About IIT Kharagpur

Kharagpur - a dusty town tucked away in the eastern corner of India, famous until 1950 as home to the longest railway platform in the world - became the nursery where the seed of the IIT system was planted in 1951. IIT Kharagpur started its journey in the old Hijli Detention Camp in Eastern India, where some of the country's great freedom fighters toiled and sacrificed their lives for India's independence. Spurred by the success of IIT Kharagpur, four younger IITs sprouted around the country in the two following decades, and from these five came thousands of IITians, the brand ambassadors of modern India. It was the success of this one institution at Kharagpur that wrote India's technological odyssey.

The Institute takes pride in its relentless effort to provide the best platform for both education as well as research in the areas of science and technology, infrastructure designs, entrepreneurship, law, management, and medical science and technology. IITKGP is not just the place to study technology, it is the place where students are taught to dream about the future of technology and beam across disciplines, making differences enough to change the world.

Program Features/ Structure

Classroom lectures – **80%**

Numerical/Problem solving, Case study and Discussion – **20%**

Program Schedule and Venue

5 days, 17 – 21 February 2020 (9:30 AM –4:30 PM)

IIT Kharagpur Extension Center, HC Block, Sector - III, Salt Lake City, Kolkata - 700106, West Bengal

Program Fee

Nil for TEQIP-III sponsored participants

For all others - **INR 5,000/-** (Five thousand) **+ GST** @18% per participant

Who will benefit (Eligibility)

You are working in Aerospace/ Mechanical Engineering domain and particularly, if you are an active researcher in the area of aerodynamics/ fluid-dynamics.

Last day of Registration

31

January 2020

Accommodation

Accommodation will be provided to the TEQIP-III sponsored participants at the institute Guest House. For all other participants, the same will be provided on chargeable basis as per rule.

How to Apply

Use the link: **https://erp.iitkgp.ac.in/CEP/courses.htm** to apply ONLINE.

Signup → Login → Form Filling → Choose a Program → Apply Now

Payment if applicable is to be done **ONLINE** after getting short listed for the program.

Contact Us

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NPIU

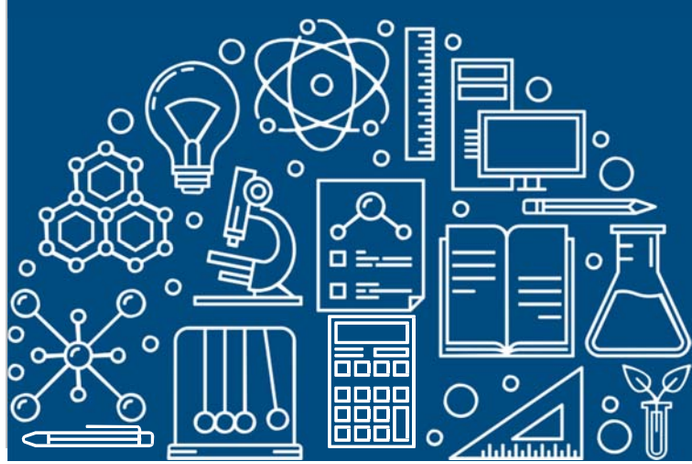
TEQIP-KIT

NPIU - A Unit of MHRD, Government of India for Implementation of World Bank Assisted Projects in Technical Education

Indian Institute of Technology Kharagpur

NON-EQUILIBRIUM AEROTHERMODYNAMICS

17– 21 February 2020



Introduction / Overview

The subject of "Non-equilibrium Aerothermodynamics" involves study of non-equilibrium gas flows from a microscopic (molecular) perspective. The approach is based on the kinetic theory, which is usually applied to the modelling of non-equilibrium gas flows, such as rarefied flows through micro/nano-channels and around high speed vehicles operating at high altitudes. Considering the ongoing focus of research/industries on micro/nano scale technologies and human space/planetary missions, it is important to have a short-term course such as "Non-equilibrium Aerothermodynamics". Such a course would not only prepare graduate students for working on state-of-the-art research problems, but also would train them to suit to the changing job requirements in the market. The proposed course, organized by IIT Kharagpur, is one such initiative in this direction, with the objective of disseminating the knowledge in this interesting subject.

Program Objectives

- The specific objectives of the course on "Non-equilibrium Aerothermodynamics" are as follows:
- To develop an ability to when and where to apply the microscopic description of fluids.
- To understand the concepts, procedures and applications of the kinetic theory of gases and the Boltzmann equation.
- To introduce the basic solution procedures of the Boltzmann equation using the particle based Direct Simulation Monte-Carlo (DSMC) approach.

What you will learn

Program Content

- Introduction to Non-equilibrium Gas Flows: Need for a molecular description of fluid flow, concepts of equilibrium, continuum breakdown, and degree of non-equilibrium.
- Molecular Model & Collisions: Molecular model, elastic collisions, concept of collision cross-section, collision frequency, mean free path, collision rate constant, hard sphere model, variable hard sphere model, inelastic collisions.
- Basic Kinetic Theory: Dilute gas flows, velocity distribution function, derivation of the Boltzmann equation and its importance, Maxwell-Boltzmann distribution, H-theorem.
- Solution of the Boltzmann Equation: Introduction to particle based approach, Direct Simulation Monte Carlo (DSMC) method, how it works, different processes modeled, gas-surface interactions, calculation of macroscopic properties, scope/mandates of the method, example problems.

About the Faculty

Dr. Rakesh Kumar

He is an Associate Professor in the Department of Aerospace Engineering at IIT Kanpur, India. He earned his Ph.D in Aerospace Engineering from the Pennsylvania State University (USA) and M.Tech in Aerospace Engineering from the IIT Bombay. Prior to joining IIT Kanpur in 2012, he also worked at the Indian Space Research Organization (Trivandrum) for several years, where he was instrumental in various successful space missions of national importance such as, CHANDRAYAAN-I. His research interests include hypersonic flows, rarefied gas dynamics, micro/nano-fluidics, heat transfer and thermal design of aerospace systems. He has been actively contributing to these fields.

Principal Coordinator

Dr. Mrinal Kaushik

He is an Assistant Professor in the Department of Aerospace Engineering at IIT Kharagpur, India. Before joining IIT Kharagpur in 2013, he worked at Defense Institute of Advanced Technology (Pune), General Motors Tech Center (Bangalore), Indian Space Research Organization (Trivandrum), and Tata Consultancy Services (Mumbai). He earned his Ph.D., M.Tech and B.Tech degrees in Aerospace Engineering in 2012, 2003, and 1999, respectively, from the IIT Kanpur, India. His research interests are Shock/Boundary-Layer Interactions and Jet Controls & Aeroacoustics. His other research includes Aerothermodynamics and Hydrodynamics. His research is supported by reputed funding agencies such as the Science and Engineering Research Board (SERB), and the Aeronautical Research and Development Board (AR&DB). He is the life member of many technical societies such as, the Aeronautical Society of India, the Institution of Engineers (India), the Indian Society for Heat and Mass Transfer, the Indian Society of Theoretical and Applied Mechanics, the Indian Society for Technical Education (ISTE), and the Indian Science Congress Association (ISCA). He has authored four books: Fundamentals of Gas Dynamics, 1st ed. (Springer Nature, Singapore, 2020); Theoretical and Experimental Aerodynamics, 1st ed. (Springer Nature, Singapore, 2018); Essentials of Aircraft Armaments, 1st ed. (Springer Nature, Singapore, 2016); and Innovative Passive Control Techniques for Supersonic Jet Mixing (Lambert Academic Publishing, Germany, 2012).