Philadelphia University

Faculty of Engineering - Department of Mechanical Engineering

Course Information

Title:	**Internal Combustion Engine (620529)**
Prerequisite:	Thermodynamics 1 & 2
Credit Hours:	3 credit hours (16 weeks per semester, approximately 44 contact hours)
Textbook:	**Engineering Fundamentals of Internal Combustion Engines by W.W Pulkrabek**, second edition 2014.
References:	**1-** Internal combustion Fundamentals, By John B. Heywood 2- Internal Combustion Engine in Theory and Practice By P.L.Ballaney 3- Internal Combustion Engines and Air Pollution , By F.D. Obert 4- Internal Combustion engine, By V. Ganeson, 10th edition.
Catalog Description	main objective of the course is to give the students an introduction to procating internal combustion engines with emphasis on cars, trucks stationary applications. focus is on explaining engine performance in terms of power, energy zation and exhaust emissions, its relation to internal processes like ıbustion, gas exchange, and varying engine operating conditions.
Website:	http://www.philadelphia.edu.jo/academics/aadaraje **https://ocw.mit.edu/courses/mechanical-engineering/2-61-interr combustion-engines-spring-2008/download-course-materials/** **http://www.princeton.edu/engineering/video/combustion-2012/** **https://ocw.mit.edu/courses/mechanical-engineering/2-61-internal-combustion-engines-spring-2008/readings/**
Instructor:	**Email**: adaraje@philadelphia.edu.jo assim_yousif20000@yahoo.com **Office**: Mechanical Engineering building, room **E 61306**, ext: 2206 **Office hours**: Sun, Tues, Thurs: 14:15-15:30 and Mon, Wed: 10:00 -11:00

Course Topics

This course presents the concepts and theories of operation of internal combustion engines based upon the fundamental engineering sciences of thermodynamics, gas dynamics, heat transfer and mechanics. Discussing the design and operating characteristics of conventional spark-ignition (gasoline), compression-ignition (diesel). Thermodynamic ideal cycles are analyzed and compared to actual cycles. Fuel and air induction and exhaust processes are examined. Pollutant formation is discussed and engine operating characteristics are assessed.

- Engine Types and their Operation (Ch.1)
- Gas Cycles (Ch. 2)
- Fuels and Combustion Thermodynamics (Ch. 3)
- Fuel-Air Cycles (Ch. 4)
- Overall Engine Performance (Ch. 5)
- Air Fuel and Exhaust Flow (Ch. 6)
- Combustion and Emissions (Ch. 7)

Course Learning Outcomes and Relation to ABET Student Outcomes:

Upon successful completion of this course, a student should:

1	• Knowledge and understanding The introduction to internal combustion engines is based on explaining processes and performance by application of first principles in thermodynamics, chemistry, heat transfer, fluid flow, and mechanical dynamics. This approach provides a basis for analyzing and understanding the complex interactions between subsystems and processes inside the engine system.	[a, c, e]
2	Upon completing the course the student should be able to: - Describe and explain different types of reciprocating internal combustion engines (ICE), their typical design features and performance characteristics, tested engine performance.	[a, c, e, k]
3	- Describe and analyze the power cycle of internal combustion engines using ideal gas cycles, air cycles, and fuel-air cycles. Compute indicated power and thermal efficiency, tested actual cycle.	[a, b, k]
4	- Describe and explain engine heat transfer and its relation to thermal loading of engine components and cooling.	b, c
5	- Explain the characteristic of homogeneous combustion in SI-engines and spray combustion in CI-engines.	
6	- Describe the main components of exhaust emissions and explain the mechanisms of emission formation.	a, b
7	- Describe methods for reduction of exhaust emissions, and their relations to fuel quality and engine performance.	h
8	- Describe the kinematics of the crank mechanism and compute inertia forces and moments in single- and multi-cylinder engines. Describe and compute balancing of inertia forces.	h
9	- Define and evaluate dynamic forces in the crank mechanism and compute the angular speed variation of the crank shaft.	a, b, c
10	Describe and explain engine friction, wear and lubrication.	a, b, c

Assessment Instruments:

Evaluation of students' performance (final grade) will be based on the following categories:

Exams:	Two written exams will be given. Each will cover about 3-weeks of lectures
Quizzes:	10-minute quizzes will be given to the students during the semester. These quizzes will cover material discussed during the previous lecture(s).
Homework:	Problem sets will be given to students. Homework should be solved individually and submitted before the due date. Copying homework is forbidden, any student caught copying the homework or any part of the homework will receive zero mark for that homework
Participation:	Questions will be asked during lecture and the student is assessed based on his/her response
Final Exam:	The final exam will cover all the class material.

Grading policy:

First Exam	20%
Second Exam	20%
Homework	5%
Quizzes and participation	15%
Final Exam	40%
Total:	100%

Attendance policy:

Absence from classes and/or tutorials shall not exceed 15%. Students who exceed the 15% limit without a medical or emergency excuse acceptable to and approved by the Dean of the relevant college/faculty shall not be allowed to take the final examination and shall receive a mark of zero for the course. If the excuse is approved by the Dean, the student shall be considered to have withdrawn from the course.