MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية			
Module Title	Thermodynamics 2		**Module Delivery**
Module Type	C		• ☐ **Theory** • ☒ **Lecture** • ☒ **Lab** • ☐ **Tutorial** • ☐ **Practical** • ☐ **Seminar**
Module Code	UOMU021031		
ECTS Credits	10		
SWL (hr/sem)	250		
Module Level	2	**Semester of Delivery**	3
Administering Department	Air-conditioning and Refrigeration Eng. Tech. Dep.	**College**	Engineering and Engineering Technologies
Module Leader	Salwan O. Waheed	**e-mail**	Salwan.obaid@uomus.edu.iq
Module Leader's Acad. Title	Prof.	**Module Leader's Qualification**	Ph.D
Module Tutor	Ali Baqer	**e-mail**	ali.baqer@uomus.edu.iq
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Scientific Committee Approval Date		**Version Number**	1.0

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	UOMU021029	**Semester**	2

Co-requisites module	None	**Semester**	1

Module Aims, Learning Outcomes and Indicative Contents **أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية**	
Module Aims أهداف المادة الدراسية	To study the principles of applied thermodynamics, as the basis of refrigeration & air conditioning engineering and power plant subjects
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1- To know the type of steam power plants. 2- To know the regenerative cycle – dual cycle, High speed gas flow. 3- To know the properties of isentropic flows, shock waves. 4- To know the supersonic nozzles, single and multi-stage reciprocating compressors. 5- To know the multistage gas turbines and velocity triangles. 6- To know the steam turbines. Internal combustion engines, Thermodynamics relations. 7- To know the Maxwell relations, Clausius Clapeyron relations 8- To know the gas mixtures, Gibbs- equations. 9- To know the gravimetric analysis, combustion, heat of reaction.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A – Steam Power Plans Regenerative cycle – dual cycle, High speed gas flow. [24 hrs.] Part B – Gas Flow Isentropic flows, shock waves, supersonic nozzles. [16 hrs.] Part C – Compressors and Turbines Single and multi-stage reciprocating compressors, multistage gas turbines, velocity triangles, steam turbines, internal combustion engines. [32 hrs.] Part D – Thermodynamics Relations Maxwell relations, Clausius Clapeyron relations, gas mixtures, Gibbs- equations. [48 hrs.]

Learning and Teaching Strategies **استراتيجيات التعلم والتعليم**	
Strategies	Assessment is based on hand-in assignment, written exams, case study, quizzes, seminars and practical testing.

Student Workload (SWL) **الحمل الدراسي للطالب**

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	158	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	11
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	92	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	10
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	250		

Module Evaluation
تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	5	5% (5)	2,5,8,10,13	LO# 1,4,5,7,8
	Assignments	5	5% (5)	1,4,7,11,15	LO# 1-15
	Lab.	10	10% (10)	1-9	LO# 1-15
	Reports	10	10% (10)	1-8	LO# 1-15
Summative assessment	Midterm Exam	3 hr	20% (20)	9	LO# 1-15
	Final Exam	3 hr	50% (50)	15	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	An overview of steam, dryness fraction measurements.
Week 2	Steam power plants, Rankine - reheat cycle.
Week 3	Regenerative cycle – dual cycle, High speed gas flow.
Week 4	Properties of isentropic flows, Shock waves.
Week 5	Supersonic nozzles, Reciprocating compressors.
Week 6	Dynamic analysis, Clearance volume.
Week 7	Multistage compressors, Gas turbines.
Week 8	Velocity triangles, frictional effects, Gas turbines comparison.
Week 9	Steam turbines. Internal combustion engines, Thermodynamics relations.
Week 10	Maxwell relations, Clausius Clapeyron relations.
Week 11	Thermodynamic relations for du, dh, ds, Cp and Cv, Real gases.
Week 12	Compressibility factors, Real gas equations of states.
Week 13	Gas mixtures, Gibbs- equations.
Week 14	Daltons law and molar ratio, Volumetric analysis.
Week 15	Gravimetric analysis, Combustion, heat of reaction.
Week 16	Final exam.

Delivery Plan (Weekly Lab. Syllabus)
المنهاج الاسبوعي المختبري

	Material Covered
Week 1	Measurement of specific heat ratio of air.
Week 2	Operating parameters of VCR.

Week 3	Saturated vapor pressure and temperature relation.
Week 4	Steam boiler efficiency.
Week 5	Determination the phase of the refrigerant for VCR system components.
Week 6	Vapor dryness fraction measurement.
Week 7	Determination the latent heat of evaporation.
Week 8	Determination of thermal efficiency for VCR cycle.
Week 9	EES software training.

Learning and Teaching Resources **مصادر التعلم والتدريس**		
	Text	**Available in the Library?**
Required Texts	1- Borgnakke, C. and Sonntag, R.E., 2022. F*undamentals of thermodynamics*. John Wiley & Sons. 2- Cengel, Y.A., Boles, M.A. and Kanoğlu, M., 2011. *Thermodynamics: an engineering approach* (Vol. 5, p. 445). New York: McGraw-hill. 3- Rajput, R.K., 2005. *A textbook of engineering thermodynamics*. Laxmi Publications	No
Recommended Texts	None	
Websites	None	

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.