COMPUTATIONAL FLUID DYNAMICS

PROF. SREENIAS JAYANTI
Department of Chemical Engineering
IIT Madras

PRE-REQUISITES : At least one course in fluid mechanics. In addition, at least one course in numerical techniques and one course in computer programming would be essential

INTENDED AUDIENCE : UG/ PG students in chem/mech/civil/aerospace engg departments

INDUSTRIES APPLICABLE TO : Automobile, Process, Power generation industries

COURSE OUTLINE : The course deals with the numerical solution of equations governing fluid flow and would be of interest to engineers and scientists—both aspiring and professional—with chemical/ mechanical/ civil/ aerospace engineering applications. In all these fields, one needs to deal extensively with fluid flow related phenomena and one needs to resolve flow-related features of the processes and equipment. Although the equations governing fluid flow have been formulated more than 150 years ago, it is only in recent years that these are being solved in the practical applications in which the flow occurs. The course deals with the basic techniques that enable the numerical solution of these equations.

ABOUT INSTRUCTOR :
Prof. Sreenivas Jayanti studied mechanical engineering at IIT-BHU, Varanasi, India; nuclear engineering at Ohio State University, Columbus, Ohio, USA; fluid mechanics at INPG, Grenoble, France, and obtained his PhD from the department of chemical engineering at Imperial College, London, UK in 1990. After a post-doctoral fellowship at Imperial College, he joined IIT Madras as a visiting faculty in 1994. He is currently a professor in the department of chemical engineering at IIT Madras. His main research interests include computational fluid dynamics, combustion and fuel cells.

COURSE PLAN :

Week 1: Introduction : calculation of flow in a rectangular duct

Week 2: Calculation of fully developed flow in a triangular duct

Week 3: Derivation of equations governing fluid flow

Week 4: Equations for incompressible flow and boundary conditions

Week 5: Basic concepts of CFD: Finite difference approximations

Week 6: Basic concepts of CFD: Consistency, stability and convergence

Week 7: Solution of Navier Stokes for compressible flows

Week 8: Solution of Navier Stokes equations for incompressible flows

Week 9: Solution of linear algebraic equations: basic methods

Week 10: Solution of linear algebraic equations: advanced methods

Week 11: Basics of finite volume method including grid generation

Week 12: Turbulent flows and turbulence modelling