



MATH45142 - 2007/2008

General Information

- Title: Introduction to Combustion Theory
- Unit code: MATH45142
- Credits: 15
- Prerequisites:
- Co-requisite units: None
- School responsible: Mathematics
- Members of staff responsible: Dr. [Joel Daou](#)

Specification

Aims

The course introduces basic modelling concepts which describe combustion phenomena and their solution, often using boundary layer theory.

Brief Description of the unit

Chemically reacting systems, which describe ignition, flames, detonation, etc., often involve small or large parameters, and wide variations in scale. Techniques used in boundary-layer theory, such as non dimensionalisation, scaling, asymptotic approximation and matching, were developed to help obtain good approximate solutions for such systems. The course will introduce the basic ingredients in the modelling of combustion, and use boundary-layer theory to provide approximate solutions for a number of combustion phenomena. Properties of flames, such as their stability, will also be examined.

Learning Outcomes

On successful completion of the course unit students should understand

- the basic modelling of combustion processes, their dimensionless forms and important dimensionless numbers;
- the asymptotic solution in simple cases, for large Zeldovich number, of homogeneous self-ignition and steady-state nonhomogenous models yielding ignition limits;
- the asymptotic description of flame-balls and planar premixed flames in gases and solids;
- the linear stability of planar premixed flames;
- simple models of planar diffusion flames and their multiple solution branches, described asymptotically and numerically (via a mini-project).

Future topics requiring this course unit

None.

Syllabus

Textbooks

- F A Williams, *Combustion Theory*, (2nd Edition), Benjamin Cummins 1985.
- J D Buckmaster and G S S Ludford, *Theory of Laminar Flames*, Cambridge University Press 1982.

Teaching and learning methods

24 lectures and 12 examples classes.

Assessment

Mid-semester coursework: weighting 20%

End of semester examination: two hours weighting 80%

Arrangements