MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Internal Combustion Engine**			**Module Delivery**	
Module Type	**Core**			☒ **Theory** ☒ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**UoB12345**				
ECTS Credits	**5**				
SWL (hr/sem)	**125**				
Module Level			**Semester of Delivery**		
Administering Department	ATU12		**College**	PMETC	
Module Leader	Balasem Abdulameer Jabbar		**e-mail**	balasemalquraishi@atu.edu.iq	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**		Ph.D.
Module Tutor	Ali Kadhum		**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**	
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 explanation with details for characteristics and applications of Internal Combustion Engines (ICE) 2. To identify the basic parameters and performance test of Internal Combustion Engines. 3. To explain the basic operation cycles for 2- stroke and 4-stroke cycle engine, for both SI and CI engine and. 4. To identify the air fuel induction system and exhaust process. 5. Identify the different fuels types used for internal combustion engine. 6. To study the combustion process and energy analysis in both, spark ignition (SI) and compression ignition (CI) engine.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. understanding of the operation of internal combustion engines. 2. Identify and classified the internal combustion engines. 3. Describe and evaluate the engine power and performance characteristics 4. Discussing the fuel combustion and mechanism of exhausting process. 5. Summarize the operation effects on the performance of ICE. 6. Discuss the basic operation cycles for SI and CI engines. 7. Understand the air-fuel mixing and valve timing diagrams for SI and CI engines
Indicative Contents المحتويات الإرشادية	

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	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	63	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	
Unstructured SWL (h/sem)	62	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	

الحمل الدراسي غير المنتظم للطالب خلال الفصل			
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**125**		

Module Evaluation
تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO #1 - #7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	Introduction to Combustion Engines, I.C Engines Classifications, I.C Engines applications, Engine Components, Basic Engine Cycles
Week 2	Engine Parameters. Operating Characteristics and Performance (Work, Mean effective pressure, Torque and power)
Week 3	Air- Fuel Ratio and Fuel- Air ratio, Engine Efficiencies. Performance Tests, Measurement of engine torque and power, Heat Balance of Engine
Week 4	Air-Standard cycles (Otto Cycle, Diesel Cycle)
Week 5	Dual Cycle, Compression of Otto, Diesel, Dual
Week 6	The Two-Stroke Engine Cycles, Regenerative Cycles Fuel Air Cycle (Variation of Specific Heats, Dissociation Effect, Comparison of P-V Diagram of Air-Standard And Fuel – Air Cycles)
Week 7	The actual cycle (Losses Occurring in The Actual Engine, Effect of Throttle Opening, Effect of Spark Timing) Valves and valves Timing Diagram for Four and Two Stroke Engines
Week 8	Air and Fuel Induction (Intake Manifold, Intake Valves, Fuel Injectors, Carburetors)
Week 9	Air And Fuel Flow in Carburetors, Supercharging and Turbocharging
Week 10	Intake For CI Engines, Effect of Operating Characteristics on Engine Performance Introduction For Two – Stroke Engine, Comparison of Two-Stroke and Four Stroke Engines

Week 11	Fuels and Combustion (Types of Fuels (Solid Fuels, Liquid Fuels, Gaseous Fuels) Combustion (Nature of combustion process, Types of combustion processes, Combustion stoichiometry)
Week 12	The air fuel ratio and incomplete combustion, Analysis of Combustion Products
Week 13	Applying the First law of thermodynamic to combustion processes. Energy Analysis of Reacting Mixtures
Week 14	Combustion In SI Engines, Combustion In CI Engines
Week 15	Exhaust Blowdown, *Exhaust Stroke*

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Study and Determine the effect of A/F Ratio on the performance of the Four-Stroke, Single-Cylinder Petrol Engine.
Week 2	Lab 2: Variable speed performances test on a Four-Strokes, Single-Cylinder Petrol Engine to find the relation of BMEP &Torque Vs. Speed.
Week 3	Lab 3: Variable load performances test on a Four-Stroke, Single-Cylinder Petrol Engine to measure thermal and volumetric efficiencies.
Week 4	Lab 4: Determination Frictional Power of Four-Stroke, Single Cylinder Diesel (Constant Speed) Engine by Willian's Line Method.
Week 5	Lab 5: Variable speed performances test on a two-Stroke, one- Cylinder Diesel Engine and draw the curves: (i) BP, BSFC, BMEP, Torque Vs Speed and (ii) Volumetric Efficiency & A/F Ratio Vs Speed.
Week 6	Lab 6: Study and Determine the effect of A/F Ratio on the performance of the Two-Stroke, Single-Cylinder Diesel Engine.
Week 7	Lab 7: Study and Determination the performance of a four-stroke petrol engine by using VDAS (Versatile Data Acquisition Software).
Week 8	Lab 8: Study and Determination the performance of a four-stroke petrol engine by using ECA100 software (Engine Cycle Analyzer).

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, University of Wisconsin. Platteville.	Yes
Recommended Texts	1. Internal Combustion Engines And Air Pollution By: E.F.Obert Publisher: Intext Educational Publishers (1973). 2. Introduction To Internal Combustion Engines, By: Richard Stone, Pub.: Macmillan (1992) - Usa. 3. Internal Combustion Engines By Fernando Salazar, Printed On April 30, 1998	No
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.