

III Year - II Semester

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COMPUTATIONAL FLUID DYNAMICS LABORATORY

Course Pre-requisites:

- Basic courses of Fluid Mechanics, Heat transfer and Numerical methods are required as pre-requisites
- Knowledge of matrices, differentiation, integration and differential equations are expected

Course Objectives:

- Solving Problems of fluid mechanics and heat transfer by writing programs in C-language and MATLAB.
- Using ANSYS-FLUENT build a geometry, mesh that geometry, Perform CFD method on the mesh, perform the calculation, and post-process the results.
- Understanding the validation of the numerical result by comparison with known analytical results.
- Understanding the numerical result by invoking the physical principles of fluid mechanics and heat transfer.

PART-A

Writing Programs in C and MATLAB for the following:

1. Solution of Transcendental equations
2. Solution of Simultaneous algebraic equations
3. Numerical differentiation and Integration
4. Solution of Ordinary Differential Equation
5. Solution of a Tri-diagonal matrix using Thomas Algorithm.
6. Solution of Partial differential equations related to
 - i) Elliptical Partial differential equations
 - ii) Parabolic Partial differential equations
 - iii) Hyperbolic Partial differential equations
7. Solution of 1-D and 2-D heat conduction with (Finite Difference method)
 - i) Constant temperature boundary conditions
 - ii) Constant heat flux boundary conditions
 - iii) Convective boundary conditions
8. Solution of Incompressible Navier-Stokes equations (Finite difference and Finite Volume methods)
9. Solution of Inviscid incompressible fluid flows.(Finite difference and Finite Volume methods)

PART-B

Using ANSYS-FLUENT solve the following problems of heat transfer analysis

1. steady state conduction
2. Lumped heat transfer
3. Convective heat transfer – Internal flow (study both velocity and thermal boundary layers)
4. Convective heat transfer – External flow (study both velocity and thermal boundary layers)
5. Radiation heat transfer– Emissivity