



# TURBULENT COMBUSTION: THEORY AND MODELLING

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Department of Aerospace Engineering  
IIT Kanpur

**TYPE OF COURSE** : Rerun | Elective | UG/PG

**COURSE DURATION** : 12 weeks (24 Jan' 22 - 15 Apr' 22)

**EXAM DATE** : 23 Apr 2022

**PRE-REQUISITES** : Fluid Mechanics, Thermodynamics, Basic Combustion, Basic turbulence

**INTENDED AUDIENCE** : Senior undergraduate students and postgraduate students of Mechanical, Aerospace and Chemical Engineering

**INDUSTRIES APPLICABLE TO** : Aerospace, Automobile, Chemical and Power Generation and Defense Industries

**COURSE OUTLINE :**

Combustion is still the world's dominant energy conversion technology. The fundamental knowledge of combustion is expected to improve the design of the industrial combustion systems by enhancing the flame stability, improving the combustion efficiency, and reduction in pollutant formation. In this course, an integrated understanding of theoretical, and numerical aspects of combustion especially in the field of unsteady turbulent combustion would be covered. The discussion would continue on basic techniques and recent progress in the fields of turbulent combustion while establishing important connections with the underlying combustion basics.

**ABOUT INSTRUCTOR :**

Prof. Ashoke De is currently working as Associate Professor in the Department of Aerospace Engineering at Indian Institute of Technology Kanpur. He leads large scale initiatives in the modeling of turbulent reacting and non-reacting flows at IIT Kanpur. So far, he has authored more than 100 peer reviewed articles in journals and conferences. His primary research focus is the emerging field of computational mechanics with particular interest in combustion and turbulent flows.

**COURSE PLAN :**

**Week 1:** Introduction, Basics of Combustion

**Week 2:** Thermo-chemistry

**Week 3:** Thermo-chemistry, Combustion chemistry

**Week 4:** Heat & Mass Transfer, Coupling of chemical kinetics & Thermodynamics

**Week 5:** Laminar Premixed flame

**Week 6:** Laminar Non-premixed flame

**Week 7:** Turbulence, Turbulence modeling

**Week 8:** Turbulent premixed flames

**Week 9:** Turbulent premixed flames (contd.)

**Week 10:** Turbulent non-premixed flames

**Week 11:** Turbulent non-premixed flames (contd.)

**Week 12:** Combustion in two-phase flows