نموذج وصف البرنامج الأكاديمي

اسم الجامعة: تكريت

الكلية: الهندسة

القسم العلمي: هندسة الطاقة المستدامة

اسم البرنامج الأكاديمي أو المهني: بكالوريوس هندسة الطاقة المستدامة

اسم الشهادة النهائية: بكالوريوس علوم في هندسة الطاقة المستدامة

النظام الدراسي: فصول دراسية

تاريخ اعداد الوصف: 2025/9/1

تاريخ ملئ الملف: 2025/9/1

التوقيع:

اسم رئيس القسم: أ.م.د. حسام سامي ذياب

التاريخ: ١٣ / ١٠ / ٢٠٢٥

التوقيع:

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التاريخ: ٢٠٢٥/١٠/١٣

دقق الملف من قبل

شعبة ضمان الجودة والأداء الجامعي

اسم مدير شعبة ضمان الجودة والأداء الجامعي: م.د. احمد ياسر رديف

التاريخ: ٢٠٢٥/١٠/١٣

التوقيع:

مصادقة السيد العميد

الاستاذ المساعد الدكتور
سعد رمضان احمد
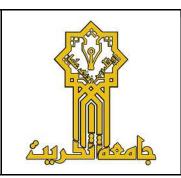عميد كلية الهندسة

Module Descriptor of Sustainable Energy Engineering Department

	Ministry of Higher Education and Scientific Research - Iraq University of Tikrit College of Engineering Department of Sustainable Energy Engineering	

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information		
معلومات المادة الدراسية		

Module Title	INTRODUCTION TO SUSTAINABLE ENERGY ENGINEERING	Module Delivery	
Module Type	CORE		Theory Lecture Tutorial Project
Module Code	SE-ENG-101		
ECTS Credits	6		
SWL (hr/sem)	150		

Module Level		UGI	Semester (s) offered	1
Administering Department		Sustainable Energy	College	Engineering
Module Leader	Prof . Dr. Manar Salih Mahdi		e-mail	m.aljethelah@tu.edu.iq
Module Leader's Acad. Title			Module Leader's Qualification	Ph.D.
Module Tutor	Asst Prof , Dr. Hussam Sami Dheyab		e-mail	hussam.sami@tu.edu.iq

Peer Reviewer Name		e-mail	
Review Committee Approval	09/09/2025	**Version Number**	1.0

Relation With Other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	-
Co-requisites module	None	**Semester**	-
Module Aims, Learning Outcomes, Indicative Contents and Brief Description أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر			
Module Aims أهداف المادة الدراسية	The aim of this module is to 1- Develop students' understanding about the basic principles of energy and sustainability. 2- Identify different energy sources, including fossil fuels and renewable energy, such as solar, wind, and geothermal energy. 3- Analyze the environmental, economic, and social impacts of energy production and consumption. 4- Enhance the awareness of the importance of sustainable practices in the use of energy resources to preserve the environment. 5- Develop the skills and knowledge necessary to engage in energy management, environmental consulting, and sustainability-related policymaking.		
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of the module, the students will be able to: 1. Understand the importance of sustainable energy and its forms. 2. Demonstrate knowledge principles of thermal, hydraulic, and electrical systems. 3. Gain knowledge of energy conversion technologies, energy management systems, energy storage, and energy conservation principles. 4. Solve problems including energy balances of thermal and hydraulic systems and energy storage.		
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. • Energy basic concepts • Thermodynamics • Heat Transfer • Fuels and Combustion • Solar energy • Wind energy • Hydro Energy • Geothermal energy • Biofuels and Biomass Energy • Energy Storage		
Course Description	This course will cover a range of energy sources and systems. The students		

will be introduced to some energy basics. The course also includes different energy sources and techniques, such as thermal and electrical solar energy systems, fuels and combustion, hydropower resources and turbines, wind energy, biofuels and biomass energy, and geothermal energy. The course also introduces energy storage

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	The learning and teaching strategy is designed to introduce energy systems through theory with work examples carried out by the students. This strategy is carefully delivered through lectures including question and answer sessions, demonstrating captured content, problem-solving, tutorial classes, and project methods with the students conducting a coursework assignment.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل			
In class lectures	42	87	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	5.8
In class tests	3			
Online	28			
Tutorial	14			
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل		63	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.2
Library, dorm, home memorizing	27			
Preparation for tests	26			
Homework	10			
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**150**			

Module Evaluation
تقييم المادة الدراسية

		(No.)	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	20% (10)	2, 15	LO #1, 2, 3, and 4
	Onsite Assignments	2	10% (5)	5, 9	LO # 2, 3, and 4
	Online Assignments	1	5% (5)	4	LO # 1, 2, and 3
	Project	1	5% (5)	12	LO # 4
Summative assessment	Midterm Exam	1	10% (10)	7	LO #1, 2, 3, and 4
	Final Exam	1	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
المنهاج الاسبوعي النظري	
Week	**Material Covered**
Week 1	Introduction and Basic Concepts - Definitions and IS Units - Properties of a System - Processes and Cycles
Week 2	Energy, Energy Transfer, and General Energy Analysis - Forms of energy - Energy Transfer by Heat - Energy Transfer by Work
Week 3	The First Law of Thermodynamics
Week 4	Second Law of Thermodynamics
Week 5	Heat Transfer - Conduction - Convection - Radiation
Week 6	Fuels and Combustion
Week 7	**Midterm exam**
Week 8	Solar Energy: Basics and collectors
Week 9	Solar Energy: Photovoltaic
Week 10	Wind Energy: Basics and wind turbines
Week 11	Hydro Energy: Basics and hydro-turbines
Week 12	Hydro Energy Turbines design basics
Week 13	Geothermal Energy
Week 14	Biofuels and Biomass Energy
Week 15	Energy Storage
Week 16	**Final Exam**

Learning and Teaching Resources		
مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	- Ibrahim Dincer, Azzam Abu-Rayash, Energy Sustainability, Elsevier (2019)	Yes
Recommended Texts	- Fundamentals and Applications of Renewable Energy, 1st Edition, Mehmet Kanoğlu, Yunus A. Çengel, John M. Cimbala, 2020, McGraw-Hill Education	No
	- Robert Bennett Dunlap, Sustainable Energy, Second	Yes

	Edition (2017)	
Websites	https://www.iea.org/energy-system	

APPENDIX:

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

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

Ministry of Higher Education and
Scientific Research - Iraq
Tikrit University
College of Engineering
Department of Sustainable Energy
Engineering

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information		
معلومات المادة الدراسية		

Module Title	CALCULUS I	Module Delivery	
Module Type	BASIC	**Theory** **Lecture** **Tutorial** **Practical** **Seminar**	
Module Code	MATH-101		
ECTS Credits	6		
SWL (hr/sem)	150		

Module Level		UGl	Semester (s) offered		1
Administering Department		Sustainable Energy	College	Engineering	
Module Leader	Dr. Hamza R. Yaseen		e-mail	hamza.r.yaseen94@tu.edu.iq	
Module Leader's Acad. Title			Module Leader's Qualification	Ph.D.	
Module Tutor	Dr. Mohanad Lateef Hamada		e-mail	muhanad-lateef@tu.edu.iq	
Peer Reviewer Name			e-mail		
Review Committee Approval			Version Number	1.0	

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

Module Aims, Learning Outcomes, Indicative Contents and Brief Description
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر

Module Aims أهداف المادة الدراسية	Developing of student ability in the general mathematics principle and applications.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1) Ability to identify, formulates, and solves engineering problems. 2) Represent functions using power series 3) Evaluate the behaviors and graphs of functions 4) Apply integrals to geometric application, physical application, and modeling problems 5) Use basic integration techniques to calculate area.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. • Review of differentiation and integration (6hrs) • Trigonometric Functions (10hrs) • The Natural Logarithm and Exponential Function (15hrs) • Methods of Integration (26hrs) • Hyperbolic Function (15hrs) • Power Series (15hrs)
Course Description	This course is based on the principles of Euclidean, plane, and solid geometries. Students will be introduced to the basic postulates and theorems of geometry and encouraged to extend these ideas to the topics of similarity, circles, area, volume, and proof. In addition, students are involved in a more technological, theoretical, and algebraic approach to geometry.

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	The learning and teaching **strategy** is designed to: We designed teaching strategies to support students' development of mathematical knowledge and problem solving as well as communication and team working skills. We used an action research perspective as various methods within this stance can ensure flexibility in responding to the dynamics of interaction between the teachers and the students.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** 84 **In class tests** 3	87	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5.8
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Library, dorm, home memorizing** 20 **Preparation for tests** 10 **Preparation for quizes** 10 **Homework** 12	63	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.2

Daily work	11			
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل		150		

Module Evaluation
تقييم المادة الدراسية

		No.	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	3	15% (5)	4,8,12	LO #1, 2, 3, and 4
	Online Assignments	5	10% (2)	3, 5, 9, 11, 12	LO # 1, 2, 3, 4, and 5
	Projects	1	7% (7)	13	LO #1, 2, 3, and 4
	Onsite Assignment	4	8%(2)	3,6 , 10,11	LO # 1, 2, 3, 4, and 5
Summative assessment	Midterm Exam	1	10% (10)	7	LO # 1-3
	Final Exam	1	50% (50)	15	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	Review of differentiation and integration
Week 2	Transcendental Functions: Inverse – Trigonometric Functions and The Derivatives of the Inverse – Trigonometric Functions
Week 3	The Natural Logarithm and its Derivative, and its properties
Week 4	The Natural Logarithm and its Derivative, and its properties
Week 5	The Exponential Function
Week 6	Methods of Integration: By parts
Week 7	Products of Powers of Trigonometric functions
Week 8	Even powers of Sine and Cosine
Week 9	Trigonometric substitutions that replace $a^2 - u^2,\ a^2 + u^2\ and\ u^2 - a^2$
Week 10	Hyperbolic Function: Definition of Hyperbolic Function
Week 11	Derivatives and Integrals of Hyperbolic Function
Week 12	Inverse of Hyperbolic Function

Week 13	Power Series: Taylor Polynomials
Week 14	Taylor's Series for Sine, Cosine and e^x
Week 15	Binomial Theorem
Week 16	**Final Exam**

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

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	"Calculus" by George B. Thomas, Jr. publishing company, 2010	Yes
Recommended Texts	"Engineering Mathematics" by K. A. Stroud, Dexter J. Booth, 5th edition, Industrial press Inc., New York, 2001. Advanced_Engineering_Mathematics_By_Erwin_Kreyszig_tenth_Edition, 2011 Higher Engineering Mathematics by JOHN, 2010	No
Websites		

APPENDIX:

GRADING SCHEME مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group	**A –** Excellent	امتياز	90 – 100	Outstanding Performance

(50 - 100)	**B** - Very Good	جيد جدا	80 – 89	Above average with some errors
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Ministry of Higher Education and
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College of Engineering
Department of Sustainable Energy
Engineering

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			

Module Title	PHYSICS	Module Delivery	
Module Type	BASIC	Theory Lecture Lab Tutorial Practical Seminar	
Module Code	SE-ENG-102		
ECTS Credits	6		
SWL (hr/sem)	150		

Module Level	UGx l	Semester (s) offered	1
Administering Department	Sustainable Energy	College	Engineering
Module Leader	Prof. Dr. Tadahmun Ahmed Yassen	e-mail	tadahmunahmed@tu.edu.iq
Module Leader's Acad. Title	Professor	Module Leader's Qualification	Ph.D.
Module Tutor	None	e-mail	None
Peer Reviewer Name	Ass. Lec. Arjan Musadaq Taha	e-mail	arjan.m.taha@tu.edu.iq
Review Committee Approval	22/09/2025	Version Number	1.0

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

Module Aims, Learning Outcomes, Indicative Contents and Brief Description	
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر	

Module Aims أهداف المادة الدراسية	This course aims to provide students with a strong foundation in the fundamental principles of physics, focusing on mechanics, energy, motion, fluids, and basic electrical and electronic concepts. It prepares students to apply these physical laws to engineering problems related to sustainable energy systems.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Identify and define the basic physical quantities and their units. 2. Explain laws of motion, energy conservation, and electricity. 3. Describe the structure of matter and behavior of fluids. 4. Interpret relationships between electrical and mechanical quantities. 5. Analyze motion and forces using Newton's laws. 6. Apply energy and momentum conservation principles to engineering problems. 7. Solve practical physics problems with analytical reasoning. 8. Perform experimental measurements and analyze data. 9. Use laboratory instruments safely and accurately. 10. Interpret experimental results in line with physical theory. 11. Communicate technical concepts effectively. 12. Work collaboratively in teams. 13. Apply scientific reasoning to real-world engineering challenges.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A – Mechanics Principles Basic Quantities, including: [5 hrs] - State SI units, and write the units and their abbreviations correctly. - - - Determine whether a physical quantity is a vector or a scalar. Distinguish between kinematic and kinetic energy. Define, calculate, and distinguish between distance and displacement, average and instantaneous speed and velocity, and average and instantaneous acceleration. Newton's three laws and it is applications: [5 hrs] - State, explain, and apply Newton's three laws of motion. - - Differentiate between static and kinetic friction, and solve friction problems. State and apply Hooke's law for ideal springs. Work, energy and power: [10 hrs] - Define work, and calculate the work done by a constant force in one and two dimensions. - - - - State the work–energy theorem, and use it to solve problems. Apply the principle of conservation of mechanical energy to solve simple problems in mechanics. Calculate both kinetic and potential energy. Calculate the power. Momentum and impulse: [5 hrs] - Define linear momentum, and calculate and compare momenta of various objects. Indicative Contents - - Express Newton's laws in terms of rates of change of linear momentum. Define and calculate impulse. The simple harmonic motion: [4 hrs]

	- Part B – Electrical Principles Atomic and its structure: [10 hrs] State, explain, and apply the simple harmonic motion. Universal gravitational force: [6 hrs] - Solve problems using Newton's law of universal gravitation and calculate the gravitation for different locations (i.e. Earth, Moon, Sun and etc.). Fluid Mechanics: [20 hrs] - Calculate the pressure and density of fluid at different depth; - - - - - Explain the Hydrostatic Pressure; Explain Pascal's principle and the operation of a hydraulic lift; Define and describe the buoyant forces and Archimedes's principle, furthermore, weighing an object immersed in a fluid; Derive the equation of continuity for fluids; Use Bernoulli's equation to calculate flow speed and pressure of a moving fluid for simple situations. be the Bohr model of an atom. - Define electron, proton, neutron and nucleus. - Explain electron shells and orbits. - Explain and calculate the energy levels. - Define valence electron, free electron and ions. Semiconductor's materials: [5 hrs] - Explain insulators, conductors, and semiconductors and how they differ. - Define valence band and conduction band, and compare between the semiconductor atom and the conductor atom. Diodes and Transistors: [8 hrs] - Explain the electrical symbols for a diode and diode applications. - Define the bias and its effect on the depletion region. - Define the barrier potential and its effects. - Explain the electrical symbol of a transistor, and describe the basic transistor operation. Current and Voltage: [5 hrs] - Understanding the fundamental concepts of current and voltage. - Explain the electrical circuit elements and its objects. Ohm's law and Kirchhoff's law: [7 hrs] - Define Ohm's law, and calculate power and energy - Analyze the electric circuits in both parallel and series connections. - Define Kirchhoff's law, and analysis the electrical circuits using Kirchhoff's law.
Course Description	This course covers classical mechanics (kinematics, dynamics, work, energy, momentum), fluid mechanics, gravitation, and basic electrical and electronic principles including Ohm's law, diodes, and transistors.

<table>
<tr><td colspan="2" align="center">Learning and Teaching Strategies
استراتيجيات التعلم والتعليم</td></tr>
<tr><td>Strategies</td><td>1. Interactive lectures and multimedia presentations.
2. Problem-solving sessions and tutorials.
3. Laboratory experiments and demonstrations.
4. Group discussions and assignments.
5. Continuous assessment through quizzes and lab reports.</td></tr>
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<tr><td colspan="4" align="center">Student Workload (SWL)
الحمل الدراسي للطالب</td></tr>
<tr>
<td>Structured SWL (h/sem)
الحمل الدراسي المنتظم للطالب خلال الفصل
In class lectures   42
Tutorial   14</td>
<td>87</td>
<td>Structured SWL (h/w)
الحمل الدراسي المنتظم للطالب أسبوعيا</td>
<td>5.8</td>
</tr>
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Lab	28			
Final Exam	3			
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل				
Library, dorm, home memorizing	20	63	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.2
Preparation for tests	10			
Home works	13			
Design Project	10			
Reports	10			
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل		150		

Module Evaluation
تقييم المادة الدراسية

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

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
Week	**Material Covered**
Week 1	Introduction to physics; Standards of length, mass and time; Scalar and Vector quantities; Kinematics; Position, Displacement and Distance; Speed, Velocity and Acceleration.
Week 2	Forces and motion; Mass and gravity force; Newton's three laws of motion.
Week 3	Spring forces and Hooke's law; Friction forces; Uniform circular motion; Work.
Week 4	Kinetic and Potential Energy; The work-kinetic energy theorem; Conservation of total mechanical energy; Power.
Week 5	Linear momentum; Momentum and kinetic energy; Rate of change of linear momentum and Newton's laws; Law of conservation of linear momentum; Impulse.
Week 6	Simple Harmonic Motion; Universal gravitation; Newton's law of universal gravitation; Free-fall acceleration and the gravitational force; and Solve problems using Newton's law of universal gravitation and calculate the gravitation for different locations.
Week 7	Midterm Exam
Week 8	Buoyant forces and Archimedes principle; the equation of continuity for fluids; and the

	Bernoulli's equation.
Week 9	Definition and description of the focal model of the atom and definition of the electron, proton, neutron, nucleus and explanation of the shells, electronic orbits, explanation and calculation of energy levels, definition of the valence electron, the free electron, ions, explanation of insulators, conductors and semiconductors and how they differ from each other, definition of the valence band, conduction band and resistance between a semiconductor atom and a conductor atom
Week 10	Explanation of diode electrical symbols and diode applications, definition of bias and its effect on the depletion region, definition of barrier voltage and its effects, explanation of the transistor electrical symbol, and description of the basic operation of the transistor.
Week 11	A comprehensive assessment of the student's level of comprehension of the grammatical and linguistic concepts covered during the first half of the course.
Week 12	Understanding the basic concepts of diode and transistor
Week 13	Understand the basic concepts of current and voltage, explain the elements of electrical circuits and their objectives (or components and functions)
Week 14	Definition of Ohm's Law, calculation of power and energy, analysis of electrical circuits in both series and parallel connections
Week 15	Definition of Kirchhoff's laws and analysis of electrical circuits using Kirchhoff's laws
Week 16	**Final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
Week	**Material Covered**
Week 1	Balance of forces with weights
Week 4	Hooke's law Experiment
Week 8	Experiment with connecting transistors in series and parallel in electrical circuits
Week 12	Diode and transistor combination experiment in electrical circuits

Ministry of Higher Education and
Scientific Research - Iraq
University of Tikrit
College of Engineering
Department of Sustainable Energy
Engineering

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information		
معلومات المادة الدراسية		
Module Title	**COMPUTER SCIENCES**	**Module Delivery**
Module Type	SUPLEMENT	☐ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar
Module Code	UOT-003	
ECTS Credits	3	
SWL (hr/sem)	75	

Module Level	UGI	**Semester (s) offered**		1
Administering Department	Sustainable Energy	**College**	Engineeeing	
Module Leader	Dr. Jalal N. Abdulbaqi	**e-mail**	Jalal.abdulbaqi@tu.edu.iq	
Module Leader's Acad. Title	Lecturer	**Module Leader's Qualification**	Ph.D.	
Module Tutor	Noor saeed saleh	**e-mail**	noor.s.saleh@tu.edu.iq	
Peer Reviewer Name		**e-mail**		
Review Committee Approval	14/9/2025	**Version Number**	1.2	

Relation With Other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	-
Co-requisites module	None	**Semester**	-
Module Aims, Learning Outcomes, Indicative Contents and Brief Description			
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر			
Module Aims			

أهداف المادة الدراسية	The aim of this module is to provide students with a comprehensive understanding of the key concepts and principles of computer science. Through the study of topics such as history, data representation, computer components, algorithms, programming languages, operating systems, applications, internet and networking, and cybersecurity, students will gain a broad understanding of the field of computer science and how it has evolved over time.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Describe the historical development of computer science and its impact on society. 2. Understand the various methods of data representation and manipulation. 3. Identify the components of a computer and their functions. 4. Design and implement algorithms for a range of problems. 5. Understand the principles of programming languages and apply them to develop software. 6. Understand the structure and functions of operating systems. 7. Identify and analyze a range of applications of computer science. 8. Understand the principles of internet and networking technologies. 9. Identify and analyze various cybersecurity threats and methods of prevention.
Indicative Contents المحتويات الإرشادية	- History introduction: Evolution of computer science, pioneers and important milestones - Data representation: Binary numbers, hexadecimal, character sets, ASCII and Unicode - Computer components: CPU, memory, input/output devices, storage devices - Algorithms: Definition, representation, complexity, searching, sorting, optimization - Programming languages: Syntax, semantics, variables, functions, control structures, abstraction - Operating systems: Structure, file systems, process management, memory management - Applications: Databases, artificial intelligence, computer graphics, human-computer interaction - Internet and networking: Protocols, network architectures, security, privacy - Cybersecurity: Threats, attacks, prevention, detection, mitigation
Course Description	This course offers students a comprehensive exploration of the fundamental concepts and principles that underpin the field of computer science. By delving into various subjects including the historical development of computing, data representation, computer components, algorithms, programming languages, operating systems, applications, internet and networking, and cyber-security, students will develop a well-rounded understanding of the discipline. By

	examining the evolution of computer science over time, students will acquire a broad perspective on the field and its significance in contemporary society. Through a combination of theoretical knowledge and practical applications, this module equips students with the necessary foundation to pursue further studies or careers in computer science.
Learning and Teaching Strategies	
استراتيجيات التعلم والتعليم	
Strategies	The module will use a range of learning and teaching strategies, including: - **Lectures**: To provide students with an overview of the main concepts and principles. - **Labs**: To provide students with hands-on experience of programming, algorithms, and data representation. - **Assignments and Quizzes**: To provide students with opportunities to apply their knowledge and skills to real-world problems and check their understanding.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	45	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Library, dorm, home memorizing 15** **Prepartion for tests 10** **Homeworks 5**	30	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	2
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	75		

Module Evaluation
تقييم المادة الدراسية

		Time (hr)	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	1	15% (15)	2, 4, 6, 8, 10	LO #1, 3, 5 and 6
	Assignments	1	11% (11)	5, 14	LO # 2, 4, 7 and 8
	Lab	14	14% (14)	Continuous	
Summative assessment	**Midterm Exam**	1.5	10% (10)	7	LO # 1-5
	Final Exam	3	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	History introduction: Evolution of computer science, pioneers and important milestones
Week 2	Data representation: Binary numbers, hexadecimal, character sets, ASCII and Unicode
Week 3	Computer components: CPU, memory, input/output devices, storage devices
Week 4	Algorithms: Definition, representation, complexity, searching, sorting, optimization
Week 5	Programming languages I
Week 6	Programming languages II
Week 7	Midterm
Week 8	Operating systems I
Week 9	Operating systems II
Week 10	Applications I: Information Systems
Week 11	Applications II: artificial intelligence
Week 12	Applications III: computer graphics, human-computer interaction
Week 13	Networking
Week 14	Internet
Week 15	Cybersecurity: Threats, attacks, prevention, detection, mitigation
Week 16	Final Exam

Delivery Plan (Weekly Lab. Syllabus)
المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	Lab 1: Computer Operating System (e.g. Microsoft Windows)
Week 2	Lab 2: Document Processing I (e.g. Microsoft Word)
Week 3	Lab 3: Document Processing II (e.g. Microsoft Word)
Week 4	Lab 4: Data Processing I (e.g. Microsoft Excel)
Week 5	Lab 5: Data Processing II (e.g. Microsoft Excel)
Week 6	Lab 6: Presentation Slides I (e.g. Microsoft PowerPoint)
Week 7	Lab 7: Presentation Slides II (e.g. Microsoft PowerPoint)

Learning and Teaching Resources		
مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	Computer Science Illuminated, by Dale, N and Lewis, J, 7th Ed, Jones & Bartlett Learning, 2020	No

Recommended Texts	-		-
Websites	-		

APPENDIX:

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

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

Ministry of Higher Education and
Scientific Research - Iraq
University of Tikrit
College of Engineering
Department of Sustainable Energy
Engineering

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information		
معلومات المادة الدراسية		

Module Title	ENGINEERING WORKSHOPS	Module Delivery	
Module Type	BASIC	**Theory** **Lecture** **Tutorial** **Practical** **Seminar**	
Module Code	ENG-106		
ECTS Credits	5		
SWL (hr/sem)	125		

Module Level	UGI	Semester (s) offered	1
Administering Department	All Departments	College	Engineering
Module Leader	Mohanad L Hamada	e-mail	muhanad-lateef@tu.edu.iq
Module Leader's Acad. Title	Lecturer	Module Leader's Qualification	Ph.D.
Module Tutor		e-mail	
Peer Reviewer Name		e-mail	
Review Committee Approval	02/09/2025	Version Number	1.0

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

Module Aims, Learning Outcomes, Indicative Contents and Brief Description			
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر			

Module Aims أهداف المادة الدراسية	Theoretical and practical training in which the student is scientifically and technically established with the most necessary skills in the field of engineering technology
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of this course students will be able to: Knowledge of technical skills in the field of industrial safety, measurement, filing, carpentry, welding, mechanical operation, sanitary engineering and the basics of electrical work
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. ● Industrial safety workshop(2 hours) ● Measurement &Marking workshop(3 hours) ● Filing workshop (10 hours) ● Carpentry workshop(10 hours) ● Welding workshop(10 hours) ● Casting workshop(10 hours) ● Machining workshop(10 hours) ● plumbing workshop(10 hours) ● Electrical workshop (10 hours)
Course Description	The engineering workshop course focuses on identifying risks in the work environment and industrial safety guidelines. And training on how to measure and determine, and the use of filing tools and their work. Learn about the types of wood used in carpentry, the process of shaping it, and the use of carpentry tools and machines. Training in welding work, its types, and the process of joining metals by welding. Training on various casting works and training on mechanical operation, which includes turning, milling, and grinding. Training on pipe knowledge, how to connect, sanitary engineering works, and training on the basics of electrical workshops.

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	The learning and teaching **strategy** is designed to: Carefully cover in lectures the necessary fundamental material and analytical techniques, and demonstrate concepts with appropriate (and where possible practical) examples Allow students adequate time to practice the techniques using a large number of carefully selected tutorial problems.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** 70 **In class tests** 3	73	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	4.8
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Library, dorm, home memorizing** 20 **Prepartion for tests** 15	52	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.4

Homeworks	17		
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation
تقييم المادة الدراسية

		Time (hr)	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	9	5% (5)	all	LO #1, 2, 3, and 9
	Assignments	9	15% (15)	All	LO # 1, 2, 3, 4, 5 and 9
Summative assessment	Midterm Exam	2	30% (30)	7	LO # 1-5
	Final Exam	3	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	Industrial safety workshop & Measurement and marking workshop
Week 2	Filing workshop
Week 3	Filing workshop
Week 4	Carpentry workshop
Week 5	Carpentry workshop
Week 6	Welding workshop
Week 7	Welding workshop
Week 8	plumbing workshop
Week 9	plumbing workshop
Week 10	Machining workshop
Week 11	Machining workshop
Week 12	Casting workshop
Week 13	Casting workshop
Week 14	Electrical workshop
Week 15	Electrical workshop
Week 16	Final Exam

	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	**Abd fares ,** Engineering workshops	Yes
Recommended Texts	Technology of Machine Tools, Steve F. Krar & J. William Oswald, McGraw-Hill Publishing Company, fourth Edition, 1991	No
Websites		

APPENDIX:

GRADING SCHEME
مخطط الدرجات

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

Note:

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

Ministry of Higher Education and
Scientific Research - Iraq
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Department of Sustainable Energy
Engineering

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information
معلومات المادة الدراسية

Module Title	ENGLISH LANGUAGE I	Module Delivery	
Module Type	SUPLEMENT	**Theory** **Lecture** **Tutorial** **Project** **Seminar**	
Module Code	UOT-002		
ECTS Credits	2		
SWL (hr/sem)	50		
Module Level	UGI	Semester (s) offered	1
Min number of students	15	Max number of students	100
Administering Department	Sustainable Energy	College	Engineering
Module Leader	Asst. Prof. Ahmed S. Abdullah	e-mail	Ahmedsubhi1981@tu.edu.iq
Module Leader's Acad. Title	Asst. Professor	Module Leader's Qualification	M.A.
Module Tutor	Asst. Prof. Ahmed S. Abdullah	e-mail	Ahmedsubhi1981@tu.edu.iq
Peer Reviewer Name		e-mail	
Review Committee Approval	01/09/2025	Version Number	1.0

Relation With Other Modules
العلاقة مع المواد الدراسية الأخرى

Prerequisite module	None	Semester	1,2
Co-requisites module	None	Semester	-

Module Aims, Learning Outcomes, Indicative Contents and Brief Description
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر

Module Aims أهداف المادة الدراسية	Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to self-life problems.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Identify various reading skills and apply them in reading, referencing and summarizing literature on engineering 2. Identify various skills of technical presentation and apply them in conducting short technical presentations based on information extracted from readings 3. Identify technical discussion skills and apply these in planning and conducting simulated technical discussions characteristic of those that go on in engineering contexts. 4. Identify and compare the structures and language characteristics of various types of written study and workplace reports characteristic of those produced by engineering students and practicing engineers (e.g., incident reports and progress reports) mainly, and applying this knowledge in writing one of the latter 5. Develop communication skills through active participation in class and group activities.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. • Technical presentations (5 hrs) • Conducting technical discussions about engineering projects (5 hrs) • Writing technical documents (5 hrs) • Writing business correspondence (5 hrs)
Course Description	This course is designed to provide engineering students with the necessary oral and written skills required for effective communication in academic and workplace contexts, both with experts in their field and lay persons. It begins by introducing them to the principles of good academic practice, which are also presented as a model for ethical workplace practice, and thus help them to avoid issues such as plagiarism. The main part then leads on to developing research and summarizing skills that form the basis for the later activities. Students next learn to apply these skills to conducting technical presentations, as well as in group discussions that culminate in project planning activities.

Learning and Teching Strategies
استراتيجيات التعلم والتعليم

Strategies	The learning and teaching **strategy** is designed to: Carefully cover in lectures the necessary fundamental material and analytical techniques, and

	demonstrate concepts with appropriate (and where possible practical) examples Allow students adequate time to practice the techniques using a large number of carefully selected tutorial problems.	

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل In class lectures 26 In class tests 3 Seminars 2	31	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	2.0
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل Data showing preparation 5 Preparation for tests 4 HomeWorks 6 project 4	19	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	1.2
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	50		

Module Evaluation
تقييم المادة الدراسية

		Time (No)	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	1	10% (10)	5, 10, 12, 14	LO #1, 2, 3, and 4
	On site assignment	1	10% (10)	2, 4, 6, 8, 10, 12	LO # 1, 2, 3, 4, 5 and 6
	Seminar	1	10% (10)	Continuous	LO # 1, 2, 3, 4, 5 and 6
	Report	1	10% (10)	7-14	All
Summative assessment	Midterm Exam	2 hr	10% (10)	7	LO # 1-3
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	A technical presentation. Students will perform various secondary research skills acquired to extract information of an engineering topic from different sources. They will then conduct a short technical presentation based on this information, using the presentation skills learnt
Week 2	
Week 3	
Week 4	Technical discussions and proposal writing Incorporating research results from the previous

Week 5	activities, students will develop a customized solution to address a context-specific problem facing a client's organization. The solution will need to be written in a recognized proposal format (e.g., a blueprint). Each student will craft one section of the document according to her/his role on the project team. Students will also plan and conduct a simulated technical team meeting with the client team to explain and discuss the solution by applying various planning and discussion skills learnt
Week 6	
Week 7	Midterm exam
Week 8	Conducting technical discussions about engineering projects Students will be guided to identify technical discussion skills through various types of exploratory and/or consciousness-raising activities, such as watching sample discussions and evaluating their effectiveness. They learn how to discuss with a client the customised technical design of a solution that can address a context-specific problem facing the client. They then apply these skills in conducting simulated technical team discussions, according to the roles assigned to them.
Week 9	
Week 10	
Week 11	A technical report:Each student produces a technical report by applying the knowledge gained in the related TLAs
Week 12	
Week 13	
Week 14	Writing business correspondence Students will produce a business email, based on the results of the previous activities, and by applying the textual features learnt.
Week 15	
Week 16	**Final Exam**

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Beer, D. & McMurrey, D. 2004, A Guide to Writing as an Engineer (2nd ed), New York: Wiley	No
Recommended Texts	Borowick, Jerome N., 2002, Technical Communication and its Applications (2nd ed), New Jersey: Prentice-Hall, Inc.	No
Websites	http://umich.edu/~elements/5e/lectures/index.html	

APPENDIX:

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

(0 – 49)	F – Fail	راسب	(0-44)	Considerable amount of work required

	Ministry of Higher Education and Scientific Research - Iraq University of Tikrit College of Engineering Department of Sustainable Energy Engineering	

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information	
معلومات المادة الدراسية	

Module Title	DEMOCRACY AND HUMAN RIGHTS (ديمقراطية وحقوق الانسان)	Module Delivery	
Module Type	SUPPLEMENT		
Module Code	UOT-004	محاضرات نظرية	
ECTS Credits	2		
SWL (hr/sem)	50		

Module Level	UGI	Semester (s) offered	1
Min number of students	15	Max number of students	100
Administering Department	Sustainable energy	College	Engineering
Module Leader	عبد الرحمن زيدان	e-mail	azaueng4@tu.edu.iq
Module Leader's Acad. Title	Asst Lacturer	Module Leader's Qualification	MSc
Module Tutor	None	e-mail	None
Peer Reviewer Name		e-mail	
Review Committee Approval	03/09/2025	Version Number	1.0

Relation With Other Modules	
العلاقة مع المواد الدراسية الأخرى	

Prerequisite module	لايوجد	Semester	1
Co-requisites module	لايوجد	Semester	-

Module Aims, Learning Outcomes, Indicative Contents and Brief Description
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر

Module Aims أهداف المادة الدراسية	1-القدرة على ادراك المفهوم الاساسي لحقوق الانسان والطفل والديمقراطية. 2- القدرة على فهم الاصول التاريخية للمفهومين. ومعرفة ايجابيات وسلبيات حقوق الانسان والديمقراطية. 3- الاطلاع على حقوق الانسان والطفل والديمقراطية في الاسلام. 4- التعرف على مصادر حقوق الانسان والطفل وخصائص وسمات الديمقراطية. 5-معرفة اثر التطور التكنولوجي على حقوق الانسان والطفل والديمقراطية. 6-التطرق لمفاهيم ذات صلة بالمصطلحين مثل (العولمة، مؤسسات المجتمع المدني ، الانتخابات والاستفتاء ، الحكم الرشيد ، الجرائم الانسانية، الدستور). 7-الاطلاع على الضمانات التي تكفل حقوق الانسان والطفل وتكفل النظام الديمقراطي والحقوق والحريات العامة.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1- التعرف على المصطلحات ذات الصلة بمفهوم حقوق الانسان والطفل والديمقراطية. 2- التعرف على اهم الحقوق التي كفلها الإسلام للإنسان والطفل واستثمارها في معالجة الآفات والحالات السلبية التي تغزو المجتمعات في العصر الحالي . الاستفادة من مزايا الديمقراطية ومكوناتها في معالجة التذبذب وعدم الاستقرار في المجتمع والحفاظ على الاستقرار والسلم المجتمعي. 3- الاطلاع على المواثيق الدولية المختصة بمجالات حقوق الانسان والطفل الصادرة عن المنظمات الدولية وجمعية الأمم المتحدة. 4- الاستفادة من تجارب الاخرين (الدول المتقدمة في مجالات حقوق الانسان والطفل والديمقراطية). 5- اللمام بالقوانين والدساتير الدولية والإقليمية والمحلية المختصة بقضايا حقوق الانسان والحريات العامة والديمقراطية. 7- التعرف على جرائم الإبادة الجماعية والجرائم الإنسانية ومدى تأثيرها على مفهوم حقوق الانسان والطفل والديمقراطية.
Indicative Contents المحتويات الإرشادية	يتضمن المحتوى الارشادي مايأتي: 1- حقوق الانسان والطفل والديمقراطية في الحضارات القديمة والإسلام (8 ساعات). 2- مصادر حقوق الانسان العالمية والمحلية، خصائص وسمات الديمقراطية (4 ساعات). 3- ضمانات حقوق الانسان العالمية والمحلية وضمانات النظام الديمقراطي (4 ساعات). 4- حقوق الانسان والطفل والديمقراطية واثر التقدم التكنولوجي عليهما (4 ساعات). 5- العولمة ، مؤسسات المجتمع المدني ، الانتخابات والاستفتاء، الدستور(4 ساعات) 6- الجرائم الإنسانية وانواعها ، الحكم الرشيد ، (2 ساعة). 7- الوثائق الدولية الخاصة بحقوق الطفل والديمقراطية المعاصرة (4 ساعات).
Course Description	حقوق الانسان: هي حقوق يتمتع بها جميع مكونات البشر لمجرد اننا من ابناء البشر، وهذه الحقوق متأصلة في جميع البشر مهما كان عرقهم او جنسهم او قوميتهم او مذهبهم ولاتمنح من أي دولة، وتتضمن حقوق الانسان والطفل في الحضارات القديمة والاسلام، المواثيق الدولية ، مصادر وضمانات حقوق الانسان ، القوانين والدساتير، مجلس حقوق الانسان، العولمة، التقدم التكنولوجي واثره على حقوق الانسان. الديمقراطية: يرجع مصطلح الديمقراطية الى الحضارة اليونانية القديمة وهي عبارة عن مصطلح مكون من مقطعين هما: (Cratia) التي تعني حكم و (Demo) التي تعني الشعب ليصبح المفهوم حكم الشعب ، وتتضمن الديمقراطية التطرق الى مفهومها ومعرفة الجذور التاريخية لها ، المكونات ، الخصائص ، المميزات ، الضمانات ، علاقة الديمقراطية ب (الدستور ، مؤسسات المجتمع المدني ، حقوق الانسان ، الحكم الرشيد، الانتخابات) ، الديمقراطية المعاصرة

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	تم وضع استراتيجية التعلم والتعليم من اجل ان يحصل الطالب على معلومات كاملة تغطي المنهج الدراسي المعد للمادة ولكي تتحقق الغاية الاساسية للمنهج الذي ينصب نحو المام وادراك الطالب بالمفاهيم الاساسية لحقوق الانسان والديمقراطية، والاطلاع على المصادر والضمانات والمواثيق الدولية للمصطلحين من اجل استثمارها في معالجة الظواهر السلبية في المجتمع والحفاظ على الاستقرار والسلم المجتمعي .

