COMPUTATIONAL FLUID DYNAMICS

Course code: 13CH1140

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Course Educational Objectives:

This course introduces the student

- The basics of computational fluid dynamics (CFD).
- What equations govern CFD.
- How these equations are solved.

Course Outcomes:

After completion of the course the student

- Will be able to set up the governing equation for any CFD problem.
- Use the correct discretisation method to solve these governing equations.

UNIT-I (12 Lectures)

Introduction to differencing schemes: Basics of Finite difference methods, finite element method and finite volume method. CFD Applications.

Final Governing differential equations of CFD and boundary conditions in Cartesian, cylindrical and spherical co-ordinate systems.

UNIT-II (12 Lectures)

Finite difference methods for diffusion problems(Theory):

Explicit Method and its Stability criteria, Implicit Method, Crank Nicholson method, Use of one Sided FDM to handle boundary conditions.

Finite difference methods for steady state convection- diffusion problems (Theory):

Use and importance of Upwinding difference method.

UNIT-III (12 Lectures)

Finite Volume method for steady sate diffusion (Theory):

One dimensional and two dimensional problems.

FINITE VOLUME METHOD FOR STEADY STATE CONVECTION-DIFFUSION PROBLEMS (THEORY):

One dimensional and two dimensional problems**.** Use and importance of Upwinding difference method, Hybrid method and Power Law method.

UNIT-IV (12 Lectures)

CASE STUDY-1:

Using FDM and FVM for solving steady and un-steady state one dimensional diffusive problem.

UNIT-V (12 Lectures)

CASE STUDY-2:

Using FDM and FVM for solving one and two dimensional convection and diffusion problem.

TEXT BOOKS:

1. Versteeg. H.K., and Malalasekera W, "*An Introduction to Computational Fluid Dynamics: The Finite Volume Method*", Longman, 1998.
2. Patankar. S.V., "*Numerical Heat Transfer and Fluid Flow*", Taylor and Francis, 1980.

REFERENCE:

Muralidhar.K and Sundararajan T., "*Computational Fluid Flow and Heat Transfer*", Narosa Publishing House, New Delhi 1995.