

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	Thermodynamic - Gas cycle		Module Delivery
Module Type	C		<input checked="" type="checkbox"/> Theory <input checked="" type="checkbox"/> Lecture <input checked="" type="checkbox"/> Lab <input checked="" type="checkbox"/> Tutorial <input type="checkbox"/> Practical <input type="checkbox"/> Seminar
Module Code	ATU12046		
ECTS Credits	4		
SWL (hr/sem)	100		
Module Level	1	Semester of Delivery	
Administering Department	ATU12	College	PMTEC
Module Leader			e-mail
Module Leader's Acad. Title	Professor	Module Leader's Qualification	Ph.D.
Module Tutor	Basemah	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

<p>Module Objectives أهداف المادة الدراسية</p>	<ol style="list-style-type: none"> 1. The course provides the student with knowledge about: 2. Conservation laws for mass and energy (including the 1st law of Thermodynamics). 3. Forms of energy such as work (power) and heat, internal energy and enthalpy. 4. Entropy and the 2nd law of thermodynamics. 5. Reasons for thermodynamic losses in the form of irreversibilities. 6. The quality of different forms of energy measured as the ability to produce work. 7. Destruction of energy quality in processes. 8. Ideal gas model, its assumptions, applications and limitations. 9. Different cyclic processes such as Carnot, Rankine, Otto, Diesel and Brayton. – The course gives the student insight about: - 10. Operation of steam and gas based power stations, internal combustion engines, heat pumps. – 11. The main components of heat & power processes, such as steam and gas turbines, compressors, pumps, fans, heat exchangers and valves. 12. The ability of fluids to change phase (solid, liquid and gas). 13. Skills: The course should enable the student to: 14. Estimate thermodynamic properties for systems by the use of tables and graphical diagrams. 15. Calculate efficiencies for power producing and power consuming processes. 16. Describe thermodynamic processes in graphical diagrams such as $p-v$, $T-v$ og $T-s$. 17. General competence: The course should give the student: 18. Basic competence that constitute central elements in other courses focusing on energy systems and industrial processes. 19. Understanding of systems and the capability to evaluate the efficiency of processes w.r.t. energy and exergy (energy quality). 20. Overview of processes for power production, heating (heat pumps)
<p>Module Learning Outcomes مخرجات التعلم للمادة الدراسية</p>	<ol style="list-style-type: none"> 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	63	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	37	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	Properties of pure substance. -Pure substance phases -Phase-change processes -Diagrams of p and $(p - T)$.
Week 2	Steam tables. -Saturated vapor tables, superheated vapor tables. -Illustrative example.
Week 3	Steam properties. -Determine parameters of state of steam -Basic relations and dryness fraction.
Week 4	Steam diagrams. -Study diagrams $(p - v)$, $(h - s)$ and $(p - T)$.
Week 5	Steam reversible non-flow processes -Constant volume process. -Constant pressure process. -Isothermal process. -Isentropic process. -Polytropic processes. -Illustrative example.
Week 6	Throttling process. Separation- throttling calorimeter. -Throttling process. -Throttling calorimeter. -Separation-throttling calorimeter.

	-Illustrative example.
Week 7	Unsteady flow energy equation -Derivation, applications. -Illustrative example.
Week 8	Steam cycles -Carnot cycle. -Ideal Rankine cycle. -Illustrative example. -Rankine cycle with superheat. -Illustrative example
Week 9	-The effect of steam conditions on thermal efficiency and steam specific consumption. -Overall efficiency.
Week 10	
Week 11	
Week 12	
Week 13	
Week 14	
Week 15	
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.				