Student Workload (SWL)
الحمل الدراسي للطالب

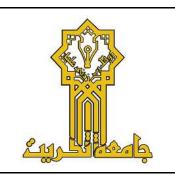| Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** 28 **In class tests** 3	31	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	2.0
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Memorizing:** 10 **Prepartion for test:** 5 **Project:** 4	19	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	1.2
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	50		

Module Evaluation
تقييم المادة الدراسية

		Time (hr)	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	4	20% (20)	3, 5, ,7, 9,11,13,	LO #1, 2,3,..........., 11
	Assignments (Homeworks)	6	15% (15)	2, 4, 6, 10,12,14	LO # 1, 2, 3, ...,11
	Discussions	7	5% (5)	Continuous	
Summative assessment	Midterm Exam	2	10% (10)	8	LO # 1-7
	Final Exam	3	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	الجذور التاريخية لحقوق الانسان والديمقراطية في الحضارات القديمة
Week 2	حقوق الانسان والطفل والديمقراطية في الاسلام
Week 3	مصادر حقوق الانسان على المستوى الخارجي الدولي، سمات وخصائص الديمقراطية
Week 4	مصادر حقوق الانسان على المستوى الداخلي المحلي، مزايا الديمقراطية
Week 5	ضمانات حقوق الانسان على المستوى المحلي، مكونات الديمقراطية
Week 6	ضمانات حقوق الانسان على المستوى الدولي، الضمانات التي تكفل النظام الديمقراطي
Week 7	مجلس حقوق الانسان، الانتخابات واهميتها
Week 8	امتحان نصف الفصل
Week 9	التطور التكنولوجي وأثره على حقوق الانسان والطفل والديمقراطية
Week 10	مفهوم العولمة، مؤسسات المجتمع المدني
Week 11	الحكم الرشيد (المبادئ، المعايير) ، الاستفتاء
Week 12	الدستور وانواعه
Week 13	المساواة بين الجنسين وحقوق الطفل
Week 14	الجرائم الانسانية (جرائم الابادة الجماعية) وتأثيرها على حقوق الانسان والطفل والانظمة الديمقراطية
Week 15	الديمقراطية المعاصرة وحقوق الانسان والطفل ودراسة حالات لأمثلة واقعية حدثت في المجتمعات الدولية والعربية وفي العراق.
Week 16	امتحان نهاية الفصل

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	كتاب حقوق الانسان والديمقراطية. من تأليف: 1-ا.د. ماهر صالح علاوي الجبوري، ا.د رياض عزيز هادي ، ا.د. رعد ناجي الجدة، ا.م.د كامل عبد العنكود ، ا.م.د علي عبد الرزاق محمد، ا.د. حسان محمد شفيق، (2009)	Yes
Recommended Texts	1ـ -الديمقراطية ،من تأليف : تشارلز تيللي ، ترجمة محمد فاضل طباخ ، الهيئة المصرية العامة للكتاب،(2010). 2ـ كتاب حقوق الانسان الاساسية والدور الامني لحمايتها، المؤلف: الدكتور مبارك علوي محمد،(2019).	No
Websites	N/A	

Ministry of Higher Education and
Scientific Research - Iraq
University of Tikrit
College of Engineering
Department of Sustainable Energy
Engineering

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information
معلومات المادة الدراسية

Module Title	CALCULUS II		**Module Delivery**
Module Type	BASIC		Theory Lecture Tutorial Practical Seminar
Module Code	MATH-102		
ECTS Credits	6		
SWL (hr/sem)	150		

Module Level	UGI	**Semester (s) offered**	2
Administering Department	Sustainable Energy Engineering	**College**	Engineering
Module Leader	Dr. Hamza R. Yaseen	**e-mail**	hamza.r.yaseen94@tu.edu.iq
Module Leader's Acad. Title	Lecturer	**Module Leader's Qualification**	Ph.D.
Module Tutor	Dr. Israa Sami Farhan	**e-mail**	israa.s.farhan@tu.edu.iq
Peer Reviewer Name		**e-mail**	
Review Committee Approval	01/09/2025	**Version Number**	1.0

Relation With Other Modules
العلاقة مع المواد الدراسية الأخرى

Prerequisite module	Math-101	**Semester**	1

Co-requisites module	None	Semester	-

Module Aims أهداف المادة الدراسية	Developing of student ability in the general mathematics principle and applications.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	However, based on the weekly content provided, learning outcomes for the module might be derived as follows: • Vectors and Space: Understand and apply vector operations in space, including dot and cross products. • Lines and Planes in Space: Determine equations for lines and planes in three-dimensional space. • Multivariable Functions and Partial Derivatives: Understand functions of two or more variables and find their partial derivatives using the chain rule. • Gradient and Directional Derivatives: Calculate the gradient of scalar fields and apply it to find directional derivatives. • Tangent Planes and Normal Lines: Determine equations for tangent planes and normal lines to surfaces. • Applications of Partial Derivatives: Solve optimization problems involving functions of several variables to find maxima, minima, and saddle points. • Multiple Integrals: Evaluate double and triple integrals in Cartesian, cylindrical, and spherical coordinates. • Complex Numbers and Operations: Understand and perform basic operations with complex numbers in both rectangular and polar form.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. • Vectors (30hrs) • Applications of Partial of Derivative (5hrs) • Multiple Integral (20hrs) • Complex Number (20hrs)
Course Description	This course is based on the principles of Euclidean, plane, and solid geometries. Students will be introduced to the basic postulates and theorems of geometry and encouraged to extend these ideas to the topics of similarity, circles, area, volume, and proof. In addition, students are involved in a more technological, theoretical, and algebraic approach to geometry.

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	The learning and teaching **strategy** is designed to: We designed teaching strategies to support students' development of mathematical knowledge and problem solving as well as communication and team working skills. We used an action research perspective as various

methods within this stance can ensure flexibility in responding to the dynamics of interaction between the teachers and the students.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل		87	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	5.8
In class lectures	56			
Lect	28			
In class tests	3			
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل		63	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.2
Library, dorm, home memorizing	33			
Prepartion for tests	13			
Homeworks	14			
Report	3			
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل		150		

Module Evaluation
تقييم المادة الدراسية

		No.	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	3	15% (5)	4,8,12	LO #1, 2, 3, and 4
	Assignment	4	12% (3)	3, 5, 9, 11, 12	LO #1, 2, 3, and 4
	Projects	1	5% (5)	13	LO #1, 2, 3, and 4
	Onsite Assignment	2	8%(4)	3,6 , 10,11	LO #1, 2, 3, and 4
Summative assessment	Midterm Exam	1	10% (10)	7	LO #1, 2, 3, and 4
	Final Exam	1	50% (50)	15	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	Vectors: Vector in Space, Dot and Cross Products
Week 2	Equations for Lines and Planes in Space
Week 3	Function of Two and more Variables and Their Derivatives: Partial Derivatives, Chain Rules
Week 4	Partial Derivatives with Constants Variables
Week 5	Gradient and Directional Derivatives

Week 6	Tangent Plane and normal lines
Week 7	Applications of Partial of Derivative (maximum, minimum and saddle point)
Week 8	Multiple Integral: Double integral
Week 9	Double integral in polar coordinates
Week 10	Changing Cartesian integrals into Polar integrals
Week 11	Triple integral (Rectangular, Cylindrical and Spherical)
Week 12	Complex Number: Addition, Subtraction
Week 13	Multiplication and Division
Week 14	Polar representation of Complex Number
Week 15	Roots
Week 16	**Final Exam**

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

Learning and Teaching Resources		
مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	"Calculus" by George B. Thomas, Jr. publishing company, 2010	Yes
Recommended Texts	"Engineering Mathematics" by K. A. Stroud, Dexter J. Booth, 5th edition, Industrial press Inc., New York, 2001. Advanced_Engineering_Mathematics_By_Erwin_Kreyszig_tenth_Edition, 2011 Higher Engineering Mathematics by JOHN, 2010	No
Websites		

APPENDIX:

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

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

Ministry of Higher Education and
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Engineering

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			

Module Title	**ENGINEERING MECHANICS**	**Module Delivery**	
Module Type	**C**ORE	Theory Lecture Tutorial Practical Seminar	
Module Code	**ENG-102**		
ECTS Credits	4		
SWL (hr/sem)	100		

Module Level	UGl	Semester (s) offered	2
Min number of students	15	**Max number of students**	100
Administering Department	Sustainable Energy Engineering	**College**	Engineering
Module Leader	Adel Mahmood Bash	**e-mail**	Adelbash@tu.edu.iq
Module Leader's Acad. Title	Prof	**Module Leader's Qualification**	Ph.D.
Module Tutor	Dr. Hamza R. Yaseen	**e-mail**	hamza.r.yaseen94@tu.edu.iq
Peer Reviewer Name		**e-mail**	
Review Committee Approval	05/09/2025	**Version Number**	1.0

Relation With Other Modules	
العلاقة مع المواد الدراسية الأخرى	

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

Module Aims, Learning Outcomes, Indicative Contents and Brief Description
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر

Module Aims أهداف المادة الدراسية	1) To provide definition of force and moment vectors and give necessary vector algebra 2) To explain the concept of equilibrium of particles and rigid bodies in plane and 3D space 3) To give information about support types and to give ability to calculate support reactions 4) To explain the equilibrium of structures and internal forces in trusses, and frames 5) To give information about distributed loads 6) To explain centroid concept 7) To provide information on moment of inertia
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	6) Use both conceptual and numerical techniques to solve engineering problems. 7) Analyze and develop free-body diagrams for any system of forces in two and three dimensions. 8) Understand and use the general idea of equilibrium of a particle. 9) Understand and use the general ideas of force system resultants. 10) Determine the moment of a force about an arbitrary point and/or axes 11) Analyze the equilibrium of rigid bodies under any system of forces. 12) Analyze trusses, beams, frames, and machines. 13) Understand and use the general ideas of internal forces and draw shear and moment diagrams. 14) Calculate center of gravity, centroids, and moments of inertia. 15) Apply friction forces and analyze their different applications.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. • Force Vectors (8 hrs) • Force System Resultants (8 hrs) • Equilibrium of a Rigid Body (8 hrs) • Friction (8 hrs) • Center of Gravity and Centroid (6 hrs) • Moments of Inertia (8 hrs) • Structure and Frames (10 hrs)
Course Description	The course covers the following topics; statics of particles: forces in plane, forces in space, equilibrium, moment of a force, moment of a couple, equivalent systems of forces on rigid bodies, equilibrium in two dimensions, equilibrium in three dimensions, distributed forces: centroids and center of gravity, analysis of structures: trusses, frames and machines, internal forces in beams and cables, friction, moments of inertia of areas, moments of inertia of masses.

	Learning and Teaching Strategies
	استراتيجيات التعلم والتعليم
Strategies	The learning and teaching **strategy** is designed to: Carefully cover in lectures the necessary fundamental material and analytical techniques, and demonstrate concepts with appropriate (and where possible practical) examples Allow students adequate time to practice the techniques using a large number of carefully selected tutorial problems.

Student Workload (SWL)				
الحمل الدراسي للطالب				
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل		59	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	3.9
In class lectures	**50**			
Final test	**5**			
Seminars	**4**			
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل		41	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	2.73
Library, dorm, home memorizing	**20**			
Preparation for tests	**15**			
Homeworks	**6**			
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل		100		

Module Evaluation					
تقييم المادة الدراسية					
		Time (hr)	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5, 10, 12, 14	LO #1, 2, 3, and 4
	Assignments	5	10% (10)	2, 4, 6, 8, 10	LO # 1, 2, 3, 4, 5 and 6
	Seminars	4	8% (8)	Continuous	
	Discussions	6	12% (12)	Continuous	
Summative assessment	**Midterm Exam**	2	10% (10)	7	LO # 1-5
	Final Exam	3	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري
Material Covered

Week 1	General principles, Principles of statics, vectors
Week 2	Planar forces, resultant of a force system
Week 3	Planar forces, resultant of a force system
Week 4	The free body diagram, definition of moment, moment of a couple
Week 5	The free body diagram, definition of moment, moment of a couple
Week 6	Equilibrium in 2-D, free body diagrams, equations of equilibrium
Week 7	Midterm exam
Week 8	Equilibrium in 3-D, free body diagrams, equations of equilibrium
Week 9	Structures Trusses and Frames
Week 10	Structures Trusses and Frames
Week 11	Center of mass, Gravity and centroid
Week 12	Centroids of Lines, Areas, and Volumes
Week 13	Moment of inertia
Week 14	Moments of inertia
Week 15	Friction (dry friction)
Week 16	**Final Exam**

Learning and Teaching Resources		
مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	**Engineering Mechanics-Statics, J.L.Meriam, L.G.Kraige, Wiley, 5th Edition, 2003, ISBN: 0-471-26607-8**	Yes
Recommended Texts	**Engineering Mechanics-Statics, Hibbeler, R.C.13th Edition, Pearson Prentice Hall, 2016, ISBN 978-0-13-31892-2."**	Yes
Websites	N/A	

APPENDIX:

GRADING SCHEME				
مخطط الدرجات				
Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	**A –** Excellent	امتياز	90 – 100	Outstanding Performance
	B - Very Good	جيد جدا	80 – 89	Above average with some errors
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	E – Sufficient	مقبول	50 – 59	Work meets minimum criteria

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MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information		
معلومات المادة الدراسية		

Module Title	Basics of Electricity	Module Delivery
Module Type	Core	**Theory** **Lecture** **Tutorial** **Practical**
Module Code	SE-ENG-103	
ECTS Credits	5	
SWL (hr/sem)	125	

Module Level		UGI	Semester (s) offered		2
Administering Department	Sustainable Energy		College	Engineering	
Module Leader	Ahmed Hefdhi Mohsin		e-mail	Ahmed.h.mohsin@tu.edu.iq	
Module Leader's Acad. Title	Asst. Lecturer		Module Leader's Qualification		MSC.
Module Tutor	Kahtan Ali Yousuf		e-mail	qahtan.a.yousif@tu.edu.iq	
Peer Reviewer Name			e-mail		
Review Committee Approval			Version Number	1.0	

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

Co-requisites module	None	Semester	-

	Module Aims, Learning Outcomes, Indicative Contents and Brief Description
	أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر

Module Aims أهداف المادة الدراسية	1. Theoretical and practical to develop problem solving skills and understanding of circuit theory through the application of techniques. 2.To understand voltage, current and power from a given circuit. 3. This course deals with the basic concept of electrical circuits. 4. This is the basic subject for all electrical and electronic circuits. 5. To understand Kirchhoff's current and voltage Laws problems for DC and AC circuits. 6. To perform Mesh, Nodal analysis, and superposition, Thevenin, Norton and maximum power transfer theorems for DC and AC circuits.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of this course students will be able to: 1. Recognize how electricity works in electrical circuits. 2. List the various terms associated with electrical circuits. 3. Summarize what is meant by a basic electric circuit. 4. Identify the basic circuit elements and their applications. 5. Describe electrical power, charge, and current. 6. Define Ohm's law and Explain the two Kirchoff's laws used in circuit analysis for DC and AC circuits and bridge networks for DC and AC circuits. 7. Discuss the various properties of resistors, capacitors, and inductors. 9. Solve basic electrical problems using Mesh, Nodal analysis, and superposition, Thevenin, Norton and maximum power transfer theorems for DC and AC circuits.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. -DC circuits – Current and voltage definitions, Passive sign convention and circuit elements, Combining resistive elements in series and parallel. Kirchhoff's laws and Ohm's law. - Introduction to Mesh, Nodal analysis, and superposition, Thevenin, Norton and maximum power transfer theorems for DC circuits. -AC circuits – Time dependent signals, average and RMS values. Capacitance and

	inductance. -Bridge networks for DC and AC circuits. -Elements in series and parallel. Kirchhoff's laws and Ohm's law. - Introduction to Mesh, Nodal analysis, and superposition, Thevenin, Norton and maximum power transfer theorems for AC circuits.
Course Description	The electrical engineering course focus on basic electrical elements and fundamentals of electrical quantities such as voltage, current, resistor and electrical power then to series, parallel and how to analyze the electrical circuits in Mesh, Nodal for DC and AC circuits as well as bridge circuits then move to Alternating current AC circuits and students will able to get knowledge to Time dependent signals, average and RMS values. Capacitance and inductance. Elements in series and parallel. Kirchhoff's laws and Ohm's law. Introduction to Mesh, Nodal analysis, and superposition, Thevenin, Norton and maximum power transfer theorems for AC circuits.
Learning and Teaching Strategies	
استراتيجيات التعلم والتعليم	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL)			
الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل In class lectures 28 Lab. 28 Tutorial 14 In class tests 3	73	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4.9
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل Library, dorm, home memorizing 30 Preparion for tests 12 Homeworks 10	52	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation					
تقييم المادة الدراسية					
As		**Time (hr)**	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	4	14% (14)	All	LO #1, 2, 3, and 9
	Assignments	4	16% (16)	All	LO # 1, 2, 3, 4, 5 and 9

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

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

Week	Material Covered
Week 1	Current, Voltage , Ohm's Law , Power and Energy Concepts
Week 2	DC Series, Parallel Circuits and DC Series – Parallel networks
Week 3	DC Bridge networks , Star –Delta conversions
Week 4	Methods of DC Analysis – Mesh
Week 5	Methods of DC Analysis – Nodal
Week 6	DC Network Theorem - Superposition
Week 7	DC Thevenin Theorem
Week 8	Midterm exam , DC Norton Theorem and Maximum Power Transfer Theorem
Week 9	The Basic Elements of AC Circuits and Sinusoidal Alternating Waveforms
Week 10	AC Series, Parallel Circuits and AC Series – Parallel networks
Week 11	AC Bridge networks , Star –Delta conversions
Week 12	Methods of AC Analysis – Mesh
Week 13	Methods of AC Analysis – Nodal
Week 14	AC Network Theorem - Superposition
Week 15	AC Thevenin Theorem, Norton Theorem and Maximum Power Transfer Theorem
Week 16	Final Exam

Delivery Plan (Weekly Lab. Syllabus)
المنهاج الاسبوعي للمختبر

Week	Material Covered

Week 1	Resistor Color Band and Ohm's Law Experiment
Week 2	DC Series, Parallel Circuits and DC Series – Parallel networks Experiment
Week 3	DC Kirchhoff's Voltage Law (KVL) and Kirchhoff's Current Law (KCL)
Week 4	DC Mesh and Nodal Experiment
Week 5	DC Superposition Theorem Experiment
Week 6	DC Thevenin Theorem Experiment
Week 7	DC Norton Theorem Experiment
Week 8	Maximum Power Transfer Theorem Experiment
Week 9	The Basic Elements of AC Circuits and Sinusoidal Alternating Waveforms Experiment
Week 10	AC Series, Parallel Circuits and DC Series – Parallel networks Experiment
Week 11	AC Mesh Experiment
Week 12	AC Superposition Theorem Experiment
Week 13	AC Thevenin Theorem Experiment
Week 14	Maximum Power Transfer Theorem Experiment
Week 15	RLC Experiment
Week 16	**Final Exam**

Learning and Teaching Resources		
مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Introductory circuit analysis, Robert L. Boylestad, Pearson Publishing Company, 12nd Edition, 2022	Yes
Recommended Texts	Fundamentals of Electric Circuits, C.K. Alexander and M.N.O Sadiku, McGraw-Hill Education	Yes
Websites		

APPENDIX:

GRADING SCHEME				
مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**

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

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

Ministry of Higher Education and
Scientific Research - Iraq
University of Tikrit
College of Engineering
Department of Sustainable Energy
Engineering

MODULE DESCRIPTOR

وصف المادة الدراسية

Module Information		
معلومات المادة الدراسية		

Module Title	ENVIRONMENT POLLUTION	Module Delivery	
Module Type	CORE	**Theory** Lecture Tutorial Practical Seminar **Lab**	
Module Code	SE-ENG-104		
ECTS Credits	5		
SWL (hr/sem)	125		

Module Level		UGl	Semester (s) offered	2
Administering Department		Sustainable Energy Engineering	College	Engineering
Module Leader	Dr. Salwa H. Ahmed		e-mail	dr. salwahadi@tu.edu.iq
Module Leader's Acad. Title		Professor	Module Leader's Qualification	Ph.D.
Module Tutor			e-mail	None
Peer Reviewer Name			e-mail	
Review Committee Approval		01/10/2025	Version Number	1.0

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

module			

<table>
<tr><td colspan="2" align="center">Module Aims, Learning Outcomes, Indicative Contents and Brief Description
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر</td></tr>
<tr>
<td>Module Aims
أهداف المادة الدراسية</td>
<td>The primary aims of this module are:

1. To provide the essential knowledge surrounding environmental pollution and its impact on ecological systems.
2. To define and differentiate between various types and sources of pollution, including water, air, soil, thermal, noise, visual, and light pollution.
3. To explore pollution control methods, mitigation strategies, and remediation techniques across different environmental media.
4. To highlight the significance of ecological balance, sustainability, and the necessity of transitioning to renewable and green energy to curb environmental deterioration.</td>
</tr>
<tr>
<td>Module Learning Outcomes

مخرجات التعلم للمادة الدراسية</td>
<td>Upon successful completion of this module, the student will be able to:

1. Define the concept of ecological balance and identify the main categories of environmental pollution, including water, air, soil, and thermal pollution.
2. Classify pollutants based on their sources, impacts, and types (primary and secondary).
3. Analyze the physical and chemical characteristics of water and explain the causes and effects of various pollution forms on ecosystems and human health.
4. Describe methods for controlling and remediating water, air, and soil pollution, including relevant treatment and repair techniques.
5. Evaluate the role of sustainable development and realize the importance of renewable and green energy sources in environmental protection.
6. Analyze the environmental impact of thermal pollution, especially concerning power plant operations, and propose strategies to mitigate various sensory pollutants (noise, light, visual).</td>
</tr>
<tr>
<td>Indicative Contents
المحتويات الإرشادية</td>
<td>Indicative content includes the following.
1. Foundational Concepts and Pollution Introduction (10 hrs) (6 T + 4 P).
2. Water Pollution Analysis and Control (14 hrs) (6 T + 8 P).
3. Air and Soil Pollution Management (23 hrs) (15 T + 8 P)
4. Thermal, Sensory Pollution, and Sustainable Solutions (20 hrs) (12 T + 8 P)
5. Course Review and Final Assessment (8 hrs) (6 T + 2 P)</td>
</tr>
<tr>
<td>Course Description</td>
<td>This module offers a comprehensive foundation in environmental pollution, covering its nature, sources, and devastating impacts on natural ecosystems and human health. It focuses on the key aspects of air, water, and soil pollution, alongside thermal and sensory pollutants. The course emphasizes the crucial role of sustainable development and green energy in mitigating environmental degradation, while developing students' practical skills in environmental sampling and laboratory analysis.</td>
</tr>
<tr><td colspan="2" align="center">Learning and Teaching Strategies
استراتيجيات التعلم والتعليم</td></tr>
<tr>
<td>Strategies</td>
<td>It is based on blended and interactive learning, aiming to develop students' critical thinking. Interactive theoretical lectures are combined with the analysis of real-life case studies for environmental impact assessment. This strategy is</td>
</tr>
</table>

complemented by a focus on practical laboratory experiments to train students in sampling and basic pollutant analysis, ensuring they acquire the technical skills necessary to apply theoretical knowledge to solve sustainable environmental problems..

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل In class lectures 28 Lect. 14 Lab. 28 Final Exam 3	73	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	4.9
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل Library, dorm, home memorizing 20 Preparation for tests Home works 12 Design Project 10 Reports 10	52	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation
تقييم المادة الدراسية

		Time (hr)	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	20% (20)	2,5, 10, 12, 14	LO #1, 2, 3, and 4
	Assignments	15	10% (10)	Continuous	LO # 1, 2, 3, 4, 5,6 and 7
	Seminars	2	10% (10)	Continuous	
Summative assessment	Midterm Exam	2	10% (10)	7	LO # 1-5
	Final Exam	3	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

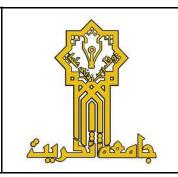|	Material Covered
Week 1	Introduction and Basics: Ecological Balance, Definition of Environmental Pollution, Main Types of Pollution (Water, Air, Soil, Thermal)
Week 2	Sources and Classification: Major Pollution Sources, Degrees of Pollution, Classification of Pollutants (Primary and Secondary)

Week 3	Water Pollution (I): Physical and Chemical Properties of Water, Water Pollutants.
Week 4	Water Pollution (II): Types of Water Pollution, River and Groundwater Contamination, Water Pollution Control Methods.
Week 5	Air Pollution (I): Atmospheric Layers, Air Components, Sources of Air Pollution.
Week 6	Air Pollution (II): Primary and Secondary Air Pollutants, Proposed Solutions for Air Pollution Reduction.
Week 7	Pollution Control: Methods Control and Remediation Techniques for Water and Air Pollution.
Week 8	Sustainability and Green Energy Sustainable: Development, Renewable/Alternative/Green Energy, and their role in environmental reduction.
Week 9	Soil Pollution (I): Soil Composition, Causes of Soil Degradation, Sources of Soil Pollution.
Week 10	Soil Pollution (II): Handling Contaminated Lands, Agricultural Soil Pollution, Biological and Radioactive Soil Pollution.
Week 11	Thermal Pollution (I): Main Sources of Thermal Pollution, Effects, and Cooling Systems in Power Plants.
Week 12	Thermal Pollution (II): Impact of Thermal Pollution on Water Resources, Methods for Reducing Thermal Pollution.
Week 13	Sensory Pollutions: Noise Pollution, Visual Pollution, and Light Pollution.
Week 14	Case Studies and Review: Review of key concepts and discussion of major environmental case studies.
Week 15	Midterm Exam: Review week or scheduled Midterm Examination.

Delivery Plan (Weekly Syllabus) المنهاج الأسبوعي العملي	
	Material Covered
Week 1-2	**Lab Safety and Sampling**: Lab safety protocols, introduction to environmental analysis equipment, and fundamental techniques for environmental sampling.
Week 3-4	**Water Quality: Physical Parameters:** Measurement of Temperature, Turbidity, and pH in water samples.
Week 5-6	**Water Quality: Chemical Parameters:** Determination of Dissolved Oxygen (DO) and Chemical Oxygen Demand (COD).
Week 7-8	**Air Quality Analysis**: Basic monitoring of airborne particulates and identification of gaseous pollutant indicators.
Week 9-10	**Soil Quality Analysis**: Correct soil sampling procedures and estimation of moisture and organic matter content in soil.
Week 11-12	**Water Treatment Simulation:** Experiment simulating primary wastewater treatment processes (e.g., coagulation and sedimentation).
Week 13-14	**Thermal and Noise Measurement**: Using specialized meters to measure noise levels and simulate the impact of thermal discharge.
Week 15	**Final Lab Report Submission and Review**: Discussion of practical findings and review of analytical techniques.

<table>
<tr><th colspan="3" style="text-align:center">Learning and Teaching Resources
مصادر التعلم والتدريس</th></tr>
<tr><td></td><td style="text-align:center">Text</td><td>Available in the Library?</td></tr>
<tr><td>Required Texts</td><td>avid A. Cornwell, Mackenzie L. Davis, Introduction to Environmental Engineering, Fifth Edition, 2012, McGraw-Hill Education.</td><td>Yes</td></tr>
<tr><td>Recommended Texts</td><td>Richard O. Mines, Environmental Engineering Principles and Practice, 2014, Wiley.</td><td>yes</td></tr>
<tr><td>Websites</td><td>-</td><td></td></tr>
</table>

APPENDIX:

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

Note:

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Department of Sustainable Energy
Engineering

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information معلومات المادة الدراسية		
Module Title	ENGINEERING DRAWING	**Module Delivery**
Module Type	CORE	☐ Theory
Module Code	ENG-101	☐ Lecture
ECTS Credits	3	☒ Lab
SWL (hr/sem)	75	☐ Tutorial ☐ Practical

Module Level	UGI	Semester (s) offered	2
Administering Department	Sustainable Energy Engineering	**College**	Engineering
Module Leader	Sabah Mohammed Hasan	**e-mail**	sabahmohamed@tu.edu.iq
Module Leader's Acad. Title	Asst.Lecturer	**Module Leader's Qualification**	M.Sc.
Module Tutor	None	**e-mail**	None
Peer Reviewer Name		**e-mail**	
Review Committee Approval	20/09/2025	**Version Number**	1.0

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

Module Aims, Learning Outcomes, Indicative Contents and Brief Description
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر

Module Aims أهداف المادة الدراسية	1. Define and explain the uses of different drawing equipment. 2. Identify the different drawing equipment. 3. Layout drawing papers and prepare a title block. 4. Practically distinguish the types of dimensioning. 5. Carry out geometrical construction of different shapes. 6. Carry out isometric and orthographic drawing of objects.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of this course students will be able to: 1. Prepare and understand drawings. 2. Identify various curves used in Engineering Drawing and their applications. 3. Use the principles of orthographic projections. 4. By studying about isometric projections students will be able to visualize three-dimensional objects and that will enable them to design new products. 5. Design and fabricate surfaces of different shapes. 6. Represent the objects in three dimensional appearances
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. • Introduction to Drawing Equipment (6hrs) • Geometrical Construction (12hrs) • Orthographic Projection (9hrs) • Sectional views(6hrs) • Isometric Projections(9hrs) • Dimensioning(3hrs)
Course Description	An engineering drawing course focuses on usage of drawing instruments, lettering, construction of geometric shapes, etc. Students study use of dimensioning, shapes and angles or views of such drawings. Dimensions feature prominently, with focus on interpretation, importance and accurate reflection of dimensions in engineering drawing. Other areas of study in this course may include projected views and development of surfaces.

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	The learning and teaching **strategy** is designed to: Carefully cover in lectures the necessary fundamental material and analytical techniques, and demonstrate concepts with appropriate (and where possible practical) examples Allow students adequate time to practice the techniques using a large number of carefully selected tutorial problems.

Student Workload (SWL)			
الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** **42** **In class tests** 3	45	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	3

Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل Library, dorm, home memorizing 15 Prepartion for tests 10 Homeworks 5	30	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	2
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	75		

Module Evaluation تقييم المادة الدراسية					
		Time (hr)	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	all	LO #1, 2, 3, and 4
	Assignments	6	30% (30)	All	LO # 1, 2, 3, 4, 5 and 6
Summative assessment	Midterm Exam	2	10% (10)	7	LO # 1-3
	Final Exam	3	50% (50)	16	All
Total assessment		100% (100 Marks)			

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	
Week 8	
Week 9	
Week 10	
Week 11	
Week 12	
Week 13	
Week 14	

Week 15	
Week 16	

Delivery Plan (Weekly Lab. Syllabus)	
المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Introduction to engineering drawing
Week 2	Primary elements of drawings
Week 3	Geometrical Construction
Week 4	Tangency
Week 5	Loci applications
Week 6	Tangency and loci applications
Week 7	Dimensioning
Week 8	Theory of Projection
Week 9	Orthographic Projections
Week 10	Orthographic Projections
Week 11	Sections and Sectional views
Week 12	Sections and Sectional views
Week 13	Isometric Projections
Week 14	Isometric Projections
Week 15	Isometric Projections
Week 16	**Final Exam**

Learning and Teaching Resources		
مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Engineering Drawing, Abdul-Rassul Abdul-Hussain, University of Technology, 1986.	Yes
Recommended Texts	SIMMONS, C., MAGUIRE, D., PHELPS, N., 2021. Manual of engineering Drawing Technical product specification and Documentation to British and International Standards, **4** ed, Elsevier Ltd:Oxford REDDY, K. , 2008. Textbook of Engineering Drawing. 2ed, Adithya Art Printers:Hyderabad SHAH, M. B. , RANA, B. C. , 2007. Engineering Drawing. 2ed, Dorling Kindersley(India) Pvt. Ltd :India	No
Websites		

APPENDIX:

GRADING SCHEME مخطط الدرجات				
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Engineering

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information معلومات المادة الدراسية			
Module Title	CHEMISTRY	**Module Delivery**	
Module Type	BASIC	Theory Lecture Lab Tutorial Practical Seminar	
Module Code	SE-ENG-105		
ECTS Credits	5		
SWL (hr/sem)	125		
Module Level	UGI	**Semester (s) offered**	2
Administering Department	Sustainable Energy	**College**	Engineering
Module Leader	Saad Nahi Saleh	**e-mail**	snsaleh@tu.edu.iq
Module Leader's Acad. Title	Assistant Prof.	**Module Leader's Qualification**	Ph.D.
Module Tutor	Sabah Mohammed Hasan	**e-mail**	sabahmohamed@tu.edu.iq
Peer Reviewer Name	Ass. Lec. Sabah M. Hasan	**e-mail**	sabahmohamed@tu.edu.iq
Review Committee Approval	20/09/2025	**Version Number**	1.0

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

module			

<table>
<tr>
<td colspan="2">Module Aims, Learning Outcomes, Indicative Contents and Brief Description
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر</td>
</tr>
<tr>
<td>Module Aims
أهداف المادة الدراسية</td>
<td>Students will be able to:
1. Understanding atomic structure and electron configuration.
2. Applying knowledge of chemical bonding and molecular geometry.
3. Performing stoichiometric calculations for chemical reactions.
4. Understanding and applying gas laws and the principles of thermodynamics.
5. Analyzing chemical equilibria and reaction kinetics.
6. Exploring the properties of acids, bases, salts, and conducting titrations.
7. Understanding the basic concepts of hydrocarbons and their reactions</td>
</tr>
<tr>
<td>Module Learning Outcomes

مخرجات التعلم للمادة الدراسية</td>
<td>
1. A good understanding of the scientific method.
2. A broad understanding of the fundamental concepts of chemical bonding، reactions, and practical applications.
3. The ability to recognize and understand the impact that chemistry has on every aspect of their lives.
4. A working knowledge of chemistry especially as it relates to the world around them.
5. The ability to read popular media and understand the significance of chemistry as it relates to the world around them.
6. Classify matter and relate its classification to physical and chemical properties.
7. Relate the properties of elements to their structure, location on the periodic table, and natural state.
8. Measure quantities in the laboratory using appropriate equipment and perform calculations preserving the precision of those measurements.
9. Identify the bonding characteristics of substances based upon their properties and elemental makeup.
10. Perform quantitative calculations to predict projected yields of reactions with regard to products, masses, and energy output or consumption.
11. Calculate specific concentration ratios and predict the dependence of reaction mechanisms (rate and direction) on relative quantities.
12. Identify acids and bases as to their properties and reactions, as well as methods to determine the concentration of acids and bases.
13. Apply theoretical ideas studied to practical situations in the laboratory.
14. Perform data collection and analysis drawing meaningful conclusions from the data as part of a cooperative group in the laboratory.
</td>
</tr>
<tr>
<td>Indicative Contents
المحتويات الإرشادية</td>
<td>Indicative content includes the following.
Atomic Structure, Electron Configuration, Elements
− Define and describe atomic structure, including protons, neutrons, and electrons.
− Explain electron configuration and its significance in determining the chemical properties of elements.
− Understand and classify elements in the periodic table, including groups and periods.
Ionic Bonding, Ionic Nomenclature, Covalent Bonding</td>
</tr>
</table>

– Define ionic bonding and explain how ions form through the transfer of electrons.
– Describe and apply the rules of ionic nomenclature to name ionic compounds.
– Explain covalent bonding, including single, double, and triple bonds, and describe how atoms share electrons.

Qualitative Analysis, Geometry, Polarity, Nomenclature
– Understand qualitative analysis techniques for identifying ions in a solution.
– Explore molecular geometry using VSEPR theory and predict the shapes of molecules.
– Discuss molecular polarity and how it affects physical properties.
– Apply rules of nomenclature to name covalent compounds.

Calculations, Moles, Reactions
– Perform chemical calculations involving moles, molar mass, and Avogadro's number.
– Write and balance chemical equations for various types of reactions.
– Understand and apply the concept of stoichiometry in chemical reactions.

Chemical Reactions, Stoichiometry
– Classify different types of chemical reactions, including synthesis, decomposition, single replacement, and double replacement.
– Perform stoichiometric calculations to determine the amounts of reactants and products in chemical reactions.
– Apply the concept of limiting reactants and percent yield in stoichiometric calculations.

Gases, Gas Laws, Phases
– Explore the properties of gases and the principles behind the gas laws (Boyle's, Charles', and Avogadro's laws).
– Apply the ideal gas law to solve problems involving pressure, volume, temperature, and moles.
– Understand the different phases of matter and the phase transitions between solid, liquid, and gas.

Solution Formation
– Describe the process of solution formation, including solvation and factors affecting solubility.
– Discuss the different types of solutions (solid, liquid, gas) and their properties.
– Explore the role of solutes and solvents in the formation of solutions.

Mid-Term Exam
– Review and assess understanding of the content covered in Weeks 1-7.

Concentration, Colligative Properties
– Calculate the concentration of solutions in terms of molarity, molality, and percent composition.
– Explore colligative properties such as boiling point elevation, freezing point depression, and osmotic pressure.
– Understand the impact of solute concentration on the physical properties of solutions.

