Total No. of Questions : 12]

SEAT No. :

P2673

[Total No. of Pages : 3

[5154]-43
B.E. (Mechanical/Sandwich)
COMPUTATIONAL FLUID DYNAMICS
(2008 Pattern)

Time : 3 Hours] *[Max. Marks : 100*

Instructions to the candidates:

1) ***Answer any three questions from each section.***
2) ***Answers to the two sections should be written in separate answer books.***
3) ***Figures to the right indicates full marks.***
4) ***Neat diagrams must be drawn wherever ncessary.***
5) ***Use of logarithmic tables, Mollier charts, electronic calculator is allowed.***
6) ***Your answer will be valued as a whole.***
7) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Define computational domain for the fluid flow problem with suitable examples. **[10]**

b) Justify significance of substantial derivative in terms of physical interpretation. **[6]**

OR

Q2) a) How is CFD being used in the sports and chemicalindustry? **[8]**

b) Explain each term of force balance equation for all the forces acting on a differential control volume. **[8]**

Q3) a) Name the sources of energy that contribute to the momentum equation. **[9]**

b) Given the function $f(x) = 0.15X^2$; find the first derivative of $f(x)$ at $x = 3$; using forward, backward and central differencing of order (Δx). Use a step size of $\Delta x = 0.1$. **[9]**

OR

Q4) a) Derive Fourier's law of heat conduction differential equation for two dimensions. **[10]**

b) What is an iteration process and how is it performed? **[8]**

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Q5) a) What are the differences between solving a fluid-flowproblem analytically compared to numerically. **[6]**

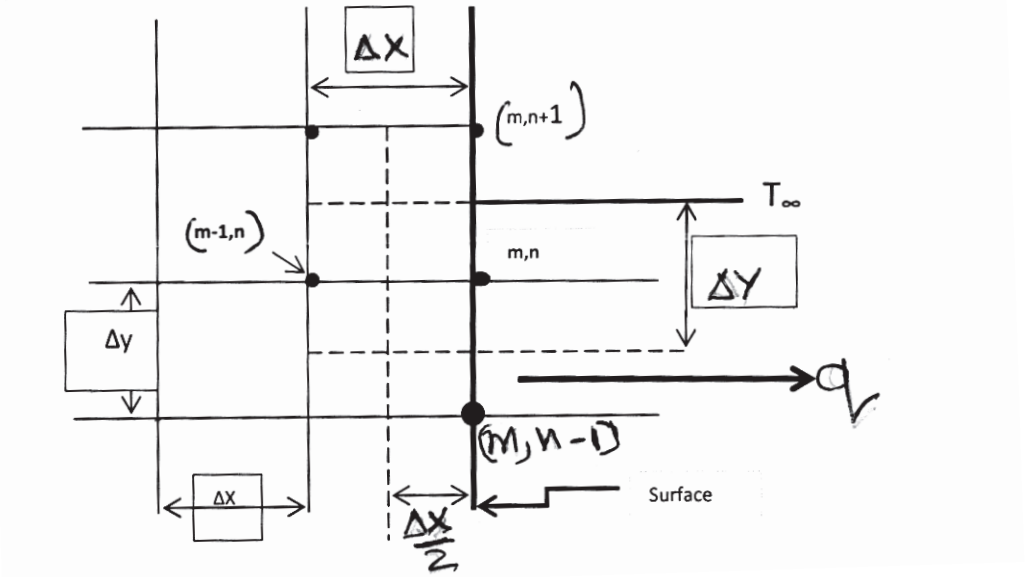
b) What are the advantages and disadvantages of each method of Q.5 (a)? **[10]**

OR

Q6) a) In a finite difference scheme, data is resolved at nodal points, how is this different to finite volume scheme? **[8]**

b) Derive an expression for the equation of a boundary node subjected to a constant heat Flux from the environment. Use Fig. 6 (B) shown below for nomenclature. **[8]**

Fig.6(B) for Q. 6(b)



SECTION - II

Q7) Derive an expression for the heat loss per square meter of the surface area of furnace wall of thickness (delta) when the thermal conductivity varies with temperature as: $k = (a + bt^2)$. W/m-degree where t is in degree centigrade.**[16]**

OR

Q8) a) Differentiate the explicit and implicit finite difference approach. **[8]**

b) How Courant numbers applied to establish stability requirement of a finite difference method? **[8]**

Q9) Describe the following types of grids: **[16]**

a) Elliptic grid

b) Square grid

c) 'C' grid

d) H grid

OR

Q10)a) Considering the steps of SIMPLER algorithm, justify the need for this algorithm. **[8]**

b) Describe the need of pressure correction approach incompressible viscous flow. **[8]**

Q11)a) What is the Neumann boundary condition? Explain how is it used as an outlet boundary condition. **[9]**

b) Explain predictor step in the McCormack techniques. **[9]**

OR

Q12)Write short notes on any two: **[18]**

a) Finite Difference method

b) Finite Volume method

c) Compare and contrast between Finite difference and Finite Volume method considering advantages and limitations.