

Total No. of Questions : 12]

SEAT No. :

P3321

[4959]-44

[Total No. of Pages : 3

B.E. (Mechanical / Sandwich)
a: COMPUTATIONAL FLUID DYNAMICS
(2008 Course) (Semester - II)

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) Black figures to the right indicate full marks.*
- 4) Neat diagrams must be drawn wherever necessary.*
- 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) Derive differential energy conservation equation for any model using Control volume method. **[12]**
- b) Explain mathematical aspect of substantial derivative to describe the physics of flow. **[4]**

OR

- Q2)** a) Give examples of automobile and sports equipment design and analyses using CFD concepts for application development. **[8]**
- b) Explain the importance of viscosity in the governing equations considering stoke's law. **[8]**

- Q3)** a) Using block diagram, give an overview process of computational procedure. **[9]**
- b) Given the function $f(x) = (1/4) X^2$; find the first derivative of $f(x)$ at $x = 2$; using forward, backward and central differencing of order (Δx) . Use a step size of $\Delta x = 0.1$ **[9]**

OR

P.T.O.

Q4) a) Derive quotient for first partial derivative of finite difference representation of a steady heat transfer. [10]

b) Describe the equations used to represent marching & initial boundary value problems. [8]

OR

Q5) a) Describe Structured grid considering aspect ratio and skewness. [6]

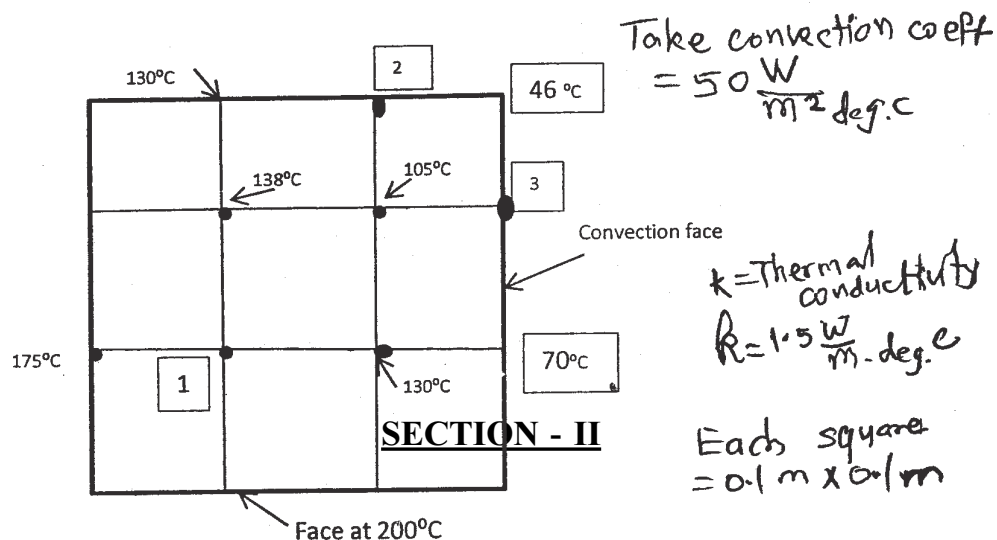
b) Considering mass conservation, determine the discretized form of two dimensional continuity equation. $\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} = 0$

By finite volume method in a structured uniform grid arrangement. [12]

OR

Q6) a) Derive differential equation of the 1D heat transfer by conduction with heat generation. [8]

b) Calculate the temperature at points 1, 2, and 3 using numerical method for equidistant grid. Top face is insulated. [10]



SECTION - II

Q7) The temperature distribution at a certain time instant through a 50 cm thick wall is described by the equation

$$T = 300 - 500x + 100x^2 + 140x^3;$$

Where temperature t in degree C and the distance x meters measured from the hot surface. If thermal conductivity of the wall is 20 kJ/m-hr-deg. C.

Calculate the energy stored per unit area of the wall. **[16]**

OR

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

b) How does time step affect stability, explain with suitable example. **[8]**

Q9) Describe the following types of grids:

a) Unstructured

b) Staggered grid

c) C type grid

d) H type grid **[16]**

OR

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

b) Describe the pressure correction method in incompressible viscous flow. **[8]**

Q11)a) Explain space marching two dimensional method for inviscid flow. **[8]**

b) Justify the need of Pressure correction method. **[8]**

OR

Q12) Write short notes on any two: **[16]**

a) Explicit method

b) Implicit method

c) Types of errors resulting in numerical solution

d) Stability and oscillation in solution.

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