Philadelphia University

Faculty of Engineering& Technology - Department of Mechanical Engineering

E-Learning Syllabus

Course Information

Title:	**Internal Combustion Engine (620529)**
Prerequisite:	Thermodynamics 2 620323
Credit Hours:	3 credit hours (15 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 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	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.
Website:	http://www.philadelphia.edu.jo/academics/nbadarneh **https://ocw.mit.edu/courses/mechanical-engineering/2-61-internal-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/

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Course Topics

Week	Topic
1,2	CH 1 Introduction to Internal Combustion Engines
3,4,5	CH 2 Engine Design and Operational Parameters
6	CH3 Review of Air standard Cycle
7,8,9	CH4 Thermochemistry of Fuel
10,11,12	CH5 Actual and Air fuel cycles
13,14	CH 6 Timing Diagram for a 4-stroke Petrol Engine and two stroke engine port
15	CH7 Combustion in SI and CI Engines and Fuel Motion within Combustion Chamber
16	Final Exam

ABET Student Outcomes (SOs)

1	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2	An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3	An ability to communicate effectively with a range of audiences
4	An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5	An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6	An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7	An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Upon completing the course the student should be able to:

1	Knowledge and understanding of 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.	1
2	Describe and explain different types of reciprocating internal combustion engines (ICE), their typical design features and performance characteristics, tested engine performance.	1
3	Describe and explain engine heat transfer and its relation to thermal loading of engine components.	1
4	Compute indicated power and thermal efficiency, tested actual cycle.	1
5	Describe the main components of exhaust emissions and explain the mechanisms of emission formation.	1,4
6	Define and evaluate dynamic forces in the crank mechanism and compute the angular speed variation of the crank shaft.	1
7	Describe and explain engine friction, wear and lubrication.	4
8	Describe methods for reduction of exhaust emissions, and their relations to fuel quality and engine performance	1,4

Assessment Instruments:

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

Exams: Mid exam will be given which will cover about 7-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:

Second Exam	30%
Homework	15%
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.