



ADVANCED THERMODYNAMICS AND COMBUSTION

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PRE-REQUISITES : No specific pre-requisite is required but the knowledge on “Basic and Applied Thermodynamics” (commonly offered at UG Course Curriculum of Mechanical/Energy/Aerospace Engineering) is preferable.

INTENDED AUDIENCE : Postgraduate students of Mechanical Engineering, Energy Engineering and Aerospace Engineering

Discipline; Faculty member associated with teaching of Thermal & Fluid Streams; Practicing engineers and Scientists in Allied Thermal Streams

INDUSTRY SUPPORT : Practicing Engineers & Scientists working in area of engine combustion and gas turbine technologies will gain theoretical benefits of fundamental concepts on the topic of research.

COURSE OUTLINE :

“Advanced Thermodynamics” is one of the core courses in the curriculum of postgraduate (PG) syllabus in the Mechanical Engineering Discipline. Also, the fundamental course on “Combustion” is also offered as an electives for PG audience and research scholars of Mechanical, Aerospace and Energy Engineering disciplines. Classically, both courses are popular in most of the engineering colleges in the country. In these courses, the basic thermodynamic fundamentals are studied in details and the thermochemistry concepts are applied to combustion phenomena occurring in internal combustion (IC) engines, gas turbine (GT) engines, rocket propulsion etc. In this backdrop, a blended version of the course has been designed for the next generation learners. It is offered in the name of “Advanced Thermodynamics and Combustion” that highlights the thermodynamic concepts/equations in various combustion process. The course package is mainly composed of the following major contents: (a) Exhaustive discussions on entropy and exergy analysis in thermodynamic systems; (b) Thermodynamic property relations and its application to gas mixtures, phase change processes; (c) Combustion fundamentals involving premixed and non-premixed flames for laminar and turbulent combustion; (d) Combustion phenomena in practical occurring applications such IC and GT engines.

ABOUT INSTRUCTOR :

Prof. Niranjana Sahoo is affiliated as “Professor” in the Department of Mechanical Engineering, Indian Institute of Technology Guwahati. Having B. Tech Degree in Mechanical Engineering, he has received PhD Degree (in the year 2004) from Department of Aerospace Engineering, Indian Institute of Science Bangalore. Till May 2020, he has 15 years of teaching and research experience at different capacity in Department of Mechanical Engineering, Indian Institute of Technology Guwahati. He has taught several courses at undergraduate and postgraduate level in the area of Fluid and Thermal Engineering, such as Fluid Mechanics, Basic and Applied Thermodynamics, Heat and Mass Transfer, Refrigeration and Air Conditioning, Combustion, Gas Dynamics and Aircraft Propulsion. Besides, he has developed interdisciplinary courses under NPTEL platform, participated in virtual laboratory courses and organized TEQIP Short Term Courses with respect to National mission projects apart from several sponsored research projects. He has more than 100 research publications in peer reviewed journals and conferences. Until date, he has achieved 13 PhD guidance with ongoing research scholars of similar number.

COURSE PLAN :

- Week 1:** Review of Basic Thermodynamics
- Week 2:** Entropy and Exergy
- Week 3:** Entropy and Exergy
- Week 4:** Thermodynamic Property Relations
- Week 5:** Properties of Gas Mixture
- Week 6:** Properties of Gas Mixture
- Week 7:** Combustion and Thermochemistry
- Week 8:** Chemical Kinetics
- Week 9:** Thermodynamics of Reactive Systems
- Week 10:** Combustion and Flames
- Week 11:** Combustion and Flames
- Week 12:** Combustion and Flames