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	RETE 304				
ECTS Credits	**6**				
SWL (hr/sem)	**150**				
Module Level	3		**Semester of Delivery**	5	
Administering Department	RETE		**College**	College of Oil and Gas Techniques Engineering - Kirkuk, Northern Technical University, Iraq	
Module Leader	Marwa Khaleel Rashid		**e-mail**	marwa.khaleel23@ntu.edu.iq	
Module Leader's Acad. Title	Assistant lecturer		**Module Leader's Qualification**	MSc	
Module Tutor	Name (if available)		**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	Thermodynamics Fluid Mechanics	**Semester**	3 3
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. Understand the compressible flow fundamentals. 2. Study the compressible flow with friction and heat transfer. 3. Know the application of normal shock in compressible flow. 4. Study the aircraft propulsion systems and rocket propulsion and its applications. 5. Recognize the working principles and characteristics of steam and gas turbines. 6. Recognize the working principles and characteristics of compressors.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of successful completion of this course, the student will be able to: 1. Ability to solve the properties of compressible fluid flow ,one Dimensional isentropic flow 2. Ability to solve and analysis of Normal and Oblique shock waves . 3. The ability to determine the properties of the flow in constant area duct with friction (fanno flow) and its applications 4. The ability to determine the properties of the flow in constsnt area duct with heat transfer (Rayleigh flow) and its applications
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	Implementing active learning in a class room requires preparation and some changes to the lecture. However, the lecture content is not changed or replaced with new material. The same lecture content is delivered to the students in a

	better way and the lecture time is used more effectively. The following are some of the techniques of active learning and cooperative learning I personally use in my engineering classes to enhance student's understanding and retention of the material: ○ **One Minute Paper**: Students are asked to write a one minute note (about the previous lecture, the homework or the material in general) to the instructor on a piece of paper. This provides a fast way for the teacher to have a quick feedback on students understanding of what was covered previously. ○ **Muddiest Point**: When there is a long lecture with multiple topics covered, the students are given the chance to discuss the material covered in the lecture and list the most difficult parts of the lecture. ○ **Clarification Pause**: During the lecture, the students are given the time to go over the material written on the board, think about it and ask if they have any questions. Then, the lecturer answers the different questions raised before resuming the next part of the lecture. ○ **Questions and answers**: Usually during the lecture, questions are raised about the new material presented and questions are solved on the board. A sample of the questions asked include "Why do you think this topic is important?" or "what is the relation between what we were talking about and this technique?" or "which technique is best?" ○ **Critical Thinking, Group Discussion**: Students are given a handout with multiple problems and they are asked to apply what they learned in the lecture to solve the problems in groups. They are asked to discuss it together and come up with a single solution that all members agree on. ○ **Critical Thinking, Think-pair-share:** Students are asked to work individually on a problem for a short time; then students pair up to compare their answers. Then they have to explain their answer and share it with the rest of the class. ○ **Peer Teaching:** If one member of the team solves the problem correctly, He will explain it to the rest of the group and discuss with them why his/her answer is correct and their answer is not. This allows the students to find out what went wrong and the mistake they made in solving the problem. This technique will help the student to avoid these mistakes when doing the homework or the exams. ○ **Active Review Sessions**: For each exam, students are given a practice test with a set of problems a week in advance. They are encouraged to work on the practice test individually first and then in groups to discuss the answers. During the review session, the students are asked questions about the problems in the practice test and they are given the choice to decide which problems they want the professor to concentrate on. ○ **Active presentations**: Students are asked to do projects and then to submit reports and give presentations. Each member of the group is required to give part of the presentation and during the presentation, the students are given the chance to have an open discussion and answer questions about their projects.

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	4.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	87	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5.8
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**	5	10% (10)	3,6,8,10	LO 1-LO3
	Assignments	5	10% (10)	2, 5,9, 12	LO #3, #4
	Projects /Lab.(report)	10	20% (20)	Continuous	All
Summative assessment					
	Mid Term exam	2 hr	10% (10)	7	LO # 1-4
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction
Week 2	Basic principles for compressible fluid flow
Week 3	Isentropic flow with variable area.
Week 4	Isentropic flow with variable area.
Week 5	The Isotropic
Week 6	Stationary Normal shock wave.
Week 7	**Mid Term exam**

Week 8	nozzle and diffusers
Week 9	Constant area adiabatic flow (Fanno flow)
Week 10	Constant area flow with heat transfer (Rayleigh flow).
Week 11	Oblique shock wave .
Week 12	Introduction to pumps, pumps classifications
Week 13	Introduction to Compressors, types of compressors
Week 14	Introduction to Compressors, types of compressors
Week 15	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: To study sound velocity in different solids and fluid
Week 2	Lab 2: To study various gas properties for different altitude in atmosphere.
Week 3	Lab 3: To study the wave propagation at different Mach number.
Week 4	Lab 4: To study the isentropic flow from variable area duct.
Week 5	Lab 5: To study the flow through constant area duct with friction. (Fanno flow).
Week 6	Lab 6: To study the shock waves generated in the flow field.
Week 7	Lab 7: To study different types of aerospace vehicles.

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	James E.A. John , Theo G , Keith , " Gas Dynamics " 3rd Edition , John –Wiely , 2006.	Yes
Recommended Texts	1. The Dynamics and Thermodynamics of Compressible Fluid Flow (Vol,1) by A.H. Shapiro 2. Power plant Technology , by M.M.El-Wakil 3. Steam Turbines Theory and Practice by W.J. Keartin.	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.

Code	Course/Module Title	ECTS	Semester
RETE 304	Gas Dynamics	6	5
Class (hr/w)	Lect/lab./prac./Tutor	SSWL (hr/sem)	USWL (hr/sem)
2	2	63	87

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