments and projects that require critical thinking and analytical skills

Student Workload (SWL) The student's academic load is calculated for 15 weeks.			
Structured SWL (h/sem) **Regular student load during the semester**	63	**Structured SWL (h/w)** **Regular weekly student load**	4.2
Unstructured SWL (h/sem) **Irregular student load during the semester**	62	**Unstructured SWL (h/w)** **Irregular student load per week**	4.1
Total SWL (h/sem) **The student's total academic load during the semester**	**125**		

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

Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO#2 and 3
	Assignments	2	10% (10)	2 and 12	LO#4and6
	Projects /Lab.	1	10% (10)	8	LO#10
	Report	1	10% (10)	11	LO #13
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO#1-7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Fundamentals of measurement systems - Definition of measurement and instrumentation - Significance of measurement
Week 2	General Measurement System - Functions of instrument in measurements - Calibration and standards
Week 3	Error and uncertainty analysis - Errors in Measurements - Accuracy and precision - Sources of errors
Week 4	Static characteristics of measurement system elements -Characteristics of instruments - Static characteristics of measuring system - Environmental effects
Week 5	Introduction to control system

	- Types of Control System - Block Diagrams
Week 6	Introduction to Block Diagrams - Block Diagram Reduction Rules
Week 7	Power circuit elements Circuit breaker Overload Relay Contactor
Week 8	Power circuit elements Circuit breaker Overload Relay Contactor
Week 9	Types and Features of Various Stratified. Thermal energy storage Tanks
Week 10	Plc basics, tutorial of symbols, equipment's
Week 11	Counters, timers, introduction to inverter
Week 12	PLC system structure, Basic ladder logic Timers, Counters & Comparators
Week 13	Up Counter (CTU), Down Counter (CTD)
Week 14	Latch and Unlatch Logic Memory Concept in Allen Bradley PLC
Week 15	Hardware of PLC circuit, review of PLC ladder
Week 16	**Preparatory week before the final exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Over view on the control workshop, tools, and measuring devices

Week 2	Knowledge of connection & operation of the measuring devices for temperature, pressure, humidity, fluid flow.
Week 3	Built electric circuit (power & control) for domestic refrigerator or freezer and checking before operating the circuit.
Week 4	Built electric circuit (power & control) for domestic water cooler and checking before operating the circuit.
Week 5	Built electric circuit (power & control) for domestic window type A/C for cooling and checking before operating the circuit.
Week 6	Built electric circuit (power & control) for domestic window type A/C for cooling & heating, and checking before operating the circuit.
Week 7	Built electric circuit (power & control) for domestic defrost refrigerator and checking before operating the circuit.
Week 8	Built electric circuit (power & control) for domestic clothes washer and checking before operating the circuit.
Week 9	Check and calibration of thermal expansion valve.
Week 10	Check and calibration for the contacts of the electrical contactor & thermal switch.
Week 11	Built a control circuit for motor power circuit (ON-OFF) start and stop from one location.
Week 12	Built a control circuit for motor power circuit (ON-OFF) start and stop from two deferent locations.
Week 13	Built a control circuit for motor power circuit (star-delta) rotate in one direction, and the other in two directions.

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	1. “Measurement and Control Basics” by Thomas A. Hughes	Yes

	2. “Principles of Measurement Systems” by John P. Bentley 3. “Industrial Instrumentation and Control Systems” by William C. Dunn 4."Process Control: A Practical Approach" by Myke King	
Recommended Texts	1. “Instrumentation and Control Systems Documentation” by Fred A. Meier 2. “Control Systems Engineering” by Norman S. Nise 3. “Automatic Control Systems” by Benjamin C. Kuo and Farid Golnaraghi 4. “Modern Control Engineering” by Katsuhiko Ogata 5. “Instrumentation for Process Measurement and Control” by Norman A. Anderson 6. “Introduction to Control System Technology” by Robert N. Bates	No
Websites	1. National Instruments: www.ni.com 2. Automation.com: www.automation.com 3. Control Global: www.controlglobal.com 4. ISA - International Society of Automation: www.isa.org 5. Omega Engineering: www.omega.com 6. Emerson Automation Solutions: www.emerson.com	

Module 43 **Subject information**		
Module Title	**Computer-based modeling and simulation of renewable energy systems**	
Module Type	**Core**	☒Theory ☐ Lecture ☒ Lab
Module Code	**RETE 403**	

ECTS Credits	**8**	☐ Tutorial ☐ Practical ☐ Seminar	
SWL (hr/sem)	**200**		
Module Level	4	Semester of Delivery	8
Administration Department	RETE	College	College of Oil & Gas Techniques Engineering/Kirkuk
Module Leader	Ali Qani Mohammed Saleh	e-mail	ali.alkurdi23@ntu.edu.iq
Module Leader's Acad. Title	Lecturer	Module Leader's Qualification	MSc.
Module Tutor	Name (if available)	e-mail	
Peer Reviewer Name		e-mail	
Scientific Committee Approval Date		Version Number	1

