AME 514 – Applications of Combustion and Reacting Flows - Spring 2015

Instructor: Paul Ronney  
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Office hours: 1:00 pm – 4:00 pm Thursdays

Grader: To be announced.

Purpose: The objective of the course is to enable students to apply fundamental understanding gained in AME 513 (Principles of Combustion) to new and rapidly evolving science and technology areas including microscale reacting flows, microgravity combustion, supersonic and hypersonic propulsion, and turbulent combustion.

Textbook: None required; course will be taught from lecture notes and handouts. However, a good general combustion textbook is S. R. Turns, An Introduction to Combustion: http://catalogs.mhhe.com/mhhe/viewProductDetails.do?isbn=0073380199

Schedule: 1 lecture per week, Tuesdays 6:40 – 9:20 pm, RTH 109.

Midterm exams: None

Final exam date: Tuesday, May 12, 7:00 pm – 9:00 pm

Distance learning: Lectures and course credit are available through the USC Distance Education Network

Credit: 3 units

Prerequisite: AME 513 (Principles of Combustion) or equivalent or permission of instructor

Grading: 5 homework assignments (60%), final exam (40%). Late homework is marked down at a rate of 10 points (out of a maximum possible of 100) per working day late. Each homework assignment will consist of two parts: (1) a report/review on a scientific paper chosen from an approved list and (2) the conventional type of homework problems.

Further information: http://ronney.usc.edu/courses/ame-514/
Tentative course outline
(some sections may be changed by vote of registered students)

1) Advanced fundamental topics (3 lectures)
   i) Emissions formation and remediation
   ii) Combustion theory – matched asymptotic expansions

2) Microscale reacting flows and power generation (3 lectures)
   i) Scaling considerations
   ii) Microscale internal combustion engines
   iii) Microscale gas turbine and rocket propulsion
   iv) Thermoelectrics
   v) Fuel cells – PEM, solid oxide
   vi) Thermal transpiration

3) Turbulent combustion (3 lectures)
   i) Premixed-gas flames
   ii) Non premixed flames
   iii) Edge flames

4) Advanced propulsion systems (3 lectures)
   i) Thrust and compressible flow
   ii) Hypersonic propulsion
   iii) Pulse detonation engines

5) Emerging technologies in reacting flows (3 lectures)
   i) Applications of combustion (aka “chemically reacting flow”) knowledge to other fields
      (1) Biofilms & microbial fuel cells
      (2) Frontal polymerization
      (3) Inertial confinement fusion
      (4) Astrophysical combustion
   ii) New research fields
      (1) HCCI engines
      (2) Plasma assisted combustion
      (3) Microbial fuel cells
   iii) Current needs in combustion research

5 homework sets will be assigned (1 per section). Each assignment will consist of a paper review and a conventional problem set.
Statement on Academic Conduct and Support Systems

Academic Conduct
Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Section 11, Behavior Violating University Standards https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, http://policy.usc.edu/scientific-misconduct.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the Office of Equity and Diversity http://equity.usc.edu or to the Department of Public Safety http://capsnet.usc.edu/department/department-public-safety/online-forms/contact-us. This is important for the safety of the whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. The Center for Women and Men http://www.usc.edu/student-affairs/cwm/ provides 24/7 confidential support, and the sexual assault resource center webpage http://sarc.usc.edu describes reporting options and other resources.

Support Systems
A number of USC’s schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the American Language Institute http://dornsife.usc.edu/ali, which sponsors courses and workshops specifically for international graduate students. The Office of Disability Services and Programs http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, USC Emergency Information http://emergency.usc.edu will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.

Policy for this course:
• You may
  o Work with others to find solutions to homework problems
  o Share ideas and opinions about a paper for the report/review
  o Study with others for the final exam
• You may NOT
  o Copy homework assignments from others – even if you work together, you must prepare and turn in assignments that were created by you only. This includes both the paper report/review and the traditional homework problems.
  o Work together during the final exam
• Violators will be reported to the Office of Committee for Student Judicial Affairs and Community Standards (http://www.usc.edu/student-affairs/SJACS/)