Syllabus

CHAPTER #	Details
Chapter 1	Introduction: Definition of CFD, Application of CFD Technique, Main elements of a CFD code: 1-Pre-processor, 2-Solver, 3-Post-processor, Types of Fluids, Types of Fluid Motion, General Transport Equation of Fluid Flow, Examples.
Chapter 2	**Steady State Diffusion:** Introduction, 1D steady state diffusion (Cartesian Coordinates): 1-Grid generation , 2- Discretisation: Diffusion Coefficient, Gradient (Flux), Source term, 3-Solution of Discretized Equations – TDMA, Solved Examples: 1D steady state diffusion: Examples 1, 2 & 3, 2D steady state diffusion (Cartesian Coordinates), 3D steady state diffusion (Cartesian Coordinates), Solved Example 4, 1D steady state diffusion (Polar Coordinates), Home Work, 1D steady state diffusion (Spherical Coordinates), Projects.
Chapter 3	**Transient Diffusion:** 1D unsteady Heat Conduction (Cartesian Coordinates),: 1- Fully Explicit, 2- Crank-Nickalson, 3- Fully Implicit, Solved Example 1, Fully implicit time scheme for 2D and 3D unsteady Heat Conduction (Cartesian Coordinates), 1D Unsteady Heat Conduction (Polar Coordinates), Home Work 1, 1D Unsteady Heat Conduction (spherical Coordinates), Home Work 2, Projects.
Chapter 4	**Steady State Convection-Diffusion:** Introduction, 1D steady state convection-diffusion, the central differencing scheme, Example 1, Properties of discretisation schemes: 1-Conservativeness, 2-Boundedness, 3-Transportiveness, Assessment of the central differencing scheme, the upwind differencing scheme, Example 2, Assessment of the upwind differencing scheme, the hybrid differencing scheme, Example 3, Assessment of the hybrid differencing scheme, Hybrid differencing scheme for multi-dimensional convection-diffusion, The power-law scheme, Higher order differencing schemes for convection-diffusion problems: 1-Quadratic upwind differencing scheme (QUICK scheme), Example 4, Assessment of the QUICK scheme, stability of the QUICK scheme, Projects.
Chapter 5	**Transient Convection-Diffusion:** Discretisation of Transient Convection-Diffusion problems, Solved Example of Transient Convection-Diffusion using QUICK scheme: Examples 1, Projects.
Chapter 6	**Pressure-Velocity Coupling**: Introduction, SIMPLE Algorithm for Pressure-Velocity Coupling in Steady State Flow, Flow chart for Steady State SIMPLE, Example 1, SIMPLE Algorithm for Pressure-Velocity Coupling in Transient flow, Flow chart for Transient SIMPLE. Projects.
APPENDIX A	**Accuracy of a Flow Simulation**

References

1. S.V. Patankar, *Numerical heat transfer and fluid flow*, Hemisphere publishing, Mc-Graw-Hill, NY, 1980.

2. J.H. Ferziger, M. Peric, *Computational methods for fluid dynamics,* 2nd ed., Springer, Berlin, 1999.

3. H.K. Versteeg, W. Malalasekera, *An introduction to computational fluid dynamics: the finite volume method,* Longman Group, England, 1996.

4. K.A. Hoffmann, *Computational fluid dynamics for engineers,* Engineering Education System, Austin-Texas, 1989.

5. T.J. Chung, *Computational fluid dynamics,* Cambridge University Press, Cambridge, United Kingdom, 2002.