# GIAN Course on

# Numerical Methods for Transport Phenomena (NMTP)

**Course Overview**

*Transport phenomena occur in several scientific or engineering problems, in the natural environment and in living organisms. Furthermore these processes play a vital role in a great variety of practical situations or on most aspects of our life. For example fluid flow and heat transfer are essential processes in most of all power production techniques, in heating or air-conditioning systems of buildings, in chemical and metallurgical industries (furnaces, heat exchangers, condensers, reactors). Aerodynamics for aircrafts or any other vehicles is primarily based on fluid dynamics. The design of electrical machinery or electronic circuits requires a severe control of heat dissipation as it is one of the main limiting factors. Meteorology or pollution of the natural environment are governed by fluid flow and heat and mass transfer (chemical species), like storms, floods, fires. Human bodies or plants rely on heat and mass transfer for breathing or for temperature control. Hence, there is a strong need for understanding and/or predicting transport phenomena, which many times develop concomitantly. Prediction will enable us to develop innovative optimum designs, operate existing equipment more safely and efficiently, and forecast potential dangers. All scientists or engineers are focused on the behavior of physical entities. These behaviors can be investigated by numerical simulation, once the physics is properly modeled owing to Partial Differential Equations and proper initial and boundary conditions.*

*A major interest in numerical simulation has grown with the development of powerful computers. Thirty years ago three-dimensional approximations were limited to simple academic configurations in Computational Fluid Dynamics (CFD). Now, three-dimensional turbulent flows can be computed on a powerful personal computer for an expert user. Now a days in Research and Development, or in design offices, engineers need to be aware of numerical simulation, even for non-users, in order to manage efficiently in time and financially their own project.*

The primary objectives of the course are as follows:

i)   Learn the basics to numerical simulation for transport phenomena,
ii)  Understand the possibilities, the limits and the constraints of such an approach,
iii) Implement a finite difference method,
iv)  Implement a finite volume method,
v)   Implement a finite element method.

## Modules

- **Course Start Date: 19/02/2018; Course End Date:28/02/2018**
- Number of Participants (maximum): 50 (Preference will be given to the participants registering against Credits)

- Mathematical formulation of physical phenomena and the need for discretization
- Discretization Methods
- The finite volume method
- The finite element method
- System Modeling and Simulation
- Tutorials/Discussions (12 Hours)

## Who can attend...

- Executives, Engineers, Scientists, and Researchers from academic, industrial and government organizations including R&D laboratories from India or abroad.

- Faculties and Students at all levels (BE/BTech/MSc/ME/MTech/PhD/Other) from academic and technical institutions/universities from India or abroad.

  Number of participants for the course will be limited to fifty. Preference will be given to the participants opting against credits.

## Fees

The participation fees for taking the course is as follows:

Participants from abroad : US $500
Industry/Research Organizations: INR 10,000
Academic Institutions: INR 2,000 (half for SC/ST students)

The above fee include all instructional materials, computer use for tutorials and assignments, laboratory equipment usage charges, 24 hours free internet facility. The participants will be provided with accommodation on payment basis.

## The Faculty

**Prof Jean-Pierre Fontaine** is a B Tech in Mechanical Engineering and M. Tech. in Space Engineering and Fluid Dynamics from Institute of Fluid Mechanics, University of Aix-Marseille, France in 1986 & 1987. After his Ph. D in 1990, He did his post doctoral studies in University of Colorado, Canada, European Space Agency, Netherland and at French Space Agency from 1992-1995, and then joined Industry in Toyota group, at Sophia Antipolis, France, and worked there from 1995-2003. And then he joined as Professor at Polytech Clermont-Ferrand, Clermont Auvergne University, France. Currently, He is working as Professor and Head of the Engineering Physics Department, Polytech-Clermont Ferrand, France since 2003. He has several industrial patents in his credit; also he is a member of several International Scientific Advisory Bodies.

**Dr. Akhilesh Tiwari** obtained his Post-Doc and Ph D in Process Engineering from Blaise Pascal University, Clermont-Ferrand, France from 2007-2012, M. Sc. and Ph. D. in Physics (Photonic Band Gap Materials), from India, in 1997 and in 2005, respectively. He has joined the Department of Applied Science as Physics Faculty at IIIT Allahabad in 2012, where currently he is working as Head, Department of Applied Science. He is Member of Editorial Boards of several International Research Journals. His research Interest includes, Modeling and Simulation, Condensation phenomenon of flat surfaces, Photonic Band Gap Materials, Photonic Crystals and Meta-materials.

## Course Coordinator

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