Redox Reactions

	– Define oxidation and reduction and identify redox reactions. – Assign oxidation states to elements in compounds and reactions. – Balance redox equations using the oxidation number method. Reaction Energetics, Equilibria – Discuss the energetics of chemical reactions, including exothermic and endothermic reactions. – Explore the concept of chemical equilibrium and the factors that affect it. – Understand and apply Le Châtelier's principle to predict changes in equilibrium. Equilibrium Constant, Le Châtelier – Define the equilibrium constant (K) and calculate it for various chemical reactions. – Apply Le Châtelier's principle to predict the effects of changes in concentration, pressure, and temperature on equilibrium. – Solve problems involving the calculation of equilibrium concentrations. Acids, Bases, Salts – Define acids, bases, and salts according to the Arrhenius, Brønsted-Lowry, and Lewis's theories. – Explore the properties of acids and bases, including pH and pOH calculations. – Discuss the formation and properties of salts. Neutralization, Titration – Understand the process of neutralization and the formation of water and salt in acid-base reactions. – Perform titration calculations to determine the concentration of acids or bases in a solution. – Explore indicators and their role in titration experiments. Introduction to Hydrocarbons – Define and classify hydrocarbons, including alkanes, alkenes, and alkynes. – Discuss the structure, nomenclature, and properties of hydrocarbons. – Explore the basic reactions of hydrocarbons, such as combustion and addition reactions. Preparatory Week Before Final Exam – Review and consolidate understanding of the entire course content. – Prepare for the final exam with practice problems, revision sessions, and Q& A.
Course Description	This course aims to establish fundamental knowledge of this subject covers techniques to understand the significance of chemistry and classification the material to physical and chemical properties. Understanding atomic structure, electron configuration, chemical bonding, and molecular geometry. Applying gas laws and the principles of thermodynamics. Analyzing chemical equilibrium and reaction kinetics. Understanding the basic concepts of hydrocarbons and their reactions.
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The primary strategy for delivering this module will be to encourage students to participate in the exercises while refining and expanding their

	critical thinking skills. This will be accomplished through classes, interactive tutorials, and the consideration of simple experiments involving sampling activities that students find interesting.		

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	73	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	4.9
(Unstructured SWL (h/sem الحمل الدراسي الغيرالمنتظم للطالب خلال الفصل الدراسي	52	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation
تقييم المادة الدراسية

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

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	Atomic Structure, Electron Configuration, Elements
Week 2	Ionic Bonding, Ionic Nomenclature, Covalent Bonding
Week 3	Qualitative Analysis, Geometry, Polarity, Nomenclature
Week 4	Calculations, Moles, Reactions,
Week 5	Chemical Reactions, Stoichiometry
Week 6	Gases, Gas Laws, Phases
Week 7	Solution Formation
Week 8	Mid-Term exam
Week 9	Concentration, Colligative, Properties

Week 10	Redox Reactions
Week 11	Reaction Energetics, Equilibria
Week 12	Equilibrium Constant, LeChâtelie
Week 13	Acids, Bases, Salts
Week 14	Neutralization,Titration
Week 15	ntroduction to Hydrocarbons
Week 16	**Preparatory week before the final Exam**

(Delivery Plan (Weekly Lab. Syllabus المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: There are no laboratory experiments.
Week 2	Lab 1: There are no laboratory experiments.

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	1. Stoker, S.H. General, Organic, and Biological Chemistry, Sixth Edition, 2010. Houghton Mifflin. Boston, Mass. 2 .Bundy, Robert, Castiglia Lab Manual for Fundamenta lChemistry I, Chemistry 101, 2014-2015 Edition	Yes
Recommended Texts		No
Websites		

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

	F – Fail	راسب	(0-44)	Considerable amount of work required

	Ministry of Higher Education and Scientific Research - Iraq University of Tikrit College of Engineering Department of Sustainable Energy Engineering	

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information
معلومات المادة الدراسية

Module Title	اللغة العربية 1	Module Delivery	
Module Type	غير أساسية (داعمة)	محاضرات نظرية	
Module Code	UOT001		
ECTS Credits	2		
SWL (hr/sem)	50		

Module Level	UGI	Semester (s) offered	2
Min number of students	15	Max number of students	100
Administering Department	Sustainable Energy	College	Engineering
Module Leader	Wasna Younis Abdullah	e-mail	Wasna.y.abdullah@tu.edu.iq
Module Leader's Acad. Title	Assistant Lecturer	Module Leader's Qualification	MSc

Module Tutor	Asst. Lecturer Ali Qais Mohammed	e-mail	Ali.aliqais8383@gmail.com
Peer Reviewer Name	Wasna Younis Abdullah	e-mail	Wasna.y.abdullah@tu.edu.iq
Review Committee Approval	9/09/2025	Version Number	3.0

Relation With Other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	لايوجد	Semester	1
Co-requisites module	لايوجد	Semester	-

Module Aims, Learning Outcomes, Indicative Contents and Brief Description	
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر	
Module Aims أهداف المادة الدراسية	1-تطوير المهارات اللغوية وحفظ بعض السور القرآنية وتعزيز حب اللغة لدى الطلبة. 2-فهم كيفية تطبيق القواعد اللغوية في الحياة اليومية، ومعرفة المصطلحات اللغوية في مجالات الهندسة والعلوم. 3-أهمية اللغة العربية في مجالات الحياة اليومية 4-استخدام القواعد اللغوية في كتابة التقارير والأبحاث العلمية بشكل صحيح. 5-تعزيز التعلم الذاتي والاستقلالية في التعلم وتشجيع الطلاب على أخذ مبادرة في تعلم اللغة العربية.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1- فهم القواعد اللغوية وعلامات الترقيم وحفظ السور القرآنية. 2-تطوير المحصلة اللغوية لدى الطلبة من خلال تعلم الشعر والقواعد اللغوية بشكل صحيح. 3-تغطية معظم المواضيع اللغوية التي يحتاجها المهندس في مسيرته العملية 4-التدرب على الحفظ والنطق الصحيح لبعض السور القرآنية بالإضافة إلى التدرب على قراءة الشعر العربي وتعلم واستخدام قواعد اللغة العربية 5- الممارسات المتكررة لشرح المادة النظرية واستخدام الآلات والوسائل الحديثة بشرح المادة مع ضمان ملائمة المادة النظرية للاحتياجات الواقعية
Indicative Contents المحتويات الإرشادية	يتضمن المحتوى الارشادي ما يأتي: 1- من سورة البقرة الآيات من 260-263(2 ساعة). 2- من الحديث النبوي الشريف (2 ساعة). 3- معلقة عمرو بن كلثوم (2 ساعة). 4- سبعة أبيات من بائية ابن الرومي (2 ساعة).

	5- القيم الإنسانية في الشعر الجاهلي (2 ساعة).
	6- الميزان الصرفي (2 ساعة).
	7- تصريف الأفعال (الصحة والاعتلال) (2ساعة).
	8- احكام كتابة علامات الترقيم (2 ساعة).
	9- أحكام كتابة الهمزة (2ساعة).
	10- أقسام الكلام وعلامات إعرابها (2 ساعة).
	11- النواسخ (2 ساعة).
	12- المدارس المعجمية (2 ساعة).
	13- معاني الألفاظ الغريبة في القرآن الكريم (2 ساعة).
	14- علم البيان (تعريفه وأنواعه (2 ساعة).
Course Description	تهدف هذه المادة إلى تعريف الطلبة باللغة العربية بوصفها لسان العرب، ولغة سامية حيّة تميزت بنظام صوتي وصرفي ونحوي وتركيبي دقيق، وهي اللغة التي نزل بها القرآن الكريم ولا يُفهم على وجهه الصحيح إلا من خلالها. ويركز المقرر على تنمية مهارات الطلبة الأساسية في القراءة السليمة، والكتابة الصحيحة، وضبط قواعد الإملاء وعلامات الترقيم، إلى جانب التذوق الأدبي للنصوص القرآنية والشعرية المختارة من التراث القديم والحديث. كما يسعى المقرر إلى ربط الطالب بهويته اللغوية والثقافية، وتمكينه من توظيف العربية في حياته الجامعية والمهنية على نحو فعّال.
Learning and Teaching Strategies	
استراتيجيات التعلم والتعليم	
Strategies	ان استراتيجية التعلم هي أسلوب تعليمي يعتمد على إعادة تنظيم المعلومات وتكييفها بطريقة تمكن من الوصول إلى معلومات جديدة، وتتميز هذه الاستراتيجية بأنها تجعل الطالب نشطاً وايجابياً ودورنا يتمثل في دور الموجه والمرشد والمخطط وهذا يُمكّن من اكتشاف المعرفة بسلاسة من قبل الطلاب.

Student Workload (SWL)			
الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **30 In class lectures** **3 In class tests**	31	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	19	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	1.2
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	50		

Module Evaluation تقييم المادة الدراسية					
As		Time (hr)	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	4	20% (20)	3, 5, 7،، ،9,11,13	LO #1, 2,3،4.......، ،،11
	Assignments (Homeworks)	6	10% (10)	2, 4, 6،10,12,14	LO # 1, 2, 3, 4.......،،11
	Discussions	7	5% (5)	Continuous	
	Seminar	3	5%(5)		
Summative assessment	Midterm Exam	2	10% (10)	8	-LO # 1،7
	Final Exam	3	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
Week	Material Covered
Week 1	سورة البقرة من الآيات 260-263
Week 2	حديث نبوي شريف
Week 3	أبيات من معلقة عمرو بن كلثوم
Week 4	سبعة أبيات من بائية ابن الرومي
Week 5	القيم الإنسانية في الشعر الجاهلي
Week 6	الميزان الصرفي
Week 7	تصريف الأفعال (الصحة والاعتلال)
Week 8	امتحان نصف الفصل
Week 9	أقسام الكلام وعلامات إعرابها
Week 10	أحكام كتابة علامات الترقيم
Week 11	أحكام كتابة الهمزة

Week 12	المدارس المعجمية
Week 13	معاني الألفاظ الغريبة في القرآن الكريم
Week 14	النواسخ
Week 15	علم البيان (تعريفه وأنواعه)
Week 16	**امتحان نهاية الفصل**

Learning and Teaching Resources		
مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	**اللغة العربية لأقسام غير الاختصاص**	Yes
Recommended Texts	**التفسير الوسيط أ.د. وهبة الزحيلي** **المنهاج في القواعد والإعراب: محمد الأنطاكي**	No
Websites	N/A	

APPENDIX:

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

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

Ministry of Higher Education and
Scientific Research - Iraq
University of Tikrit
College of Engineering
Department of Sustainable Energy
Engineering

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information
معلومات المادة الدراسية

Module Title	FLUİD MECHANİCS	**Module Delivery**
Module Type	CORE	✓☐ Theory ✓☐ Lecture ✓☐ Lab ✓☐ Tutorial ✓☐ Practical ✓☐ Seminar
Module Code	SE-ENG-201	
ECTS Credits	5	
SWL (hr/sem)	125	

Module Level	UGII	**Semester (s) offered**	3
Administering Department	Sustainable Energy Engineering	**College**	Engineering
Module Leader	Seenaa Khudhayre Salman	**e-mail**	s.khudhayre@tu.edu.iq
Module Leader's Acad. Title	Lecturer	**Module Leader's Qualification**	MSc
Module Tutor		**e-mail**	
Peer Reviewer Name	-	**e-mail**	-
Review Committee Approval	9/09/2025	**Version Number**	1.0

Relation With Other Modules
العلاقة مع المواد الدراسية الأخرى

Prerequisite module	Math-101, Math-102	**Semester**	1,2

Co-requisites module	None		Semester	-

Module Aims, Learning Outcomes, Indicative Contents and Brief Description
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر

Module Aims أهداف المادة الدراسية	**The course objective is:** 1. Provide the students with the fundamental physical and analytical principles of fluid mechanics through the understanding of the: conservation of mass, conservation of energy, and the conservation of momentum equations. 2. It is implied that the student will be able to correctly apply the course content to new situations to evaluate potential industrial applications of fluid theory through physical induction and mathematical analysis/computation. 3. The Statement of the importance of studying fluids for the students in practical life with the derivation of mathematical formulas that govern the movement of fluids. 4. The understanding from the students and benefiting from this subject to the fullest extent in daily life for different scopes.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	**On successful completion of this course, the students should be able to:** 1. Be familiar with the terminology associated with fluid mechanics and fluid flow states such as (stable or unstable, regular or irregular, laminar or turbulent) in various applications. 2. To understand the methods of pressure measurement and hydrostatic forces on plane surfaces and curved Surface. 3. To understand the basic concepts of statics and fluid dynamics and their various engineering applications with calculations of fluid forces on submerged and floating surfaces. 4. To learn the basic analysis of fluid motion in two cases the rigid body and fluid Rotating in the Cylindrical Containers. 5. Adjusting the practical aspects of this course-1 "Principles of Fluid Mechanics" through laboratory sessions (practical tests) by Interpreting experimental and test results and presenting these in an appropriate engineering report format.
Indicative Contents المحتويات الإرشادية	**Indicative content includes the following.** • Introduction of Fluid Mechanics Principles. • Units and Scales of Pressure Variation Measurement Fluid Properties. • Hydrostatic Forces on Plane Surfaces and Curved Surface. • Buoyancy Force and Stability of Floating and Submerged Bodies. • Fluids in Rigid-Body Motion, and Rotation in a Cylindrical Container.
Course Description	The course begins with the material properties of fluids. This is followed by studying fluid statics including pressure measurement, hydrostatics and buoyancy. Then study the principles of fluid motion including mass conservation (the continuity equation) and energy conservation (Bernoulli's equation). Next, this course description provides a necessary summary of the most important characteristics of the course and the learning outcomes expected of the student to achieve. Also, the demonstrates whether he has made the most of the available learning opportunities. Besides, It should be linked to the program description. In addition, this course is provided to engineering students with basic skills in fluid mechanics. It provides a clear and thorough demonstration of the theory and application of hydrodynamics equations. Among the main concepts that are covered in this course are pressure, velocity, discharge of flow, laminar, and turbulent flow.

Learning and Teaching Strategies	
استراتيجيات التعلم والتعليم	
Strategies	The module will use a range of learning and teaching strategies, including: - **Lectures**: To provide students with an overview of the main concepts and principles in the fluid mechanic's field. This can be achieved by giving lectures, Reading methodology and sourcebooks viewing some websites (self-learning), and Discussion in the classroom. - **Labs**: To provide students with hands-on experience of fluid applications by testing the fluid devices practically. - **Assignments and Quizzes:** To provide students with opportunities to apply their knowledge and skills to real-world problems and check their understanding by achieving the Monthly and final exams, Short tests and participation in the classroom, Submission of scientific and theoretical reports, and the student's performance in the Laboratory.

Student Workload (SWL)				
الحمل الدراسي للطالب				
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** 28 **In class tests** 3 **Discussions** 28 **Laboratory hours** 14	73	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا		4.9
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Library, dorm, home memorizing** 24 **Preparation for tests** 18 **Homework's** 10	52	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا		3,4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**125**			

Module Evaluation					
تقييم المادة الدراسية					
		Time (No.)	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	10% (5)	5, 14	LO #1, 2, 3 and 4
	Online Assignments	5	5% (1)	2, 4, 9, 11, 13	LO # 1, 2, 3 and 4
	Onsite Assignments	2	4% (2)	6, 12	LO # 1, 2, 3 and 4
	Lab	3	15 % (5)	Continuous	LO # 1, 2, 3 and 5
	Seminar	1	6 % (6)	10	LO # 1, 2, 3, and 4
Summative assessment	**Midterm Exam**	1	10% (10)	7	LO # 1, and 2
	Final Exam	1	50% (50)	16	All
Total assessment		100% (100 Marks)			

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction of Fluid Mechanics Principles
Week 2	Application Areas of Fluid Mechanics.
Week 3	Classification Of Fluid Flows.
Week 4	Pressure Variation in Static Fluid.
Week 5	Fluids at rest state and pressure applications
Week 6	Fluids at rest state and pressure applications
Week 7	**Midterm**
Week 8	Forces on submerged bodies and surfaces
Week 9	Fluid acceleration and their relative motion
Week 10	Buoyancy Force
Week 11	Stability of Floating and Submerged Bodies.
Week 12	Introduction to Fluid in Rigid-Body Motion
Week 13	Introduction to Fluid in Rigid-Body Motion
Week 14	Continuity equation
Week 15	Fluid motion equations and applications
Week 16	**Final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: **Rotameter Calibration** (Group A)
Week 2	Lab 2: Rotameter Calibration (Group B)
Week 3	Lab 3: Rotameter Calibration (Group C)
Week 4	Lab 4: Rotameter Calibration (Group D)
Week 5	**Midterm exam of Lab tests**
Week 6	Lab **5**: **Center of Pressure** (Group A)
Week 7	Lab 6: Center of Pressure (Group B)
Week 8	Lab 7: Center of Pressure (Group C)
Week 9	Lab 8: Center of Pressure (Group D)
Week 10	Lab **9**: **Bernoulli equation** (Group A)
Week 11	Lab 10: Bernoulli equation (Group B)
Week 12	Lab 11: Bernoulli equation (Group C)
Week 13	Lab 12: Bernoulli equation (Group D)

Week 14	Final Exam of Lab tests

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Fluid Mechanics Fundamentals and Applications, Yunus A. Cengel, John M. Cimbala.	No
Recommended Texts	1-Fluid Mechanics-Victor Lyle Streeter 2-FLUID MECHANICS WITH ENGINEERING APPLICATIONS BY ROBERT L DAUGHERTY	-
Websites	1. Fundamentals of Fluid Mechanics, Munson, Young, Okiishi. 2. Introduction to Fluid Mechanics, Fox, and McDonald. 3.https://www.youtube.com/watch?v=fa0zHI6nLUo&list=PLbMVogVj5nJTZJHsH6uLCO00I-ffGyBEm	

APPENDIX:

GRADING SCHEME
مخطط الدرجات

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

Note:

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

Ministry of Higher Education and
Scientific Research - Iraq
University of Tikrit
College of Engineering
Department of Sustainable Energy
Engineering

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	THERMODYNAMICS I	**Module Delivery**	
Module Type	CORE	**Theory** **Lecture** **Tutorial** **Practical** **Seminar**	
Module Code	SE-ENG-202		
ECTS Credits	5		
SWL (hr/sem)	125		
Module Level	UGII	**Semester (s) offered**	3
Administering Department	Sustainable Energy Engineering	**College**	Engineering
Module Leader	Israa Sami Farhan	**e-mail**	israa.s.farhan@tu.edu.iq
Module Leader's Acad. Title	Lecturer	**Module Leader's Qualification**	Ph.D.
Module Tutor		**e-mail**	
Peer Reviewer Name		**e-mail**	
Review Committee Approval	01/09/2025	**Version Number**	1.0

Relation With Other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module		**Semester**	-
Co-requisites module		**Semester**	-
Module Aims, Learning Outcomes, Indicative Contents and Brief Description			

	أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر
Module Aims أهداف المادة الدراسية	-To cover the *basic principles* of thermodynamics -To present a wealth of real-world engineering examples to give students a feel for how thermodynamics is applied in engineering practice. -To develop an intuitive understanding of thermodynamics by emphasizing the physics and physical arguments
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of this course students will be able to: 1. Understand the principles of thermodynamics, develop the schematic diagram for the system, and apply energy balance models to develop governing equations. 2. Set up and solve for engineering thermal systems according to first and second law of thermodynamics 3. Understand the energy conversion and where it is used. 4. Understand the approach for open and closed systems and its practical applications.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. • Introduction to thermodynamics (6hrs) • The first law of thermodynamics is introduced, energy, energy transfer and general energy analysis (6hrs) • A general understanding of various forms of energy, mechanical of energy transfer, the concepts of energy balance, thermo-economics, energy conversion, and conversion efficiency using familiar setting that involve mostly electrical and mechanical forms of energy. (6hrs) • Exposes students to some exciting real-world applications of thermodynamics early in this course, and helps them establish a sense of the monetary value of energy(9hrs) • Steam formations and steam tables (6hrs) • Enthalpies, internal energies in thermodynamics open and closed systems (9hrs)
Course Description	Thermodynamics is an exciting and fascinating subject that deals with energy, which is essential for sustenance of life, and thermodynamics has long been an essential part of engineering curricula all of the world. It has a broad application area ranging from microscopic organisms to common household appliances, transportation vehicles, power generation systems, this course contains sufficient material for fundamental and principles of thermodynamics.

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	The learning and teaching **strategy** is designed to: Carefully cover in lectures the necessary fundamental material and analytical techniques, and demonstrate concepts with appropriate (and where possible practical) examples Allow students adequate time to practice the techniques using a large number of carefully selected tutorial problems.

Student Workload (SWL)

الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	73	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4.9
In class lectures 28 **Lab.** 28 **Tut.** 14 **In class tests** 3			
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	52	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.4
home memorizing 17 **Prepartion for tests** 15 **Homeworks** 10 **Report** 10			
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation
تقييم المادة الدراسية

		No	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	10% (5)	All	LO# 1,2
	Online assignments	2	8% (4)	All	LO#2
	Project	1	4%(4)		LO#3
	Onsite assignments	2	8% (4)		LO#4
	Lab.	2	10% (5)		LO#(1-4)
Summative assessment	**Midterm Exam**	1	10% (10)	7	LO # (1-4)
	Final Exam	1	50% (50)	16	LO# (1-4,)
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	Basic concepts related to thermodynamics, introduction, definition of engineering thermodynamics, definition of thermodynamics
Week 2	Definition of thermodynamic laws, thermodynamic systems
Week 3	Thermodynamic systems, system, boundary, and surroundings, closed system, open system. control volume and control surface, isolated system, adiabatic system, macroscopic and microscopic approach, thermodynamic equilibrium, properties of systems, state, process, non-flow process and flow processes, cycle.
Week 4	Point functions, path functions, temperature, Zeroth-law of thermodynamics, pressure, definition of pressure, gauge pressure, vacuum pressure and absolute of pressure, units of pressure, manometer, barometer, U-Tube manometer, reversible and irreversible processes, energy, work and heat, reversible work

Week 5	Tutorial sheets
Week 6	The first-law of thermodynamic and its applications, corollaries of the first-law of thermodynamics, perpetual motion machine of the first kind(PMM1), the perfect gas, Boyle's law, Charle's law, the characteristic equation of gas, Avogadro's hypothesis.
Week 7	Midterm exam
Week 8	Specific heats, Joule's law, internal energy, enthalpy, forms of energies.
Week 9	Applications of first-law of thermodynamics to non-flow processes, steady non-flow energy equation, reversible constant-volume process(Isochoric process), reversible constant-pressure process(Isobaric process), constant temperature process(or Isothermal process), adiabatic process, polytropic process, relationship between T-V-P.
Week 10	Applications of first-law to steady-flow processes, steady-flow energy equation, engineering applications of steady flow-energy equation, water turbine, steam or gas turbine, centrifugal water pump, centrifugal compressor, reciprocating compressor.
Week 11	Steam and two-phase systems, the formation of steam, saturation of temperature and pressure, the triple point
Week 12	Enthalpy and the formation of steam at constant pressure, steam tables, reference state of tables, liquid enthalpy, enthalpy of evaporation, enthalpy of dry saturated vapor, enthalpy of superheated vapor
Week 13	Temperature-enthalpy diagram, volume of steam, volume of water, volume of dry saturated steam, volume of wet steam, volume of superheated steam, the internal energy of steam
Week 14	Dryness fraction of wet steam, Examples
Week 15	Summary of subject course
Week 16	**Final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Boyle's Law
Week 2	Discussions
Week 3	Measuring the ratio between the two specific heats(γ)
Week 4	Discussions
Week 5	The relationship between saturation pressure and temperature of water vapor
Week 6	Discussions
Week 7	Reports Discussion

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Cengel, Y., & Thermodynamics: An engineering Approach, 5*th*	Yes

	edition.	
Recommended Texts	Michael J. Moran et al"Fundamentals of Engineering Thermodynamics", 9th edition	Yes
Websites	-	

APPENDIX:

<table>
<tr><td colspan="5">GRADING SCHEME
مخطط الدرجات</td></tr>
<tr><td>Group</td><td>Grade</td><td>التقدير</td><td>Marks (%)</td><td>Definition</td></tr>
<tr><td rowspan="5">Success Group (50 - 100)</td><td>A – Excellent</td><td>امتياز</td><td>90 – 100</td><td>Outstanding Performance</td></tr>
<tr><td>B - Very Good</td><td>جيد جدا</td><td>80 – 89</td><td>Above average with some errors</td></tr>
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<tr><td rowspan="2">Fail Group (0 – 49)</td><td>FX – Fail</td><td>مقبول بقرار</td><td>(45-49)</td><td>More work required but credit awarded</td></tr>
<tr><td>F – Fail</td><td>راسب</td><td>(0-44)</td><td>Considerable amount of work required</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="5">Note:</td></tr>
<tr><td colspan="5">NB Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.</td></tr>
</table>

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information
معلومات المادة الدراسية

Module Title	HEAT TRANSFER I	Module Delivery	
Module Type	CORE	Theory Lecture Tutorial Practical Seminar	
Module Code	SE-ENG-203		
ECTS Credits	5		
SWL (hr/sem)	125		

Module Level	UGII	Semester (s) offered	3
Administering Department	Sustainable Energy	College	Engineering
Module Leader	Dr. Tadahmun A. Yassen	e-mail	tadahmunahmed@tu.edu.iq
Module Leader's Acad. Title	Professor	Module Leader's Qualification	Ph.D.
Module Tutor	Asst Prof , Dr. Hussam Sami Dheyab	e-mail	hussam.sami@tu.edu.iq
Peer Reviewer Name		e-mail	
Review Committee Approval	01/10/2025	Version Number	1.0

Relation With Other Modules
العلاقة مع المواد الدراسية الأخرى

Prerequisite module		Semester	-

Co-requisites module		Semester	-

Module Aims, Learning Outcomes, Indicative Contents and Brief Description
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر

Module Aims أهداف المادة الدراسية	This course provides a comprehensive introduction to heat transfer fundamentals and their applications. The course introduces students to the analysis of steady-state and transient one- and multi-dimensional heat conduction.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of this course students will be able to: 5. Understand a thermal system, develop the schematic diagram for the system, and apply energy balance and heat transfer models to develop governing equations. 6. Set up and solve for heat transfer rates as a function of geometry and materials in 1-D conduction using various tools: I. Material properties II. Fourier's Law III. Circuit Analogy 7. Estimate heat transfer from Extended Surfaces, Radial Geometry, and involving Energy Generation. 8. Construct a transient heat transfer analysis, testing for the lumped capacitance approximation and understanding the assumptions. 9. Understand the approach for setting up numerical analysis for 2-D conduction heat transfer.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. • Introduction to heat transfer (6hrs) • One-dimension steady state conduction without heat generation (6hrs) • One-dimension steady state conduction with heat generation (6hrs) • Heat transfer from extended surfaces (9) • Transient one dimension conduction(6hrs) • Two dimensions conduction (9hrs)
Course Description	This is the first course in heat transfer, with an emphasis on understanding the fundamental physics underlying different heat transfer processes, making proper approximations for analytical heat transfer calculations and numerical methods for engineering heat transfer analysis. Topics include: introduction to three modes of heat transfer, thermal resistance network analysis, steady-state conduction, transient conduction, numerical methods for heat conduction

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	The learning and teaching **strategy** is designed to: Carefully cover in lectures the necessary fundamental material and analytical techniques, and demonstrate concepts with appropriate (and where possible practical) examples Allow students adequate time to practice the techniques using a large number of carefully selected tutorial problems.

Student Workload (SWL)				
الحمل الدراسي للطالب				
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** **70** **In class tests** **3**		73	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4.9
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Library, dorm, home memorizing 22** **Prepartion for tests** **20** **Homeworks** **10**		52	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل		125		

Module Evaluation					
تقييم المادة الدراسية					
		Time (hr)	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	1	10% (10)	All	All
	Assignments	5	30% (30)	All	All
Summative assessment	**Midterm Exam**	2	10% (10)	7	LO # 1-3
	Final Exam	3	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction to Heat transfer
Week 2	Introduction to Heat transfer
Week 3	Steady state one dimension conduction in plane wall without heat generation
Week 4	Steady state one dimension conduction in cylinder and sphere without heat generation
Week 5	Steady state one dimension conduction in plane wall with heat generation
Week 6	Steady state one dimension conduction in cylinder and sphere with heat generation
Week 7	Midterm exam
Week 8	Extended surfaces (Fins), fin general conduction analysis

Week 9	Fin efficiency
Week 10	Fin effectiveness
Week 11	Critical thickness of insulation
Week 12	Steady state two-dimensions conduction, numerical analysis
Week 13	Steady state two-dimensions conduction, numerical analysis
Week 14	Unsteady state conduction, lamped heat capacity system
Week 15	Transient heat flow in a semi-infinite solid
Week 16	**Final Exam**

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

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Cengel, Y., & Heat, T. M. (2003). A practical approach. *Second edi*.	Yes
Recommended Texts	Holman, J. P. (2010). Heat transfer. Bergman, T. L., Lavine, A. S., Incropera, F. P., & DeWitt, D. P. (2011). *Introduction to heat transfer*. John Wiley & Sons.	No
Websites		

APPENDIX:

GRADING SCHEME مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group	**A –** Excellent	امتياز	90 – 100	Outstanding Performance

(50 - 100)	**B -** Very Good	جيد جدا	80 – 89	Above average with some errors
	C – Good	جيد	70 – 79	Sound work with notable errors
	D – Satisfactory	متوسط	60 – 69	Fair but with major shortcomings
	E – Sufficient	مقبول	50 – 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	مقبول بقرار	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note:

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

Ministry of Higher Education and
Scientific Research - Iraq
University of Tikrit
College of Engineering
Department of Sustainable Energy
Engineering

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information		
معلومات المادة الدراسية		

Module Title	ENGINEERING ANALYSIS I		**Module Delivery**	
Module Type	BASIC			
Module Code	MATH-201		**Theory** **Lecture** **Tutorial** **Practical**	
ECTS Credits	6			
SWL (hr/sem)	150			
Module Level	UGll	**Semester (s) offered**	3
Administering Department	Sustainable Energy	**College**	Engineering
Module Leader	Dr. Hamza R. Yaseen	**e-mail**	hamza.r.yaseen94@tu.edu.iq

Module Leader's Acad. Title	Lecturer	Module Leader's Qualification	Ph.D.
Module Tutor		e-mail	
Peer Reviewer Name		e-mail	
Review Committee Approval	01/09/2025	Version Number	1.0

Relation With Other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	MATH-101, MATH-102	Semester	1,2
Co-requisites module	None	Semester	-

Module Aims, Learning Outcomes, Indicative Contents and Brief Description
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر

Module Aims أهداف المادة الدراسية	The aim of this module is to develop students' mathematical knowledge with a comprehensive understanding of the mathematics used in mechanical engineering and develop the necessary skills for its use. This module also aims to equip students with the knowledge and skill to be able to analyze a variety of engineering systems. Through a combination of practical mechanical engineering applications and theoretical knowledge. This module equips students with the necessary foundation to pursue further studies in mechanical engineering.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of the module, the students will be able to: 1. Explain basic concepts of mathematical modeling and engineering analysis. 2. Identify the type of analysis suitable for the solution of an engineering problem with their respective advantages and limitations. 3. Recognize and explain equations governing typical engineering problems. 4. Demonstrate knowledge and understanding of mathematical principles necessary to underpin their education across mechanical engineering. 5. Enable students to apply mathematical methods, tools, and notations proficiently in the analysis and solution of mechanical engineering problems.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. • First Order Ordinary Differential Equation • Second Order Ordinary Differential Equations • Simultaneous Linear Differential Equations • Special Functions.
Course Description	This course will cover a range of engineering analysis techniques related to the first and second differential and then utilizes it to solve problems in mechanical engineering applications, methods for solving differential equations are discussed. The course also includes power series solutions,

	special functions, and Laplace transforms and utilizes it to solve the differential equation. Fourier series and separation of variables are also introduced.

Learning and Teaching Strategies	
استراتيجيات التعلم والتعليم	
Strategies	The learning and teaching strategy is designed to introduce engineering analysis through theory with work examples carried out by the students. This is carefully delivered through lectures including question and answer sessions, demonstrating captured content, problem-solving, tutorial classes, and project methods with the students conducting a coursework assignment.

Student Workload (SWL)			
الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** 56 **In class tests** 3 **Online** 28	87	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5.8
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Library, dorm, home memorizing** 28 **Preparation for tests** 25 **HomeWorks** 10	63	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.2
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**150**		

Module Evaluation					
تقييم المادة الدراسية					
		(No.)	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	3	15% (5)	2, 5, 9	LO #1, 2, 3, and 4
	Onsite Assignments	2	10% (5)	4, 12	LO # 1, 2, 3, 4, 5 and 6
	Online Assignments	2	10% (5)	3, 11	LO # 2, 3, 4, 5 and 6
	Seminars	1	5% (5)	13	LO # 2, 3, 5, and 6
Summative assessment	**Midterm Exam**	1	10% (10)	7	LO # 1-3
	Final Exam	1	50% (50)	16	All
Total assessment			100% (100 Marks)		

<table>
<tr><th colspan="2">Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري</th></tr>
<tr><td></td><td>Material Covered</td></tr>
<tr><td>Week 1</td><td>First Order Ordinary Differential Equations</td></tr>
<tr><td>Week 2</td><td>-Separable Equations</td></tr>
<tr><td>Week 3</td><td>- Linear Equations</td></tr>
<tr><td>Week 4</td><td>- Exact Equations</td></tr>
<tr><td>Week 5</td><td>Second Order Ordinary Differential Equations
Homogeneous</td></tr>
<tr><td>Week 6</td><td>Non- Homogeneous (un-determent Coefficient, Variation of Parameter)</td></tr>
<tr><td>Week 7</td><td>Midterm exam</td></tr>
<tr><td>Week 8</td><td>Homogeneous Equations Higher Order, The Euler Cauchy Differential Equations,</td></tr>
<tr><td>Week 9</td><td>Power Series Solutions</td></tr>
<tr><td>Week 10</td><td>Simultaneous Linear Differential Equations</td></tr>
<tr><td>Week 11</td><td>Simultaneous Linear Differential Equations</td></tr>
<tr><td>Week 12</td><td>Special Functions: -Gamma Function</td></tr>
<tr><td>Week 13</td><td>Special Functions: -Gamma Function</td></tr>
<tr><td>Week 14</td><td>Special Functions: -Euler Beta Function</td></tr>
<tr><td>Week 15</td><td>Special Functions: -Euler Beta Function</td></tr>
<tr><td>Week 16</td><td>Final Exam</td></tr>
</table>

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Advanced Engineering Analysis C. Ray Wylie	Yes
Recommended Texts	Advanced Engineering Mathematics, Kreyszig Kreyszig, 10th Edition, John Wiley & Sons, Inc	No
Websites	https://www.thriftbooks.com/w/advanced-engineering-mathematics_clarence-raymond-wylie/327947/#edition=3546946&idiq=4215961	

APPENDIX:

GRADING SCHEME
مخطط الدرجات

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Ministry of Higher Education and
Scientific Research - Iraq
University of Tikrit
College of Engineering
Department of Sustainable Energy
Engineering

MODULE DESCRIPTOR

وصف المادة الدراسية

Module Information		
معلومات المادة الدراسية		

Module Title	ENGINEERING MATERIALS	Module Delivery
Module Type	CORE	**Theory** **Lecture** **Tutorial** **Practical** **Seminar**
Module Code	SE-ENG- 204	
ECTS Credits	4	
SWL (hr/sem)	100	

Module Level	UGII	Semester (s) offered	3
Min number of students	15	Max number of students	100

Administering Department	Sustainable Energy	College	Engineering	
Module Leader	Dr. Mohanad L. Hamada	e-mail	muhanad-lateef@tu.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	01/09/2025	Version Number	1.0	

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

Module Aims, Learning Outcomes, Indicative Contents and Brief Description
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر

Module Aims أهداف المادة الدراسية	Students will gain a basic knowledge of metals, polymers, and ceramics, along with some aspects of nanomaterials. Students will also learn the fundamental properties of materials, along with the fundamental aspects of phase diagrams and the concepts of degradation and failure.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	6. Describe various kinds of materials (metals, polymers, and ceramics), and account for their characteristics. 7. Account for the relationship between the structure and some mechanical properties of various materials. 8. Determine contributions of various strengthening mechanisms, including solid solution strengthening, precipitation strengthening, and strain hardening. 9. Understand the relations between the composition, temperature and phase fractions applied to equilibrium phase diagrams for given material systems.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. • Introduction to material science (2 hrs) • Atomic Structure and Bonding (Atomic Structure, Bonding Types and correlations with properties) (8 hrs) • Material Building Blocks (22 hrs) • Mechanical Properties, Deformation, and Strengthening Mechanisms (12 hrs) • Phase Diagrams and Diffusion (6 hrs) • Materials Failure (6 hrs)
Course Description	This course aims to establish fundamental knowledge of Engineering

	Materials. Presentation of the course starts with principles of bonding, structure, and structure/property relationships for metals and their alloys, ceramics, polymers and composites. Emphasis on properties and how processes change structure. Study deeply the phase diagrams, diffusion and materials failure

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	The learning and teaching **strategy** is designed to: Carefully cover in lectures the necessary fundamental material and analytical techniques, and demonstrate concepts with appropriate (and where possible practical) examples Allow students adequate time to practice the techniques using a large number of carefully selected tutorial problems.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل		Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	
In class lectures and lab	22		
In class tests	5	59	4.0
Seminars	2		
Laboratory	30		
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل		Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	
Library, dorm, home memorizing	13		
Preparation for tests	15	41	2.7
Homework	13		
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل		100	

Module Evaluation
تقييم المادة الدراسية

		Time (hr)	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5, 10, 12, 14	LO #1, 2, 3, and 4
	Assignments	6	18% (18)	2, 4, 6, 8, 10, 12	LO # 1, 2, 3, and 4
	Seminars	4	12% (12)	Continuous	
Summative assessment	Midterm Exam	2	10% (10)	8	LO # 1-3
	Final Exam	3	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction to material science
Week 2	The structure of crystalline solids
Week 3	Structures of Polymers
Week 4	Imperfections in Solids
Week 5	Introduction to Ceramics
Week 6	Mechanical properties of metals
Week 7	Dislocations and strengthening mechanisms
Week 8	Midterm exam
Week 9	Mechanical Properties: Deformation
Week 10	Mechanical Properties: Strengthening Mechanisms
Week 11	Material Failure
Week 12	Phase diagrams
Week 13	Diffusion
Week 14	Thermal Properties
Week 15	Introduction to Nanomaterials
Week 16	**Final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Prepare a sample for laboratory examination
Week 2	Lab 2: Cooling curve
Week 3	Lab 3: Hardness test
Week 4	Lab 4: The Tensile test
Week 5	Lab 5: The Impact test
Week 6	Lab 6: The Wear test
Week 7	Lab 7: The Bending
Week 8	Lab 8: Heat treating

	Learning and Teaching Resources مصادر التعلم والتدريس	
	Text	**Available in the Library?**
Required Texts	The Science and Engineering of Materials, Third Edition, Donald R. Askeland, Frank Haddleton, Phil Green, Howard Robertson.	Yes
Recommended Texts		No

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

Note:	

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

Ministry of Higher Education and
Scientific Research - Iraq
University of Tikrit
College of Engineering
Department of Sustainable Energy
Engineering

MODULE DESCRIPTOR

وصف المادة الدراسية

Module Information		
معلومات المادة الدراسية		

Module Title	COMPUTER PROGRAMMING	**Module Delivery**
Module Type	SUPLEMENT	☐ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar
Module Code	ENG-105	
ECTS Credits	3	
SWL (hr/sem)	75	

Module Level	UGII	**Semester (s) offered**	3
Administering Department	Sustainable Energy	**College**	Engineering
Module Leader	Jalal Nazar Abdulbaqi	**e-mail**	jalal.abdulbaqi@tu.edu.iq
Module Leader's Acad. Title	Lecturer	**Module Leader's Qualification**	Ph.D.
Module Tutor	Noor saeed saleh	**e-mail**	noor.s.saleh@tu.edu.iq
Peer Reviewer Name		**e-mail**	
Review Committee Approval	01/09/2025	**Version Number**	1.0

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

Module Aims, Learning Outcomes, Indicative Contents and Brief Description	
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر	
Module Aims أهداف المادة الدراسية	• To introduce students to the Python programming language and its syntax. • To provide students with an understanding of the conditional and iteration statements used in programming. • To enable students to design and implement functions to solve programming problems. • To introduce students to the basic data structures of Python, including lists, tuples, dictionaries, and sets. • To provide students with an understanding of string manipulation and regular expressions in Python.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Demonstrate an understanding of the Python programming language and its syntax. 2. Design and implement conditional and iteration statements in Python. 3. Design and implement functions to solve programming problems. 4. Demonstrate an understanding of the basic data structures of Python, including lists, tuples, dictionaries, and sets. 5. Demonstrate an understanding of string manipulation and regular expressions in Python. 6. Demonstrate an understanding of how to deal with files and exceptions.
Indicative Contents المحتويات الإرشادية	• Introduction to Python: syntax, data types, and control structures. • Condition Statements: if, elif, and else statements. • Iteration Statements: for and while loops. • Functions: defining functions and parameter passing. • Lists: creation, indexing, and slicing. • Tuples: creation and unpacking. • Dictionaries: creation and manipulation. • Sets: creation and manipulation. • Strings: creation, manipulation, and regular expressions. • Files: creation, saving and manipulation.
Course Description	This module introduces students to the Python programming language, its syntax, and its use in solving programming problems. The module covers the basic programming concepts of condition statements and iteration statements, along with the design and implementation of functions. The module also covers the basic data structures of Python, including lists, tuples, dictionaries, and sets. The module concludes with an introduction to string manipulation and regular expressions in Python.

