Course Name:
Computational Fluid Dynamics and Heat Transfer

Course number:
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Credit:
3

Course Content (Outline):

- Introduction to CFD and its applications
- Governing equations: Integral and differential formulations. Continuity, momentum, and energy equations. Physical meaning of different terms.
- Mathematical behavior of PDEs: Classification and mathematical properties. Elliptic, Parabolic, and hyperbolic equations.
- Flow Types. Simplification and modeling governing equation. Viscous, Inviscid, Incompressible, compressible. Laminar, Turbulent
- Discretization: numerical methods. Finite difference method. Boundary conditions, Error analysis. Stability and convergence.
- Solution of algebraic systems of equations: Gauss method. LU decomposition. Iterative methods
- Unsteady Problems- Implicit and explicit methods. Stability and Error Analysis.
- Solution of Navier-Stokes, energy and scalar equations: Incompressible flows, compressible flows, Pressure-based methods, marching methods. Complex geometry and grid generation. Complex flows involving turbulence, multiphase transport and/or chemical reaction.
- Finite volume methods, complex grid systems, spectral methods, Lagrangian methods.

References:

- "Computational Fluid Mechanics", J.D. Anderson, McGraw-Hill.
- "Computational Fluid Mechanics", T.J Chung, Cambridge.
- "Computational Fluid Mechanics and Heat Transfer", Petcher et al., CRC Press.
- "Computational Fluid Mechanics and Heat Transfer", Tannehill et al., Taylor and Francis.