COMPUTATIONAL FLUID DYNAMICS

(Professional Elective-VI)

Course Code: 15CH1145

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Course Outcomes :

At the end of the Course, the Student will be able to:

CO 1 Recite the significance of CFD applications and able to apply the concepts of FDM and FVM methods

CO 2 Apply discretization in FDM handling different boundary conditions

CO 3 Write discretization in FVM for 1 D and 2 D convective diffusion problems at the end of course and also able to apply UDS scheme for convective term

CO 4 Predict the temperature distribution for steady and unsteady diffusive problems using FVM and FDM

CO 5 Analyze the flow patterns in 1D and 2D using FDM and FVM

UNIT-I **(10 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 **(10 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 (10 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 (10 Lectures)

CASE STUDY-1:

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

UNIT-V (10 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