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	The module will be delivered through a combination of lectures, assignments, quizzes, and lab sessions. Lectures will provide an overview of the topics, while assignments and quizzes will enable students to apply their knowledge and check their understanding. Lab sessions will provide hands-on experience with Python programming tools and techniques. The module will also include self-directed learning, where students are expected to read and research on their own to enhance their understanding of the subject matter.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	45	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Library, dorm, home memorizing 15** **Prepartion for tests 10** **Homeworks 5**	30	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	2
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	75		

Module Evaluation
تقييم المادة الدراسية

		Time (hr)	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	9% (9)	5,9,11	LO # 1, 3, 6
	Assignments	2	16% (16)	4, 5, 6,9,11	LO # 2, 4, 5
	Lab	14	15% (15)	Continuous	
Summative assessment	**Midterm Exam**	1.5	10% (10)	7	LO # 1-3
	Final Exam	3	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الأسبوعي النظري

	Material Covered

Week 1	Introduction to Python: syntax, data types, and control structures
Week 2	Condition Statements: if, elif, and else statements.
Week 3	Iteration Statement: while loop
Week 4	Iteration Statement: for loop
Week 5	Functions: defining functions and parameter passing.
Week 6	Functions: Libraries and their functions
Week 7	Midterm
Week 8	Lists: creation, indexing, and slicing.
Week 9	Tuples: creation and unpacking.
Week 10	Dictionaries: creation and manipulation.
Week 11	Sets: creation and manipulation.
Week 12	Strings: creation, manipulation, and regular expressions.
Week 13	Files
Week 14	Exceptions
Week 15	Array-Oriented Programming with "numpy"
Week 16	Final Exam

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Introduction to Python IDLE + mathematical manipulation
Week 2	Condition Statements
Week 3	Iteration Statements
Week 4	Functions
Week 5	List and Tuples
Week 6	Dictionaries and sets
Week 7	Strings and files

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	*Intro to Python® for Computer Science and Data Science: Learning to Program with AI, Big Data and the Cloud by Paul & Harvey Deitel, 1st Ed, Pearson Education, 2020*	No

Recommended Texts	چِرار سوينُ، ترجمة: هشام رزق الله وآخرون، تعلم البرمجة مع بايثون 3، 2013 ألن داوني، ترجمة طارق زيد الكيالين، فكر بايثون: كيف تفكر كعالم حاسوب، منشورات جرين يت، 2012	No
Websites	Python.org, learnpython.org, realpython.com	

APPENDIX:

GRADING SCHEME مخطط الدرجات				
Group	**Grade**	**التقدير**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A** – Excellent	امتياز	90 – 100	Outstanding Performance
	B - Very Good	جيد جدا	80 – 89	Above average with some errors
	C – Good	جيد	70 – 79	Sound work with notable errors
	D – Satisfactory	متوسط	60 – 69	Fair but with major shortcomings
	E – Sufficient	مقبول	50 – 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	مقبول بقرار	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required
Note:				
NB Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.				

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Engineering

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information		
معلومات المادة الدراسية		
Module Title	اللغة العربية 2	**Module Delivery**
Module Type	غير أساسية(داعمة)	محاضرات نظرية
Module Code	UOT0011	
ECTS Credits	2	
SWL (hr/sem)	50	

Module Level	UGII	**Semester (s) offered**	3
Min number of students	15	**Max number of students**	100
Administering Department	Sustainable Energy	**College**	Engineering
Module Leader	Wasna Younis Abdullah	**e-mail**	Wasna.y.abdullah@tu.edu.iq
Module Leader's Acad. Title	Assistant Lecturer	**Module Leader's Qualification**	MSc
Module Tutor	Asst. Lecturer Ali Qais Mohammed	e-mail	Ali.aliqais8383@gmail.com
Peer Reviewer Name	Wasna younis Abdullah	**e-mail**	Wasna.y.abdullah@tu.edu.iq
Review Committee Approval	9/09/2025	**Version Number**	3.0

Relation With Other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	لايوجد	**Semester**	-
Co-requisites module	لايوجد	**Semester**	-
Module Aims, Learning Outcomes, Indicative Contents and Brief Description			
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر			
Module Aims أهداف المادة الدراسية	1-تطوير المهارات اللغوية وحفظ بعض السور القرآنية وتعزيز حب اللغة لدى الطلبة. 2-فهم كيفية تطبيق القواعد اللغوية في الحياة اليومية، ومعرفة المصطلحات اللغوية في مجالات الهندسة والعلوم. 3ـأهمية اللغة العربية في مجالات الحياة اليومية 4ـاستخدام القواعد اللغوية في كتابة التقارير والأبحاث العلمية بشكل صحيح. 5ـــتعزيز التعلم الذاتي والاستقلالية في التعلم وتشجيع الطلاب على أخذ مبادرة في تعلم اللغة العربية.		
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1- فهم القواعد اللغوية وعلامات الترقيم وحفظ السور القرآنية. 2-تطوير المحصلة اللغوية لدى الطلبة من خلال تعلم الشعر والقواعد اللغوية بشكل صحيح. 3-تغطية معظم المواضيع اللغوية التي يحتاجها المهندس في مسيرته العملية 4-التدرب على الحفظ والنطق الصحيح لبعض السور القرآنية بالإضافة إلى التدرب على قراءة الشعر العربي وتعلم واستخدام قواعد اللغة العربية 5- الممارسات المتكررة لشرح المادة النظرية واستخدام الآلات والوسائل الحديثة بشرح المادة مع ضمان ملائمة المادة النظرية للاحتياجات الواقعية		
Indicative Contents المحتويات الإرشادية	يتضمن المحتوى الارشادي ما يأتي: 1. من سورة الإسراء الآيات من 23-29/ سورة يوسف من 1-7 (2 ساعة) 2. حديث نبوي شريف (2 ساعة) 3. أبيات من قصيدة الشريف الرضي/ ميمية المتنبي (2 ساعة) 4. أبيات لكل من الجواهري (سلام على باسقات النخيل) / السياب (أنشودة المطر) (2 ساعة) 5. الأخطاء اللغوية الشائعة (2 ساعة) 6. أحكام كتابة التاء المفتوحة والمربوطة/ أحكام العدد والمعدود (2 ساعة) 7. كتابة الضاد والظاء/ أحكام كتابة الألف الممدودة والمقصورة (2 ساعة) 8. مراحل جمع اللغة/ منهج مدرستي المقاييس والصحاح (2 ساعة) 9. الأخطاء اللغوية الشائعة (2 ساعة) 10. تصريف الأسماء (الاسم من حيث التذكير والتأنيث) / الفعل المضارع نصبه وجزمه (2 ساعة) 11. علم البديع وأثره في بلاغة الكلام (2 ساعة) 12. المحسنات المعنوية (التورية، الطباق، المقابلة، حسن التعليل، تأكيد المدح بما يشبه الذم) (2 ساعة) 13. المحسنات اللفظية (الجناس، السجع، الاقتباس، التضمين (2 ساعة)		
Course Description	تهدف هذه المادة إلى تعريف الطلبة باللغة العربية بوصفها لسان العرب، ولغة سامية حيّة تميزت بنظام صوتي وصرفي ونحوي وتركيبي دقيق، وهي اللغة التي نزل بها القرآن الكريم ولا يُفهم على وجهه الصحيح إلا من خلالها. ويركز المقرر على تنمية مهارات الطلبة الأساسية في القراءة السليمة، والكتابة الصحيحة، وضبط قواعد الإملاء وعلامات الترقيم، إلى جانب التذوق الأدبي للنصوص القرآنية والشعرية المختارة من التراث القديم والحديث. كما يسعى المقرر إلى ربط الطالب بهويته اللغوية والثقافية، وتمكينه من توظيف العربية في حياته الجامعية والمهنية على نحو فعّال.		

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	ان استراتيجية التعلم هي أسلوب تعليمي يعتد على إعادة تنظيم المعلومات وتكييفها بطريقة تمكن من الوصول إلى معلومات جديدة، وتتميز هذه الاستراتيجية بأنها تجعل الطالب نشطاً وايجابياً ودورنا يتمثل في دور الموجه والمرشد والمخطط وهذا يُمكّن من اكتشاف المعرفة بسلاسة من قبل الطلاب.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** 30 **In class tests** 1	31	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	19	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	1.2
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	50		

Module Evaluation
تقييم المادة الدراسية

		Time (hr)	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	4	20% (20)	3, 5, ,7, 9,11,13,	LO #1, 2,3,4,...... ,11
	Assignments (Homeworks)	6	15% (15)	2, 4, 6, 10,12,14	LO # 1, 2, 3, 4 ,......,11
	Discussions	7	5% (5)	Continuous	
Summative assessment	**Midterm Exam**	2	10% (10)	8	LO # 1-7
	Seminar	5	10(10)		
	Final Exam	3	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	من سورة الإسراء الآيات من 23-29/ سورة يوسف من 1-7
Week 2	حديث نبوي شريف
Week 3	أبيات من قصيدة الشريف الرضي/ ميمية المتنبي

Week 4	أبيات لكل من الجواهري (سلام على باسقات النخيل) / السياب (أنشودة المطر)
Week 5	الأخطاء اللغوية الشائعة
Week 6	أحكام كتابة التاء المفتوحة والمربوطة/ أحكام العدد والمعدود
Week 7	امتحان نصف الفصل
Week 8	كتابة الضاد والظاء/ أحكام كتابة الألف الممدودة والمقصورة
Week 9	مراحل جمع اللغة/ منهج مدرستي المقاييس والصحاح
Week 10	الأخطاء اللغوية الشائعة
Week 11	تصريف الأسماء (الاسم من حيث التذكير والتأنيث) / الفعل المضارع نصبه وجزمه
Week 12	علم البديع وأثره في بلاغة الكلام
Week 13	المحسنات المعنوية (التورية، الطباق، المقابلة، حسن التعليل، تأكيد المدح بما يشبه الذم)
Week 14	المحسنات اللفظية (الجناس، السجع، الاقتباس، التضمين
Week 15	امتحان نهاية الفصل

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	اللغة العربية العامة لأقسام غير الاختصاص	Yes
Recommended Texts	التفسير الوسيط أ.د. وهبة الزحيلي المنهاج في القواعد والإعراب: محمد الأنطاكي	No
Websites	N/A	

APPENDIX:

GRADING SCHEME مخطط الدرجات				
Group	**Grade**	**التقدير**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A** – Excellent	امتياز	90 – 100	Outstanding Performance
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	D – Satisfactory	متوسط	60 – 69	Fair but with major shortcomings
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Fail Group (0 – 49)	**FX** – Fail	مقبول بقرار	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required
Note:				

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

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Engineering

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	THERMODYNAMICS II	**Module Delivery**	
Module Type	CORE	Theory Lecture Tutorial Practical Seminar	
Module Code	SE-ENG-205		
ECTS Credits	6		
SWL (hr/sem)	150		
Module Level	UGII	**Semester (s) offered**	4
Administering Department	Sustainable Energy	**College**	Engineering
Module Leader	Israa Sami Farhan	**e-mail**	israa.s.farhan@tu.edu.iq
Module Leader's Acad.	Lecturer	**Module Leader's**	Ph.D.

Title		Qualification	
Module Tutor		e-mail	
Peer Reviewer Name		e-mail	
Review Committee Approval	01/09/2025	Version Number	1.0

Relation With Other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	SE-ENG-202	Semester	3
Co-requisites module		Semester	-
Module Aims, Learning Outcomes, Indicative Contents and Brief Description			
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر			
Module Aims أهداف المادة الدراسية	-To cover the *second-law of thermodynamics statements* -To present a wealth of real-world engineering examples to give students a feel for how thermodynamics is applied in engineering practice. -To develop an intuitive understanding of thermodynamics by emphasizing the physics and physical arguments		
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of this course students will be able to: 10. Understand the statements of second-law of thermodynamics, Clausius Inequality, PMM1, Heat reservoir, heat source, heat sink. 11. Set up and solve for engineering thermal systems according to second-law of thermodynamics, Carnot cycle, Carnot theorem, corollary of Carnot's theorem, Heat engine cycle, thermal efficiency, 12. Understand the coefficient of performance of reversed heat engine (Refrigerators and heat pumps). 13. Understand the entropy property, reversible, irreversible cycles. 14. Steam and air-standard cycles 15. Chemical reaction, air-fuel ratio, combustion, main and secondary products		
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. - Introduction to second-law of thermodynamics (6hrs) - The second- law of thermodynamics, Carnot cycle, heat engine cycle, reversed heat engine cycle, entropy, are introduced (6hrs) - A general understanding of second-law applications, ideal Rankin cycle, gas power cycle, air-standard cycles. (6hrs) - Exposes students to some exciting real-world applications of thermodynamics early in this course, and helps them establish a sense of the monetary value of energy(9hrs)		
Course Description	Thermodynamics is an exciting and fascinating subject that deals with energy, which is essential for sustenance of life, and thermodynamics has long been an essential part of engineering curricula all of the world. It has a broad application area ranging from microscopic organisms to common household appliances, transportation vehicles, power generation systems, this course contains sufficient material for fundamental and principles of		

	thermodynamics.	

<table>
<tr><td colspan="3">Learning and Teaching Strategies
استراتيجيات التعلم والتعليم</td></tr>
<tr><td>Strategies</td><td colspan="2">The learning and teaching strategy is designed to: Carefully cover in lectures the necessary fundamental material and analytical techniques, and demonstrate concepts with appropriate (and where possible practical) examples Allow students adequate time to practice the techniques using a large number of carefully selected tutorial problems.</td></tr>
</table>

<table>
<tr><td colspan="4">Student Workload (SWL)
الحمل الدراسي للطالب</td></tr>
<tr>
<td>Structured SWL (h/sem)
الحمل الدراسي المنتظم للطالب خلال الفصل

In class lectures   28
In class tests   3
Discussions   14
Tut   14
Laboratory hours   28</td>
<td>87</td>
<td>Structured SWL (h/w)
الحمل الدراسي المنتظم للطالب أسبوعيا</td>
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</tr>
<tr>
<td>Unstructured SWL (h/sem)
الحمل الدراسي غير المنتظم للطالب خلال الفصل

Library, dorm, home memorizing 30
Prepartion for tests   25
Homeworks   8</td>
<td>63</td>
<td>Unstructured SWL (h/w)
الحمل الدراسي غير المنتظم للطالب أسبوعيا</td>
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<tr>
<td>Total SWL (h/sem)
الحمل الدراسي الكلي للطالب خلال الفصل</td>
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<table>
<tr><td colspan="6">Module Evaluation
تقييم المادة الدراسية</td></tr>
<tr>
<td colspan="2"></td>
<td>Time (No.)</td>
<td>Weight (Marks)</td>
<td>Week Due</td>
<td>Relevant Learning Outcome</td>
</tr>
<tr>
<td rowspan="5">Formative assessment</td>
<td>Quizzes</td>
<td>2</td>
<td>10% (10)</td>
<td>5, 14</td>
<td>LO #1, 2, 3 and 4</td>
</tr>
<tr>
<td>Online Assignments</td>
<td>5</td>
<td>5% (1)</td>
<td>2, 4, 9, 11, 13</td>
<td>LO # 1, 2, 3 and 4</td>
</tr>
<tr>
<td>Onsite Assignments</td>
<td>2</td>
<td>4% (2)</td>
<td>6, 12</td>
<td>LO # 1, 2, 3 and 4</td>
</tr>
<tr>
<td>Lab</td>
<td>3</td>
<td>15 % (5)</td>
<td>Continuous</td>
<td>LO # 1, 2, 3 and 5</td>
</tr>
<tr>
<td>Project</td>
<td>1</td>
<td>6 % (6)</td>
<td>10</td>
<td>LO # 1, 2, 3, and 4</td>
</tr>
<tr>
<td rowspan="2">Summative assessment</td>
<td>Midterm Exam</td>
<td>1</td>
<td>10% (10)</td>
<td>7</td>
<td>LO # 1-3</td>
</tr>
<tr>
<td>Final Exam</td>
<td>1</td>
<td>50% (50)</td>
<td>16</td>
<td>All</td>
</tr>
</table>

Delivery Plan (Weekly Syllabus)	
المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Second-law of thermodynamics, introduction, statement of second-law of thermodynamics, Kelvin-Planck statements, Clausius statement, definition of: heat reservoir, heat source, heat sink
Week 2	Cycle efficiency of a heat engine or thermal efficiency, Carnot cycle, Carnot theorem
Week 3	Corollary of Carnot's theorem, coefficient of performance for Refrigerators and heat pumps, the thermodynamic temperature scale.
Week 4	Entropy, introduction, definition of entropy, Inequality of Clausius ,increase of entropy principle
Week 5	Entropy change for a closed system, general case for change of entropy of a gas, heating a gas at constant volume, heating a gas at constant pressure, reversible adiabatic process, polytropic process.
Week 6	Steam cycle, ideal Rankin cycle, first law analysis of vapor power cycle, steady- flow energy equations of power plant units, Pump, Boiler, Turbine, Condenser.
Week 7	Midterm exam
Week 8	Gas power cycles, definition of Air-standard efficiency, air- standard cycles, Carnot cycle.
Week 9	Constant-volume cycle or Otto cycle, constant pressure cycle or Diesel cycle,
Week 10	Dual combustion cycle, Brayton cycle or Joule cycle.
Week 11	Tutorial sheets for example solutions
Week 12	Gas mixtures, introduction, composition of a gas mixtures mass and mole fractions.
Week 13	P-V-T behavior of gas mixtures: Ideal and Real gases, Dalton's law of additive pressures, Amagat's law of additive volumes, properties of gas mixtures: Ideal gases
Week 14	Chemical Reactions, fuel and combustion, theoretical and actual combustion processes, enthalpy of formation and enthalpy of combustion, first-law analysis of reacting systems, adiabatic flame temperature
Week 15	Entropy changes of reacting systems, second-law analysis of reacting systems.
Week 16	**Final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab1: The relationship between saturation pressure and temperature of water vapor (Group A)
Week 2	Lab2: The relationship between saturation pressure and temperature of water vapor (Group B)
Week 3	Lab3: The relationship between saturation pressure and temperature of water vapor (Group C)
Week 4	Lab4: The relationship between saturation pressure and temperature of water vapor (Group D)
Week 5	Midterm Exam of Lab tests
Week 6	Lab5: Specific heats of solids Measuring the ratio between the two specific heats(γ)(Group A)
Week 7	Lab6: Specific heats of solids Measuring the ratio between the two specific heats(γ) (Group B)
Week8	Lab7: Specific heats of solids Measuring the ratio between the two specific heats(γ) (Group C)
Week9	Lab8: Specific heats of solids Measuring the ratio between the two specific heats(γ) (Group D)
Week10	Lab 9: Heat pump (Group A)
Week11	Lab 10: Heat pump (Group B)
Week12	Lab 11: Heat pump (Group C)
Weeh13	Lab12: Heat pump (Group D)
Week14	Final Exam of Lab tests

<table>
<tr><td colspan="3" align="center">**Learning and Teaching Resources**
مصادر التعلم والتدريس</td></tr>
<tr><td></td><td align="center">**Text**</td><td>**Available in the Library?**</td></tr>
<tr><td>**Required Texts**</td><td>Cengel, Y., & Thermodynamics: An engineering Approach, *Seven edi.*</td><td align="center">Yes</td></tr>
<tr><td>**Recommended Texts**</td><td>Applied thermodynamics for engineering technologists, third edi, by T.D.EASTOP</td><td align="center">Yes</td></tr>
<tr><td>**Websites**</td><td></td><td></td></tr>
</table>

APPENDIX:

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

Note:

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

Ministry of Higher Education and
Scientific Research - Iraq
University of Tikrit
College of Engineering
Department of Sustainable Energy
Engineering

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information		
معلومات المادة الدراسية		

Module Title	STRENGTH OF MATERIALS	**Module Delivery**	
Module Type	CORE	✓☐ Theory ✓☐ Lecture ✓☐ Lab ✓☐ Tutorial ✓☐ Practical ✓☐ Seminar	
Module Code	SE-ENG - 206		
ECTS Credits	5		
SWL (hr/sem)	125		

Module Level	UGll	**Semester (s) offered**	4
Administering Department	Sustainable Energy Engineering	**College**	Engineering
Module Leader	Adel Mahmood Bash	**e-mail**	Adelbash@tu.edu.iq
Module Leader's Acad. Title	Prof.	**Module Leader's Qualification**	Ph.D.
Module Tutor		**e-mail**	
Peer Reviewer Name		**e-mail**	
Review Committee Approval	1/9/2025	**Version Number**	1.0

Relation With Other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	SE-ENG-102	**Semester**	1
Co-requisites module	None	**Semester**	-

Module Aims, Learning Outcomes, Indicative Contents and Brief Description
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر

Module Aims أهداف المادة الدراسية	**The course objective is:** 5. Review some of the important principles of statics and show how they are used to determine the internal resultant loadings in a body. Afterwards the concepts of normal and shear stress will be introduced, and specific applications of the analysis and design of members subjected to an axial load or direct shear. 6. The Statement of the importance of studying mechanics of materials for the students in practical life with the derivation of mathematical formulas that govern the deformation of rigid bodies. 7. It is implied that the student will be able to correctly apply the course content to new situations to evaluate potential industrial applications of mechanics of materials through physical induction and mathematical analysis 8. Enable students to develop a comprehensive understanding of the methodology of solving strength of material problems. 9. The course represents an effective tool to introduce machine element design
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	**On successful completion of this course, the students should be able to:** 6. Be familiar with the terminology associated with mechanics of materials such as (stress, strain, shear, torsion, bending….etc) in various applications. 7. To understand the basic concepts of static stress and strain and their various engineering types and applications with calculations. 8. Interpret and analyze the stress and strain in simple structures. 9. The definition of the deformation of a body is specified using the concepts of normal and shear strain, and show how they can be determined for various types of problems. 10. Adjusting the practical aspects of this course, "Mechanics of materials" through laboratory sessions (practical tests) by interpreting experimental test results and presenting these in an appropriate engineering report format.
Indicative Contents المحتويات الإرشادية	**Indicative content includes the following.** 1. Introduction of engineering Mechanics Principles. 2. Units and Scales of stress and strain. 3. Normal stresses and shear stresses, 4. Beams (shear and bending diagrams, stresses on beams, deflection of beams) 5. stresses on an inclined surface, combined stresses, and the solution using analytical and graphical methods 6. the deformation of a body for various types of problems.
Course Description	The course begins with the distinguishing between rigid body mechanics (statics and dynamics) and non-rigid body mechanics (strength of materials). This is followed by studying the effect of internal forces on rigid bodies and their intensities (stresses). Then the study of multi-types of simple stresses i.e. tensile, compressive, shear, bearing, torsion, bending and how to distinguish between these types of stress. Next, this course description provides a necessary summary of the most important characteristics and the learning outcomes expected of the student to achieved. Also, the demonstrates whether has made

	the most of the available learning opportunities. Besides, it should be linked to the program description. In addition, this course is provided to engineering students with basic skills in engineering mechanics. It provides a clear and thorough demonstration of the theory and application of engineering mechanics equations. It's also important to learn the students how to predict the magnitude of deformation (either linear, lateral, or torsional), by using multi-techniques. stresses on an inclined surface, combined stresses, and their analyses using analytical and graphical (Mohr) methods. Finally, a special topic is covered such as, factor of safety and stress concentration effects to made a good introduction to machine design.

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	The learning and teaching **strategy** is designed to: • Carefully covering the necessary fundamental material and analytical techniques, through a comprehensive theoretical analysis • demonstrate concepts with appropriate examples • Allow students adequate time to practice the techniques using a large number of carefully selected tutorial problems. • Provide a practical learning through a well selected lab experiment. • To provide students with opportunities to apply their knowledge and skills to real-world problems and check their understanding by achieving quizzes and exams.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** 40 **In class tests** 3 **Discussions** 15 **Laboratory hours** 15	73	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	4.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Library, dorm, home memorizing** 32 **Preparation for tests** 10 **Homework's** 10	52	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.1
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation
تقييم المادة الدراسية

		Time (No.)	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	10% (5)	5, 14	LO #1, 2, 3 and 4
	Online Assignments	3	6% (2)	2, 4, 9, 11, 13	LO # 1, 2, 3 and 4

	Onsite Assignments	2	4% (2)	6, 12	LO # 1, 2, 3 and 4
	Lab	3	15% (5)	Continuous	LO # 1, 2, 3,4 and 5
	Seminar	1	5% (5)	10	LO # 1, 2, 3, and 4
Summative assessment	**Midterm Exam**	1	10% (10)	7	LO # 1, and 2
	Final Exam	1	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)		
المنهاج الاسبوعي النظري		

	Material Covered
Week 1	Simple stress- Normal stress
Week 2	Shearing stress- Bearing stress
Week 3	Simple strain –Hooks; law (Axial deformation)
Week 4	Shearing Deformation
Week 5	Biaxial Deformation (Poisson's ratio)
Week 6	Statically indeterminate members
Week 7	Mid Tern Exam
Week 8	Thermal stresses and Torsion
Week 9	Torsion- Torsion formulas Torsion
Week 10	Shear and moment in beams
Week 11	Shear and bending moment diagrams
Week 12	Stresses in beams- bending stresses
Week 13	Stresses in beams- bending stresses
Week 14	Unsymmetrical beams
Week 15	Shearing stresses in beams
Week 16	Final Exam

Delivery Plan (Weekly Lab. Syllabus)		
المنهاج الاسبوعي للمختبر		

	Material Covered
Week 1	Lab 1: **Tensile Test** (Group A)
Week 2	Lab 2: Tensile Test (Group B)
Week 3	Lab 3: Tensile Test (Group C)
Week 4	Lab 4: Tensile Test (Group D)
Week 5	**Midterm exam of Lab tests**
Week 6	Lab **5**: **Torsion Test** (Group A)

Week 7	Lab 6: Torsion Test (Group B)
Week 8	Lab 7: Torsion Test (Group C)
Week 9	Lab 8: Torsion Test (Group D)
Week 10	Lab **9**: **Beam Deflection Test** (Group A)
Week 11	Lab 10: Beam Deflection Test (Group B)
Week 12	Lab 11: Beam Deflection Test (Group C)
Week 13	Lab 12: Beam Deflection Test (Group D)
Week 14	**Final Exam of Lab tests**

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	**Mechanics of Materials, Andrew Pytel, Jaan Kiusalaas Second Edition 2011**	Yes
Recommended Texts	**Mechanics of Materials, R. C. Hibbeler, Eighth Edition**	Yes
Websites		

APPENDIX:

GRADING SCHEME
مخطط الدرجات

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

Note:

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

Ministry of Higher Education and
Scientific Research - Iraq
University of Tikrit
College of Engineering
Department of Sustainable Energy
Engineering

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	Economic Energy Management and Ethics	**Module Delivery**	
Module Type	CORE	Theory Lecture Tutorial Seminar	
Module Code	SE-ENG-207		
ECTS Credits	4		
SWL (hr/sem)	100		
Module Level	UGll	**Semester (s) offered**	4
Administering Department	Sustainable Energy Engineering	**College**	Engineering
Module Leader	Manar S.M. Al-Jethelah	**e-mail**	m.aljethelah@tu.edu.iq
Module Leader's Acad. Title	Prof.	**Module Leader's Qualification**	Ph.D.
Module Tutor		**e-mail**	
Peer Reviewer Name		**e-mail**	
Review Committee Approval	2/9/2025	**Version Number**	

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

Co-requisites module	None		Semester	-

Module Aims, Learning Outcomes, Indicative Contents and Brief Description
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر

Module Aims أهداف المادة الدراسية	The aim of this course is provide students of engineering with: • Knowledge of the basic rules and concepts of the solution. • The principles and foundations of the solution of engineering equations. • The principles and foundations of engineering economics and engineering management requirements • Ability to take responsible moral agents, competent and humane professionals, and informed and engaged citizens.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	At the end of this course, the student will be able to 1) Understand economic principles underpinning the demand for, and supply of energy resources. 2) Understand the role of energy policy and efficient and sustainable energy use. 3) Conduct an economic analysis of energy investments 4) Apply economic criteria to determination of prices and taxes in the energy field 5) Define the concept of ethics and explain the general principles of ethics.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. • Economic analysis • Energy demand and supply • Regulation and management • Morals and engineering ethics
Course Description	This course is designed to introduce undergraduate engineering students to the concepts, theory and practice of engineering ethics. It will allow students to explore the relationship between ethics and engineering and apply classical moral theory and decision making to engineering issues encountered in academic and professional careers. Also, this course provides students with the conceptual tools to make autonomous, informed, comprehensive and coherent judgments about personal, professional, and public ethical issues.

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	This course aims to introduce students to energy indicators, basic principles of energy balance, analysis and forecasting energy demand and supply, development and functioning of energy markets, key issues of energy sector, economic aspects of energy-environment relations, regulatory mechanisms and management in domain of energy industries and to provide relevant theoretical methodological and practical knowledge for creating and managing energy policies and strategies. Besides, moral and ethics for engineers will be introduced. Also, students

	will have adequate time to practice the techniques using a large number of carefully selected tutorial problems.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل			Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	
In class lectures	28	59		3.93
Online lectures	14			
Tutorial	14			
In class tests	3			
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل			Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	
Library, dorm, home memorizing	20	41		2.73
Preparation for tests	14			
HomeWorks	7			
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل		100		

Module Evaluation
تقييم المادة الدراسية

		No.	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	20% (10)	3, 14	LO #1, 2, and 3
	Assignments	2	10% (5)	5, 12	LO # 2, 3 and, 4
	Seminars	1	10% (10)	8	LO # 1-5
Summative assessment	Midterm Exam	1	10% (10)	8	All
	Final Exam	1	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	Introduction to Energy Economics
Week 2	A brief history of energy
Week 3	The theory and practice of energy policy and strategy
Week 4	Energy policy and economic growth
Week 5	Energy Crises: Causes, Outcomes and Consequences

Week 6	Analysis and forecasting of energy demand
Week 7	Economics of energy supply
Week 8	Mid exam
Week 9	Economic aspects of interactions between energy and the environment
Week 10	Economic Analysis of Energy investments
Week 11	Economic Analysis of Energy investments
Week 12	Morals and ethics
Week 13	Engineering ethics
Week 14	The importance of ethics in science and engineering
Week 15	Professional responsibilities of engineers
Week 16	Final Exam

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Energy Finance and Economics: Analysis and Valuation, Risk Management, and the Future of Energy by Betty Simkins and Russell Simkins.	Yes
Recommended Texts		No
Websites		

APPENDIX:

GRADING SCHEME
مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A – Excellent	امتياز	90 - 100	Outstanding Performance
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	E – Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	مقبول بقرار	(45-49)	More work required but credit awarded
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Note:

| | Ministry of Higher Education and Scientific Research - Iraq
University of Tikrit
College of Engineering
Department of Sustainable Energy Engineering | |

MODULE DESCRIPTOR
وصف المـادة الدراسية

<table>
<tr><td colspan="5" align="center">Module Information
معلومات المادة الدراسية</td></tr>
<tr><td>Module Title</td><td colspan="2">HEAT TRANSFER II</td><td colspan="2">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="2">CORE</td><td rowspan="4" colspan="2">Theory
Lecture
Tutorial
Practical
Seminar</td></tr>
<tr><td>Module Code</td><td colspan="2">SE-ENG-208</td></tr>
<tr><td>ECTS Credits</td><td colspan="2">5</td></tr>
<tr><td>SWL
(hr/sem)</td><td colspan="2">125</td></tr>
<tr><td>Module Level</td><td>UGII</td><td colspan="2">Semester (s) offered</td><td>4</td></tr>
<tr><td>Administering Department</td><td>Sustainable Energy</td><td>College</td><td colspan="2">Engineering</td></tr>
<tr><td>Module Leader</td><td>Dr. Tadahmun A. Yassen</td><td>e-mail</td><td colspan="2">tadahmunahmed@tu.edu.iq</td></tr>
<tr><td>Module Leader's Acad. Title</td><td>Professor</td><td colspan="2">Module Leader's Qualification</td><td>Ph.D.</td></tr>
<tr><td>Module Tutor</td><td>Asst Prof , Dr. Hussam Sami Dheyab</td><td>e-mail</td><td colspan="2">hussam.sami@tu.edu.iq</td></tr>
</table>

Peer Reviewer Name		e-mail		
Review Committee Approval	01/10/2025	Version Number	1.0	

Relation With Other Modules العلاقة مع المواد الدراسية الأخرى				
Prerequisite module	SE-ENG-202, SE-ENG-207		**Semester**	- 3,4
Co-requisites module			**Semester**	-

Module Aims, Learning Outcomes, Indicative Contents and Brief Description
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر

Module Aims أهداف المادة الدراسية	1. Predict the rate of heat transfer by force convection (conduction with a moving fluid) between a solid and an internal or external fluid flow. 2. Predict the rate of heat transfer by natural convection. 3. Analyze the performance of heat exchangers. 4. Predict the rate of heat transfer by radiation between solids.

Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of this course students will be able to:
	16. Understand a thermal system with convection heat transfer, construct a schematic diagram for the system, characterize the geometry and flow conditions, and apply the appropriate convection models:
	  i. Boundary layer effects, laminar and turbulent flow.
	  ii. Similarity solutions and non-dimensional parameters.
	 iii. Reynold's analogy
	 v. Use convection correlations for Nusselt Number
	17. Understand and model external forced convection heat transfer.
	18. Understand and model internal forced convection heat transfer.
	19. Understand and model natural convection heat transfer.
	20. Understand heat exchangers and carry out analysis to design and selection the type of heat exchangers.
	21. Understand key aspects of radiation heat transfer and solve simple problems. Understand radiative properties and models like black body, surface emission and radiosity.
	22. Understand and estimate view factors and compute radiation exchange between grey surfaces.

Indicative Contents المحتويات الإرشادية	Indicative content includes the following. • Principal of force convection (6hrs) • Force Convection from flat plate (external flow) (6hrs) • Force convection inside pipes and channels (internal flow) (6hrs) • Flow across cylinder and sphere (6hrs) • Flow across bank of tubes(3hrs) • Natural convection (6hrs) • Heat exchangers (9hrs) • Radiation heat transfer (6hrs)
Course Description	The course considers the analysis of heat transfer by convection using

	empirical and boundary layer approximations. Both forced and natural convection are considered. Force convection deals in two ways which are external and internal. Natural convection from the solid surfaces is taken into account. The Radiation heat transfer is considered with applications to multi-body radiation. In addition, the properties of thermal radiation, Radiation heat transfer between solids and shape factor is taken in consider.