Relation with other Modules

Prerequisite module	RETE 402	Semester	7
Co-requisites module	None	Semester	--

Module Aims, Learning Outcomes and Indicative Contents

Module Aims	10. Modeling Proficiency: The aim of this module is to develop students' proficiency in using computer-based modeling techniques to accurately represent and simulate the behavior of energy renewable systems, including solar, wind, hydropower, and biomass. Students will gain the skills to create realistic and dynamic models of these systems. 11. Performance Evaluation and Optimization: This module aims to enable students to assess the performance of renewable energy systems using computer-based models and simulations. Students should be able to identify opportunities for optimization and make informed decisions to enhance the performance, efficiency, and reliability of these systems. 12. Real-World Application: By the end of the module, students should be capable of applying computer-based modeling and simulation techniques to practical scenarios in the renewable energy sector. They will gain the competence to address real-world challenges, evaluate the impact of different factors on system behavior, and contribute to the design, analysis, and optimization of renewable energy projects.

Module Learning Outcomes	(LO19). Model Development: Students will be able to develop and implement computer-based models that accurately represent the behavior and components of various renewable energy systems, including solar, wind, hydropower, and biomass. (LO20). Simulation Proficiency: Upon completion of the module, students will possess the skills to use computer-based modeling and simulation tools to create detailed and dynamic models of energy renewable systems, allowing for the analysis of system performance under various conditions. (LO21). Data Collection and Integration: Students will learn to gather, process, and integrate relevant data into their computer-based models, ensuring that their simulations reflect real-world scenarios accurately. (LO22). Performance Evaluation: The module will equip students to assess the performance and efficiency of renewable energy systems using computer-based models and simulations, providing insights into system behavior. (LO23). Optimization Techniques: Students will gain knowledge of optimization methods and strategies to enhance the efficiency, reliability, and economic viability of renewable energy systems, considering factors such as resource availability and load demand. (LO24). Grid Integration and Energy Storage: Students will understand how to simulate the integration of renewable energy systems into the broader energy infrastructure, considering grid compatibility, energy storage solutions, and backup systems. (LO25). Scenario Analysis: Graduates of the module will be proficient in conducting scenario analysis, allowing them to evaluate the resilience and adaptability of renewable energy systems in different conditions, including extreme weather events and fluctuating energy demands. (LO26). Report Generation and Communication: Students will be able to effectively communicate their simulation results and findings to various stakeholders, such as project managers, policymakers, and investors. (LO27). Practical Applications: Upon completion, students should be able to apply their computer-based modeling and simulation skills to practical situations in the renewable energy sector, contributing to the design, analysis, and optimization of real-world renewable energy projects.

Indicative Contents	Indicative content includes the following.
	• Introduction to Computer-Based Modeling
	  • Basics of computer-based modeling
	  • Role of modeling and simulation in renewable energy systems
	• Mathematical Modeling Techniques
	  • Differential equations and system representation
	  • Development of mathematical models for renewable systems
	  • Numerical methods and techniques
	• Software Tools for Simulation
	  • Introduction to simulation software (eg, MATLAB/Simulink, PSCAD, HOMER)
	  • Hands-on training with simulation tools
	  • Model development using software

	• Solar Energy System Modeling
	  • Modeling of solar PV systems
	  • Solar thermal system modeling
	  • Simulation of solar irradiance and weather conditions
	• Wind Energy System Modeling
	  • Wind turbine modeling
	  • Wind farm modeling
	  • Wind resource assessment and simulation
	• Hydropower System Modeling
	  • Hydroelectric power plant modeling
	  • Run-of-river and dam-based systems
	  • Impact of water flow and reservoir levels
	• Biomass Energy System Modeling
	  • Biomass combustion and gasification modeling
	  • Biogas and biofuel production simulation
	  • Resource availability and feedstock analysis
	• Geothermal Energy System Modeling
	  • Geothermal power plant modeling
	  • Geothermal heat pump modeling
	  • Ground heat exchanger simulations
	• Data Collection and Integration
	  • Gathering relevant data for simulation
	  • Data processing and integration into models
	  • Incorporating real data into simulations
	• Performance Evaluation
	  • Assessing the performance of renewable energy systems through computer-based simulations
	  • Evaluation of system efficiency and reliability
	• Optimization Techniques
	  • Strategies for optimizing renewable energy system performance using computer-based tools
	  • Sensitivity analysis and scenario planning for optimization
	• Grid Integration and Energy Storage
	  • Simulating grid-connected renewable energy systems
	  • Modeling energy storage solutions and load balancing
	• Case Studies and Projects
	  • Analysis of real-world renewable energy projects using computer-based modeling and simulation
	  • Group projects and hands-on simulation exercises
	• Sustainability and Environmental Impact Assessment
	  • Incorporating sustainability aspects into computer-based simulations
	  • Environmental impact assessments in renewable energy projects
	• Report generation and communication
	  • Effective communication of simulation results to stakeholders
	  • Presentation of findings and insights

