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

Course Syllabus: Advanced Internal Combustion Engines - ME 377

Division	Physical Science and Engineering Division
Course Number	ME 377
Course Title	Advanced Internal Combustion Engines
Academic Semester	Spring
Academic Year	2017/2018
Semester Start Date	01/28/2018
Semester End Date	05/24/2018
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	4219, 5, Al-Kindi (bldg. 5)	9-17

Teaching Assistant(s)

Name	Email
Sven Gustav Nyrenstedt	sven.nyrenstedt@kaust.edu.sa

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" ME376. 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 include laboratories for HCCI and PPC combustion modes. A mandatory report of the two labs will be required before the student can take the final exam.
Course Policies	Students are expected to attend the lectures and must take part in the two labs.
Additional Information	

Tentative Course Schedule *(Time, topic/emphasis & resources)*		
Week	**Lectures**	**Topic**
1	Tue 01/30/2018	Introduction
1	Thu 02/01/2018	IC engine history 1/2
2	Tue 02/06/2018	Guest lectures Sunfuels
2	Thu 02/08/2018	IC engine history 2/2
3	Tue 02/13/2018	Measurement techniques
3	Thu 02/15/2018	Heat release analysis
4	Tue 02/20/2018	SI engine cycle to cycle variations
4	Thu 02/22/2018	SI engine ignition system
5	Tue 02/27/2018	SI engine fuel system and GDI
5	Thu 03/01/2018	HCCI part 1 fundamentals
6	Tue 03/06/2018	CCRC workshop
6	Thu 03/08/2018	CCRC workshop
7	Tue 03/13/2018	HCCI part 2 optical diagnostics
7	Thu 03/15/2018	HCCI part 3 Closed loop combustion control
8	Tue 03/20/2018	HCCI part 4 concepts and fuel effects
8	Thu 03/22/2018	PPC part 1 concept
9	Tue 03/27/2018	Break/lab feedback
9	Thu 03/29/2018	Break/lab feedback
10	Tue 04/03/2018	Spring break
10	Thu 04/05/2018	Spring break
11	Tue 04/10/2018	SAE 2018
11	Thu 04/12/2018	SAE 2018
12	Tue 04/17/2018	PPC part 2 Fuel effects
12	Thu 04/19/2018	PPC part 3 Low load strategies
13	Tue 04/24/2018	PPC part 4 Combustion stratification
13	Thu 04/26/2018	HIgh efficieny thermodynamics
14	Tue 05/01/2018	Gas engine technology
14	Thu 05/03/2018	ICE engine trends 2017/2018
15	Tue 05/08/2018	Assignments
15	Thu 05/10/2018	Assignments
16	Tue 05/15/2018	Assignments
16	Thu 05/17/2018	Assignments
17	Tue 05/22/2018	Assignments
17	Thu 05/24/2018	Assignments

Note

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