Learning and Teaching Strategies	
استراتيجيات التعلم والتعليم	
Strategies	The learning and teaching **strategy** is designed to: Carefully cover in lectures the necessary fundamental material and analytical techniques, and demonstrate concepts with appropriate (and where possible practical) examples Allow students adequate time to practice the techniques using a large number of carefully selected tutorial problems.

Student Workload (SWL)			
الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** 60 **In class tests** 4	64	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4.3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Library, dorm, home memorizing** 34 **Preparation for tests** 20 **Homeworks** 32	86	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5.7
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation					
تقييم المادة الدراسية					
		Time (hr)	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	All	All
	Assignments	5	30% (30)	All	All
Summative assessment	**Midterm Exam**	2	10% (10)	7	LO # 1-3
	Final Exam	3	50% (50)	16	All
Total assessment			100% (100 Marks)		

<table>
<tr><td colspan="2" align="center">**Delivery Plan (Weekly Syllabus)**
المنهاج الاسبوعي النظري</td></tr>
<tr><td></td><td>**Material Covered**</td></tr>
<tr><td>**Week 1**</td><td>Force convection, viscos flow, hydrodynamic and thermal boundary layer thickness</td></tr>
<tr><td>**Week 2**</td><td>Force convection of the laminar flow over flat plate</td></tr>
<tr><td>**Week 3**</td><td>Relation between fluid friction and heat transfer</td></tr>
<tr><td>**Week 4**</td><td>Force convection of the turbulent flow over flat plate</td></tr>
<tr><td>**Week 5**</td><td>Force convection of the laminar and turbulent flow inside tubes and channels</td></tr>
<tr><td>**Week 6**</td><td>Flow across cylinder and sphere</td></tr>
<tr><td>**Week 7**</td><td>Midterm exam</td></tr>
<tr><td>**Week 8**</td><td>Flow across banks of tube</td></tr>
<tr><td>**Week 9**</td><td>Natural convection</td></tr>
<tr><td>**Week 10**</td><td>Natural convection</td></tr>
<tr><td>**Week 11**</td><td>Heat exchanger, Log Mean Temperature Difference</td></tr>
<tr><td>**Week 12**</td><td>Effectiveness NTU method</td></tr>
<tr><td>**Week 13**</td><td>Heat exchanger design</td></tr>
<tr><td>**Week 14**</td><td>Radiation heat transfer, Radiation shape factor</td></tr>
<tr><td>**Week 15**</td><td>Relation between shape factors, heat exchange between gray bodies</td></tr>
<tr><td>**Week 16**</td><td>**Final Exam**</td></tr>
</table>

<table>
<tr><td colspan="2" align="center">**Delivery Plan (Weekly Lab. Syllabus)**
المنهاج الاسبوعي للمختبر</td></tr>
<tr><td></td><td>**Material Covered**</td></tr>
<tr><td>**Week 1**</td><td>Force convection in horizontal channel</td></tr>
<tr><td>**Week 2**</td><td>Force convection in horizontal channel</td></tr>
<tr><td>**Week 3**</td><td>Force convection in horizontal channel</td></tr>
<tr><td>**Week 4**</td><td>Natural convection</td></tr>
<tr><td>**Week 5**</td><td>Natural convection</td></tr>
<tr><td>**Week 6**</td><td>Solar radiation</td></tr>
<tr><td>**Week 7**</td><td>Solar radiation</td></tr>
</table>

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	**Available in the Library?**
Required Texts	Cengel, Y., & Heat, T. M. (2003). A practical approach. *Second edi*.	Yes
Recommended Texts	Holman, J. P. (2010). Heat transfer. Bergman, T. L., Lavine, A. S., Incropera, F. P., & DeWitt, D. P. (2011). *Introduction to heat transfer*. John Wiley & Sons.	No
Websites		

APPENDIX:

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

Note:

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

Ministry of Higher Education and
Scientific Research - Iraq
University of Tikrit
College of Engineering
Department of Sustainable Energy
Engineering

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information	
معلومات المادة الدراسية	

Module Title	ENGINEERING ANALYSIS II	Module Delivery	
Module Type	BASIC	**Theory** **Lecture** **Tutorial** **Practical**	
Module Code	MATH-202		
ECTS Credits	6		
SWL (hr/sem)	150		

Module Level	UGII	Semester (s) offered	4
Administering Department	Sustainable Energy	College	Engineering
Module Leader	Hamza Raad Yaseen	e-mail	hamza.r.yaseen94@tu.edu.iq
Module Leader's Acad. Title	Lecturer	Module Leader's Qualification	Ph.D.
Module Tutor		e-mail	
Peer Reviewer Name		e-mail	
Review Committee Approval	01/09/2025	Version Number	1.0

Relation With Other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	MATH-201, MATH-101, MATH-102	Semester	1, 2, 3
Co-requisites	None	Semester	-

module			

Module Aims, Learning Outcomes, Indicative Contents and Brief Description
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر

Module Aims أهداف المادة الدراسية	The aim of this module is to develop students' mathematical knowledge with a comprehensive understanding of the mathematics used in mechanical engineering and develop the necessary skills for its use. This module also aims to equip students with the knowledge and skill to be able to analyze a variety of engineering systems. Through a combination of practical mechanical engineering applications and theoretical knowledge. This module equips students with the necessary foundation to pursue further studies in mechanical engineering.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of the module, the students will be able to: 6. Explain basic concepts of mathematical modeling and engineering analysis. 7. Identify the type of analysis suitable for the solution of an engineering problem with their respective advantages and limitations. 8. Recognize and explain equations governing typical engineering problems. 9. Demonstrate knowledge and understanding of mathematical principles necessary to underpin their education across mechanical engineering. 10. Enable students to apply mathematical methods, tools, and notations proficiently in the analysis and solution of mechanical engineering problems.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. • Laplace Transform • Fourier Series • Fourier Transform • Orthogonality Properties of Sine and Cosine • Partial Differential Equations
Course Description	This course will cover a range of engineering analysis techniques related to the first and second differential and then utilizes it to solve problems in mechanical engineering applications, methods for solving differential equations are discussed. The course also includes power series solutions, special functions, and Laplace transforms and utilizes it to solve the differential equation. Fourier series and separation of variables are also introduced.

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	The learning and teaching strategy is designed to introduce engineering analysis through theory with work examples carried out by the students. This is carefully delivered through lectures including question and answer sessions, demonstrating captured content, problem-solving, tutorial classes, and project methods with the students conducting a coursework assignment.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** 56 **In class tests** 3 **Online** 28	87	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5.8
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Library, dorm, home memorizing** 28 **Preparation for tests** 25 **HomeWorks** 10	63	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.2
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**150**		

Module Evaluation
تقييم المادة الدراسية

		(No.)	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	3	15% (5)	2, 5, 9	LO #1, 2, 3, and 4
	Onsite Assignments	2	10% (5)	4, 12	LO # 1, 2, 3, 4, 5 and 6
	Online Assignments	2	10% (5)	3, 11	LO # 2, 3, 4, 5 and 6
	Project	1	5% (5)	13	LO # 2, 3, 5, and 6
Summative assessment	**Midterm Exam**	1	10% (10)	7	LO # 1-3
	Final Exam	1	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

Week	Material Covered
Week 1	Laplace Transform The General Method
Week 2	Laplace Transform: The Transform of Special Functions
Week 3	The Shifting Theorems
Week 4	The Differentiation and Integration of Transforms
Week 5	Solving Differential Equations by Laplace Transform
Week 6	Solving Differential Equations by Laplace Transform

Week 7	Midterm exam
Week 8	Fourier Series: The Euler Formulas
Week 9	Fourier Series: Half Range Expansion
Week 10	Fourier Transform: Properties of Fourier Transform
Week 11	Fourier Transform: Solving Differential Equations
Week 12	Fourier Transform: Solving Differential Equations
Week 13	Fourier Transform: Orthogonality Properties of Sine and Cosine
Week 14	Partial Differential Equations Separation of Variables (Heat Equations)
Week 15	Partial Differential Equations Separation of Variables (Wave Equations)
Week 16	Final Exam

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Advanced Engineering Analysis C. Ray Wylie	Yes
Recommended Texts	Advanced Engineering Mathematics, Kreyszig Kreyszig, 10th Edition, John Wiley & Sons, Inc	No
Websites	https://www.thriftbooks.com/w/advanced-engineering-mathematics_clarence-raymond-wylie/327947/#edition=3546946&idiq=4215961	

APPENDIX:

GRADING SCHEME
مخطط الدرجات

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

Note:

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

Ministry of Higher Education and
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University of Tikrit
College of Engineering
Department of Sustainable Energy
Engineering

MODULE DESCRIPTOR

وصف المادة الدراسية

Module Information		
معلومات المادة الدراسية		

Module Title	ENGLISH LANGUAGE II	**Module Delivery**	
Module Type	SUPLEMENT	**Theory** **Lecture** **Tutorial** **Project** **Seminar**	
Module Code	UOT-021		
ECTS Credits	2		
SWL (hr/sem)	50		

Module Level	UGII	**Semester (s) offered**	4
Min number of students	15	**Max number of students**	100
Administering Department	Sustainable Energy Engineering	**College**	Engineering
Module Leader	Asst. Prof. Ahmed S. Abdullah	**e-mail**	Ahmedsubhi1981@tu.edu.iq
Module Leader's Acad. Title	Asst. Prof.	**Module Leader's Qualification**	Ph.D.
Module Tutor		**e-mail**	
Peer Reviewer Name		**e-mail**	
Review Committee Approval	01/09/2025	**Version Number**	1.0

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

module			

Module Aims أهداف المادة الدراسية	Develop the ability/skill needed to earn a job and develop his/her critical thinking skills to work, develop and communicate.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Upon successful completion of the course, the students should be able to: • learn how to make job applications and which recruitment procedures they must go through in the process and, acquire the special terminology used in job applications and recruitment procedures • learn how to design a letter of application and CV • have a clear idea about how to prepare for an interview and how to behave during an interview • become familiar with the methods of writing a "letter of intent" ("statement of purpose") when applying for academic studies, and have an idea about the "letter of recommendation" that they will need when applying for an academic program after completing their university education • gain an understanding of presentation techniques • become familiar with the basic principles of "Paragraph Writing", learn and practice the key concepts of paragraph writing such as Topic Sentence, Supporting Sentences, Concluding Sentence, Unity and Coherence, and gain insight into the essential principles of "Essay Writing"
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. • Job applications and which recruitment procedures (6 hrs) • Learn how to design a letter of application and CV and how to prepare for an interview and how to behave during an interview (8 hr) • Presentation techniques (6 hrs) • Paragraph Writing (10 hrs)
Course Description	You will also develop the business communication skills required for anyone in the global economy. This includes topics like delivering presentations, writing emails, or speaking in meetings. This gives you the ability to communicate across departments with a strong ability in reading, writing, speaking, and listening.

Strategies	The learning and teaching **strategy** is designed to: Carefully cover in lectures the necessary fundamental material and analytical techniques, and demonstrate concepts with appropriate (and where possible practical) examples Allow students adequate time to practice the techniques using a

	large number of carefully selected tutorial problems.	

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل		31	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	2.0
In class lectures	15			
In class tests	3			
Seminars	2			
Online lecture	1			
Tutorial	10			
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل		19	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.0
Data showing preparation	6			
Preparation for tests	3			
HomeWorks	6			
project	4			
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل		50		

Module Evaluation
تقييم المادة الدراسية

		Time (No)	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	1	10% (10)	5, 10, 12, 14	LO #1, 2, 3, and 4
	On site assignment	1	10% (10)	2, 4, 6, 8, 10, 12	LO # 1, 2, 3, 4, 5 and 6
	Seminar	1	10% (10)	Continuous	LO # 1, 2, 3, 4, 5 and 6
	Report	1	10% (10)	7-14	All
Summative assessment	Midterm Exam	2 hr	10% (10)	7	LO # 1-3
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	learn how to make job applications and which recruitment procedures must be gone through in the process
Week 2	acquire the special terminology used in job applications and recruitment procedures
Week 3	learn how to design a letter of application and CV
Week 4	have a clear idea about how to prepare for an interview and how to behave during

	an interview
Week 5	become familiar with the methods of writing a "letter of intent" ("statement of purpose") when applying for academic studies
Week 6	have an idea about the "letter of recommendation" that will be needed when applying for an academic program after completing university education
Week 7	**Midterm exam**
Week 8	gain an understanding of presentation techniques
Week 9	gain an understanding of presentation techniques
Week 10	become familiar with the basic principles of "Paragraph Writing"
Week 11	become familiar with the basic principles of "Paragraph Writing"
Week 12	learn and practice the key concepts of paragraph writing such as Topic Sentence, Supporting Sentences, Concluding Sentence, Unity and Coherence
Week 13	learn and practice the key concepts of paragraph writing such as Topic Sentence, Supporting Sentences, Concluding Sentence, Unity and Coherence
Week 14	gain insight into the essential principles of "Essay Writing"
Week 15	gain insight into the essential principles of "Essay Writing"
Week 16	**Final Exam**

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Beer, D. & McMurrey, D. 2004, A Guide to Writing as an Engineer (2nd ed), New York: Wiley	No
Recommended Texts	Borowick, Jerome N., 2002, Technical Communication and its Applications (2nd ed), New Jersey: Prentice-Hall, Inc.	No
Websites	http://umich.edu/~elements/5e/lectures/index.html	

APPENDIX:

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

Ministry of Higher Education and
Scientific Research - Iraq
University of Tikrit
College of Engineering
Department of Sustainable Energy
Engineering

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	جرائم حزب البعث البائد	**Module Delivery**	
Module Type	غير أساسية(داعمة)	محاضرات نظرية	
Module Code	UOT-109		
ECTS Credits	2		
SWL (hr/sem)	50		
Module Level	UGII	**Semester (s) offered**	4
Min number of students	15	**Max number of students**	100
Administering Department	Sustainable Energy	**College**	Engineering
Module Leader	عبد الرحمن زيدان	**e-mail**	azaueng4@tu.edu.iq
Module Leader's Acad. Title	Asst. Lacturer	**Module Leader's Qualification**	

Module Tutor	None		e-mail	None	
Peer Reviewer Name			e-mail		
Review Committee Approval	01/09/2025		Version Number	1.0	

Relation With Other Modules العلاقة مع المواد الدراسية الأخرى				
Prerequisite module	لايوجد		Semester	1
Co-requisites module	لايوجد		Semester	-

Module Aims, Learning Outcomes, Indicative Contents and Brief Description
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر

Module Aims أهداف المادة الدراسية	1-التعرف على جرائم الحزب والانتهاكات التي قام بها خلال فترة الحكم. 2ـ القدرة على فهم الاثار السلبية لهذا الحزب على الجانب النفسي والاجتماعي والثقافي لأفراد الشعب العراقي. 3ـ التعرف على التأثير السلبي على واقع البيئة العراقية.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1- التعرف على المصطلحات ذات الصلة بجرائم الحزب. 2ـ التعرف على اهم الاثار السلبية الذي تركها الحزب على واقع المجتمع العراقي في جميع مجالات الحياة.
Indicative Contents المحتويات الإرشادية	يتضمن المحتوى الارشادي ماياتي: 1ـ انتهاكات الحقوق والحريات (8 ساعات). 2ـ التأثير على الميدان النفسي والاجتماعي (2ساعة). 3ـ التأثير على الميدان الثقافي والدين والدولة وعسكرة المجتمع (2ساعة). 4ـ اثر القمع على البيئة والسكان (3) ساعات
Course Description	جرائم حزب البعث: هي الجرائم التي ارتكبها الحزب بأبناء الشعب العراقي والتي ادت الى اثار سلبية على المستوى النفسي والاجتماعي والثقافي والاقتصادي والبيئي وعسكرة المجتمع .

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	تم وضع استراتيجية التعلم والتعليم من اجل ان يحصل الطالب على معلومات كاملة تغطي المنهج الدراسي المعد للمادة ولكي تتحقق الغاية الاساسية للمنهج الذي ينصب نحو الام وادراك الطالب بالجرائم والاثار السلبية التي قام بها الحزب على نسيج المجتمع العراقي، والاطلاع على الانتهاكات والتجاوزات التي حصلت اثناء فترة الحكم من اجل منع تكرار تلك التجربة مستقبلا.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** **15** **In class tests** **3**	18	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	1.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	7	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	0.5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	25		

Module Evaluation
تقييم المادة الدراسية

		Time (hr)	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	4	20% (20)	3, 5, ,7, 9,11,13,	LO #1, 2,3,4,....... ,11
	Assignments (Homeworks)	6	15% (15)	2, 4, 6, 10,12,14	LO # 1, 2, 3, 4 ,.......,11
	Discussions	7	5% (5)	Continuous	
Summative assessment	Midterm Exam	2	10% (10)	8	LO # 1-7
	Final Exam	3	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	نبذة وصفية عن الانظمة السياسية في العراق من عام 1921-2003
Week 2	انتهاكات النظام البعثي للحقوق والحريات العامة
Week 3	اثر سلوكيات النظام البعثي في المجتمع
Week 4	اثر المرحلة الانتقالية في محاربة السياسة الاستبدادية
Week 5	الميدان النفسي
Week 6	الميدان الاجتماعي
Week 7	الدين والدولة
Week 8	امتحان نصف الفصل
Week 9	الثقافة والاعلام وعسكرة المجتمع

Week 10	استعمال الاسلحة المحرمة دوليا والتلوث البيئي
Week 11	سياسة الارض المحروقة
Week 12	تجفيف الاهوار
Week 13	المقابر الجماعية وتدمير دور العبادة
Week 14	امثلة واقعية عن جرائم الحزب من واقع المجتمع العراقي
Week 15	مراجعة لمحتويات المادة
Week 16	امتحان نهاية الفصل

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	**منهاج معتمد من الوزارة**	Yes
Recommended Texts		No
Websites	N/A	

APPENDIX:

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

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

Ministry of Higher Education and
Scientific Research - Iraq
University of Tikrit
College of Engineering
Department of Sustainable Energy
Engineering

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information		
معلومات المادة الدراسية		
Module Title	Thermal Solar Energy Systems	**Module Delivery**
Module Type	CORE	**Theory** **Lecture** **Tutorial** **Seminar**
Module Code	SE-ENG-301	
ECTS Credits	6	
SWL (hr/sem)	150	

Module Level	UGIII	Semester (s) offered	5
Administering Department	Sustainable Energy Engineering	**College**	Engineering
Module Leader	Manar S.M. Al-Jethelah	**e-mail**	m.aljethelah@tu.edu.iq
Module Leader's Acad. Title	Prof.	**Module Leader's Qualification**	Ph.D.
Module Tutor		**e-mail**	
Peer Reviewer Name		**e-mail**	
Review Committee Approval	2/9/2025	**Version Number**	

Relation With Other Modules	
العلاقة مع المواد الدراسية الأخرى	

Prerequisite module	Heat Transfer-1 Heat Transfer-2	Semester	3 & 4
Co-requisites module	None	Semester	-

Module Aims, Learning Outcomes, Indicative Contents and Brief Description
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر

Module Aims أهداف المادة الدراسية	The aim of this course is 1. Cognitive development of students by recognizing the thermal solar energy systems. 2. Engineering skills development for students to learn how to model the thermal solar energy systems. 3. Identify the special mathematical models of thermal solar energy systems. 4. Design methods of energy systems. 5. Learn how to calculate the efficiency and performance of thermal solar energy systems.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	6) Classify solar thermal collectors based on their construction and principle of working 7) Compare the different solar concentrator technologies 8) Identify the energy balance of solar thermal collectors 9) Compute the efficiency factor, heat removal factor and instantaneous efficiency of solar thermal collectors 10) Describe the different methods of thermal energy storage
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. • Introduction to thermal solar energy • Flat plate collector • Concentrating solar collectors • Solar Dryers • Solar stills • Thermal storage
Course Description	This course provides knowledge to design of various thermal solar energy systems, the technology of thermal solar energy conversion, and the use of thermal solar energy in Iraq and worldwide.

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	This course aims to overview the thermal solar energy fundamentals. Various solar thermal devices will be covered besides their performance. Besides, thermal storage techniques will be discussed. Also, students will have adequate time to practice the techniques using a large number of carefully selected tutorial problems.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	87	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	5.8

In class lectures **28** **Online lectures** **14** **Lab** **28** **Tutorial** **14** **In class tests** **3**		
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Library, dorm, home memorizing 33** **Preparation for tests** **20** **HomeWorks** **10**	63	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا 4.2
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150	

Module Evaluation
تقييم المادة الدراسية

		No.	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	20% (10)	3, 14	LO #1, 2, and 3
	Assignments	2	10% (5)	5, 12	LO # 2, 3 and, 4
	Seminars	1	10% (10)	8	LO # 1-5
Summative assessment	**Midterm Exam**	1	10% (10)	7	All
	Final Exam	1	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	**Introduction to solar energy**
Week 2	**Solar radiation types and measurements**
Week 3	**Flat plate solar water collectors**
Week 4	**Flat plate solar air collectors**
Week 5	**Parabolic dish solar collectors**
Week 6	**Parabolic trough solar collectors**
Week 7	**Mid exam**
Week 8	**Compound parabolic solar collectors**
Week 9	**Compound parabolic solar collectors**

Week 10	Fresnel solar collectors
Week 11	Solar tower
Week 12	Solar cooker
Week 13	Solar dryers
Week 14	Solar stills
Week 15	Thermal storage of solar energy
Week 16	Final Exam

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	-John A. Duffie - Solar Engineering of Thermal Processes -Sathyajith Mathew - Wind Energy	Yes
Recommended Texts	-John Twidell, Tony Weir – Renewable Energy Resources	No
Websites		

APPENDIX:

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

Note:

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

Ministry of Higher Education and
Scientific Research - Iraq
University of Tikrit
College of Engineering
Department of Sustainable Energy
Engineering

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information		
معلومات المادة الدراسية		
Module Title	NUMERICAL METHODS	**Module Delivery**
Module Type	CORE	Theory Lecture Tutorial Practical Seminar
Module Code	MATH-301	
ECTS Credits	4	
SWL (hr/sem)	100	

Module Level	UGIII	**Semester (s) offered**	5
Administering Department	Sustainable Energy Engineering	**College**	Engineering
Module Leader	Dr. Ibrahim Thamer Nazzal	**e-mail**	dribrahimthamer@tu.edu.iq
Module Leader's Acad. Title	Assist. Prof	**Module Leader's Qualification**	Ph.D.
Module Tutor		**e-mail**	
Peer Reviewer Name		**e-mail**	
Review Committee Approval	01/09/2025	**Version Number**	1.0

Relation With Other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	MATH-202	**Semester**	4

Co-requisites module	None	Semester	-

<table>
<tr><td colspan="2" align="center">Module Aims, Learning Outcomes, Indicative Contents and Brief Description
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر</td></tr>
<tr>
<td>Module Aims
أهداف المادة الدراسية</td>
<td>

The aim of the module is to motivate, describe, analyze, and implement numerical methods for problems, including a solution of nonlinear equations; approximation of integrals; numerical interpolation, and solution of differential equations. Different methods are presented for solving such problems on a modern computer, together with their applicability and error analysis. A significant part of the module is devoted to programming these methods. This module also aims to develop skills in programming numerical methods. Through a combination of practical mechanical applications and theoretical knowledge, they will develop an understanding of the numerical techniques used within modern computer packages.

</td>
</tr>
<tr>
<td>Module Learning Outcomes
مخرجات التعلم للمادة الدراسية</td>
<td>
At the end of this module, students will be able to:

explain basic concepts of numerical analysis
Identify the type of analysis suitable for the solution of an engineering problem with their respective advantages and limitations.
Recognize and explain equations governing typical engineering problems.
demonstrate knowledge and critical understanding of the well-established principles within a wide range of basic numerical methods, including iterative methods, interpolation, quadrature, finite difference approximation of initial-value problems for ordinary differential equations (ODEs)
Implement numerical methods using both hand and computer software, and apply them in examples.
Implement numerical methods for different classes of problems using common software packages.
Understand the concept of computer algorithms and programming
Analyze and validate simulated results against benchmarks.
estimate the errors inherent in different numerical methods

</td>
</tr>
<tr>
<td>Indicative Contents
المحتويات الإرشادية</td>
<td>
Indicative content includes the following.

Mathematical Background:
System Of Linear Algebraic Equations
Solving nonlinear equations
Curve Fitting
Numerical interpolation

</td>
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</table>

	• Numerical Integration • Numerical differentiation • Solving Ordinary Differential Equations (initial value problems) • Solving Ordinary Differential Equations (finite difference methods)
Course Description	This course will cover a range of numerical analysis techniques related to matrix problems, solving systems of linear algebraic equations, solving nonlinear equations, Curve Fitting, polynomial approximation and interpolation, numerical integration and differentiation, and ordinary and partial differential equations. All of these numerical problems will be programmed, debugged, and executed.

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	The learning and teaching strategy is designed to introduce numerical methods and machine learning through theory with work examples carried out by the students. This is carefully delivered through lectures including question and answer sessions, demonstrating captured content, problem-solving, tutorial classes, and project methods with the students conducting a coursework assignment.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل In class lectures **42** In class tests **3** lab **14**	59	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	3.9
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل Library, dorm, home memorizing **24** Prepartion for tests **10** Homeworks **7**	41	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	2.7
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

Module Evaluation
تقييم المادة الدراسية

		Time (hr)	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	10% (10)	5, 10, 12, 14	LO #1, 2, 3, and 4
	Assignments	6	18% (18)	2, 4, 6, 8, 10,	LO # 1, 2, 3, 4, 5 and

				12	6
	Seminars	3	12% (12)	Continuous	
Summative assessment	**Midterm Exam**	2	10% (10)	7	LO # 1-3
	Final Exam	3	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Mathematical Background: - matrix - matrix operations (addition, multiplication,….
Week 2	- Determinant - Matrix inversion
Week 3	System Of Linear Algebraic Equations Gauss Elimination
Week 4	Matrix Inversion The Gauss-Seidel Method
Week 5	Open Methods to Estimate Root. The Newton-Raphson Method The Secant Method
Week 6	Curve Fitting Linear Regression Newton's Divided-Difference Interpolation Polynomials
Week 7	Midterm exam
Week 8	Lagrange Interpolation Polynomials
Week 9	Numerical Integration -The Trapezoidal Rule
Week 10	-Simpson Rules
Week 11	Numerical Differentiation -Richardson Extrapolation
Week 12	Ordinary Differential Equations Euler's Method Modified Euler's Method
Week 13	Runge -Kutta Methods
Week 14	Partial Differential Equations Finite Difference Method for Elliptic Equations
Week 15	Finite Difference method for Parabolic Equations
Week 16	Final Exam

Delivery Plan (Weekly Lab. Syllabus)
المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Numerical Methods for Engineers. By Stephen Chapra	Yes
Recommended Texts	Numerical Methods for Engineers and Scientists: An Introduction with Applications Using MATLAB by Amos Gilat	No
Websites	http://umich.edu/~elements/5e/lectures/index.html	

APPENDIX:

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

Note:

| | Ministry of Higher Education and Scientific Research - Iraq University of Tikrit College of Engineering Department of Sustainable Energy Engineering | |

MODULE DESCRIPTOR

وصف المادة الدراسية

Module Information
معلومات المادة الدراسية

Module Title	Photovoltaic Energy Systems	Module Delivery	
Module Type	CORE		**Theory** **Lecture** **Tutorial** **Seminar**
Module Code	SE-ENG-302		
ECTS Credits	5		
SWL (hr/sem)	125		

Module Level	UGIII	Semester (s) offered	5
Administering Department	Sustainable Energy Engineering	College	Engineering
Module Leader	Khalaf S Gaeid	e-mail	khalafgaeid@tu.edu.iq
Module Leader's Acad. Title	Prof.	Module Leader's Qualification	Ph.D.
Module Tutor		e-mail	
Peer Reviewer Name		e-mail	

Review Committee Approval	2/11/2025	Version Number	

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

Module Aims, Learning Outcomes, Indicative Contents and Brief Description	
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر	
Module Aims أهداف المادة الدراسية	The aim of this course is 1. The aims of a photovoltaic (PV) energy systems module are to provide comprehensive knowledge of solar radiation, system design, and energy storage. 2. To develop skills in designing and analyzing PV systems for various applications. 3. Understanding the principles of the photovoltaic effect, analyzing solar data, and learning how to connect modules to create an efficient, cost-effective, and reliable system for generating clean energy.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	11) Explain the fundamentals of solar energy and the photovoltaic effect, which is the process of converting light directly into electricity. 12) Identify and describe the different components of a PV system, including solar cells, modules, panels, arrays, inverters (DC/AC converters), charge controllers, batteries (for energy storage), mounting structures, and wiring. 13) Compare and contrast different types of PV technologies (e.g., crystalline silicon, thin-film) and system architectures (e.g., grid-tied, off-grid, hybrid, utility-scale, residential) based on efficiency, cost, and application. 14) Understand the basic electrical principles (current, voltage, power, Ohm's law) relevant to PV systems, including series and parallel connections, grounding 15) Understanding the types of protection of the PV .
Indicative Contents المحتويات الإرشادية	A comprehensive course on photovoltaic (PV) energy systems typically includes a mix of fundamentals of solar energy, detailed study of system components, practical aspects of design and installation, and economic/environmental analysis.
Course Description	A photovoltaic (PV) energy systems course provides knowledge on converting sunlight into electricity, covering fundamental principles of

	solar cells and the design, installation, and economics of both stand-alone and grid-connected PV systems. Topics often include solar resource assessment, PV module and system components, energy yield simulation, energy storage integration, and maintenance, with a focus on practical applications and technical skills for the renewable energy sector.	

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	This course aims to overview the thermal solar energy fundamentals. Various solar thermal devices will be covered besides their performance. Besides, thermal storage techniques will be discussed. Also, students will have adequate time to practice the techniques using a large number of carefully selected tutorial problems.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل			Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	
In class lectures	45	73		4.9
Online lectures	3			
Lab	14			
Tutorial	8			
In class tests	3			
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل		52	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.5
Library, dorm, home memorizing	32			
Preparation for tests	10			
HomeWorks	10			
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل		125		

Module Evaluation
تقييم المادة الدراسية

		No.	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	20% (10)	3, 14	LO #1, 2, and 3
	Assignments	2	10% (5)	5, 12	LO # 2, 3 and, 4
	Seminars	1	10% (10)	8	LO # 1-5
Summative assessment	Midterm Exam	1	10% (10)	7	All
	Final Exam	1	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
المنهاج الاسبوعي النظري	
	Material Covered
Week 1	**Introduction:** History, advantages/disadvantages, role in the energy landscape, and safety overview.
Week 2	**Solar Resource and Site Assessment**: Solar radiation, sun's movement, and basic site analysis.
Week 3	**PV Device Physics**: Semiconductor basics, solar cell operation, and materials.
Week 4	**PV Modules and Arrays:** How cells are assembled, array design, and performance characteristics
Week 5	**Balance of System (BOS) Components:** Detailed look at inverters, charge controllers, and batteries bank sizing and management.
Week 6	**System Design and Sizing**: Load calculation, system design principles, and design software.
Week 7	Mid exam
Week 8,9	**Installation and Integration:** Electrical and mechanical installation, grounding, and code requirements
Week 10	**Maintenance and Troubleshooting**: Identifying and solving common problems.
Week 11	**Economics and Grid Connection**: Cost-benefit analysis and connecting to the utility grid.
Week 12	**Advanced Topics**: Latest technologies, policy, and large-scale applications.
Week 13	**Performance and efficiency:** Techniques for optimizing performance, including Maximum Power Point Tracking (MPPT)
Week 14	**Practical projects and seminars**
Week 15	Final Exam
Week 16	

Learning and Teaching Resources		
مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	**Antonio Luque, Handbook of Photovoltaic Science and Engineering . John Wiley & Sons Ltd,2003**	Yes
Recommended Texts	**-John Twidell, Tony Weir – Renewable Energy Resources**	No

Websites	

APPENDIX:

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

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

Ministry of Higher Education and
Scientific Research - Iraq
University of Tikrit
College of Engineering
Department of Sustainable Energy
Engineering

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information		
معلومات المادة الدراسية		
Module Title	Power plant	**Module Delivery**
Module Type	Core	Theory Lecture Tutorial Practical Seminar
Module Code	SE-ENG-303	
ECTS Credits	4	
SWL (hr/sem)	100	

Module Level	UGIII	Semester (s) offered		5
Administering Department	Sustainable Energy Engineering	**College**	Engineering	
Module Leader	Thamir K. Ibrahim	**e-mail**	thamirmathcad@tu.edu.iq	
Module Leader's Acad. Title	Prof.	**Module Leader's Qualification**	Ph.D.	
Module Tutor	None	**e-mail**	None	
Peer Reviewer Name		**e-mail**		
Review Committee Approval	01/09/2025	**Version Number**	1.0	

Relation With Other Modules		
العلاقة مع المواد الدراسية الأخرى		
Prerequisite module		**Semester**	-
Co-requisites module		**Semester**	-

	Module Aims, Learning Outcomes, Indicative Contents and Brief Description أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر	
Module Aims أهداف المادة الدراسية	-To provide a simple understanding of the power plant engineering -To present a wealth of real-world engineering examples to give students a feel for how power plants is applied in engineering practice. -To develop an intuitive understanding of power plants by emphasizing the physics and physical arguments	
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of this course students will be able to: 23. Describe and analyze different types of sources and mathematical expressions related to thermodynamics and various terms and factors involved with power plant operation. 24. Analyze the working and layout of steam power plants and the different systems comprising the plant and discuss its economic and safety impacts. 25. Combine concepts from previously learned courses to define the working principle of the conventional power plant, its layout, and safety principles and compare it with plants of other types. 26. Describe the working principle and basic components of the nuclear power plant and the economic and safety principles involved with it. 27. Discuss the working principle and basic components of the hydroelectric plants and the economic principles and safety precautions involved with it. 28. Discuss and analyze the mathematical and working principles of different Solar power plants.	
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. • Introduction to Steam cycle power plants (12hrs) • The Gas turbine power plants performance introduced (5hrs) • A general understanding of combined cycle power plants. (6hrs) • Exposes students to some exciting real-world applications of power plants early in this course, and helps them establish a sense of the monetary value of energy(17hrs)	
Course Description	This Course provides a simple understanding of the power plant engineering. The course contains the details of steam and gas thermal power plants, hydro power plants, nuclear power plants, along with solar, wind and geothermal energy power systems in addition to the direct energy conversion. The economics of power generation and the environmental aspect of power generation are also being addressed in this course.	
	Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The learning and teaching **strategy** is designed to: Carefully cover in lectures the necessary fundamental material and analytical techniques, and demonstrate concepts with appropriate (and where possible practical) examples Allow students adequate time to practice the techniques using a large number of carefully selected tutorial problems.	

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل		59	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	3.9
In class lectures	40			
Discussion	15			
In class tests	4			
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل		41	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	2.7
Library, dorm, home memorizing	21			
Preparation for tests	10			
Homework's	10			
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل		100		

Module Evaluation
تقييم المادة الدراسية

		Time (hr)	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	All	All
	Assignments	5	20% (20)	All	All
Summative assessment	Midterm Exam	2	10% (10)	7	LO # 1-3
	Final Exam	3	60% (60)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	The energy scenario, steam power plants, fuel handling, ash handling, chimney draught
Week 2	Fossil fuel steam generators, high pressure boilers, performance of boilers, fuels and combustion, steam turbines. Steam power plant cycle (Ranking cycle), Power station superheated processes. Power station reheated processes, Steam power plant refrigeration- processes Open feed water – close backward feed water, close forward heater
Week 3	The function of power plant (boiler operation) fire tube boiler, - water tube boiler water circulation in boiler. Steam turbine Impulse steam turbine- the principle of impulse steam turbine (power produced by the efficiency of stages). Reaction turbine: (principle of reaction turbine, velocity diagrams, power produced by turbine stages, and efficiency of stages).
Week 4	Condensers, principal condenser operation, circulation of water system, Pumping system (circulation of water). Cooling tower (system classification, and operation performance),
Week 5	Air compressor (classification, system operation), Combustion chamber (combined the air and fuel, design) principle, the efficiency of the combustion chamber, and operation

Week 6	Performance analysis of gas turbine power plants
Week 7	Midterm exam
Week 8	Introduction to combined cycle power
Week 9	Thermal analysis of the combined cycle power
Week 10	Classification of hydro-plants, hydraulic turbines, hydro plant controls, problem solving
Week 11	Principles of nuclear energy, thermal fission reactors and Power Plants, Fast breeder reactors,
Week 12	Solar energy, solar thermal energy
Week 13	Hybrid Solar Gas-Turbine Power Plants
Week 14	Nuclear power plant, Principle of nuclear power plant, Pressurized water rector (PWR), Boiling –water reactor (BWR).
Week 15	Energy storage, economics of power generation, economics of power generation, environmental aspect of power generation, problem solving
Week 16	**Final Exam**

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

Learning and Teaching Resources		
مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Cengel, Y., & Thermodynamics: An engineering Approach, Seven *edi*.	Yes
Recommended Texts	Applied thermodynamics for engineering technologists, third edi, by T.D. EASTOP	Yes
Websites		

APPENDIX:

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

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

Ministry of Higher Education and
Scientific Research - Iraq
University of Tikrit
College of Engineering
Department of Sustainable Energy
Engineering

MODULE DESCRIPTOR

وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	APPLIED ELECTRONICS	**Module Delivery**	
Module Type	CORE	Theory Lecture Tutorial lab	
Module Code	SE-ENG-304		
ECTS Credits	6		
SWL (hr/sem)	150		
Module Level	UGIII	**Semester (s) offered**	5
Administering Department	Sustainable Energy Engineering	**College**	Engineering
Module Leader	Omer Nafa'a Mahmmoud	**e-mail**	eng.omernafaa2016@st.tu.edu.iq
Module Leader's Acad. Title	Assistant Lecturer	**Module Leader's Qualification**	MSc
Module Tutor	Ayad Tareq Mahmood	**e-mail**	ayad.tariq.m@tu.edu.iq
Peer Reviewer Name	None	**e-mail**	None
Review Committee Approval	01/09/2025	**Version Number**	1.0

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

Module Aims, Learning Outcomes, Indicative Contents and Brief Description

	أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر
Module Aims أهداف المادة الدراسية	In this course, students learn Field Effect Transistors (FET). FET: Junction field-effect transistor (JFET): physical operation and static characteristics. - Metal - Oxide semiconductor FET (MOSFET): depletion -type MOSFET, enhancement - type MOFET. DC analysis of FET, the FET as an amplifier, graphical (load line) analysis, small-single FET models, analysis of CS, CD and CG configurations, using FETs as switch, voltage variable resistor, and constant current source. Multistage Amplifiers: Analysis of multistage amplifiers (voltage gain, current gain. etc.). Types of multistage amplifiers (cascade ... etc.). RC-Coupled BJT Amplifier, Direct- Coupled BJT Amplifiers, Frequency Response, Multistage FET Amplifiers, Transformer Coupling. Introduction to four-layer Description and operation of silicon-controlled rectifier, DIAC, GTO and TRIAC.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Demonstrate knowledge and understanding of basic electronic components. 2. Analyze and understand the behavior of any electronic circuit or device. 3. Design of electronic and electrical systems. 4. Planning and implementing applied electronic activities, evaluating results and drawing applicable results.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. ● Field Effect Transistors (FET). FET: Junction field-effect transistor (JFET): physical operation and static characteristics. - Metal - Oxide semiconductor FET (MOSFET): depletion -type MOSFET, enhancement - type MOFET. - DC analysis of FET, the FET as an amplifier, graphical (load line) analysis (20 hrs.) ● small-single FET models, analysis of CS, CD and CG configurations, using FETs as switch, voltage variable resistor, and constant current source (20 hrs.) ● Multistage Amplifiers: Analysis of multistage amplifiers (voltage gain, current gain. etc.). Types of multistage amplifiers (cascade ... etc.). RC-Coupled BJT Amplifier, Direct- Coupled BJT Amplifiers, Frequency Response, Multistage FET Amplifiers, Transformer Coupling (15 hrs.). ● Introduction to four-layer Description and operation of silicon-controlled rectifier, DIAC, GTO and TRIAC (10 hrs.)
Course Description	This course aims to establish fundamental knowledge of Field Effect Transistors (FET). FET: Junction field-effect transistor (JFET): physical operation and static characteristics. - Metal - Oxide semiconductor FET (MOSFET): depletion -type MOSFET, enhancement - type MOFET. DC analysis of FET, the FET as an amplifier, graphical (load line) analysis, small-single FET models, analysis of CS, CD and CG configurations, using FETs as switch, voltage variable resistor, and constant current source. Multistage Amplifiers: Analysis of multistage amplifiers (voltage gain, current gain. etc.). Types of multistage amplifiers (cascade ... etc.). RC-Coupled BJT Amplifier, Direct- Coupled BJT Amplifiers, Frequency Response, Multistage FET Amplifiers, Transformer Coupling. Introduction to four-layer Description and operation of silicon-controlled rectifier, DIAC,

			GTO and TRIAC.		

