Q.P.Code: 21499

(3 Hours) [80 Marks]

N. B. :

i) Solve any **FOUR** questions.
ii) Assume suitable additional data if necessary & draw the sketches wherever required

Q1) a) Explain with diagram various types of elements used in 2-D and 3-D meshing. **05**

b) Explain Finite volume method **06**

c) Identify boundary condition type **04**

d) Explain effect of Turbulence on flow and Reynolds stress **05**

Q2) a) Explain Reynolds's Transport Theorem and its application. **10**

b) Explain advantages and disadvantages of Algebraic, Elliptic Method Grids. Briefly explain Adaptive Grids. **10**

Q3) a) What is a SIMPLE algorithm used for? Explain the steps involved in the algorithm. **10**

b) Explain in detail significance of turbulence modeling. List the different types of turbulence models available. Explain any two of them **10**

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Q4) a) Derive the continuity equation in three dimension. 08

b) Consider 1-D thermal diffusion equation $\frac{dT}{dt} = \alpha\left(\frac{\partial^2 T}{\partial x^2}\right)$ 12

Using central differencing for the convection and diffusion terms and forward differencing for $\frac{dT}{dt}$

Derive (a) a Crank-Nicolson type (i.e. a semi-implicit) (b) Pure Implicit FDE that can be used to solve this problem.

Q5) a) Using Taylor's series, derive first order forward, backward and central difference for $\partial u/\partial x$ 10

b) Transform following equation into body fitted computational system 10

$$\left(\frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2}\right) = 0$$

Q6) a) What is CFD? Give its application 10

b) Derive the Navier Stokes equation in X- direction and discuss the various parameters in the equation. 10

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