Total No. of Questions : 10]

SEAT No. : ____

P4902

[Total No. of Pages : 2

[4959]-1224
B.E. (Automobile)
FUNDAMENTALS OF COMPUTATIONAL FLUID DYNAMICS
(2012 Course) (Semester - I)

Time : 2.5 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Neat diagrams must be drawn wherever necessary.***
2) ***Figures to the right side indicate full marks.***
3) ***Assume suitable data if necessary.***
4) ***Use of scientific calculator is allowed.***

Q1) a) Explain Navier Stoke's model used in CFD solvers. **[6]**

b) Write in brief about steps used in CFD solution procedure. **[4]**

OR

Q2) a) What is the gird types used in CFD solution? **[6]**

b) Write four strengths and weakness of CFD? **[4]**

Q3) Explain in brief Couette flow equation $\left(\frac{\partial p}{\partial x}=0\right)$ using FTCS and Cranck - Nicholson's method. **[10]**

OR

Q4) How to obtain 2D solution by Explicit and Alternating Direction Implicit method (ADI Method)? **[10]**

Q5) a) Consider long slab (2L*2L) in which heat is generated at a uniform rate of q_m W/m^3 All the four sides are maintain at T = T∞ temperatrue of surrounding fluid. Sketch the domain with 4*4 girds. **[12]**

i) Write down governing equation and boundary conditions.

ii) Apply finite difference (central) and discuss the method of solution.

b) What is peclet number? Explain its significance. **[6]**

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OR

Q6) a) Derive the differential equation for first order wave equation with upwind method and Mac Cormac scheme. **[12]**

b) Write in brief about Lax Wendroff method and its stability criteria. **[6]**

Q7) a) Explain the difference between SIMPLE, SIMPLER, SIMPLEC algorithm with the help of Navier stroke equation. **[10]**

b) Write a note on finite volume method. **[6]**

OR

Q8) a) Consider a viscous flow over a flat plate. Variation in velocity with respect to y is given as $U = 1582 (1-e^{-y/L})$. Where L = 1 unit and $\mu = 3.37*10^{-7}$ units. Y is from 0 to 0.3 in the step of 0.1.

Find the percentage error in shear stress involved in 1^{st} and 2^{nd} order difference compared with exact solution. **[10]**

b) How CFD is applicable for problems related to fluid flow through pipes? **[6]**

Q9) a) Explain following boundary conditions in brief (any 3) **[9]**

i) no slip

ii) free slip

iii) rotating wall

iv) symmetry

b) Enlist four CFD tools used for solving CFD problems and preprocessor settings for any one of them. **[7]**

OR

Q10)a) Explain following solver models **[9]**

i) SA model

ii) K- €

iii) K- ω

b) Explain how to control residual in any CFD tool and how to setup solver for obtaining plots for analysis? **[7]**