MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Gas Dynamics**			**Module Delivery**	
Module Type	**Core**			☒ **Theory** ☐ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☒ **Seminar**	
Module Code	**RE 302**				
ECTS Credits	**8**				
SWL (hr/sem)	**200**				
Module Level	3		**Semester of Delivery**	5	
Administering Department	PM		**College**	TEMO	
Module Leader	Firas Aziz Ali		**e-mail**	firasaziz@ntu.edu.iq	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	M.Sc.	
Module Tutor			**e-mail**		
Peer Reviewer Name			**e-mail**		
Scientific Committee Approval Date	01/6/2023		**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. To discuss the effect of compressibility in gas flow 2. To derive the steady one-dimensional isentropic flow equation 3. To discuss the effects of friction and heat transfer on compressible flows through constant area duct 4. To familiarize the occurrence of shocks and calculate property changes across a shock wave 5. To derive the thrust equation and discuss its application in jet and rocket.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks. 1. **CO1**: Apply the thermodynamics concepts in relation to compressible flows and derive relationships between various compressible flow parameters 2. **CO2**: Understanding of isentropic compressible flows in variable area ducts and apply in design of static components like nozzles and diffusers 3. **CO3**: Solve for compressible flow characteristics with friction and heat transfer 4. **CO4**: Develop relationship for shocks and determine their characteristics under various conditions 5. **CO5**: Analyse the performance of aircraft and rocket propulsion engines
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A - Introduction to gas dynamics, Isentropic flow, Bryton cycle ideal and actual. [15hrs] Shock waves in supersonic flow, normal shock and oblique shock waves[15 hrs] Introduction to gas turbine power plant, [10 hrs] Introduction to rockets thrust equations, [15hrs] Part B –

	Fundamentals . To understand the charts of oblique shock waves, [15 hrs] Types of pumps, pumps Characteristics, [7 hrs] Introduction to jet propulsion, The Kinds, Impulse Turbine, Blades Efficiency. [15 hrs]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Type something like: The major approach used to offer this module will be to promote student engagement in the exercises while also enhancing and broadening their critical thinking abilities. This will be accomplished through lectures, interactive tutorials, and the consideration of various sorts of easy experiments incorporating some engaging sampling exercises for the students.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ أسبوعا			
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	137	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	9
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**200**		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	5	20% (20)	3,4,9 and 11	LO #1, #2,#3and #4, #5
	Assignments	4	10% (10)	2,6,8 and 12	LO #2, #3, #4 and#5
	Projects / Lab.	3	10% (10)	Continuous	All
	Report	0	0% (0)		
Summative assessment	**Midterm Exam**	3hr	10% (10)	7	LO #1 - #3
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	**Conservations laws, Mass, Energy, and Momentum equations**
Week 2	**Introduction to Compressible Flow**, classifications of fluid flow
Week 3	**Wave Propagation, stagnation condition, Thermodynamics relationships**
Week 4	**Isentropic flow of a perfect gas in varying area duct**
Week 5	**Isentropic Flow in Converging-diverging Nozzles and Diffusers**
Week 6	**Thrust of Rocket Engine**, specific thrust equation
Week 7	**Introduction to Stationary Normal Shock Waves**
Week 8	**Stationary Normal Shock Waves in C-D Nozzles**
Week 9	**Stationary Normal Shock Waves in C-D Diffusers**
Week 10	**Moving Normal Shock Waves**

Week 11	**Introduction to Oblique Shock Waves** relationships
Week 12	**Oblique Shock Waves over wedges and inlets**
Week 13	**Introduction to pumps**, pumps classifications
Week 14	**Introduction to Compressors**, types of compressors
Week 15	**Introduction to Gas Turbines**.

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Introduction of gas dynamics instruments
Week 2	Subsonic wind tunnel pressure distribution
Week 3	Subsonic wind tunnel velocity distribution

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Dynamics and Thermodynamics of compressible flow, A. Shapiro	No
Recommended Texts	Fundamentals 0f engineering thermodynamics, Michael J. Moran and Howard N. Shapiro, Fifth edition	No
Websites	https://www.linquip.com/ Linquip Content Management Team	

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.

Code	Course/Module Title	ECTS	Semester
RE 302	Gas Dynamics	8	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	63	137

Description

The course on Thermal Power Plants covers various sections to provide students with a comprehensive understanding. It begins by introducing thermodynamics and studying thermal systems in terms of energy interactions with their surroundings. Students will learn how to measure differences in the relevant properties of the system and its surroundings, emphasizing their engineering applications.

The course also delves into one-dimensional compressible flows, covering essential concepts such as isentropic flow, normal and oblique shock waves, and flows with heat transfer, friction, and mass addition. Additionally, students will explore topics like simple waves, small perturbation theory for linearized and steady flows, and the method of characteristics for two-dimensional steady flow and one-dimensional unsteady flow.

By the end of the course, students will have gained a solid foundation in thermodynamics, with a specific focus on thermal power plants. They will be equipped with the knowledge and skills to analyze and comprehend the complex dynamics involved in these systems.