	Ministry of Higher Education and Scientific Research - Iraq University of Warith Al_Anbiyaa Engineering Department Refrigeration and Air Conditioning Techniques Engineering	

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	MPAC203				
ECTS Credits	10				
SWL (hr/sem)	250				
Module Level	2		**Semester of Delivery**	TCB	
Administering Department	Refrigeration and Air Conditioning Techniques		**College**	Engineering	
Module Leader	Zainab Abdelkarim		**e-mail**	zainab.abdelkarim@uowa.edu.iq	
Module Leader's Acad. Title	Asst.Lecturer		**Module Leader's Qualification**	M.Sc	
Module Tutor			**e-mail**		
Peer Reviewer Name			**e-mail**		
Scientific Committee Approval Date	31.08.2025		**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	MPAC108	**Semester**	L1,S1
Co-requisites module	None	**Semester**	

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 Clapyron 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
	Report	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

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	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. *Fundamentals 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

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.

رئيس القسم

ا.م.د محمد حسن عبود

التاريخ: ٣١-٠٨-٢٠٢٥

استاذ المادة

التاريخ : ٣١-٠٨-٢٠٢٥