جامعة الملك عبدالله
للعلوم والتقنية
King Abdullah University of
Science and Technology

Course Syllabus: Advanced Internal Combustion Engines - ME 391B

Division	Physical Science and Engineering Division
Course Number	ME 391B
Course Title	Advanced Internal Combustion Engines
Academic Semester	Spring
Academic Year	2016/2017
Semester Start Date	01/22/2017
Semester End Date	05/18/2017
Class Schedule (Days & Time)	10:30 AM - 12:00 PM | Tue Thu

Instructor(s)

Name	Email	Phone	Office Location	Office Hours
Bengt Johansson	bengt.johansson@kaust.edu.sa	+966128087293	4335, 5, Al-Kindi (bldg. 5)	9-17

Teaching Assistant(s)

Name	Email

Course Information

Comprehensive Course Description	The course starts with an in-cylinder pressure analysis for heat release evaluation. Modern and advanced Otto and Diesel type engines are investigated as well as the historical development of engines. Advanced gas exchange systems are discussed and special emphasis is provided on direct fuel injection since such systems have evolved dramatically the last years. New types of internal combustion engines such as HCCI and PPC are explained. Measuring techniques for the analyzing of engines as well as engine control are presented. Fuel aspects with emphasis on engine performance and emissions are presented.
Course Description from Program Guide	The course starts with an in-cylinder pressure analysis for heat release evaluation. Modern and advanced Otto and Diesel type engines are investigated as well as the historical development of engines. Advanced gas exchange systems are discussed and special emphasis is provided on direct fuel injection since such systems have evolved dramatically the last years. New types of internal combustion engines such as HCCI and PPC are explained. Measuring techniques for the analyzing of engines as well as engine control are presented. Fuel aspects with emphasis on engine performance and emissions are presented.
Goals and Objectives	The objective of the course is to provide a deeper understanding of the design of modern internal combustion engines as well as on advanced engine concepts and methods

Required Knowledge	The student should have background knowledge in internal combustion engines equililent to the content of the course "Introduction to Internal Combustion Engines" ME391A. This means a student should be able to give an overview of the functions of main components of a modern combustion engine as well as how they have evolved over time be able to provide an individual written explanation of the combustion processes in spark ignition and compression ignition engines and how they are influenced by various operating and design parameters at a detailed conceptual level ? be able to perform stoichiometric analysis of combustion of any hydrocarbon fuel with air ?*Competences and skills* ?For a passing grade the student must ?be able to use mean effective pressures and other characteristic engine parameters to analyse combustion engines, select an engine type and design the engine (in terms of displacement volume, number of cylinders, cylinder bore and engine speed) for a given simple application ? be able to calculate the air/fuel ratio given a measured exhaust composition as well as the air requirement for complete combustion of any hydrocarbon fuel ? be able to apply ideal thermodynamic cycles in order to calculate efficiency and mechanical work for combustion engines and relate the results to real thermodynamic cycles ?
Reference Texts	"Combustion Engines - Volume 2" by Prof. Bengt Johansson
Method of evaluation	**100.00**% - Final exam
Nature of the assignments	The course will have a simulation study of engine gas exchange performed with the code GT-power. A mandatory report on th esimulation should be handed in before the final exam is taken.
Course Policies	Students are expected to attend the lectures and must take part in the simulation study.
Additional Information	

Tentative Course Schedule *(Time, topic/emphasis & resources)*		
Week	**Lectures**	**Topic**
1	Tue 01/24/2017 Thu 01/26/2017	Guest Lectures by Prof. Anders Erlandsson KTH, Stockholm, Sweden.
2	Tue 01/31/2017 Thu 02/02/2017	NO lectures due to travel
3	Tue 02/07/2017 Thu 02/09/2017	Engine history part 1 Engine history part 2
4	Tue 02/14/2017 Thu 02/16/2017	Measurement techniques Heat release analysis
5	Tue 02/21/2017 Thu 02/23/2017	Spark Ignition engine combustion cycle to cycle variation SI engine ignition systems
6	Tue 02/28/2017 Thu 03/02/2017	Tuesday: canceled Thursday: SI engine fuel system and gasoline direct injection, GDI
7	Tue 03/07/2017 Thu 03/09/2017	CCRC workshop. Attend the ICE lectures
8	Tue 03/14/2017 Thu 03/16/2017	HCCI Part 1: Fundamentals HCCI part 2: Optical Diagnostics
9	Tue 03/21/2017 Thu 03/23/2017	HCCI part 3: Closed loop combustion control HCCI part 4: Concepts and fuel effects
10	Tue 03/28/2017 Thu 03/30/2017	Mid term break
11	Tue 04/04/2017 Thu 04/06/2017	Spring break
12	Tue 04/11/2017 Thu 04/13/2017	PPC part 1: Concept PPC part 2: Fuel Effects
13	Tue 04/18/2017 Thu 04/20/2017	High efficiency thermodynamics GT-Power part 1
14	Tue 04/25/2017 Thu 04/27/2017	GT-Power part 2 GT-Power part 3
15	Tue 05/02/2017 Thu 05/04/2017	GT-power part 4 Summary
16	Tue 05/09/2017 Thu 05/11/2017	
17	Tue 05/16/2017 Thu 05/18/2017	
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Note

The instructor reserves the right to make changes to this syllabus as necessary.