<table>
<tr><td colspan="6" align="center">Learning and Teaching Strategies
استراتيجيات التعلم والتعليم</td></tr>
<tr><td>Strategies</td><td colspan="5">The learning and teaching strategy is planned in order to provide sufficient information to study electronic components, including semiconductors, and to demonstrate concepts with appropriate (and practical where possible) examples that allow students sufficient time to practice and apply techniques using a large number of carefully selected educational electronic components.</td></tr>
</table>

<table>
<tr><td colspan="4" align="center">Student Workload (SWL)
الحمل الدراسي للطالب</td></tr>
<tr>
<td>Structured SWL (h/sem)
الحمل الدراسي المنتظم للطالب خلال الفصل

In class lectures   56
In class tutorials   15
In class tests   10
Seminars   6</td>
<td>87</td>
<td>Structured SWL (h/w)
الحمل الدراسي المنتظم للطالب أسبوعيا</td>
<td>5.8</td>
</tr>
<tr>
<td>Unstructured SWL (h/sem)
الحمل الدراسي غير المنتظم للطالب خلال الفصل

Library, dorm, home memorizing 31
Prepartion for tests   22
Homeworks   10</td>
<td>63</td>
<td>Unstructured SWL (h/w)
الحمل الدراسي غير المنتظم للطالب أسبوعيا</td>
<td>4.2</td>
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<tr>
<td>Total SWL (h/sem)
الحمل الدراسي الكلي للطالب خلال الفصل</td>
<td colspan="3">150</td>
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<table>
<tr><td colspan="6" align="center">Module Evaluation
تقييم المادة الدراسية</td></tr>
<tr><td colspan="2"></td><td>Time (hr)</td><td>Weight (Marks)</td><td>Week Due</td><td>Relevant Learning Outcome</td></tr>
<tr><td rowspan="4">Formative assessment</td><td>Quizzes</td><td>3</td><td>15% (10)</td><td>5, 10 ,13</td><td>LO #1, 2, 3, and 4</td></tr>
<tr><td>Assignments</td><td>4</td><td>8% (10)</td><td>3,6, 11,14</td><td>LO # 1, 2, 3, 4, 5 and 6</td></tr>
<tr><td>Lab.</td><td>1</td><td>12% (10)</td><td>Continuous</td><td></td></tr>
<tr><td>Report</td><td>1</td><td>5% (10)</td><td>13</td><td>LO # 1, 2, 5 and 6</td></tr>
<tr><td rowspan="2">Summative assessment</td><td>Midterm Exam</td><td>3 hrs</td><td>15% (10)</td><td>7</td><td>LO # 1-3</td></tr>
<tr><td>Final Exam</td><td>4 hrs</td><td>8% (10)</td><td>16</td><td>All</td></tr>
<tr><td colspan="2">Total assessment</td><td></td><td>100% (100 Marks)</td><td></td><td></td></tr>
</table>

<table>
<tr><td align="center">Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري</td></tr>
</table>

	Material Covered
Week 1	ENGINEERING ETHICS Consensus and Controversy – Models of professional roles – Theories about right action.
Week 2	Introduction to the Field Effect Transistors (FET). Junction field-effect transistor (JFET): physical operation and static characteristics
Week 3	Physical operation and static characteristics. - Metal - Oxide semiconductor FET (MOSFET): depletion -type MOSFET, enhancement - type MOFET.
Week 4	DC analysis of FET
Week 5	The FET as an amplifier.
Week 6	Graphical (load line) analysis
Week 7	Small-single FET models
Week 8	Midterm exam
Week 9	Analysis of CS, CD and CG configurations
Week 10	Using FETs as switch, voltage variable resistor, and constant current source.
Week 11	Multistage Amplifiers: Analysis of multistage amplifiers (voltage gain, current gain. etc.).
Week 12	Types of multistage amplifiers (cascade ... etc.). RC-Coupled BJT Amplifier, Direct-Coupled BJT Amplifiers, Frequency Response
Week 13	Multistage FET Amplifiers, Transformer Coupling
Week 14	Introduction to four-layer Description and operation of silicon-controlled rectifier
Week 15	DIAC, GTO and TRIAC.
Week 16	**Final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Unipolar junction Field Effect Transistors (FET).
Week 2	Lab 2: The FET transfer characteristics curve
Week 3	Lab 3: small signal FET common drain amplifier
Week 4	Lab 4: small signal FET common source amplifier
Week 5	Lab 5: Multistage FET Amplifiers
Week 6	Lab 6: Multistage BJT Amplifiers
Week 7	Lab 7: Final tests

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the

		Library?
Required Texts	"Electronic Devices & circuit theory" by Robert L. Boylestad and Louis Nashelsky, 11th ed. Taylor & Francis, 2013, ISBN-10: 0-13-262226-2, ISBN-13: 978-0-13-262226-4.	Yes
Recommended Texts	1. ELECTRONIC DEVICES by Thomas L. Floyd, Ninth Edition, 2012. 2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, ―Engineering Ethics – Concepts and Cases, Cengage Learning, 2009.	Yes
Websites	http://www.pearsonhighered.com/electronics	

APPENDIX:

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

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

Ministry of Higher Education and
Scientific Research - Iraq
University of Tikrit
College of Engineering
Department of Sustainable Energy
Engineering

MODULE DESCRIPTOR

وصف المادة الدراسية

Module Information
معلومات المادة الدراسية

Module Title	ELECTRIC MACHINE	Module Delivery	
Module Type	BASIC	☒ Lecture	
Module Code	SE-ENG-305	☒ Lab	
ECTS Credits	5	☒ Tutorial	
SWL (hr/sem)	125		

Module Level	UGIII	Semester (s) offered	5
Administering Department	Sustainable Energy Engineering	College	Engineering
Module Leader	Omer Nafa'a Mahmmoud	e-mail	eng.omernafaa2016@st.tu.edu.iq
Module Leader's Acad. Title	Assistant Lecturer	Module Leader's Qualification	
Module Tutor	Kahtan Ali yousif	e-mail	qahtan.a.yousif@tu.edu.iq
Peer Reviewer Name		e-mail	
Review Committee Approval	01/09/2025	Version Number	1.0

Relation With Other Modules
العلاقة مع المواد الدراسية الأخرى

Prerequisite module		Semester	2
Co-requisites module	None	Semester	-

Module Aims, Learning Outcomes, Indicative Contents and Brief Description أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر	
Module Aims أهداف المادة الدراسية	The module introduces students to the fundamental principles of electric and magnetic fields at low frequencies and provides an overview of the working principles of transformers and DC electrical machines. Learn the construction of dc machine, and enhance the students' skills for the principles of commutation and armature reaction. Then they learn various types of dc machines including characteristics Subject content aims: • To introduce students to the main parameters and properties of electric and magnetic fields at low frequencies. • To introduce students to the principles of electro-mechanics and electromechanical energy conversion to show how electromagnetic fields can be used to induce forces and torques on current carrying conductors. • To introduce students to the basics of electrical machine construction and the structure and operational principles of DC machines. • To introduce students to the concept of magnetic circuits and the operational principles and characteristics of transformers. Graduate skills aim: • To develop skills in basic numerical and analytical techniques. • To develop professional laboratory working practices.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	10. Understand and use Ampere's Law to calculate the flux in simple types of magnetic circuits with and without air gaps, so as to be able to analyze magnetic circuits using the concepts of magneto motive force and magnetic reluctance. 11. Understand and be able to state Faraday's Law and know that the induced EMF in a coil is proportional to the rate of change of magnetic flux through that coil. 12. Demonstrate an understanding of the relations between flux linkage, inductance and energy. 13. Understand the concept of mutual inductance and for a two winding transformer be able to draw the equivalent circuit and calculate the voltage, current and impedance ratio. 14. Demonstrate an understanding of how magnetic fields induce a force on a current carrying coil and be able to calculate the torque on such a coil. 15. Demonstrate an understanding of basic electrical machine construction and terminology and be able to explain the operation of a DC machine.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. • Basic principles of electromagnetic machines. Direct Current Generators and Motors (6 hrs) • Types and characteristics of DC Electrical Machines and Transformers (12 hrs) • Ideal and practical transformers and their circuit models

	• (12 hrs) • Evaluate the design and efficiency of electrical machines (9 hrs) • Apply mathematical principles to solve analytical problems on electrical machines (15 hrs) •
Course Description	This course aims to introduce the student to establish fundamental knowledge of the main technologies for the generation and transformation of electrical power with an emphasis on their operating principles, their stability when interconnected and techniques for their control.

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	The learning and teaching **strategy** is designed to: Carefully cover in lectures the necessary fundamental material and analytical techniques, and demonstrate concepts with appropriate (and where possible practical) examples Allow students adequate time to practice the techniques using a large number of carefully selected tutorial problems.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** **60** **In class tests** **13**	73	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4.9
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Library, dorm, home memorizing 22** **Preparation for tests** **20** **HomeWorks** **10**	52	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation
تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	3	15% (10)	5, 10 ,13	LO #1, 2, 3, and 4
	Assignments	4	8% (10)	3,6, 11,14	LO # 1, 2, 3, 4, 5 and 6
	Lab.	1	12% (10)	Continuous	
	Report	1	5% (10)	13	LO # 1, 2, 5 and 6
Summative assessmen	**Midterm Exam**	3 hrs	15% (10)	7	LO # 1-3
	Final Exam	4 hrs	8% (10)	16	All

t					
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	General principle of rotating electrical machines
Week 2	Construction of DC machines
Week 3	EMF and torque Equation of DC machines
Week 4	Types of armature winding of dc machines
Week 5	Armature reaction in DC machines
Week 6	Calculating demagnetizing and cross-magnetizing force
Week 7	**Midterm exam**
Week 8	Classification of DC generators
Week 9	The fundamental characteristics of DC Generators
Week 10	Condition required for buildup voltage for self-excited DC Generator
Week 11	Formula and equations of different types of DC Generators
Week 12	Parallel operation of DC Generators
Week 13	Losses and efficiency of DC Generator
Week 14	Voltage regulation of DC Generator
Week 15	Round up
Week 16	**Final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: The measurement devices
Week 2	Lab 2: DC Shunt Generator No load test
Week 3	Lab 3: DC Shunt Generator load test
Week 4	Lab 4: DC Series Generator load test
Week 5	Lab 5: DC Compound Generator load test
Week 6	Lab 6: DC Separately excited Generator load test

<table>
<tr><td colspan="3" align="center">Learning and Teaching Resources
مصادر التعلم والتدريس</td></tr>
<tr><td></td><td align="center">Text</td><td align="center">Available in the Library?</td></tr>
<tr><td>Required Texts</td><td>Electrical Machinery Fundamentals, Stephen J Chapmans, 4th edition, MicGraw Hill, 2005.</td><td align="center">Yes</td></tr>
<tr><td>Recommended Texts</td><td>2-Electrical Machines, D. P. Kothari and I. J. Nagrath, 4th edition, MicGraw Hill, 2010</td><td align="center">No</td></tr>
<tr><td>Websites</td><td align="center">http://umich.edu/~elements/5e/lectures/index.html</td><td></td></tr>
</table>

APPENDIX:

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Ministry of Higher Education and
Scientific Research - Iraq
University of Tikrit
College of Engineering
Department of Sustainable Energy
Engineering

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information
معلومات المادة الدراسية

Module Title	TURBOMACHINERY	**Module Delivery**	
Module Type	CORE	☒ **Theory** ☒ **Lecture** ☒ **Tutorial** ☒ **Practical** ☒ **Seminar**	
Module Code	SE-ENG- 306		
ECTS Credits	6		
SWL (hr/sem)	150		

Module Level	UGIII	**Semester (s) offered**	6
Min number of students	15	**Max number of students**	100
Administering Department	Sustainable Energy Engineering	**College**	Engineering
Module Leader	Ali Ahmed Gitan	**e-mail**	aliagitan@tu.edu.iq
Module Leader's Acad. Title	Assist. Professor	**Module Leader's Qualification**	Ph.D.
Module Tutor	Mohammed Ibrahim Khalaf	**e-mail**	mohammed.i.khalaf@tu.edu.iq
Peer Reviewer Name		**e-mail**	
Review Committee Approval	11/9/2025	**Version Number**	1.0

Relation With Other Modules
العلاقة مع المواد الدراسية الأخرى

Prerequisite module	Fluid Mechanics	**Semester**	3

Co-requisites module	None		Semester	-

Module Aims, Learning Outcomes, Indicative Contents and Brief Description أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر	

Module Aims أهداف المادة الدراسية	This module aims to: 1. Develop an understanding of the physical principles governing turbomachinery operation and performance. 2. Explain the application of similarity laws for modeling and scaling of pumps and turbines. 3. Provide analytical and problem-solving skills in evaluating turbine, pump, and compressor performance. 4. Familiarize students with the design considerations and performance characteristics of different turbomachines. 5. Enable students to apply theoretical concepts to real-world energy and propulsion systems.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	• MLO1: Explain the working principles and classifications of turbomachines. • MLO2: Describe and apply similarity laws to pumps and turbines. • MLO3: Identify the characteristics and performance parameters of impulse and reaction turbines. • MLO4: Explain the operation and performance of axial and centrifugal pumps, compressors, and gas turbines. • MLO5: Analyze and compare efficiencies, work done, and energy conversion in turbomachines. • MLO6: Interpret characteristic curves and assess cavitation and flow phenomena. • MLO7: Select appropriate turbomachinery for specific engineering applications. • MLO8: Communicate technical findings effectively in written and oral form.
Indicative Contents المحتويات الإرشادية	• Introduction to turbomachinery and classifications • Energy transfer and Euler's equation for turbomachines • Dimensional analysis and similarity laws of pumps and turbines • Impulse turbines – Pelton wheel, velocity triangles, work done, and efficiencies • Reaction turbines – main components, Francis and Kaplan turbines, energy and pressure distribution • Cavitation and flow regulation in reaction turbines • Centrifugal and axial-flow pumps – principles, discharge, pressure rise, efficiency • Multi-stage, series, and parallel operation of pumps • Characteristic curves and performance evaluation • Axial and centrifugal compressors – velocity triangles, flow behavior, pressure ratio, and efficiency • Gas turbines – working cycle, components, performance characteristics, and applications
Course Description	This module introduces the theory, operation, and performance characteristics

of **turbomachines**, focusing on energy transfer between fluids and rotating mechanical components. It covers both **energy-producing** and **energy-absorbing** machines used in hydraulic and thermal systems.

Key topics include **similarity laws** for pumps and turbines, **impulse turbines** (Pelton wheel), **reaction turbines** (Francis and Kaplan types), **centrifugal and axial pumps**, **axial and centrifugal compressors**, and **gas turbines**. Emphasis is placed on performance analysis, efficiency, cavitation, and characteristic curves.

By integrating theoretical principles with practical applications, students gain analytical skills essential for designing and evaluating turbomachines in power, propulsion, and industrial systems.

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	• **Lectures:** Presentation of key theories, derivations, and design principles using multimedia and visual aids. • **Tutorials:** Problem-solving sessions focusing on calculations, performance analysis, and application of similarity laws. • **Case Studies:** Real-world examples linking theory to engineering applications. • **Laboratory / Demonstrations (if available):** Observation of pump and turbine performance and measurement of efficiency. • **Independent Study:** Directed reading, report writing, and assignment completion.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل		Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	
In class lectures 45 Tutorial 15 Online Lectures 15 Seminars 1 Final Exam 3	79		5.27
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل		Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	
Library, dorm, home memorizing 30 Prepartion for tests 30 Homeworks 11	71		4.73
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation
تقييم المادة الدراسية

	Time	Weight (Marks)	Week Due	Relevant Learning

		(hr)			Outcome
Formative assessment	**Quizzes**	3	15% (15)	3, 5, 10, 12, 14	LO #1, 2, 3, and 4
	Assignments (Home works)	3	5% (5)	2, 6, 10	(LO # 1, 2, 4 and 6)
	Seminars	1	5% (5)	Continuous	LO# 7 and 8
	Onsite assignment	1	5% (5)	4, 8	LO# 3 and 5
	Project	1	10% (10)	10	LO# 7 and 8
Summative assessment	**Midterm Exam**	2	10% (10)	7	LO # 1-5
	Final Exam	3	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week1	Introduction to turbomachinery, classification, and energy transfer principles
Week 2	Euler's turbine equation and energy conversion
Week 3	Dimensional analysis and similarity laws (turbines and pumps)
Week 4	Impulse turbines – Pelton wheel: velocity triangles and efficiencies
Week 5	Impulse turbine: work done, governing mechanism, performance curves
Week 6	Reaction turbines – main parts, principle of operation
Week 7	Francis and Kaplan turbines – energy distribution, cavitation
Week 8	Midterm Examination
Week 9	Centrifugal pumps – theory, discharge, and pressure rise
Week 10	Efficiency and cavitation in pumps
Week 11	Multi-stage, series, and parallel pump systems
Week 12	Pump characteristic curves and system matching
Week 13	Axial compressors – velocity triangles, performance parameters
Week 14	Centrifugal compressors – pressure ratio, flow behavior, efficiency
Week 15	Gas turbines – working principles, cycle, and applications
Week 16	**Final Exam**

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	**Available in the**

		Library?
Required Texts	A text book of hydraulic machines, R. S. Khurmi	Yes
Recommended Texts	1.Turbomachinery Design and Theory, Rama S. R Gorla & Aijaz A. Khan. 2.Thermal and Hydraulic machines, R. K. Singal & Rishi Singal.	Yes
Websites	https://www.youtube.com/@ivsl77	

APPENDIX:

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

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

Ministry of Higher Education and
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University of Tikrit
College of Engineering
Department of Sustainable Energy
Engineering

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information		
معلومات المادة الدراسية		
Module Title	Principles of Combustion and Emissions	**Module Delivery**
Module Type	CORE	
Module Code	SE-ENG-307	**Theory**
ECTS Credits	6	**Lecture**
SWL (hr/sem)	150	**Tutorial** **Seminar**

Module Level	UGIII	Semester (s) offered	6
Administering Department	Sustainable Energy Engineering	**College**	Engineering
Module Leader	Khalaf I. Hamada	**e-mail**	dr_khalafih@tu.edu.iq
Module Leader's Acad. Title		**Module Leader's Qualification**	
Module Tutor		**e-mail**	
Peer Reviewer Name		**e-mail**	
Review Committee Approval	1/9/2025	**Version Number**	

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

Co-requisites module	None		Semester	-

Module Aims, Learning Outcomes, Indicative Contents and Brief Description
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر

Module Aims أهداف المادة الدراسية	The aim of this course is 1. The students will develop an understanding of the combustion processes, fuels used, and emissions formed. 2. To understand the fundamentals: the theoretical and technical principles of combustion phenomena, including the physical processes and chemical reactions involved. 3. Students learn about the chemical and physical processes of combustion, how to use tools like stoichiometry and thermodynamics to solve problems, and how to apply this knowledge to modern systems, often with a focus on sustainability and alternative fuels. 4. Explore the types of fuels: Investigate the fuel types as a way to move toward more sustainable energy systems. 5. Minimize emissions: Understand the sources and types of emissions produced by combustion and develop methods to reduce them, with a particular focus on environmental impact and greenhouse gases.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	16) understanding of the principles of combustion. 17) understanding of the fuel and its types. 18) To explain the Thermochemistry of fuel. 19) understanding of the mechanisms of combustion-generated emissions and the techniques that can be used to control them.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. • Introduction to the fundamentals of combustion and fuel • Thermodynamics of fuel • Fuels • combustion • Emission and air pollution
Course Description	This course provides an understanding of the fundamental principles of combustion processes, the formation mechanisms of pollutants, and the technologies used to control and mitigate atmospheric emissions from various energy systems.

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	This course aims to overview of the thermal solar energy fundamentals. Various solar thermal devices will be covered, besides their performance. Besides, thermal storage techniques will be discussed. Also, students will have adequate time to practice the techniques using a large number of carefully selected tutorial problems.

Student Workload (SWL)

الحمل الدراسي للطالب				
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** **28** **Online lectures** **14** **Lab** **28** **Tutorial** **14** **In class tests** **3**	87	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا		5.8
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Library, dorm, home memorizing** **33** **Preparation for tests** **20** **HomeWorks** **10**	63	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا		4.2
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150			

Module Evaluation
تقييم المادة الدراسية

		No.	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	20% (10)	3, 14	LO #1, 2, and 3
	Assignments	2	10% (5)	5, 12	LO # 2, 3 and, 4
	Seminars	1	10% (10)	8	LO # 1-5
Summative assessment	**Midterm Exam**	1	10% (10)	7	All
	Final Exam	1	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	**Basic Fuels Chemistry: Fuels and Their Properties**
Week 2	**Review of Basic Thermodynamics of Ideal Gas Mixtures**
Week 3	**Combustion; Stoichiometry, Off-Stoichiometry**
Week 4	**Flue Gas Analysis: Dry and Wet Gas Analyses**
Week 5	**First Law of Thermodynamics Analysis for a Reacting System**
Week 6	**Enthalpies of Combustion & Formation, Calorific Value of Fuels**
Week 7	**Mid exam**

Week 8	Adiabatic Combustion Temperature
Week 9	Dissociation and Chemical Equilibrium
Week 10	Emissions & Air Pollution
Week 11	Combustion-Generated Air Pollution: Air Quality and Air Pollution
Week 12	Legislation of Air Pollution
Week 13	Pollutants Formation
Week 14	Pollutant Emissions Reduction Techniques
Week 15	Greenhouse Warming and Its Reduction Techniques
Week 16	Final Exam

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	-John A. Duffie - Solar Engineering of Thermal Processes -Sathyajith Mathew - Wind Energy	Yes
Recommended Texts	-John Twidell, Tony Weir – Renewable Energy Resources	No
Websites		

APPENDIX:

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

Note:

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Ministry of Higher Education and
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College of Engineering
Department of Sustainable Energy
Engineering

MODULE DESCRIPTOR

وصف المادة الدراسية

Module Information		
معلومات المادة الدراسية		
Module Title	**Energy Storage Systems**	**Module Delivery**
Module Type	CORE	
Module Code	SE-ENG-308	**Theory** **Lecture** **Tutorial** **Seminar**
ECTS Credits	5	
SWL (hr/sem)	125	

Module Level	UGlll	Semester (s) offered	6
Administering Department	Sustainable Energy Engineering	**College**	Engineering
Module Leader	Hussam Sami Dheyab	**e-mail**	Hussam.sami@tu.edu.iq
Module Leader's Acad. Title	Assistant Prof.	**Module Leader's Qualification**	Ph.D.
Module Tutor		**e-mail**	
Peer Reviewer Name		**e-mail**	
Review Committee Approval	2/11/2025	**Version Number**	

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

Co-requisites module	None		Semester	-

Module Aims, Learning Outcomes, Indicative Contents and Brief Description
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر

Module Aims أهداف المادة الدراسية	The aim of this course is 6. Comprehensive Understanding: The aim of this module is to provide students with a comprehensive understanding of various energy storage systems. 7. Technical Proficiency: This module aims to equip students with the technical knowledge and skills necessary to analyze, evaluate, and design energy storage systems.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of this course, the students would be able to: 20) Discuss the scientific principles underpinning the operation of energy storage systems. 21) Classify various types of energy storage and various devices used for the purpose 22) Resolve the intermittency of renewable energy sources by utilizing problem solving skills in energy storage engineering 23) Work with a team to apply energy storage knowledge to develop and conduct a project.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. • Thermal energy storage • Mechanical Energy Storage • Chemical energy Storage • Electrochemical Energy Storage
Course Description	This course introduces students to energy storage systems and provides a broad understanding and appreciation of the scientific principles that underpin the operation of such systems. Energy storage systems are discussed for benchmarking and comparisons. Topics covered include electrical, chemical, thermal, mechanical, electrochemical, thermochemical and thermomechanical energy storage systems.

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	This course aims to overview the energy storage fundamentals. Various energy storage techniques will be covered besides their performance.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل In class lectures 42 Online lectures 14 Tutorial 14 In class tests 3	73	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4.87
Unstructured SWL (h/sem)	52	**Unstructured SWL (h/w)**	3.47

الحمل الدراسي غير المنتظم للطالب خلال الفصل **Library, dorm, home memorizing 32** **Preparation for tests 20** **HomeWorks 10**		الحمل الدراسي غير المنتظم للطالب أسبوعيا	
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

<table>
<tr><th colspan="6">Module Evaluation
تقييم المادة الدراسية</th></tr>
<tr><td></td><td></td><td>No.</td><td>Weight (Marks)</td><td>Week Due</td><td>Relevant Learning Outcome</td></tr>
<tr><td rowspan="3">Formative assessment</td><td>Quizzes</td><td>2</td><td>20% (10)</td><td>3, 14</td><td>LO #1, 2, and 3</td></tr>
<tr><td>Assignments</td><td>2</td><td>10% (5)</td><td>5, 12</td><td>LO # 2, 3 and, 4</td></tr>
<tr><td>Seminars</td><td>1</td><td>10% (10)</td><td>8</td><td>LO # 1-5</td></tr>
<tr><td rowspan="2">Summative assessment</td><td>Midterm Exam</td><td>1</td><td>10% (10)</td><td>7</td><td>All</td></tr>
<tr><td>Final Exam</td><td>1</td><td>50% (50)</td><td>16</td><td>All</td></tr>
<tr><td colspan="2">Total assessment</td><td colspan="2">100% (100 Marks)</td><td></td><td></td></tr>
</table>

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري
	Material Covered
Week 1	**Introduction and Fundamentals**
Week 2	**Main categories of energy storage methods.**
Week 3	**Sensible heat storage- Part 1**
Week 4	**Sensible heat storage- Part 2**
Week 5	**Latent heat storage - Part 1**
Week 6	**Latent heat storage – Part 2**
Week 7	**Mid exam**
Week 8	**Mechanical Energy Storage: Pumped Hydro Storage**
Week 9	**Mechanical Energy Storage: Compressed Air Energy Storage**
Week 10	**Mechanical Energy Storage: flywheels**
Week 11	**Chemical energy Storage: Hydrogen**
Week 12	**Chemical energy Storage: Synthetic Natural Gas (SNG**
Week 13	**Electrochemical Energy Storage: Batteries and supercapacitors.**

Week 14	Electrochemical Energy Storage: fuel cells and hydrogen systems.
Week 15	Electrochemical Energy Storage: Superconducting Magnetic Energy Storage (SMES) System
Week 16	Final Exam

	Learning and Teaching Resources مصادر التعلم والتدريس	
	Text	**Available in the Library?**
Required Texts	- Robert A. Huggins, Energy storage, Springer Science & Business Media (2010)	Yes
Recommended Texts	Ralph Zito, Energy storage: A new approach, Wiley (2010)	No
Websites		

APPENDIX:

GRADING SCHEME مخطط الدرجات				
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Engineering

MODULE DESCRIPTOR

وصف المادة الدراسية

Module Information
معلومات المادة الدراسية

Module Title	Computer Engineering Design	Module Delivery	
Module Type	Core	**Theory** **Lecture** **Practical** **Seminar**	
Module Code	SE-ENG-309		
ECTS Credits	4		
SWL (hr/sem)	100		

Module Level	UGIII	Semester (s) offered	6
Min number of students	15	Max number of students	100
Administering Department	Sustainable Energy Engineering	College	Engineering
Module Leader	Omar Jamal Abdul Kareem	e-mail	omaralkaylany@tu.edu.iq
Module Leader's Acad. Title	Assistant Lecture	Module Leader's Qualification	MSc
Module Tutor		e-mail	
Peer Reviewer Name		e-mail	
Review Committee Approval	01/09/2025	Version Number	1.0

Relation With Other Modules
العلاقة مع المواد الدراسية الأخرى

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

	Module Aims, Learning Outcomes, Indicative Contents and Brief Description
	أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر
Module Aims أهداف المادة الدراسية	• Develop skills in the reading, interpretation and production of Mechanical Engineering drawings and diagrammatic illustrations conforming to ASTM and ISO Standards. • To make the students to understand the concepts of I.S. conventions, methods of dimensioning, the title boxes, to draw the machine elements and simple parts. • To make the students to understand and draw assemblies of machine parts and to draw their sectional views
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	After completing the Mechanical Engineering Drawing course, the student will be able to: • Demonstrate a basic understanding of the fundamentals of Part Modeling. • Demonstrate an understanding of the extrude and revolve features. • Demonstrate an understanding of the fundamentals of drawing. • Demonstrate an understanding of Sweep, Loft, Wrap & Additional Features. • Demonstrate an understanding of the fundamentals of Assembly Modeling. • Demonstrate an understanding of top-down assembly modeling • Demonstrate an understanding Rapid Prototyping.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. • Fundamentals of Part Modeling • Extrude and Revolve Feature • Fundamentals of Drawing • Sweep, Loft, Wrap & Additional Features • Fundamentals of Assembly Modeling
Course Description	In Solidworks course, you will learn the fundamental tools and concepts for the Solidworks engineering and design software. You will learn how to use the Solidworks software to build parametric models of parts and assemblies, and how to make drawings of those parts and assemblies.
	Learning and Teaching Strategies
	استراتيجيات التعلم والتعليم
Strategies	The learning and teaching **strategy** is designed to: Carefully cover in lectures the necessary fundamental material and analytical techniques and demonstrate concepts with appropriate (and where possible practical) examples Allow students adequate time to practice the techniques using a large number of carefully selected tutorial problems. In addition, a set of experiments were delivered to consolidate the theoretical concepts.

Student Workload (SWL)

الحمل الدراسي للطالب				
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** 45 **In class tests** 10 **Seminars** 2 **Discussions** 2	59	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا		3.9
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Library, dorm, home memorizing** 20 **Preparation for tests** 12 **HomeWorks** 9	41	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا		2.7
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100			

Module Evaluation
تقييم المادة الدراسية

		Time (hr)	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	10% (10)	5, 10, 12, 14	LO #1, 2, 3, and 4
	Assignments (Homeworks)	5	10% (10)	2, 4, 6, 8, 10	LO # 1, 2, 3, 4, 5 and 6
	Seminars	4	8% (8)	Continuous	
	Discussions	6	12% (12)	Continuous	
Summative assessment	**Midterm Exam**	2	10% (10)	7	LO # 1-5
	Final Exam	3	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	Section A: Basics & Introduction ¬ Graphic User Interface ¬ System requirements
Week 2	¬ Parametric design ¬ Basic part modeling ¬ Feature based modeling ¬ File Management ¬ Managing SolidWorks environment
Week 3	Section B: Sketching with SolidWorks ¬ 2D Sketching ¬ Sketching entities and relations
Week 4	Dimensions ¬ Sketch tool ¬ Mirror, Convert entity ¬ Move & Copy
Week 5	Section C: Part Modeling ¬ Part Modeling ¬ Extrude and Cut extrude ¬ Revolve and Sweep ¬ View toolbar ¬ Creating Reference geometries ¬
Week 6	Fillet and Chamfer ¬ Hole wizard ¬ Calculating weight/mass & other geometric properties

	¬ Export / Import of CAD files
Week 7	Midterm exam
Week 8	Section D: Advanced Part Modeling ¬ Adding ribs and draft ¬ Circular and rectangular pattern ¬ Shell and Boss feature ¬
Week 9	Configuration and Design Tables ¬ Material Library & Assigning Material ¬ Library Features & Smart Fasteners ¬ Boolean operations
Week 10	Section E: Assembly Mode ¬ Getting started with Assembly ¬ Inserting components in assembly ¬ Top-Down Assembly ¬ Feature Manager Design tree & Symbols ¬ Hiding components & controlling transparency ¬
Week 11	Sub Assemblies ¬ Using mates in assembly ¬ Use of Smart Fasteners ¬ Bottom -Up Assembly ¬ Interference detection and misalignment of holes ¬ Exploding assemblies and adding explode lines
Week 12	Section F: Generating detail drawings from Model ¬ Drafting overview ¬ Drawing sheets and views ¬ Adding drawing views
Week 13	View settings and drawing properties ¬ Smart Dimensioning ¬ Annotations and Symbols ¬ Sheet Formats and Templates ¬ Ballooning for nomenclature ¬ Adding Bill of Material and tables
Week 14	Section G: Surface Modeling / Sheet Metal ¬ Introduction to surfacing tools ¬ Sweep, Loft, Revolve, Offset etc. ¬ Filleting and trimming ¬ Utilization of Sheet Metal & forming tools
Week 15	Section H: Add-on Modules ¬ Weldment ¬ Core & Cavity ¬ Pipe routing
Week 16	**Final Exam**

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	**Engineering Design with SOLIDWORKS 2021: A Step-by-Step Project Based Approach Utilizing 3D Solid Modeling 1st Edition**	No
Recommended Texts	**Learn SOLIDWORKS: Get up to speed with key concepts and tools to become an accomplished SOLIDWORKS Associate and Professional, 2nd Edition**	No
Websites	N/A	

APPENDIX:

GRADING SCHEME مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C – Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings

	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	مقبول بقرار	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note:	

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

	Ministry of Higher Education and Scientific Research - Iraq University of Tikrit College of Engineering Department of Sustainable Energy Engineering	

MODULE DESCRIPTOR

وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	Geothermal Energy	Module Delivery	
Module Type	CORE	Theory Lecture Tutorial Seminar	
Module Code	SE-ENG-310		
ECTS Credits	5		
SWL (hr/sem)	125		
Module Level	UGlll	Semester (s) offered	6
Administering Department	Sustainable Energy Engineering	College	Engineering
Module Leader	Fayadh M. Abed	e-mail	fayadh_mohamed@tu.edu.iq
Module Leader's Acad. Title	Prof.	Module Leader's Qualification	Ph.D.

Module Tutor		e-mail	
Peer Reviewer Name		e-mail	
Review Committee Approval	2/9/2025	Version Number	

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

Module Aims, Learning Outcomes, Indicative Contents and Brief Description أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر	
Module Aims أهداف المادة الدراسية	The aim of this course is 8. To provide students with a solid foundation in the fundamentals of geothermal energy and a working knowledge of the scientific, technological and business aspects of the geothermal energy industry. 9. Equip students with the technical and business skills to exploit geothermal energy for decarbonizing heating and cooling applications.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of this course, the students would be able to: 24) Analyze the current energy transition and the role of geothermal energy technologies in producing sustainable energy, heating and cooling. 25) Evaluate the fundamentals, prospects, operations and advanced technologies used in the generation of electricity from geothermal energy resources. 26) Analyze the scientific, technological, environmental and social components of geothermal energy; drilling techniques, geothermal pumps, Enhanced and Advanced Geothermal Systems. 27) Economic evaluation of geothermal systems. 28) Critically appraise the technical and non-technical barriers to geothermal energy development
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. • Geothermal energy resources, geothermal energy production, heating and cooling. • Drilling for geothermal energy production • Economics of geothermal systems. • Technical and non-technical barriers to geothermal energy development, geothermal system components
Course Description	This course introduces students to geothermal energy and provides a broad understanding and appreciation of the scientific principles that underpin the operation of such energy. Applications of thermodynamics

	and heat transfer principles will explain how energy is transformed from geothermal energy to useable energy for large- and small-scale systems. Students will determine heating and cooling loads leading to the selection of the correct system installation to meet the demand.

