FUNDAMENTALS OF COMBUSTION

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INTENDED AUDIENCE : UG, PG, MS and PhD students doing research in Combustion and related areas
INDUSTRIES APPLICABLE TO : TATA steels, Thermax, BHEL

COURSE OUTLINE :
To enable students to apply the knowledge of thermodynamics to combustion. To emphasize the basics of fuels, stoichiometry, chemical kinetics and equilibrium, mass transfer, and different types of combustion process. To explain the mathematics involved in transport processes of a reactive flow, simplifications involved and the parameters affecting different types of combustion processes.

ABOUT INSTRUCTOR :

Prof. Vasudevan Raghavan is currently working as Professor in the Department of Mechanical Engineering, Indian Institute of Technology Madras (IITM), India. He obtained his PhD degree from IITM and has carried out his post-doctoral research in the University of Nebraska-Lincoln, USA, microgravity droplet combustion simulations. His areas of research include Computational Fluid Dynamics applied to reacting flows, laminar flames, fire modelling, evaporation and combustion of liquid fuel droplets, flame spread and liquid fuel pool combustion, gasification and combustion of coal and biomass. Prof. Raghavan has graduated 10 PhD students and 18 MS students till July 2020. He has authored about 112 international peer reviewed journal articles, 60 international conference articles and a book on Combustion Technology ‚Äì Essentials of Flames and Burners, published by ANE Publishers and John Wiley & Sons Ltd., UK, 2016. He teaches graduate courses such as Theory of Fire Propagation, Fundamentals of Combustion, Combustion Technology and Applied Thermodynamics at the Department of Mechanical Engineering in IITM.

COURSE PLAN :

Week 1**:** Fuels and their properties

Week 2**:** Review of basic thermodynamics of ideal gas mixtures

Week 3**:** Stoichiometry

Week 4**:** First and Second Laws of Thermodynamics applied to combustion; Heat, temperature and composition of products in equilibrium

Week 5**:** Mass transfer basics

Week 6**:** Fundamentals of combustion kinetics

Week 7**:** Governing equations for a reacting flow

Week 8**:** General characteristics of combustion flame and detonation

Week 9**:** Laminar flame propagation-Flammability limits and quenching of laminar flames-Ignition-Flame stabilization

Week 10**:** Gas jets and combustion of gaseous fuel jets

Week 11**:** Turbulent premixed and non-premixed flames

Week 12**:** Droplet evaporation and combustion; Combustion of a carbon particle