MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Fundamentals of Thermodynamics**			**Module Delivery**	
Module Type	**C**			☒ **Theory** ☒ **Lecture** ☒ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**ATU12024**				
ECTS Credits	**6**				
SWL (hr/sem)	**150**				
Module Level	1		**Semester of Delivery**	2	
Administering Department	ATU12		**College**	PMETC	
Module Leader			**e-mail**		
Module Leader's Acad. Title	Professor		**Module Leader's Qualification**	Ph.D.	
Module Tutor			**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E-mail	
Scientific Committee Approval Date	01/06/2023		**Version Number**	1.0	

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

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	1. Basic terms and definitions: energy, thermodynamic system, properties, state and thermodynamic equilibrium. Units. The zeroth law of thermodynamics 2. Microscopic forms of energy. The basic axiom of thermodynamics. Work and heat, moving boundary work. The first law of thermodynamics for closed systems 3. Specific heat, enthalpy, ideal gas equation of state, characteristic thermodynamic processes 4. The first law of thermodynamics for open systems (control volume). The concept of entropy, causes of entropy change, reversible and irreversible processes, entropy as a function of the state. 5. The second law of thermodynamics. Examples of thermodynamic cycles: gas power cycles, refrigeration and heat pump cycles. 6. Phases of a pure substance, saturated liquid, saturated liquid-vapor mixture, critical parameters, triple point, property diagrams for phase-change processes, properties of gas and two-phase mixtures. 7. Unconventional sources of energy
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. On completion of the course, students will have basic knowledge on energy, thermodynamic system and thermodynamic parameters, thermodynamic equilibrium, work and heat as methods of energy transport between systems 2. A student will have skills concerning basic laws of physics relating to thermodynamics and the laws of thermodynamics for closed and open systems. 3. A student will have a fundamental knowledge of the ideal gas equation, polytropic processes and characteristic processes. 4. A student will have the skills to utilize the procedures for energy balancing and methods of energy transport between systems. 5. A student will be able to utilize mathematical tools to solve problems related to the principles of thermodynamics. A student can interpret the obtained results. 6. A student will have the skills to computations in the field of typical issues of heating of a system by work transfer or by heat transfer 7. A student will have learning skills to utilize the ideal gas equation 8. A student will be able to present graphs of thermodynamic processes 9. A student will be aware of the method of generating energy and the operation of energy devices (heat engines, etc.) on the natural environment. 10. A student will be able to work in a team during measurements and to analyse the results; a student will be aware of the importance of knowledge concerning the principles of teamwork
Indicative Contents المحتويات الإرشادية	1. Basic terms and definitions: energy, thermodynamic system, properties, state and thermodynamic equilibrium. Units. The zeroth law of thermodynamics. 2. Microscopic forms of energy. The basic axiom of thermodynamics. Work and heat, moving boundary work. The first law of thermodynamics for closed systems. 3. Specific heat, enthalpy, ideal gas equation of state, characteristic thermodynamic processes. 4. The first law of thermodynamics for open systems (control volume). The concept of entropy, causes of entropy change,

	reversible and irreversible processes, entropy as a function of the state. 5. The second law of thermodynamics. Examples of thermodynamic cycles: gas power cycles, refrigeration and heat pump cycles. 6. Phases of a pure substance, saturated liquid, saturated liquid-vapor mixture, critical parameters, triple point, property diagrams for phase-change processes, properties of gas and two-phase mixtures.

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

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	78	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	7
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	72	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**150**		

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

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	**Introduction** - Introduction to Thermodynamics - Thermodynamics System - Dimensions, Units & symbols , units system
Week 2	**Properties of System** - Thermodynamic Process - Intensive & extensive Variables - Specific Value, Mole Independent & dependent properties
Week 3	**Thermal Equilibrium, Temperature** - Thermal & thermodynamic equilibrium - Zero Law - Thermometers Temperature Scale
Week 4	**Energy** - Types and source of energy - Kinetic & potential energy The conservation of energy, use
Week 5	**Kinetic Theory of Gases** - Molecular Motion of Gases - Internal Energy, joule's law Molecular Energy
Week 6	**Heat** - Specific Heat - Relation between (q,Q,Q) - Sensible & Latent Heat Joule's Equivalent
Week 7	**Work** - Displacement Work - Work & (p-v) Diagram - State & Path Function - Electrical Work Relation Between (Q, W)
Week 8	**Ideal (Perfect) Gas** - Actual & Ideal Gas Boyle's & Charles Law

	- Equation of Ideal Gas Absolute Scale
Week 9	**Enthalpy** - Enthalpy Joule's Experiment
Week 10	**The First Law of Thermodynamic** - Joule's Law of Internal Energy - The First Law Statements Energy Equation
Week 11	**Application of the First Law on the Closed Systems** - Constant Volume Process - Constant Pressure Process Constant Temperature Process - Adiabatic Process Polytrophic Process
Week 12	**Open systems** - Motion of Fluid - Steady & none Steady Flow - Flow, Shaft Work - Energy Equation
Week 13	**Application of steady flow Energy Eq.** - Boiler & Condenser Compressor & Turbine - Nozzle & throttling Heat Exchanger
Week 14	**The Second Law of Thermodynamics** - Friction Reversible & Irreversible Process
Week 15	- Heat Engine - Reversed Heat Engine - Engine Thermal Efficiency Coefficient of Performance
Week 16	**Preparatory week before the 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	Headway book for learning English	Yes
Recommended Texts	Skills in writing and Learning English	Yes
Websites	https://www.bbc.co.uk/learningenglish/	

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 المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

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