	• Emerging Technologies and Future Trends
	  • Exploration of innovative modeling and simulation techniques
	  • Future trends in the modeling and simulation of renewable energy systems

Learning and Teaching Strategies

Strategies	Teaching Method 1 - Lectures Description: Attendance Recorded: Yes Teaching Method 2 - Asynchronous on-line course materials Description: Podcasts, videos and articles in thermodynamics Attendance Recorded: No Unscheduled Directed Student Hours (time spent away from the timetabled sessions but directed by the teaching staff). Teaching Method 3 - Tutorials Description: Attendance Recorded: Yes Teaching Method 4 - Practical Description: Practical homework assignments Attendance Recorded: No Unscheduled Directed Student Hours (time spent away from the timetabled sessions but directed by the teaching staff).

Student Workload (SWL)

Structured SWL (h/sem) Regular student load during the semester	93	Structured SWL (h/w) Regular weekly student load	6.2
Unstructured SWL (h/sem) Irregular student load during the semester	107	Unstructured SWL (h/w) Irregular student load per week	7.13
Total SWL (h/sem) The student's total academic load during the semester	200		

Module Evaluation

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

Formative assessment	Quizzes	5	10% (10)	3,5,7,9 and 15	LO #2, #3, #5 ,#9 and #11
	Assignments	4	10% (10)	2,6,8 and 12	LO #4, #8, #6and #10
	Projects /Lab.	4	20% (10)	Continuous	All
	Report				
Summative assessment	Midterm Exam	2 hours	10%(10)	7	LO #1 - #5
	Final Exam	3 hours	50%(50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
Week 1	Introduction to Computer-Based Modeling - Overview of the course, Role of modeling and simulation in renewable energy, Introduction to mathematical modeling
Week2	Mathematical Modeling Techniques - Basics of differential equations, Development of mathematical models for renewable systems, Numerical methods and techniques
Week3	Software Tools for Simulation - Introduction to simulation software (eg, MATLAB/Simulink, PSCAD, HOMER), Hands-on training with simulation tools, Model development using software
Week4	Solar Energy System Modeling - Modeling of solar PV systems, Solar thermal system modeling, Simulation of solar irradiance and weather conditions
Week5	Wind Energy System Modeling - Wind turbine modeling, Wind farm modeling, Wind resource assessment and simulation
Week6	Hydropower System Modeling - Hydroelectric power plant modeling, Run-of-river and dam-based systems, Impact of water flow and reservoir levels
Week7	Biomass Energy System Modeling - Biomass combustion and gasification modeling, Biogas and biofuel production simulation, Resource availability and feedstock analysis
Week8	Geothermal Energy System Modeling - Geothermal power plant modeling, Geothermal heat pump modeling, Ground heat exchanger simulations
Week9	Data Collection and Integration - Gathering relevant data for simulation, Data processing and integration into models, Incorporating real data into simulations
Week 10	Performance Evaluation - Assessing the performance of renewable energy systems through computer-based simulations, Evaluation of system efficiency and reliability
Week 11	Optimization Techniques - Strategies for optimizing renewable energy system performance using computer-based tools, Sensitivity analysis and scenario planning for optimization
Week 12	Grid Integration and Energy Storage - Simulating grid-connected renewable energy systems, Modeling energy storage solutions and load balancing
Week 13	Case Studies and Projects - Analysis of real-world renewable energy projects using computer-based modeling and simulation, Group projects and hands-on simulation exercises
Week 14	Sustainability and Environmental Impact Assessment - Incorporating sustainability aspects into computer-based simulations, Environmental impact assessments in renewable energy projects
Week 15	Report Generation and Communication - Effective communication of simulation results to stakeholders, presentation of findings and insights

Learning and Teaching Resources		
	Text	Available in the Library?
Required Texts	Renewable Energy Integration: Practical Management of Variability, Uncertainty, and Flexibility in Power Grids by Lawrence E. Jones	No
Recommended Texts	Modeling and Simulation for Electrical Power Engineering by Dragan Jovcic and Damir Novosel	No
	Computer Simulation in Management Science by Michael Pidd	No