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	This course aims to overview the geothermal energy fundamentals. Various geothermal energy techniques will be covered besides their performance.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل		Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	4.87
In class lectures 28 Lab 28 Tutorial 14 In class tests 3	73		
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل		Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.47
Library, dorm, home memorizing 32 Preparation for tests 10 HomeWorks 10	52		
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation
تقييم المادة الدراسية

		No.	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	20% (10)	3, 14	LO #1, 2, and 3
	Assignments	2	10% (5)	5, 12	LO # 2, 3 and, 4
	Seminars	1	10% (10)	8	LO # 1-5
Summative assessment	Midterm Exam	1	10% (10)	7	All
	Final Exam	1	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Origins and principles of geothermal energy
Week 2	Overview of geothermal energy technologies
Week 3	Fluid Flow and Geochemistry: Subsurface Fluid Flow
Week 4	Reservoir engineering
Week 5	Flash steam power plants
Week 6	Flash steam power plants
Week 7	Mid exam
Week 8	Double flash steam power plants
Week 9	Double flash steam power plants
Week 10	Dry steam power plants
Week 11	Binary cycle power plants
Week 12	Installation procedures_1
Week 13	Installation procedures_2
Week 14	Cost Analysis
Week 15	Environmental benefits and challenges associated with geothermal energy utilization
Week 16	Final Exam

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	"Geothermal Power Plants", Ronald DiPippo, 2nd Edition, Elsevier, 2008	Yes
Recommended Texts	Solar and Geothermal Energy, John Tabak, Facts On File, 2009	No
Websites		

APPENDIX:

GRADING SCHEME مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C – Good	جيد	70 - 79	Sound work with notable errors
	D –	متوسط	60 - 69	Fair but with major shortcomings

	Satisfactory			
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX – Fail**	مقبول بقرار	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

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

Ministry of Higher Education and
Scientific Research - Iraq
University of Tikrit
College of Engineering
Department of Sustainable Energy
Engineering

MODULE DESCRIPTOR

وصف المادة الدراسية

Module Information

معلومات المادة الدراسية

Module Title	Engineering statistics	**Module Delivery**
Module Type	Basic	**Theory** **Lecture** **Tutorial** **Seminar**
Module Code	Math-302	
ECTS Credits	4	
SWL (hr/sem)	100	

Module Level	UGIII	**Semester (s) offered**	6
Min number of students	15	**Max number of students**	100
Administering	Sustainable Energy	**College**	Engineering

Department	Engineering		
Module Leader	Dr. Nassir D Mokhlif	e-mail	nassirdhamin@tu.edu.iq
Module Leader's Acad. Title	Prof.	Module Leader's Qualification	Ph.D.
Module Tutor	None	e-mail	None
Peer Reviewer Name		e-mail	
Review Committee Approval	03/9/2025	Version Number	1.0

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

Module Aims, Learning Outcomes, Indicative Contents and Brief Description

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر

Module Aims أهداف المادة الدراسية	1) To provide definition of statistic and give necessary idea. 2) To explain the concept of data collection and representation. 3) To give information about how to make data tabled. 4) To explain the descriptive statistics. 5) To calculate central and variation measurement. 6) To give information about investigative statistics. 7) To explain probability laws. 8) To make analysis and decision.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1) Use both conceptual and numerical techniques to solve engineering problems. 2) Analyze and make decision. 3) Understand and use the general idea of statistics of a particle. 4) Understand and use the general ideas probability. 5) Determine the distribution appropriate for any problem. 6) Analyze the data collect from field. 7) Find sample volume. 8) Understand and use the general ideas of hypothesis tests.

	9) Apply data analysis by using SPSS program.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. ● Data collection and data representation. (6 hrs) ● Central and Variation measurements. (6 hrs) ● Principles of probability theory (9 hrs) ● Correlation and Regression (9 hrs) ● Hypotheses and Fitness tests (9 hrs) ● Test of variation, one-way test, two-way test. (9 hrs)
Course Description	The course covers the following topics; statistics of applications: Data collection, Data representation, Central measurements, comparisons between central measurements, Variation measurements, comparisons between Variation measurements Sampling and Estimation, Principles of probability theory, Probability Distributions, Correlation and Regression, Hypotheses and Fitness tests, Test of variation, one-way test, Test of variation, two-way test, method of virtual work.

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	The learning and teaching **strategy** is designed to: Carefully cover in lectures the necessary fundamental material and analytical techniques, and demonstrate concepts with appropriate (and where possible practical) examples Allow students adequate time to practice the techniques using a large number of carefully selected tutorial problems.

Student Workload (SWL)

الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل		Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	
In class lectures 40 In class tests 12 Seminars 3 Discussions 4	59		3.9
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل		Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	
Library, dorm, home memorizing 20 Prepartion for tests 11 Homeworks 10	41		2.7
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

<table>
<tr><td colspan="6" align="center">Module Evaluation
تقييم المادة الدراسية</td></tr>
<tr><td></td><td></td><td>Time (hr)</td><td>Weight (Marks)</td><td>Week Due</td><td>Relevant Learning Outcome</td></tr>
<tr><td rowspan="3">Formative assessment</td><td>Quizzes</td><td>2</td><td>10% (10)</td><td>2, 3, 4, 5, 6, 7</td><td>LO #1, 2, 3, and 4</td></tr>
<tr><td>Assignments (Homeworks)</td><td>3</td><td>10% (10)</td><td>2, 4, 6, 8, 10</td><td>LO # 1, 2, 3, 4, 5 and 6</td></tr>
<tr><td>Discussions</td><td>4</td><td>12% (20)</td><td>Continuous</td><td></td></tr>
<tr><td rowspan="2">Summative assessment</td><td>Midterm Exam</td><td>2</td><td>10% (10)</td><td>8</td><td>LO # 1-5</td></tr>
<tr><td>Final Exam</td><td>3</td><td>50% (50)</td><td>16</td><td>All</td></tr>
<tr><td colspan="2">Total assessment</td><td></td><td>100%
(100 Marks)</td><td></td><td></td></tr>
</table>

<table>
<tr><td colspan="2" align="center">Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري</td></tr>
<tr><td></td><td>Material Covered</td></tr>
<tr><td>Week 1</td><td>General principles, Principles of statistics</td></tr>
<tr><td>Week 2</td><td>Data collection, Data representation</td></tr>
<tr><td>Week 3</td><td>Central measurements, Harmonic mean, median, mode.</td></tr>
<tr><td>Week 4</td><td>comparisons between central measurements.</td></tr>
<tr><td>Week 5</td><td>Variation measurements, Range, Mean deviation, Slandered deviation.</td></tr>
<tr><td>Week 6</td><td>Coefficient of variance, comparisons between variance measurements, sequence and measurements</td></tr>
<tr><td>Week 7</td><td>Coefficient of variance, comparisons between variance measurements, sequence and measurements</td></tr>
<tr><td>Week 8</td><td>Midterm exam</td></tr>
<tr><td>Week 9</td><td>Principles of probability theory</td></tr>
<tr><td>Week 10</td><td>Principles of probability theory</td></tr>
</table>

Week 11	Probability Distributions
Week 12	Probability Distributions
Week 13	Sampling and Estimation
Week 14	Hypotheses and Fitness tests
Week 15	Hypotheses and Fitness tests
Week 16	**Final Exam**

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	المدخل إلى الإحصاء"ـد. خاشع محمود الراوي-جامعة الموصل/كلية الزراعة والغابات -1984.	Yes
Recommended Texts	- مبادئ الإحصاء الهندسي", د. باسم نزهت السامرائي، د. مثنى جبر، الجامعة التكنولوجية، دار الحكمة للطباعة والنشر، بغداد، 1990 - الأساليب الإحصائية في العلوم الإدارية، تطبيقات باستخدام (spss)",د. صلاح الدين حسن إلهيتي، جامعة مؤتة، دار الوائل للطباعة والنشر، عمان 2004. - مدخل الى علم الإحصاء د. علي محمد الجمعة 2007	Yes No
Websites	N/A	

APPENDIX:

GRADING SCHEME				
مخطط الدرجات				
Group	Grade	التقدير	Marks (%)	Definition
Success Group **(50 - 100)**	**A - Excellent**	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings

	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group	**FX – Fail**	مقبول بقرار	(45-49)	More work required but credit awarded
(0 – 49)	**F – Fail**	راسب	(0-44)	Considerable amount of work required

Note:

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Ministry of Higher Education and
Scientific Research - Iraq
University of Tikrit
College of Engineering
Department of Sustainable Energy
Engineering

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			

Module Title	OPTIMIZATION	**Module Delivery**	
Module Type	CORE	✓☐ Theory ✓☐ Lecture ✓☐ Tutorial ✓☐ Practical ✓☐ Seminar	
Module Code	SE-ENG-401		
ECTS Credits	4		
SWL (hr/sem)	100		

Module Level	UGIV	**Semester (s) offered**	7
Administering Department	Sustainable Energy Engineering	**College**	Engineering
Module Leader	Mohanad L Hamada	**e-mail**	muhanad-lateef@tu.edu.iq
Module Leader's Acad. Title	Lecturer	**Module Leader's Qualification**	Ph.D.
Module Tutor		**e-mail**	
Peer Reviewer Name		**e-mail**	
Review Committee Approval	1/9/2025	**Version Number**	1.0

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

Module Aims, Learning Outcomes, Indicative Contents and Brief Description أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر	
Module Aims أهداف المادة الدراسية	The aim of this module is to provide students with a solid understanding of the fundamental principles, mathematical formulations, and computational methods used in engineering optimization. Students will learn how to identify, model, and solve optimization problems that arise in mechanical engineering systems and processes. Specifically, the module aims to: 1. Develop the ability to formulate real-world engineering problems as mathematical optimization models. 2. Introduce students to analytical and numerical optimization techniques, including linear programming, simplex methods, and quadratic programming. 3. Build proficiency in interpreting and analyzing the results of optimization models for engineering decision-making. 4. Cultivate problem-solving and critical-thinking skills through practical examples and applications relevant to mechanical engineering design, manufacturing, and energy systems. 5. Provide a foundation for advanced study or research in optimization and related computational engineering fields.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	**By the end of this module, students will be able to:** 1. Explain the fundamental concepts and importance of optimization in engineering applications. 2. Identify and classify various types of optimization problems. 3. Formulate engineering problems as mathematical optimization models. 4. Solve linear programming problems using graphical and simplex methods. 5. Transform constraints into standard forms using slack, surplus, and artificial variables. 6. Apply matrix notation to represent and solve optimization systems. 7. Interpret optimization results and evaluate their engineering meaning. 8. Communicate solutions and analysis effectively in technical form. 9. Demonstrate analytical and problem-solving skills relevant to mechanical and energy systems.
Indicative Contents المحتويات الإرشادية	**Indicative content includes the following.** 1. Fundamentals and applications of optimization. 2. Formulation of optimization problems. 3. Linear, nonlinear, quadratic, and integer programming. 4. Graphical solution methods. 5. Standard form, slack and surplus variables. 6. Big-M and two-phase simplex methods. 7. Matrix representation and simplex tableau. 8. Interpretation of results and engineering applications.

Course Description	This course introduces the fundamental principles and mathematical techniques of optimization used in engineering analysis and design. It focuses on formulating real-world engineering problems as mathematical models and solving them using analytical and computational methods. Topics include linear and nonlinear programming, standard forms, simplex and two-phase methods, and the application of optimization to mechanical and energy systems. Emphasis is placed on developing problem-solving skills and understanding the role of optimization in improving engineering performance and efficiency.

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	The learning and teaching **strategy** is designed to:
	• Lectures will be used to present key theories, mathematical foundations, and methods of optimization in a structured manner.
	• Tutorials will focus on solving numerical examples and practical problems to strengthen understanding and application skills.
	• Class discussions will encourage students to analyze, compare, and interpret optimization models in engineering contexts.
	• Problem-based learning will be integrated through real engineering case studies to develop critical and analytical thinking.
	• Independent study will enable students to review lecture notes, complete assignments, and explore additional reading materials.
	• Use of computational and graphical tools will support visualization, modeling, and verification of optimization solutions.
	• Regular assessments such as quizzes, homework, and exams will provide feedback on learning progress and promote continuous improvement.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل		Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	
In class lectures 30 **In class tests** 4 **Discussions** 15 **Laboratory hours** 10	59		3.9
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل		Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	
Library, dorm, home memorizing 22 **Preparation for tests** 10 **Homework's** 9	41		2.7
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

Module Evaluation
تقييم المادة الدراسية

		Time (No.)	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	15% (5)	5, 9, 14	LO #1, 2, 3 and 4
	Online Assignments	3	10% (2)	2, 4, 9, 11, 13	LO # 1, 2, 3 and 4
	Onsite Assignments	2	5% (2)	6, 12	LO # 1, 2, 3 and 4
	Seminar	1	10% (10)	10	LO # 1, 2, 3, and 4
Summative assessment	**Midterm Exam**	1	10% (10)	7	LO # 1, and 2
	Final Exam	1	50% (50)	16	All
Total assessment		100% (100 Marks)			

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction to Optimization
Week 2	Mathematical Formulation of Optimization Problems
Week 3	Types of Optimization Problems
Week 4	Examples & Problem Formulation Practice
Week 5	Graphical (Geometric) Solution Methods
Week 6	Linear Programming: Standard Form
Week 7	Mid Tern Exam
Week 8	Initial Feasible Solution & Penalty Method (Big-M Method)
Week 9	Matrix Representation and Standard Form Practice
Week 10	Introduction to the Simplex Method
Week 11	Simplex Method Steps (Phase I)
Week 12	Two-Phase Simplex Method (Artificial Variables)
Week 13	Nonlinear Programming: Single-Variable Optimization
Week 14	Sequential-Search Techniques
Week 15	Convex Functions
Week 16	Final Exam

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Hillier, F. S. & Lieberman, G. J. Introduction to Operations Research.	Yes

Recommended Texts	Bazaraa, M. S., Sherali, C. M., & Shetty, C. M. Nonlinear Programming: Theory and Algorithms.		Yes
Websites			

APPENDIX:

GRADING SCHEME مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A –** Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
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Fail Group (0 – 49)	**FX –** Fail	مقبول بقرار	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required
Note:				

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

	Ministry of Higher Education and Scientific Research - Iraq University of Tikrit College of Engineering Department of Sustainable Energy Engineering	

MODULE DESCRIPTOR
وصف المادة الدراسية

<table>
<tr><td colspan="4" align="center">**Module Information**
معلومات المادة الدراسية</td></tr>
<tr><td>**Module Title**</td><td>**Principle of Fuel Cell Technology**</td><td>**Module Delivery**</td><td></td></tr>
<tr><td>**Module Type**</td><td>CORE</td><td rowspan="4">**Theory**
Lecture
Tutorial
Seminar</td><td rowspan="4"></td></tr>
<tr><td>**Module Code**</td><td>SE-ENG-402</td></tr>
<tr><td>**ECTS Credits**</td><td>6</td></tr>
<tr><td>**SWL**
(hr/sem)</td><td>150</td></tr>
<tr><td>**Module Level**</td><td>UGIV</td><td>**Semester (s) offered**</td><td>7</td></tr>
<tr><td>**Administering Department**</td><td>Sustainable Energy Engineering</td><td>**College**</td><td>Engineering</td></tr>
<tr><td>**Module Leader**</td><td>Tadahmun Ahmed Yassen</td><td>**e-mail**</td><td>tadahmunahmed@tu.edu.iq</td></tr>
<tr><td>**Module Leader's Acad. Title**</td><td>Prof.</td><td>**Module Leader's Qualification**</td><td>Ph.D.</td></tr>
<tr><td>**Module Tutor**</td><td></td><td>**e-mail**</td><td></td></tr>
<tr><td>**Peer Reviewer Name**</td><td></td><td>**e-mail**</td><td></td></tr>
<tr><td>**Review Committee Approval**</td><td>01/09/2025</td><td>**Version Number**</td><td></td></tr>
</table>

<table>
<tr><td colspan="4" align="center">**Relation With Other Modules**
العلاقة مع المواد الدراسية الأخرى</td></tr>
<tr><td>**Prerequisite module**</td><td>None</td><td>**Semester**</td><td>-</td></tr>
<tr><td>**Co-requisites module**</td><td>None</td><td>**Semester**</td><td>-</td></tr>
<tr><td colspan="4" align="center">**Module Aims, Learning Outcomes, Indicative Contents and Brief Description**
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر</td></tr>
<tr><td>**Module Aims**
أهداف المادة الدراسية</td><td colspan="3">The aim of this course is
10. To impart knowledge on use of fuel cell for achieving sustainable growth and facilitate analysis of the challenges in transition to hydrogen economy
11. To analyze any kind of scientific and technological method of obtaining and handling hydrogen for use in fuel cells and express</td></tr>
</table>

	rules for its implementation, optimization and / or modification.
	12. To provide students the skills to identify the problems and deficiencies of energy installations and electrical devices and be able to provide engineering solutions.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	29) Ability to understand and demonstrate the hydrogen production technologies, storage methods and strategies for transition to hydrogen economy. 30) Ability to know the concepts and characteristics of various types of fuel cell 31) Ability to consist and demonstrate the working of fuel cells 32) Ability to know the application of fuel cells with economic and environment analysis. 33) Demonstrate a good knowledge and understanding on the main sources of information, current projects and future challenges related to the processes of obtaining hydrogen and different types of fuel cells.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Program Learning Outcomes describe what students are expected to know and be able to do by the time of graduation. These relate to the knowledge, skills, and behaviors that students acquire as they progress through the program. A graduate of the (Hydrogen and Fuel Cell Technology) program will demonstrate.
Course Description	This course covers fuel cell technologies, systems, engine design, safety, and maintenance. It also presents the different types of fuel cells and hybrid electric vehicles.

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	The learning and teaching strategy is designed to: Carefully cover in lectures the necessary fundamental material and analytical techniques, and demonstrate concepts with appropriate (and where possible practical) examples Allow students adequate time to practice the techniques using a large number of carefully selected tutorial problems.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل		Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	
In class lectures 28 Online lectures 14 Lab 28 Tutorial 14 In class tests 3	87		5.8
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	63	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.2

Library, dorm, home memorizing 33 Preparation for tests 20 HomeWorks 10		
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150	

Module Evaluation
تقييم المادة الدراسية

		Time (hr)	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	20% (10)	3, 14	LO #1, 2, and 3
	Assignments	2	10% (5)	5, 12	LO # 2, 3 and, 4
	Seminars	1	10% (10)	8	LO # 1-5
Summative assessment	Midterm Exam	1	10% (10)	7	All
	Final Exam	1	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	Introduction to Fuel Cells
Week 2	Fuel Cell Electrochemistry
Week 3	Fuel Cell Components
Week 4	Classification of Fuel Cells
Week 5	PEM Fuel Cells
Week 6	SOFC
Week 7	DMFC and AFC
Week 8	Mid exam
Week 9	Hydrogen Production and Storage
Week 10	Fuel Cell Performance
Week 11	System Design and Modeling
Week 12	Applications
Week 13	Integration with Renewable Energy
Week 14	Materials and Manufacturing

Week 15	Challenges and Future Trends
Week 16	Final Exam

<table>
<tr><th colspan="3">Learning and Teaching Resources
مصادر التعلم والتدريس</th></tr>
<tr><td></td><td>Text</td><td>Available in the Library?</td></tr>
<tr><td>Required Texts</td><td>Fuel Cells and Hydrogen: From Fundamentals to Applied Research, Editors: Viktor Hacker, Shigenori Mitsushima, 1st Edition, 2018</td><td>Yes</td></tr>
<tr><td>Recommended Texts</td><td></td><td></td></tr>
<tr><td>Websites</td><td></td><td></td></tr>
</table>

APPENDIX:

<table>
<tr><th colspan="5">GRADING SCHEME
مخطط الدرجات</th></tr>
<tr><th>Group</th><th>Grade</th><th>التقدير</th><th>Marks (%)</th><th>Definition</th></tr>
<tr><td rowspan="5">Success Group (50 - 100)</td><td>A - Excellent</td><td>امتياز</td><td>90 - 100</td><td>Outstanding Performance</td></tr>
<tr><td>B - Very Good</td><td>جيد جدا</td><td>80 - 89</td><td>Above average with some errors</td></tr>
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<tr><td>D - Satisfactory</td><td>متوسط</td><td>60 - 69</td><td>Fair but with major shortcomings</td></tr>
<tr><td>E - Sufficient</td><td>مقبول</td><td>50 - 59</td><td>Work meets minimum criteria</td></tr>
<tr><td rowspan="2">Fail Group (0 – 49)</td><td>FX – Fail</td><td>مقبول بقرار</td><td>(45-49)</td><td>More work required but credit awarded</td></tr>
<tr><td>F – Fail</td><td>راسب</td><td>(0-44)</td><td>Considerable amount of work required</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Note:

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

Ministry of Higher Education and Scientific Research - Iraq
University of Tikrit
College of Engineering
Department of Sustainable Energy Engineering

MODULE DESCRIPTOR

وصف المادة الدراسية

<table>
<tr><td colspan="4" align="center">Module Information
معلومات المادة الدراسية</td></tr>
<tr><td>Module Title</td><td>Design of Sustainable Energy Systems</td><td colspan="2">Module Delivery</td></tr>
<tr><td>Module Type</td><td>CORE</td><td colspan="2" rowspan="4">Theory
Lecture
Tutorial
Seminar</td></tr>
<tr><td>Module Code</td><td>SE-ENG-403</td></tr>
<tr><td>ECTS Credits</td><td>5</td></tr>
<tr><td>SWL
(hr/sem)</td><td>125</td></tr>
</table>

Module Level	UGIV	Semester (s) offered	7
Administering Department	Sustainable Energy Engineering	College	Engineering
Module Leader	Manar S.M. Al-Jethelah	e-mail	m.aljethelah@tu.edu.iq
Module Leader's Acad. Title	Prof.	Module Leader's Qualification	Ph.D.
Module Tutor	Hussam Sami Dheyab	e-mail	Hussam.sami@tu.edu.iq
Peer Reviewer Name		e-mail	
Review Committee Approval	2/9/2025	Version Number	

<table>
<tr><td colspan="4" align="center">Relation With Other Modules
العلاقة مع المواد الدراسية الأخرى</td></tr>
<tr><td>Prerequisite module</td><td>None</td><td>Semester</td><td>-</td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td>-</td></tr>
<tr><td colspan="4" align="center">Module Aims, Learning Outcomes, Indicative Contents and Brief Description
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر</td></tr>
<tr><td colspan="2">Module Aims
أهداف المادة الدراسية</td><td colspan="2">The aim of this course is
13. To provide students with a solid foundation in the fundamentals and design of sustainable energy
14. Equip students with the technical knowledge and skills necessary to analyze, evaluate, and design renewable energy systems. At the end of the module, students should be proficient in assessing the technical feasibility and performance of these systems.</td></tr>
<tr><td colspan="2">Module Learning</td><td colspan="2">By the end of this course, the students would be able to:</td></tr>
</table>

Outcomes مخرجات التعلم للمادة الدراسية	34) Demonstrate an in-depth understanding of the core principles of sustainability, including energy efficiency, carbon footprint reduction, and the integration of renewable energy technologies into the broader energy landscape. 35) analyze and evaluate the design, operation, and performance characteristics of various renewable energy technologies, such as photovoltaic systems, wind turbines, hydroelectric power, biomass conversion processes, and geothermal energy extraction methods. 36) Assess the technical and operational challenges of integrating renewable energy sources into existing power grids, including the implementation of smart grid technologies, energy storage systems, and advanced grid management techniques to optimize energy distribution and reliability. 37) Critically analyze the economic viability, environmental impact, and social implications of sustainable energy systems, and evaluate the effectiveness of policies, regulations, and incentives designed to promote the adoption and integration of renewable energy technologies into national and global energy frameworks.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. • Geothermal energy resources, geothermal energy production, heating and cooling. • Drilling for geothermal energy production • Economics of geothermal systems. • Technical and non-technical barriers to geothermal energy development, geothermal system components
Course Description	This course examines the production and consumption of energy from a systems perspective to accelerate sustainable energy transformations. Sustainability is examined by studying global and regional environmental impacts, economics, energy efficiency, consumption patterns and energy policy.
Learning and Teaching Strategies استراتيجيات التعلم والتعليم
Strategies	This course aims to overview the Design of Sustainable Energy Systems fundamentals. First, the physics of energy and energy accounting methods are introduced. Next the current energy system that encompasses supply (resource extraction, conversion processes) and demand (end-uses) is covered. Strategies and interventions to address climate change and other sustainability challenges are explored in depth with an emphasis on emerging renewable energy technologies (e.g., biomass, wind, and photovoltaics), building technologies, alternative vehicle technologies, and end-use efficiency and conservation..

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem)	73	**Structured SWL (h/w)**	4.87

الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** **42** **Online lectures** **14** **Tutorial** **14** **In class tests** **3**		الحمل الدراسي المنتظم للطالب أسبوعيا		
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Library, dorm, home memorizing 32** **Preparation for tests** **20** **HomeWorks** **10**	52	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.47	
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125			

Module Evaluation
تقييم المادة الدراسية

		No.	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	20% (10)	3, 14	LO #1, 2, and 3
	Assignments	2	10% (5)	5, 12	LO # 2, 3 and, 4
	Seminars	1	10% (10)	8	LO # 1-5
Summative assessment	**Midterm Exam**	1	10% (10)	7	All
	Final Exam	1	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	**Introduction to Sustainable Energy**
Week 2	**Solar non-concentrating systems**
Week 3	**Solar concentrating systems**
Week 4	**Photovoltaics_1**
Week 5	**Photovoltaics_2**
Week 6	**Hydropower_1**
Week 7	**Hydropower_2**
Week 8	**Mid exam**
Week 9	**Wind Energy_1**

Week 10	Wind Energy_2
Week 11	Biomass_1
Week 12	Biomass_2
Week 13	Fuel cell
Week 14	Environmental Impact and Sustainability
Week 15	Economic Analysis and Financing
Week 16	Final Exam

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Dincer, I. and Abu-Rayash, A., 2019. Energy sustainability. Academic Press.	Yes
Recommended Texts	Dincer, I. and Zamfirescu, C., 2011. Sustainable energy systems and applications. Springer Science & Business Media.	No
Websites		

APPENDIX:

GRADING SCHEME
مخطط الدرجات

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

Note:

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

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College of Engineering
Department of Sustainable Energy
Engineering

MODULE DESCRIPTOR

وصف المادة الدراسية

Module Information
معلومات المادة الدراسية

Module Title	Mechanical Vibration	Module Delivery	
Module Type	Core		**Theory** **Lecture** **Tutorial** **Practical** **Seminar**
Module Code	SE-ENG-404		
ECTS Credits	6		
SWL (hr/sem)	150		
Module Level	UGIV	Semester (s) offered	7
Administering Department	Sustainable Energy Engineering	College	Engineering
Module Leader	Adel Mahmood Bash	e-mail	Adelbash@tu.edu.iq
Module Leader's Acad. Title	Prof.	Module Leader's Qualification	Ph.D.
Module Tutor	None	e-mail	None
Peer Reviewer Name		e-mail	
Review Committee Approval	03/09/2025	Version Number	1.0

Relation With Other Modules
العلاقة مع المواد الدراسية الأخرى

Prerequisite module	None	Semester	-

Co-requisites module	None		Semester	-

Module Aims, Learning Outcomes, Indicative Contents and Brief Description
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر

Module Aims أهداف المادة الدراسية	Enable students to develop a comprehensive understanding of the methodology of linking the behaviors of vibrated bodies.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	16. Interpret and analyses dynamics of rigid bodies. 17. Apply the dynamics concepts to study the vibrated bodies 18. Identify and formulate problems in mechanical engineering of bodies that undergoes vibratory motions 19. Utilization of engineering soft wares such as Matlab,in problem solving.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. • Undergraduate Review (4 hrs) • Fundamentals of (16 hrs) • (20 hrs) • (10 hrs) • (6 hrs)
Course Description	This course aims to establish fundamental knowledge of mechanical vibrations. Presentation of the course starts by applying Newton's second law to derive the equation of motion and then utilizes it to find the natural frequency and mode shapes if the system is two degree of freedom.

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	The learning and teaching **strategy** is designed to: Carefully cover in lectures the necessary fundamental material and analytical techniques, and demonstrate concepts with appropriate (and where possible practical) examples Allow students adequate time to practice the techniques using a large number of carefully selected tutorial problems.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** 56 **In class tests** 25 **Seminars** 6	87	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	5.8
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Library, dorm, home memorizing 33** **Preparation for tests** 20	63	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.2

Homeworks	10			
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل		150		

Module Evaluation تقييم المادة الدراسية					
		Time (hr)	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5, 10, 12, 14	LO #1, 2, 3, and 4
	Assignments	6	18% (18)	2, 4, 6, 8, 10, 12	LO # 1, 2, 3, 4, 5 and 6
	Seminars	3	12% (12)	Continuous	
Summative assessment	Midterm Exam	2	10% (10)	7	LO # 1-3
	Final Exam	3	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Mathematical back ground (kinematics of rigid body, second order D.E)
Week 2	Basic Concepts of Vibration (generalized coordinates, stiffness , inertia, equivalent spring constants)
Week 3	Combination of springs, parallel, series potential energy concept
Week 4	Combination of masses (translational motion , rotational motion
Week 5	Applications
Week 6	Equation of Motion single DOF: Natural Frequency
Week 7	Equation of Motion single DOF: Natural Frequency
Week 8	Solution of un-damped Equation of Motion single DOF
Week 9	Equation of Motion for damped single DOF: damped Natural Frequency, damping factor
Week 10	Under damped critical damped and over damped systems
Week 11	Solution of damped Equation of Motion single DOF
Week 12	Measurement of Damping (logarithmic decrement)
Week 13	Applications
Week 14	Free Two DOF systems (natural frequencies and mode shapes)
Week 15	Free Two DOF systems (natural frequencies and mode shapes)
Week 16	Final Exam

<table>
<tr><td colspan="2">Delivery Plan (Weekly Lab. Syllabus)
المنهاج الاسبوعي للمختبر</td></tr>
<tr><td></td><td>Material Covered</td></tr>
<tr><td>Week 1</td><td>Lab 1: spring mass system</td></tr>
<tr><td>Week 2</td><td>Lab 2: torsional vibrations</td></tr>
<tr><td>Week 3</td><td>Lab 3: verification of parallel axis theorem</td></tr>
</table>

<table>
<tr><td colspan="3">Learning and Teaching Resources
مصادر التعلم والتدريس</td></tr>
<tr><td></td><td>Text</td><td>Available in the Library?</td></tr>
<tr><td>Required Texts</td><td>Theory of Vibration with Application by William T. Thomson

Mechanical Vibration by Rao</td><td>Yes</td></tr>
<tr><td>Recommended Texts</td><td>Fundamentals of Vibrations by Leonard Meirovitch</td><td>No</td></tr>
<tr><td>Websites</td><td>http://</td><td></td></tr>
</table>

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<tr><td colspan="5">Note:</td></tr>
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Ministry of Higher Education and
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Department of Sustainable Energy
Engineering

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information
معلومات المادة الدراسية

Module Title	Automatic Control Systems	Module Delivery	
Module Type	CORE	**Theory** **Lecture** **Tutorial**	
Module Code	SE_ENG-405		
ECTS Credits	6		
SWL (hr/sem)	150		
Module Level	UGIV	Semester (s) offered	7
Administering Department	Sustainable Energy Engineering	College	Engineering
Module Leader	Khalaf S Gaeid	e-mail	khalafgaeid@tu.edu.iq
Module Leader's Acad. Title	Prof.	Module Leader's Qualification	Ph.D.
Module Tutor		e-mail	
Peer Reviewer Name		e-mail	
Review Committee Approval	01/09/2025	Version Number	

Relation With Other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Math-201	Semester	3
Co-requisites module	None	Semester	-

	Module Aims, Learning Outcomes, Indicative Contents and Brief Description أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر	
Module Aims أهداف المادة الدراسية	The aim of this course is 15. Analyze the response of these systems to inputs and initial conditions. It is of particular interest to analyze systems obtained as interconnections (e.g., feedback) of two or more other systems. We will learn how to design (control) systems that ensure desirable properties (e.g., stability, performance) of the interconnection with a given dynamic system 16. Represent, structure, and behavior of multi-input, multi-output (MIMO) linear time-invariant (LTI) systems. 17. Understand the Meaning of control and how to control and investigate the stability and represent systems by mathematical models. 18. Modeling of dynamic systems; analysis of stability, transient and steady state characteristics of dynamic systems; characteristics of feedback systems. 19. Control systems design of PID control laws using frequency response methods and the root locus technique. 20. Introduction to nonlinear and optimal control systems. 21. Analysis and synthesis of linear feedback systems by classical and state space techniques.	
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	38) Describe the response characteristics and distinguishes between the open loop and closed loop of a control system 39) Derive mathematical model for simple electrical and mechanical systems using transfer function by Laplace transform and determine the response of a control system. 40) Reduce a block diagram of multiple subsystems and multi input to a single block representing the transfer function from input to output. 41) Determine the reduction of multiple subsystems to a single transfer function by block diagram reduction and signal flow graph 42) Determine the stability of a control system using Routh-Hurwitz method. 43) Understand the transient response and steady state response.	
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Program Learning Outcomes describe what students are expected to know and be able to do by the time of graduation. These relate to the knowledge, skills, and behaviors that students acquire as they progress through the program. A graduate of the (Control Systems) program will demonstrate.	
Course Description	This course of Control Systems addresses dynamic systems, i.e., systems that involve with time. Typically, these systems have inputs and outputs; it is of interest to understand how the input affects the output (or, vice-versa, what inputs should be given to generate a desired output). In particular, it will be concentrated on systems that can be modeled by Ordinary Differential Equations (ODEs), and that satisfy certain linearity and time-	

	invariance conditions.

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	The learning and teaching strategy is designed to: Carefully cover in lectures the necessary fundamental material and analytical techniques, and demonstrate concepts with appropriate (and where possible practical) examples Allow students adequate time to practice the techniques using a large number of carefully selected tutorial problems.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** 60 **In class tests** 27	87	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	5.8
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Library, dorm, home memorizing** 20 **Preparation for tests** 30 **Homeworks** 13	63	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.2
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation
تقييم المادة الدراسية

		Time (hr)	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	10% (10)	5, 10, 12, 14	LO #1, 2, 3, and 6
	Assignments	6	30% (30)	2, 4, 6, 8	LO # 1 to 6
Summative assessment	**Midterm Exam**	2	10% (10)	16	All
	Final Exam	3	50% (50)	5, 10, 12, 14	LO #1, 2, 3, and 4
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	**Introduction**
Week 2	**Control systems**

Week 3	Transfer function
Week 4	Mechanical system
Week 5	Electrical system
Week 6	Laplace transform
Week 7	Laplace transform
Week 8	Mid exam
Week 9	Mathematical models
Week 10	Block diagram
Week 11	Reduction of block diagram
Week 12	Signal flow graph
Week 13	Stability and Routh criteria
Week 14	Time analysis, first and second system
Week 15	Final Exam
Week 16	

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Engineering Control System by Ogata	Yes
Recommended Texts	1-Automatic Control Systems by Dazo 2-control engineering theory and practice by M.N.Bandyopadhyay	Yes
Websites		

APPENDIX:

GRADING SCHEME
مخطط الدرجات

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

Note:

| | Ministry of Higher Education and Scientific Research - Iraq
University of Tikrit
College of Engineering
Department of Sustainable Energy Engineering | |

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information		
معلومات المادة الدراسية		

Module Title	GRADUATION PROJECT I	Module Delivery	
Module Type	CORE		Theory Lecture Seminar
Module Code	ENG-401		
ECTS Credits	3		
SWL (hr/sem)	75		

Module Level	UGIV	Semester (s) offered	7
Min number of students	20	Max number of students	80
Administering Department	Sustainable Energy Engineering	College	Engineering
Module Leader	All faculty members	e-mail	-
Module Leader's Acad. Title	-	Module Leader's Qualification	-
Module Tutor	None	e-mail	None

Peer Reviewer Name		**e-mail**	
Review Committee Approval	01/09/2025	**Version Number**	1.0

Relation with Other Modules
العلاقة مع المواد الدراسية الأخرى

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

Module Aims, Learning Outcomes, Indicative Contents and Brief Description
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر

Module Aims أهداف المادة الدراسية	The main aim of this course is to prepare students for the practical tasks of the work place after graduation. This includes building his/her ability to perform a complete project.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Upon completion of this course, the student should be able to: 2. Structure a working schedule for the project. 3. Present Clear aim and objectives of the graduation project. 4. Present the literature review with relation to the selected topic. 5. Carry out the design (or any topic selected). 6. Write a technical report. 7. Defend the technical report in front of a committee and be able to answer questions asked by the committee members.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following: - Basic concepts of a project. (6hrs) - Physical and Mechanical Properties of a product (6 hr) - Storage, handling and transportation (4 hr) - Material balance (16 hrs)
Course Description	Preparatory studies of the literature and data collection for the graduation project in a particular area of concentration and under the supervision of one of the faculty members. The course covers directed readings in the literature of civil engineering, introduction to research methods, seminar discussions dealing with special engineering topics of current interest. Planning, design, construction and management of an engineering project. Writing a technical report.

