Introduction to Computational Fluid Dynamics

Course Code: 28439
Credits: 3
Course Type: Theoretical
Prerequisites: Num. Computations**,** Fluid Mechanics 2, Heat Transfer 1
Corequisite: -
Course Length: 51 hours

Outlines:

1- Importance and Use of Computational techniques in Engineering

2- Mathematical and Physical Classification of Partial Differential Equations

3- Relation between physical and mathematical characteristics of equations

4- Basic grid generation techniques (Structured and Unstructured methods)

5- Basic Discretization Methods (Finite Difference, Finite Volume and Finite Element Methods)

6- Model Equations (Laplace, Poisson, Heat Conduction, Wave, Linear and non-linear wave equations, Inviscid and Viscous Burgers Equations)

7- Basic Techniques for solving model equations

8- Analysis of Consistency, Stability and Convergence of methods

9- Numerical solution of Incompressible Fluid Flows (pressure based and density based methods)

10- Numerical solution of compressible Fluid Flows (Central and Upwind methods)

References:

1. J. C. Tannehill, D. A. Anderson and R. H . Pletcher, “Computational Fluid Mechanics and Heat Transfer”, (QA 901. A53)
2. C. Hirsch, “Numerical Computation of Internal and External Flows”, (Volumes 1 &2), (TA357, H 574).
3. C.A.J. Fletcher, “Computational Techniques for Fluid Dynamics”, (Volumes 1& 2), (QC151. F58)
4. J. H. Ferziger and M. Peric, “Computational Methods for Fluid Dynamics”, (QA911. F 434)
5. H. K. Versteeg, W. Malalasekera, “An Introduction to Computational Fluid Dynamics: The Finite Volume Method”. (QA911, V47, 1995).
6. J. N. Reddy, “An Introduction to the Finite Element Method”, (TA347, F 5R4).