Module 44 Subject information				
Module Title	Graduation Project		Module Delivery	
Module Type	**Core**		☒Theory ☐ Lecture ☐ Lab ☐ Tutorial ☒ Practical ☒ Seminar	
Module Code	**COGTEK 401**			
ECTS Credits	**6**			
SWL (hr/sem)	**150**			
Module Level	4	Semester of Delivery	8	
Administration Department	RETE	College	College of Oil and Gas Techniques Engineering - Kirkuk, Northern Technical University, Iraq	
Module Leader		e-mail	@ntu.edu.iq	
Module Leader's Acad. Title	Assistant lecturer	Module Leader's Qualification	M.Sc.	
Module Tutor		e-mail		
Peer Reviewer Name		e-mail		
Scientific Committee Approval Date		Version Number		

Relation with other Modules			
Prerequisite module	NTU 400	Semester	7
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	8. To Understand the significance of scientific research and its role in advancing knowledge. 9. To Identify the key characteristics of scientific research. 10. This course deals with the basic concept of Formulate research questions and objectives. 11. This is the basic subject for all ethical considerations in scientific research 12. Recognize the importance of conducting a literature review in research. 13. Familiarize with quantitative and qualitative data collection methods. 14. Understand the principles of experimental design.
Module Learning Outcomes	***12.*** Understand the nature and significance of scientific research. Identify the characteristics and principles of scientific research. Demonstrate an awareness of ethical considerations in scientific research. ***13.*** Recognize between various research designs. ***14.*** List the various formulate clear research questions and objectives ***15.*** Summarize what is literature review to identify relevant research articles. ***16.*** Discuss and evaluate the credibility and relevance of research articles. ***17.*** Design experiments that maximize internal and external validity. ***18.*** Determine the appropriate sample size for a survey based on research objectives. ***19.*** Demonstrate proficiency in employing different approaches to qualitative research. ***20.*** Recognize and apply ethical principles and guidelines in research involving human subjects ***21.*** Communicate research results in a clear and concise manner to different audiences. ***22.*** Formulate a clear and concise research problem statement.
Indicative Contents	Indicative content includes the following. Part A - Definition and significance of scientific research [5 hrs.] Part B- Research Problem Formulation [5 hrs.] Part C- Research Design and Methodology [5 hrs.] Part D- Literature Review [5 hrs.]

	Part E- Data Collection and Measurement [5 hrs.] Part F- Homework and Discussion [7 hrs.]

Learning and Teaching Strategies	
Strategies	Studying the Methodology of Scientific Research requires a combination of active learning strategies and focused study techniques, such as; Read the Course Materials, Engage in Discussions, Take Detailed Notes, Practice with Examples, Review and Summarize, Create Visual Aids, and Work on Exercises and Assignments

Student Workload (SWL)			
Structured SWL (h/sem) Regular student load during the semester	63	Structured SWL (h/w) Regular weekly student load	4.13
Unstructured SWL (h/sem) Irregular student load during the semester	87	Unstructured SWL (h/w) Irregular student load per week	5.86
Total SWL (h/sem) The student's total academic load during the semester	125		

Module Evaluation					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	3,and 9	LO #10, 11
	Assignments	2	10% (10)	2, and 12	LO #4 and 7
	Projects / Lab.	1	10% (10)	Continuous	All
	Lab Report	5	10% (10)	3,7,11,13,14	LO #5,8,11,13,15
Summative assessment	Mid Term exam	2 hours	10% (10)	7	LO #1 - 7
	Final Exam	3hr	50% (50)	16	All
100% (100 Marks)					

Delivery Plan (Weekly Syllabus)	
Week 1	Introduction to Scientific Research
Week 2	Research Design
Week 3	Literature Review
Week 4	Data Collection Methods

Week 5	Data Analysis
Week 6	Experimental Design
Weeks 7	Survey Design and Sampling
Weeks 8	Qualitative Research Methods
Week 9	Ethics in Scientific Research
Week 10	Data Interpretation and Presentation
Week 11	Peer Review and Publication Process
Week 12	Research Proposal Writing
Week 13	Project Management and Time Planning
Week 14	Presentations and Research Conferences
Week 15	Research Ethics Review and Course Wrap-up

Learning and Teaching Resources		
	Text	Available in the Library?
Required Texts	1. “Research Design: Qualitative, Quantitative, and Mixed Methods Approaches” by John W. Creswell and J. David Creswell 2. “The Craft of Research” by Wayne C. Booth, Gregory G. Colomb, and Joseph M. Williams 3. “Research Methodology: A Step-by-Step Guide for Beginners” by Ranjit Kumar	Yes
Recommended Texts	Academic Databases: Utilize academic databases such as PubMed, Google Scholar, JSTOR, and IEEE Xplore to search for research papers in the methodology of scientific research. Use relevant keywords such as “research methodology,” “scientific research design,” or specific methodologies you are interested in (eg, “qualitative research methods,” “experimental design”).	No
	(www.socialresearchmethods.net) (www.researchmethodology.org) (www.qualres.org)	