ISTANBUL TECHNICAL UNIVERSITY
DEPARTMENT OF MECHANICAL ENGINEERING

SPARK IGNITION ENGINE COMBUSTION - MAK 652E
2016 - 2017 SPRING

Instructors : Prof. Dr. Cem SORUŞBAY (Room # 331),
ITU Automotive Laboratory
Phone & e-mail : 0212 285 34 66 - sorusbay@itu.edu.tr

Lecture hours : Thursday 09:30 - 12:30 (Classroom # 227 – ITU Automotive Laboratory)
Office hours : Mon 13:30 - 15:30 , Wed 13:30 - 15:30
Prerequisites : Combustion Fundamentals, Internal Combustion Engines

Course Description :
Introduction to engine combustion process and engine performance, premixed combustion process, stratified charge engines, lean combustion in engines, cyclic variations, combustion modelling in engines, thermodynamic and multidimensional models, CFD applications in modelling, mathematical modelling of turbulence, detailed kinetic mechanisms for HC fuels, reduced mechanisms, alternative fuels, kinetics of methane combustion, autoignition in engines, knock modelling, exhaust emissions, kinetics of pollutant formation, catalytic reactors.

Textbook :
Soruşbay, C., SI Engine Combustion, Lecture Notes (Power point files), İ.T.Ü., 2014.

Other References :

Mattavi, J.N. ve Amann, C.A. (Eds.), Combustion Modelling in Reciprocating Engines, Plenum Press, New York, 1980.

Heywood, J.B., Internal Combustion Engine Fundamentals, McGraw Hill Book Company, New York, 1988.

S.R. Turns, An Introduction to Combustion**,** S.R. Turns, McGraw Hill Inc., New York, 1996.

J. Warnatz, U. Mass, R.W. Dibble, Combustion**,** Springer Verlag, Berlin, 1996.

AvL FIRE Software, ESE Diesel User Manual and Tutorials, 2013.

Objectives :
To provide essential knowledge on SI-engine combustion and parameters effecting combustion performance, by mathematical modelling studies of combustion process in engines.

Outcomes :
This course will provide,
1) fundamental knowledge on combustion systems applied in SI engines,
2) ability to model physical and chemical processes and solve them by applying computational modelling approaches,
3) examine the parameters that effect engine performance by applying fundamental scientific knowledge

Additional information :

Students are expected to follow the course web site for additional or updated information related to the course material, homework and project assignments, examination dates and grades obtained.

COURSE PLAN

Week	Topics
1	Introduction to engine combustion process, engine performance and emissions, new trends
2	Premixed combustion systems
3	Combustion modelling in engines, SI engine cycle analysis, thermodynamic models
4	Multidimensional modelling of SI engines, CFD applications, governing equations, discritization techniques
5	**Midterm Exam I : 16th March, 2017 10:00 – 12:00**
6	CFD applications AvL FIRE , Tutorials
7	**Ara Tatil (Break – no classes) 30thMarch 2017**
8	Turbulent premixed combustion systems
9	Lean combustion in engines, Stratified charge engines, GDI, cyclic variations
10	Chemical kinetics of HC combustion, Detailed mechanisms and reduction techniques, Autoignition in engines, modelling of knock
11	**Midterm Exam II** : **27th April, 2017 10:00 – 12:00**
12	Exhaust emissions, kinetics of pollutant formation, exhaust emission control
13	Project presentations : **11th May, 2017 Group #1 and #2**
14	Project presentations : **18th May, 2017 Group #3 and #4** **Project Final Report submission, 11th May, 2017**

Assessment Criteria :

Mid-term Examinations	Quantity**:**	**2**	Percentage **:**	**30 %**
Project		**1**		**20**
Final Exam		**1**		**50**

Notes:

- **In order to be able to take the final exam, *you must attend at least 70%* of the classes**