Total No. of Questions : 12]

SEAT No. :

P3321

[Total No. of Pages : 3

[4959]-44

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 $f(x) = (¼) X^2$; find the first derivative of $f(x)$ at $x = 2$; using forward, backward and central differencing of order (Δ x). 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]**

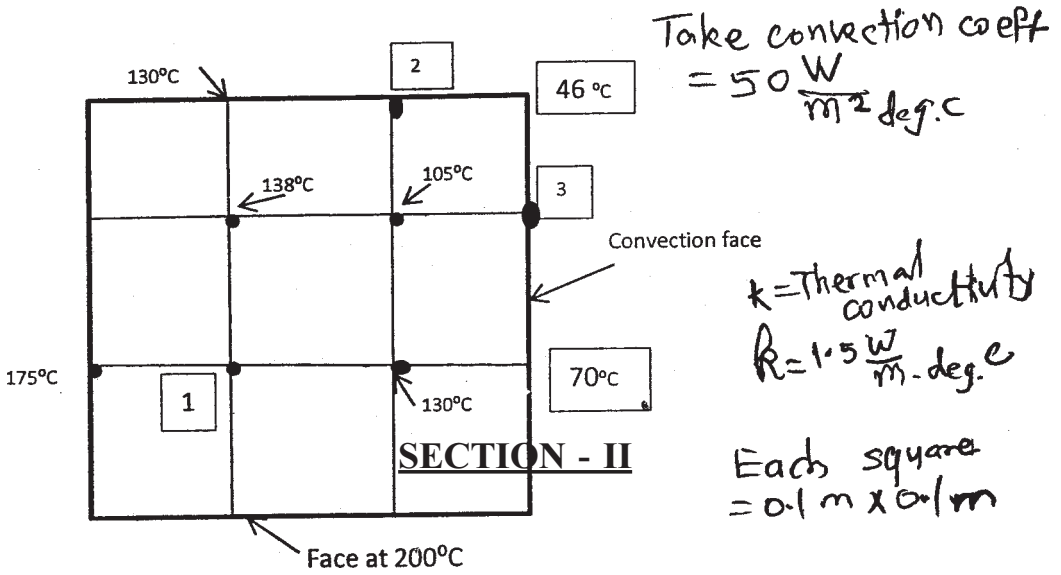
b) Considering mass conservation, determine the discretized form of two dimensional continuity equation. $\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} = 0$

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 though 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.