MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Combustion & Pollution Engineering**			**Module Delivery**	
Module Type	**Core**			☒ **Theory** ☐ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**RE 404**				
ECTS Credits	**6**				
SWL (hr/sem)	**150**				
Module Level	4		**Semester of Deliver**	8	
Administering Department	PM		**College**	TEMO	
Module Leader	Omar Mohammed yousif		**e-mail**	Omar.m.yousif@ntu.edu.iq	
Module Leader's Acad. Title	Ass.Lecture		**Module Leader's Qualification**	M.S.C.	
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. Introduce the student to the types of Fuel & combustion process. 2. Introduce the student Basic Concepts of Thermodynamics of combustion , stoichiometric combustion , incomplete combustion , complete combustion , Air fuel ratio *(A/F)*, 3. Introducing students how to calculate adiabatic flame temperature , constant pressure adiabatic flame temperature , constant volume adiabatic flame temperature. 4. Introducing students to study Classifications of engines and Engine performance. 5. Introducing the student to Air-Standard cycles . 6. Introduce the student types of hydrocarbon fuels , Hydrocarbon fuels gasoline , Diesel fuel , Alternate fuels . 7. Introducing students study Octane Number &Cetane Number , Self-Ignition Characteristics of Fuels , Octane Number and Engine Knock 8. Introduce the student Basic Concepts of air pollution, physical and chemical fundamentals . 9. Introduce the student Ambient air quality standards for criteria pollutants , Air pollution standards , Air pollution regulation. 10. To understand Air pollutants classification , Transport and air pollution , Causes of air pollution from Transportation. 11. Introducing students study the Strategies for control of emissions in SI engines; Add on systems to control emissions inside the engine: EGR, crankcase and evaporative emission control
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. Show the student's ability to use knowledge to prepare scientific and applied research. 2. The ability to use electronic programs to solve the problems of combustion process . 3. The ability to think to extract engineering solutions to problems related to combustion and pollution . 4. The ability to keep pace with scientific and technical modernity. 5. Teaching leadership skills, the value of commitment, love of work and devotion to it. 6. The ability to calculate the rate of adiabatic flame temperature . 7. The ability to calculate the Calculation of concentrations of air pollutants in the atmosphere . 8. The ability to control emissions in SI engines .
Indicative Contents	After studying this chapter, the student is expected to master the following knowledge and skills: .

المحتويات الإرشادية	1-Basic Concepts of combustion , and types of combustion [15 hrs] 2- calculations adiabatic flame temperature [10 hrs] 3- Classifications of engines and Engine performance. [15 hrs] 4- Types of hydrocarbon fuels , Hydrocarbon fuels gasoline , Diesel fuel , Alternate fuels . [15 hrs] 5-Studying Octane Number &Cetane Number [10 hrs] 6- air pollution and Air pollution regulation [20 hrs]. 7- Strategies for control of emissions in SI engines [15 hrs] .

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Type something like: 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	78	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	72	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5
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	4	20% (20)	2, 6 and 9, 12	LO #1, #5 and #6, #8
	Assignments	3	15% (15)	4, 8 and 14	LO #2, #3 and #7
	Projects / Lab.				
	Report	1	5% (5)	13	LO #4
Summative assessment	Midterm Exam	2hr	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	Thermodynamics of combustion, . Review of property relations ,letant heat of vaporization , Ideal gas mixtures ,Fuel & combustion , stoichiometric combustion , incomplete combustion , complete combustion , Air fuel ratio *(A/F)*
Week 2	Excess of air , less of air ,theoretical of air , Equivalence ratio.
Week 3	Application of 1st law of thermodynamic on combustion process, Closed system (non-flow process) , Open system (steady -flow process)
Week 4	adiabatic flame temperature , constant pressure adiabatic flame temperature , constant volume adiabatic flame temperature
Week 5	Classifications of engines, Types of Ignition, Engine Cycle, Basic Design, Air Intake Process, Method of Fuel Input for SI Engines, Fuel Used , Application , Type of Cooling
Week 6	Engine performance , brake power , brake thermal efficiency , brake mean effective pressure , Specific fuel consumption , Mechanical efficiency , Volumetric efficiency
Week 7	Air-Standard cycle , Air-Standard Assumptions , pressure volume diagram , Mean process on p-v diagram , Otto Cycle , Thermal efficiency of the ideal Otto cycle , diesel cycle , Thermal efficiency of the ideal diesel cycle
Week 8	Air-fuel cycle , Air-fuel cycle assumption , constant volume cycle (gasoline engine cycle) , constant pressure cycle (Diesel engine cycle
Week 9	hydrocarbon fuels , Hydrocarbon fuels gasoline , Diesel fuel , Alternate fuels

Week 10	Octane Number &Cetane Number , Self-Ignition Characteristics of Fuels , Octane Number and Engine Knock
Week 11	Introduction to pollution , Ecological Systems and pollution , Toxic pollutants , Environmental factors affecting toxicity , Ambient air quality standards for criteria pollutants , Air pollution standards , Air pollution regulation
Week 12	Air pollutants classification , Transport and air pollution , Causes of air pollution from Transportation
Week 13	Calculation of concentrations of air pollutants in atmosphere , Description of air pollutants , A-Criteria Pollutants , Carbon Monoxide (CO) , Nitrogen Oxides (NO2) , Sulphur Oxides (SO_x) , Particulate Matter (PM-10) , Organic air pollutants (VOCS) , Hydrocarbons (HC) , Ozone (O3) , Lead(Pb)
Week 14	Calculation of concentrations of air pollutants in atmosphere ,
Week 15	Global Climate Change - Greenhouse Gases Toxic Pollutants, Radioactive pollutants, indoor pollutants and Non-Criteria pollutants
Week 16	Preparatory week before the final Exam

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	. Engineering Fundamentals of the Internal Combustion Engine .*By* Willard W. Pulkrabek	Yes
Recommended Texts	AN INTRODUCTION TO COMBUSTION Concepts and Application.BY Stephen R. Turns	yes
Websites		

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.

Undergraduate Courses 2023-2024

Code	Course/Module Title	ECTS	Semester
RE 404	**Combustion & Pollution Engineering**	**6**	**8**
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/sem)**
3	**2**	**78**	**72**
Description			
The main focus of combustion is the application of the engineering sciences, especially the thermal sciences, to internal combustion engines. The goals are to familiarize Basic Concepts of Thermodynamics of combustion , stoichiometric combustion , incomplete combustion , complete combustion with engine nomenclature, describe how internal combustion engines work, . An internal combustion engine is defined as an engine in which the chemical energy of the fuel is released inside the engine and used directly for mechanical work, as opposed to an external combustion engine in which a separate combustor is used to burn the fuel. the overall performance of internal combustion engines. Major engine cycles, configurations,. The will apply the principles of thermodynamics, combustion, fluid flow, friction, and heat transfer to determine an internal combustion engine's temperature and pressure profiles, work, thermal efficiency, and exhaust emissions. Also The main objectives of pollution is to Introduce Basic Concepts of air pollution, physical and chemical fundamentals and Introducing Ambient air quality standards for criteria pollutants , Air pollution standards , Air pollution regulation. To understand Air pollutants classification , Transport and air pollution , Causes of air pollution from Transportation and Introducing the Strategies for control of emissions in SI engines.			