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	The learning and teaching **strategy** is designed to: Carefully describe the course design and teaching methodology for project and applications lectures specifically aimed at small college and university instruction.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** 10 **Office hours** 20	44	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	2.9

In class tests	4		
Discussions	6		
Practical	4		
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Library, dorm, home searching** 10 **Preparation for final test** 10 **Technical writing** 11	31	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	2.0
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	75		

Module Evaluation
تقييم المادة الدراسية

		Time (hr)	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Discussion**	30	30% (30)	5, 10, 12, 14	LO #1, 2, 3, and 4
	Assignments	0	0% (0.0)	-	LO # 1, 2, 3, 4, 5 and 6
	Seminars	10	10% (10)	Continuous	All
Summative assessment	**Midterm Exam**	0	0% (0)	-	-
	Final defiance	3	60% (60)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	Select a research problem
Week 2	Preparing the general framework of the project: introduction, formulation of the problem (questions - hypotheses)
Week 3	Define concepts and terminology
Week 4	Objectives, Importance
Week 5-6-7	Limits, methodology
Week 8-9	Present the research plan to the supervisor and discuss it.
Week 10-11	Prepare the theoretical background using the latest sources and references
Week 12-13	Previous studies and commentary
Week 14	Submit the graduation project proposal to the supervisor for review and comments

Week 15	Oral Presentation
Week 16	Final Seminar

	Learning and Teaching Resources مصادر التعلم والتدريس	
	Text	**Available in the Library?**
Required References	Perry's Mechanical Engineers' Handbook, Ninth Edition. Don W. Green, Marylee Z. Southard McGraw Hill Professional, Jul 13, 2018 - Technology & Engineering - 2352 pages.	No
Recommended Texts	Coulson Richardson's Mechanical Engineering Vol.6 Mechanical Engineering Design 4th Edition. R. K. SINNOTT, J. M. COULSON, J. F. RICHARDSON. ELSEVIER BUTTERWORTH-HEINEMANN, OXFORD, 2005	Yes
Websites	TBD	

APPENDIX:

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

Note:

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

<table>
<tr><td rowspan="5" style="width:20%"></td></tr>
</table>

	Ministry of Higher Education and Scientific Research - Iraq University of Tikrit College of Engineering Department of Sustainable Energy Engineering	

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information		
معلومات المادة الدراسية		
Module Title	SUSTAINABLE BUILDING DESIGN	**Module Delivery**
Module Type	CORE	Theory Lecture Tutorial Practical Seminar
Module Code	SE-ENG-406	
ECTS Credits	4	
SWL (hr/sem)	100	

Module Level	UGIV	**Semester (s) offered**	8
Min number of students	15	**Max number of students**	100
Administering Department	Sustainable Energy Engineering	**College**	Engineering
Module Leader	Raaid R. Jassem	**e-mail**	raaidaldoury@tu.edu.iq
Module Leader's Acad. Title	Prof.	**Module Leader's Qualification**	Ph.D.
Module Tutor		**e-mail**	
Peer Reviewer Name		**e-mail**	
Review Committee Approval	04/9/2025	**Version Number**	1.0

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

Co-requisites module	None		Semester	-

Module Aims, Learning Outcomes, Indicative Contents and Brief Description
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر

Module Aims أهداف المادة الدراسية	Promote sustainable buildings design by teaching principles that reduce environmental impact and conserve resources for future generations. Empower professionals and students to design buildings that balance comfort, performance, and sustainability using modern technologies and scientific analysis
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Understand the fundamental of sustainable, low energy, green buildings, and their concern. Ability to assess existing buildings and provide suggestions that improve their performance. Be familiar with the software that can be applied to such concepts. Estimating the cooling and heating loads of specific buildings, their energy consumption, and environmental effects.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. • Sustainable building concept and design (8 hrs.) • Conditioning load. (8 hrs.) • Energy flow (6 hrs.) • Exergy Flow. (6 hrs.)
Course Description	This course presents a comprehensive introduction to sustainable building design technology and options. Moreover, how building energy consumption affects global warming and consequent results (cost and pollution). Present the methods that achieve sustainable building and sustainability mathematically and numerically. Assessment of the performance of the existing building and study of the applicable options that lead to enhancing the performance and parts priority.

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	The learning and teaching **strategy** is designed to: Carefully cover in lectures the necessary fundamental material and analytical techniques, and demonstrate concepts with appropriate (and where possible practical) examples Allow students adequate time to practice the techniques using a large number of carefully selected tutorial problems.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل		63	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	4.2
In class lectures	45			
Tutorial	15			
Final Exam	3			
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل		37	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	2.5
Preparation for tests	15			
Homeworks	15			

Prepare for the exam	07		
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل		100	

<table>
<tr><td colspan="6" align="center">Module Evaluation
تقييم المادة الدراسية</td></tr>
<tr><td></td><td></td><td>Time (hr)</td><td>Weight (Marks)</td><td>Week Due</td><td>Relevant Learning Outcome</td></tr>
<tr><td rowspan="5">Formative assessment</td><td>Quizzes</td><td>2</td><td>10% (10)</td><td>10, 14</td><td>LO #1, 2, 3, and 4</td></tr>
<tr><td>Assignments (Home works)</td><td>2</td><td>8% (8)</td><td>, 6, 10</td><td>(LO # 1, 2, 3, 4, 5 and 6)</td></tr>
<tr><td>Seminars</td><td>1</td><td>6% (6)</td><td>Continuous</td><td>SOL3,5</td></tr>
<tr><td>Onsite assignment</td><td>1</td><td>6% (6)</td><td></td><td></td></tr>
<tr><td>exam</td><td>2</td><td>10% (10)</td><td></td><td></td></tr>
<tr><td rowspan="2">Summative assessment</td><td>Midterm Exam</td><td>1</td><td>10% (10)</td><td>7</td><td>LO # 1-5</td></tr>
<tr><td>Final Exam</td><td>3</td><td>50% (50)</td><td>16</td><td>All</td></tr>
<tr><td colspan="2">Total assessment</td><td></td><td>100%
(100 Marks)</td><td></td><td></td></tr>
</table>

<table>
<tr><td colspan="2" align="center">Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري</td></tr>
<tr><td></td><td>Material Covered</td></tr>
<tr><td>week1</td><td>Introduction: Climate changes effects and negative consequents results (pollutions and the cost of energy demand over the world.</td></tr>
<tr><td>Week 2</td><td>What are sustainable buildings, Low Energy Building, and zero energy buildings? The main steps to achieve the goal.</td></tr>
<tr><td>Week 3</td><td>The conditioning loads calculations main steps.</td></tr>
<tr><td>Week 4</td><td>The conditioning loads calculations main steps.</td></tr>
<tr><td>Week 5</td><td>Method and a Pre-Design Tool: all steps of analysis of the buildings.</td></tr>
<tr><td>Week 6</td><td>Exergy, energy, energy and exergy flows.</td></tr>
<tr><td>Week 7</td><td>Moments of inertia</td></tr>
<tr><td>Week 8</td><td>Static, dynamic,analyses</td></tr>
<tr><td>Week 9</td><td>Midterm exam</td></tr>
<tr><td>Week 10</td><td>exergoeconomic and Environment analyses:</td></tr>
<tr><td>Week 11</td><td>Alternative sources of energy and their effects.</td></tr>
<tr><td>Week 12</td><td>Solar, Wind, geothermal,</td></tr>
</table>

Week 13	Economic Aspect of Exergy, Specific Exergy Costing (SPECO) appr
Week 14	Economic Aspect of Exergy, Specific Exergy Costing (SPECO) appr
Week 15	Software that can be used for these analyses
Week 16	**Final Exam**

Learning and Teaching Resources		
مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	**Hand book of Green Building Design and Construction, Leed, Breeam, and Green Globs., 2nd Edition, 2017.**	No
Recommended Texts	• Exergy Energy, Environment And Sustainable Development, Ibrahim Dicer, and Marc A. Rosen,Elsiver, 2nd edition 2013. • Thermodynamics an Engineering Approaches, Cengel and Bolis, 2008 • AHSRAE Handbook, 2013	No
Websites	N/A	

APPENDIX:

GRADING SCHEME				
مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
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Ministry of Higher Education and
Scientific Research - Iraq
University of Tikrit
College of Engineering
Department of Sustainable Energy
Engineering

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	Wind Energy Systems	**Module Delivery**	
Module Type	CORE	**Theory** **Lecture** **Tutorial** **Seminar**	
Module Code	SE-ENG-407		
ECTS Credits	6		
SWL (hr/sem)	150		
Module Level	UGIV	**Semester (s) offered**	8
Administering Department	Sustainable Energy Engineering	**College**	Engineering
Module Leader	Ali Ahmed Gitan	**e-mail**	aliagitan@tu.edu.iq
Module Leader's Acad. Title	Assistant Prof.	**Module Leader's Qualification**	Ph.D.
Module Tutor		**e-mail**	
Peer Reviewer Name		**e-mail**	
Review Committee Approval	8/9/2025	**Version Number**	

Relation With Other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	SE-ENG-301: Turbomachinery	**Semester**	6

Co-requisites module	None		Semester	-

Module Aims, Learning Outcomes, Indicative Contents and Brief Description
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر

Module Aims أهداف المادة الدراسية	The aim of this course is 22. To provide students with an understanding of the basic principles of design and operation of wind turbines and wind farms. 23. To provide students with an understanding of wind energy as a resource.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	44) Understand the origin and development of windmills and wind turbines. 45) Understand the main components of wind energy system and its functions 46) Able to know the different types of wind turbines 47) Understand rotor aerodynamics 48) Be able to know wind turbine design procedure, topologies, machine elements, and components
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. • Wind energy background • Wind turbines types and design • Economic and environmental impacts of wind farms
Course Description	This course provides knowledge of wind energy fundamental, different components, cost, and environmental effects. Also, it introduces to wind power meteorology and wind turbine aerodynamics and design.

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	This course aims to overview the wind energy fundamentals. Various solar wind turbines will be covered. The wind tower components will be discussed. Students will have adequate time to practice the techniques using a large number of carefully selected tutorial problems.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل			Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	
In class lectures	28	87		5.8
Online lectures	14			
Lab	28			
Tutorial	14			
In class tests	3			
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل			Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	
Library, dorm, home memorizing	33	63		4.2
Preparation for tests	20			
HomeWorks	10			

Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150

Module Evaluation
تقييم المادة الدراسية

		No.	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	20% (10)	3, 14	LO #1, 2, and 3
	Assignments	2	10% (5)	5, 12	LO # 2, 3 and, 4
	Seminars	1	10% (10)	8	LO # 1-5
Summative assessment	**Midterm Exam**	1	10% (10)	7	All
	Final Exam	1	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	**Historical applications of wind energy**
Week 2	**Electrical Power from the Wind and the batteries**
Week 3	**Electrical Power from the Wind and the batteries**
Week 4	**Wind energy system (rotor blades, the tower, Mechanical Drive, Electrical System, etc)**
Week 5	**Wind energy system (rotor blades, the tower, Mechanical Drive, Electrical System, etc)**
Week 6	
Week 7	**Mid exam**
Week 8	**Physical Principles of Wind Energy Conversion**
Week 9	**Physical Principles of Wind Energy Conversion**
Week 10	**Basic concepts of wind energy Converters (turbines)**
Week 11	**Aerodynamics of turbines**
Week 12	**Wind turbine design**
Week 13	**Wind turbine control**
Week 14	**Offshore and onshore wind turbines**
Week 15	**Wind turbine costs and Environmental impact**
Week 16	**Final Exam**

<table>
<tr><th colspan="3">Learning and Teaching Resources
مصادر التعلم والتدريس</th></tr>
<tr><td></td><td>Text</td><td>Available in the Library?</td></tr>
<tr><td>Required Texts</td><td>Wind Energy Explained: Theory, Design and Application, by J. F. Manwell, J. G. McGowan, A. L. Rogers.</td><td>Yes</td></tr>
<tr><td>Recommended Texts</td><td>Wind Turbine Control Systems Principles, Modelling and Gain Scheduling Design, by Fernando D. Bianchi, Hernán De Battista and Ricardo J. Mantz.</td><td>No</td></tr>
<tr><td>Websites</td><td></td><td></td></tr>
</table>

APPENDIX:

GRADING SCHEME مخطط الدرجات				
Group	Grade	التقدير	Marks (%)	Definition
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Ministry of Higher Education and Scientific Research - Iraq
University of Tikrit
College of Engineering
Department of Sustainable Energy Engineering

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information
معلومات المادة الدراسية

Module Title	BIOMASS ENERGY SYSTEMS	Module Delivery	
Module Type	CORE	**Theory** **Lecture** **Tutorial** **Practical** **Seminar** **Lab**	
Module Code	SE-ENG-408		
ECTS Credits	6		
SWL (hr/sem)	150		
Module Level	UGIV	Semester (s) offered	8
Administering Department	Sustainable Energy Engineering	College	Engineering
Module Leader	Dr. Salwa H. Ahmed	e-mail	dr. salwahadi@tu.edu.iq
Module Leader's Acad. Title	Professor	Module Leader's Qualification	Ph.D.
Module Tutor		e-mail	None
Peer Reviewer Name	Dr. Salwa H. Ahmed	e-mail	dr. salwahadi@tu.edu.iq
Review Committee Approval	08/09/2025	Version Number	1.0

Relation With Other Modules
العلاقة مع المواد الدراسية الأخرى

Prerequisite module		Semester	
Co-requisites module		Semester	-

Module Aims, Learning Outcomes, Indicative Contents and Brief Description
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر

Module Aims أهداف المادة الدراسية	The primary aims of this module are: 5. Provide students with a comprehensive understanding of bioenergy concepts, different types of bioenergy, and various biomass sources. 6. Introducing students to technologies for converting biomass into thermal, electrical, and biofuel energy, including anaerobic digestion, fermentation, and thermochemical and biochemical conversion processes. 7. Enhance students' knowledge of environmental, economic, and social factors affecting the utilization and implementation of bioenergy systems. 8. Enable students to design and operate laboratory experiments for converting waste and biomass into energy.

	9. Develop the ability to analyze bioenergy production data and evaluate conversion efficiency using practical and computational tools. 10. Strengthening students' skills in preparing scientific reports, oral presentations, and teamwork within bioenergy projects. 11. Instill awareness of environmental and economic sustainability in bioenergy applications. 12. Encourage critical and innovative thinking to develop sustainable solutions for waste management and energy production. 13. Promote teamwork, scientific responsibility, and professional ethics when handling bioenergy experiments and projects.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Upon successful completion of this module, the student will be able to: 1. Explain the fundamental concepts of bioenergy, including its types, sources, and global significance. 2. Describe the physical, chemical, and biological properties of biomass relevant to energy conversion. 3. Identify and compare the main technologies for biomass-to-energy conversion: anaerobic digestion, aerobic decomposition, fermentation, thermochemical conversion (combustion, pyrolysis, gasification), and biodiesel/ethanol production. 4. Evaluate the environmental, economic, and social impacts of bioenergy systems, including sustainability considerations and life-cycle assessment. 5. Collect, prepare, and characterize biomass samples using laboratory techniques (moisture content, ash, calorific value, C/N ratio). 6. Design and operate small-scale experimental systems for bioenergy production (e.g., biogas digesters, fermentation setups, biodiesel production). 7. Measure, record, and analyze data on bioenergy production and conversion efficiency, including biogas composition, biofuel yields, and energy output. 8. Apply computational or software tools (e.g., Excel, OpenLCA) to evaluate bioenergy systems and perform basic life-cycle assessment. 9. Demonstrate awareness of environmental sustainability and responsible use of biomass resources in energy production. 10. Exhibit critical thinking, problem-solving, and innovation in designing and optimizing bioenergy systems. 11. Work effectively in teams to plan, execute, and report on laboratory experiments and mini projects in bioenergy. 12. Communicate scientific results clearly through written reports, oral presentations, and graphical data representation.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. 1. Introduction and Biomass Resources: Overview of bioenergy, its importance, types, and sources (agricultural, forestry, municipal, aquatic biomass). 2. Biological and Thermochemical Conversion: Anaerobic digestion, aerobic decomposition, fermentation (bioethanol), combustion, pyrolysis, and gasification processes. 3. Biofuel Production and Characterization: Biodiesel and bioethanol production, sample preparation, laboratory characterization (moisture, ash, calorific value, C/N ratio). 4. System Analysis and Sustainability: Energy efficiency, life cycle assessment (LCA), environmental, economic, and social considerations, and case studies of bioenergy applications

Course Description	This course introduces the principles and applications of bioenergy systems. Students will study various biomass resources and their conversion into biofuels through biological and thermochemical processes. Practical laboratory sessions cover biomass characterization, biofuel production, and energy efficiency assessment. The course also addresses environmental, economic, and sustainability aspects of bioenergy, supported by global case studies

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	1. Interactive Lectures: Explaining key concepts, encouraging questions, and fostering critical thinking. 2. Laboratory Practicals: Hands-on experiments to apply theoretical knowledge, develop technical skills, and analyze bioenergy processes. 3. Group Projects & Case Studies: Collaborative problem-solving on real-world bioenergy systems, sustainability, and policy issues. 4. E-Learning & Self-Directed Study: Using online resources, simulations, videos, and guided readings to reinforce understanding and support independent learning

Student Workload (SWL)			
الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** 28 **Tutorial** 14 **Lab** 28 **Lect** 14 **Final Exam** 3	87	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5.8
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Library, dorm, home memorizing** 20 **Preparation for tests** **Home works** 13 **Design Project** 10 **Reports** 10 **Seminar** 10	63	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.2
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation				
تقييم المادة الدراسية				
		Time (hr)	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	20% (20)	2,5, 10, 12, 14	LO #1, 2, 3, and 4
	Assignments	15	10% (10)	Continuous	LO # 1, 2, 3, 4, 5,6 and 7

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

	Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري
	Material Covered
Week 1	Introduction to Bioenergy: Definition, importance, types, comparison with other renewable and non-renewable energy sources.
Week 2	Biomass Resources: Agricultural residues, industrial waste, municipal solid waste, forest resources, aquatic biomass
Week 3	Physical and Chemical Properties of Biomass: Carbon-to-nitrogen ratio (C/N), moisture content, calorific value, volatile solids
Week 4	Anaerobic Digestion I: Microbial processes, stages (hydrolysis, acidogenesis, acetogenesis, methanogenesis), end products
Week 5	Anaerobic Digestion II: Reactor types (Batch, CSTR, UASB), design parameters, operating conditions
Week 6	Aerobic Decomposition and Composting: Mechanisms, process stages, factors affecting composting, final product quality
Week 7	Thermochemical Conversion I – Pyrolysis: Fundamentals, reactor types, bio-oil and biochar production, temperature effects
Week 8	Thermochemical Conversion II – Gasification and Combustion: Overview, energy recovery, gas quality, applications
Week 9	Bioethanol Production: Fermentation process, feedstocks (sugar/starch/lignocellulose), distillation, challenges
Week 10	Biodiesel Production: Transesterification, feedstock selection, catalysts, fuel properties, engine applications
Week 11	Life Cycle Assessment (LCA) of Bioenergy Processes: Environmental impact analysis, carbon footprint, introduction to LCA software tools
Week 12	Bioenergy Economics and Feasibility: Cost-benefit analysis, economic drivers, bioenergy markets, scalability
Week 13	Environmental and Social Impacts: Greenhouse gas emissions, land use change, food vs. fuel debate, rural development
Week 14	Global Bioenergy Policies and Case Studies: Examples from Germany, Brazil, India, USA; policy frameworks and incentives
Week 15	Midterm Exam

	Delivery Plan (Weekly Syllabus) المنهاج الأسبوعي العملي
	Material Covered

Week 1-2	Biomass Characterization: • Collection and preparation of biomass samples (drying, grinding) • Determination of moisture, ash, and volatile matter content • Calculation of calorific value
Week 3-4	Anaerobic Digestion – Reactor Setup: • Setup of a small-scale anaerobic digester using organic waste • Adjustment of operating conditions (pH, C/N ratio, moisture) • Development of a monitoring plan for daily gas production
Week 5-6	Anaerobic Digestion – Gas Production and Quality Analysis: • Measurement of biogas volume using water displacement or gas syringe method • Analysis of methane (CH_4) and carbon dioxide (CO_2) concentrations • Comparison of gas yield from different feedstocks
Week 7-8	Composting Experiment: • Construction of a small compost pile with organic waste and activators • Monitoring temperature, moisture, and pH over time • Documentation of microbial degradation stages
Week 9-10	Bioethanol Production – Fermentation: • Preparation of sugar- or starch-rich raw materials (e.g. food waste) • Fermentation using yeast culture • Ethanol recovery through simple distillation or alternative methods
Week 11-12	Biodiesel Production – Transesterification: • Reaction of vegetable waste oil with methanol and a catalyst • Separation of biodiesel and glycerol layers • Washing and drying of the biodiesel product
Week 13-14	Fuel Property Testing: • Measurement of biodiesel properties (density, viscosity, flash point) • Comparison with conventional diesel standards • Interpretation of results according to ASTM or EN standards
Week 15	Environmental Assessment – Life Cycle Analysis (LCA) • Introduction to LCA using Open LCA or Excel models • Data input for bioenergy production systems • Carbon footprint comparison of two bioenergy pathways

Learning and Teaching Resources		
مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	• Zhu, D., Dar, M. A., & Shahnawaz, M. (Eds.). (2024). Biofuels and Sustainability: Life-Cycle Assessments, System Biology, Policies, and Emerging Technologies. Woodhead Publishing. mitpressbookstore • Tripathi, M., & Kaur, S. (Eds.). (2025). Biotechnological Advancements in Biomass to Bioenergy Biotransformation: Sustainable Implications in Circular Economy. Springer Singapore.	Yes
Recommended Texts	Singh, P. (Ed.). (2024). Emerging Trends and Techniques in Biofuel Production from Agricultural Waste. Springer Singapore. SpringerLink	Yes

APPENDIX:

<table>
<tr><td colspan="5" align="center">GRADING SCHEME
مخطط الدرجات</td></tr>
<tr><td>Group</td><td>Grade</td><td>التقدير</td><td>Marks (%)</td><td>Definition</td></tr>
<tr><td rowspan="5">Success Group
(50 - 100)</td><td>A - Excellent</td><td>امتياز</td><td>90 - 100</td><td>Outstanding Performance</td></tr>
<tr><td>B - Very Good</td><td>جيد جدا</td><td>80 - 89</td><td>Above average with some errors</td></tr>
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<tr><td>D -
Satisfactory</td><td>متوسط</td><td>60 - 69</td><td>Fair but with major shortcomings</td></tr>
<tr><td>E - Sufficient</td><td>مقبول</td><td>50 - 59</td><td>Work meets minimum criteria</td></tr>
<tr><td rowspan="2">Fail Group
(0 – 49)</td><td>FX – Fail</td><td>مقبول بقرار</td><td>(45-49)</td><td>More work required but credit awarded</td></tr>
<tr><td>F – Fail</td><td>راسب</td><td>(0-44)</td><td>Considerable amount of work required</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="5">Note:</td></tr>
</table>

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

Ministry of Higher Education and
Scientific Research - Iraq
University of Tikrit
College of Engineering
Department of Sustainable Energy
Engineering

MODULE DESCRIPTOR

وصف المادة الدراسية

Module Information		
معلومات المادة الدراسية		
Module Title	**Inelegant Network systems**	**Module Delivery**
Module Type	CORE	Theory Lecture Tutorial
Module Code	SE-ENG-409	

ECTS Credits	6			Seminar	
SWL (hr/sem)	150				
Module Level	UGIV		Semester (s) offered		8
Administering Department	Sustainable Energy Engineering		College	Engineering	
Module Leader	Khalaf S Gaeid		e-mail	khalafgaeid@tu.edu.iq	
Module Leader's Acad. Title	Prof.		Module Leader's Qualification	Ph.D.	
Module Tutor			e-mail		
Peer Reviewer Name			e-mail		
Review Committee Approval	01/09/2025		Version Number		

Relation With Other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module		Semester	-
Co-requisites module	None	Semester	-
Module Aims, Learning Outcomes, Indicative Contents and Brief Description أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر			
Module Aims أهداف المادة الدراسية	The aim of this course is 24. Understand the fundamental principles of artificial intelligence, machine learning, IOT and 6G 25. Gather knowledge about various AI and ML optimization algorithms and their applications 26. Demonstrate proficiency in applying AI and ML strategies to real-world scenarios, security and multiagent		
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	49) Formalization and design of systems capable of automated reasoning. 50) Implementation and application of machine learning techniques in prediction problems. 51) Implementation and application of data mining techniques. 52) Identify the type of search strategy (blind/heuristic/adversarial) that is more appropriate to address a particular problem and implement the selected strategy 53) Design appropriate heuristics for a particular problem and security 54) Formalize and implement constraints in search problems		
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Program Learning Outcomes describe what students are expected to know		

	and be able to do by the time of graduation. These relate to the knowledge, skills, and behaviors that students acquire as they progress through the program. A graduate of the (Artificial network system) program will demonstrate.
Course Description	Intelligent network systems are advanced communication networks that separate call control from the switching layer to provide enhanced, flexible services beyond basic voice and data. These systems use software and data to enable value-added services like caller ID, call waiting, and variable charging, allowing operators to manage networks more efficiently and offer more services to customers.

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم
Strategies	The learning and teaching **strategy** is designed to: Carefully cover in lectures the necessary fundamental material and analytical techniques, and demonstrate concepts with appropriate (and where possible practical) examples Allow students adequate time to practice the techniques using a large number of carefully selected tutorial problems.

Student Workload (SWL)			
الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** 70 **In class tests** 12 **Seminars** 5	87	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5.8
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Library, dorm, home memorizing** 36 **Preparation for tests** 17 **Homeworks** 10	63	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.2
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation					
تقييم المادة الدراسية					
		Time (hr)	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	18% (18)	5, 10, 12, 14	LO #1, 2, 3, and 4
	Assignments	6	12% (12)	2, 4, 6, 8	LO # 1, 2, 3, 4, 5, and 6
	Seminars	2	20% (20)	7	LO # 1-6
Summativ	**Midterm Exam**	3	50% (50)	16	All

e assessment	Final Exam	2	18% (18)	5, 10, 12, 14	LO #1, 2, 3, and 4
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
المنهاج الاسبوعي النظري	
	Material Covered
Week 1	**Network Fundamentals:** Theory of networks
Week 2	modern network architectures with IoT,
Week 3	modern network architectures (6G)
Week 4	network planning
Week 5	Introduction to Artificial Intelligence - History of AI - Systems and intelligent agents
Week 6,7	o Machine Learning: Supervised, unsupervised, and reinforcement learning, with a focus on applications in networks.
Week 8	Exam
Week 9	Neural network and fuzzy logic
Week 10	**Optimization** algorithms
Week 11	• Intelligent Routing: Routing and data dissemination in small, intelligent networks, such as sensor networks.
Week 12	• Cooperative Intelligence: Multi-agent systems and cooperative sensing and tracking.
Week 13	• Security: Using AI for cybersecurity, penetration testing, and vulnerability assessment.
Week 14	Projects and practical application
Week 15	Final Exam

Learning and Teaching Resources		
مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Russell, S. y Norvig, P.: "Artificial Intelligence, a modern approach", Ed. Prentice Hall, 1995	No
Recommended Texts	J. Harju, T. Karttunen & O. Martikainen "Introduction to intelligent networks"2025	Yes

APPENDIX:

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

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

Ministry of Higher Education and
Scientific Research - Iraq
University of Tikrit
College of Engineering
Department of Sustainable Energy
Engineering

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information معلومات المادة الدراسية		
Module Title	PRINCIPLES OF AIR CONDITIONING AND REFRIGERATION	**Module Delivery**
Module Type	CORE	⬜ Theory ⬜ Lecture ⬜ Lab ⬜ Tutorial ⬜ Practical
Module Code	SE-ENG-410	
ECTS Credits	4	

SWL (hr/sem)	100			☐ Seminar	
Module Level		UGIV	**Semester (s) offered**		8
Administering Department		Sustainable Energy Engineering	**College**	Engineering	
Module Leader	Saad Sami Farhan		**e-mail**	saadsami@tu.edu.iq	
Module Leader's Acad. Title		Assistant Prof.	**Module Leader's Qualification**		
Module Tutor			**e-mail**		
Peer Reviewer Name			**e-mail**		
Review Committee Approval		01/09/2025	**Version Number**	1.0	

Relation With Other Modules
العلاقة مع المواد الدراسية الأخرى

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

Module Aims, Learning Outcomes, Indicative Contents and Brief Description
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر

Module Aims أهداف المادة الدراسية	1. To define the main concepts of Air-Conditioning. 2. To explain the physical differences of Air-Conditioning. 3. To Derive the equations of relative humidity and moister content. 4. To analyze the humidification and dehumidification processes. 5. To develop the optimum methods of air mixing and air supply condition. 6. To the consider the effect of heat sources on cooling load. 7. To have a robust awareness about some applications such as calculation of overall heat transfer coefficient and wall surface temperature. 8. To understand the principals and performance of Heat Gain from solar and renewable sources.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	At the end of this course, the students will be able to: 1. Understand the concepts of Air-Conditioning. 2. Solve the problems related to the Air mixing and air supply condition. 3. Analyze the comfortable condition. 4. Determine the heating and cooling load. 5. Find out the effect of heating or cooling in building. 6. Explain the effect of heat gain from solar.
Indicative Contents المحتويات الإرشادية	1. **Basic concepts of Air-Conditioning:** Moister content, Relative humidity, Physical differences between flow types, The adiabatic steady flow, Saturation state, Critical state and dew point. 2. **Air mixing and air supply condition**: Overall heat transfer Coefficient calculation and wall surface temperature calculation, Comfortable conditions, Indoor air quality. 3. **Design temperature and outdoor and indoor room temperatures:** Introduction, Governing equations of heating load calculation, Heat loss through building structure, Infiltration and space heating, Cooling load Calculation, heat sources. 4. **Constant Area Duct Flow:** Frictional flow in constant area duct, Governing

	equation of frictional flow, Fanno line, Relations for frictional flow, Frictionless flow with heat transfer in constant area duct, Governing equation of frictionless flow with heat transfer, Rayleigh line. 5. **Pressure drops of internal fluid flow through circular and rectangular duct and fittings:** Design and selection of Air- Conditioning systems.
Course Description	This course aims to establish fundamental knowledge of Air-Conditioning design and engineering. To achieve this goal, fundamentals of thermodynamics, heat transfer, and transport physics applied to Air-Conditioning systems. Topics include design temperature and outdoor and indoor room temperatures, Introduction, governing equations of heating load calculation, heat loss through building structure, Infiltration and space heating, cooling load calculation, heat sources. Also, this course discusses Pressure drop of internal fluid flow through circular and rectangular duct and fittings. Design and selection of Air-Conditioning systems. All the numerical examples will be in SI units.

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	The module will use a range of learning and teaching strategies, including: 1. **Lectures**: To provide students with an overview of the main concepts and principles. 2. **Labs**: To provide students with hands-on experience of devices and instruments. 3. **Assignments and Quizzes**: To provide students with opportunities to apply their knowledge and skills to real-world problems and check their understanding. 4. **Scientific visits and trips**: To provide a real-life experience by visiting one of the industrial sites or Buildings. 5. **Project:** To test the student knowledge of designing fabrication and testing one model of Air- Conditioning systems concepts.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل		59	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	3.9
In class lectures	45			
Discussions	11			
In class tests	3			
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل		41	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	2.7
Project	10			
Preparation for tests, memorizing	10			
Writing reports	10			
Homeworks	11			
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل		100		

Module Evaluation
تقييم المادة الدراسية

	Time	Weight (Marks)	Week Due	Relevant Learning

		(hr)			Outcome
Formative assessment	**Quizzes**	2	10% (10)	5, 10, 12, 14	LO #1, 2, 3, and 4
	Assignments (Homework's)	5	10% (10)	2, 4, 6, 8, 10	LO # 1, 2, 3, 4, 5 and 6
	Seminars	4	5% (5)	Continuous	
Summative assessment	**Lab**	15	15% (15)	Continuous	LO # 1 and 6
	Midterm Exam	2	10% (10)	7	LO # 1-5
	Final Exam	3	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
المنهاج الاسبوعي النظري	

	Material Covered
Week 1	Basic concepts of Air Conditioning: Air velocity, Pressure, Moist air properties.
Week 2	The adiabatic steady flow, Saturation and Dew point, Air psychometric chart.
Week 3	Calculation of relative humidity: Partial steam pressure, Partial dry air pressure, Critical and saturation conditions.
Week 4	Air mixing and air supply condition.
Week 5	Overall heat transfer Coefficient calculation and wall surface temperature calculation.
Week 6	Comfortable conditions, Indoor air quality
Week 7	Midterm Exam
Week 8	Design temperature and outdoor and indoor room temperatures.
Week 9	Heating load calculation.
Week 10	Heat loss through building structure, Infiltration and space heating.
Week 11	Cooling load Calculation, heat sources.
Week 12	Heat gain from solar intensity and renewable energy sources.
Week 13	Pressure drops of internal fluid flow through circular and rectangular duct and fittings.
Week 14	The effect of cavitation on the internal flow.
Week 15	Design and selection of Air- Conditioning systems
Week 16	Final Exam

Delivery Plan (Weekly Lab. Syllabus)	
المنهاج الاسبوعي للمختبر	

	Material Covered
Week 1	Exp. 1: Wind tunnel (Groupe A)
Week 2	Exp. 1: Wind tunnel (Groupe B)
Week 3	Exp. 1: Wind tunnel (Groupe C)
Week 4	Exp. 1: Wind tunnel (Groupe D)

Week 5	Exp. 1: Wind tunnel (Groupe E)
Week 6	Exp. 2: Pelton turbine (Groupe A)
Week 7	Exp. 2: Pelton turbine (Groupe B)
Week 8	Exp. 2: Pelton turbine (Groupe C)
Week 9	Exp. 2: Pelton turbine (Groupe D)
Week 10	Exp. 3: Pelton turbine (Groupe E)
Week 11	Exp. 3: Centrifugal pump (Groupe A)
Week 12	Exp. 3: Centrifugal pump (Groupe B)
Week 13	Exp. 3: Centrifugal pump (Groupe C)
Week 14	Exp. 3: Centrifugal pump (Groupe D)
Week 15	Exp. 3: Centrifugal pump (Groupe E)
Week 16	Experimental Test

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	1. Refrigeration and Air-Conditioning, By Stoecher, First edition, McGraw-Hill, 2006.	No
Recommended Texts	1. Air-Conditioning and Refrigeration, By Jones, First edition, McGraw-Hill, 1983. 2. مبادئ هندسة التكييف والتثليج، د. حالد الجودي، 1986 3. A text book of hydraulic machines, R. S. Khurmi.	No
Websites		

APPENDIX:

GRADING SCHEME				
مخطط الدرجات				
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	Ministry of Higher Education and Scientific Research - Iraq University of Tikrit College of Engineering Department of Sustainable Energy Engineering	

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information		
معلومات المادة الدراسية		
Module Title	GRADUATION PROJECT II	**Module Delivery**
Module Type	CORE	
Module Code	ENG-402	Theory Lecture Seminar
ECTS Credits	4	
SWL (hr/sem)	100	
Module Level	UGIV	**Semester (s) offered**	8
Min number of students	15	**Max number of students**	80

Administering Department	Sustainable Energy Engineering	College	Engineering	
Module Leader	All faculty members	**e-mail**	-	
Module Leader's Acad. Title	-	**Module Leader's Qualification**	-	
Module Tutor	None	**e-mail**	None	
Peer Reviewer Name		**e-mail**		
Review Committee Approval	01/09/2025	**Version Number**	1.0	

<table>
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العلاقة مع المواد الدراسية الأخرى</td></tr>
<tr><td>**Prerequisite module**</td><td colspan="2">None</td><td>**Semester**</td><td>-</td></tr>
<tr><td>**Co-requisites module**</td><td colspan="2">None</td><td>**Semester**</td><td>-</td></tr>
</table>

Module Aims, Learning Outcomes, Indicative Contents and Brief Description
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر

Module Aims أهداف المادة الدراسية	The main aim of this course is to prepare students for the practical tasks of the work place after graduation. This includes building his/her ability to perform a complete project.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	8. Upon completion of this course, the student should be able to: 9. Structure a working schedule for the project. 10. Present Clear aim and objectives of the graduation project. 11. Present the literature review with relation to the selected topic. 12. Carry out the design (or any topic selected). 13. Write a technical report. 14. Defend the technical report in front of a committee and be able to answer questions asked by the committee members.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following: - Basic concepts of a project. (6hrs) - Physical and Mechanical Properties of a product (6 hr) - Storage, handling and transportation (4 hr) - Material balance (16 hrs)
Course Description	Preparatory studies of the literature and data collection for the graduation project in a particular area of concentration and under the supervision of one of the faculty members. The course covers directed readings in the literature of civil engineering, introduction to research methods, seminar discussions dealing with special engineering topics of current interest. Planning, design, construction and management of an engineering project. Writing a technical report.

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	The learning and teaching **strategy** is designed to: Carefully describe the course design and teaching methodology for project and applications

	lectures specifically aimed at small college and university instruction.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** **0** **Office hours** **20** **In class tests** **0** **Discussions** **14** **Practical** **10**	44	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	2.9
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Library, dorm, home searching** **35** **Preparation for final test** **11** **Technical writing** **10**	56	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.73
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

Module Evaluation
تقييم المادة الدراسية

		Time (hr)	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Discussion**	30	30% (30)	5, 10, 12, 14	LO #1, 2, 3, and 4
	Assignments	0	0% (0.0)	-	LO # 1, 2, 3, 4, 5 and 6
	Seminars	10	10% (10)	Continuous	All
Summative assessment	**Midterm Exam**	0	0% (0)	-	-
	Final defiance	3	60% (60)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	Select a research problem
Week 2	Preparing the general framework of the project: introduction, formulation of the problem (questions - hypotheses)
Week 3	Define concepts and terminology
Week 4	Objectives, Importance
Week 5-6-7	Limits, methodology
Week 8-9	Present the research plan to the supervisor and discuss it.

Week 10-11	Prepare the theoretical background using the latest sources and references
Week 12-13	Previous studies and commentary
Week 14	Submit the graduation project proposal to the supervisor for review and comments
Week 15	**Oral Presentation**
Week 16	**Final Seminar**

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required References	Perry's Mechanical Engineers' Handbook, Ninth Edition. Don W. Green, Marylee Z. Southard McGraw Hill Professional, Jul 13, 2018 - Technology & Engineering - 2352 pages.	No
Recommended Texts	Coulson Richardson's Mechanical Engineering Vol.6 Mechanical Engineering Design 4th Edition. R. K. SINNOTT, J. M. COULSON, J. F. RICHARDSON. ELSEVIER BUTTERWORTH-HEINEMANN, OXFORD, 2005	Yes
Websites	TBD	

APPENDIX:

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

Note:

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