Total No. of Questions : 10]

SEAT No. :

P3680

[Total No. of Pages : 3

[4959]-1047
B.E. (Mechanical / Sandwich)
COMPUTATIONAL FLUID DYNAMICS
(2012 Pattern) (End Sem.) (Semester-II) (402050 A) (Theory)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q1 or Q2; Q3 or Q4; Q5 or Q6; Q7 or Q8; Q9 or Q10.***
2) ***Figures to the right indicate full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Use of electronic calculator is allowed.***
5) ***Your answer will be valued as a whole.***
6) ***Assume suitable data, if necessary.***

Q1) a) Write 1D governing equations each in Cartesian coordinates and label each term used for CFD analysis. **[5]**

b) Justify the need of equation of state required to carry out solution of governing equations. **[5]**

OR

Q2) a) Give examples of three types of grid and explain any two with neat sketch. **[5]**

b) Explain Alternating Direction Implicit method with neat sketch and the numerical method. **[5]**

Q3) a) Explain the central difference approach in numerical method. Write three equations citing example. **[4]**

b) Given the function $f(x) = 0.45\ x^2$; find the first derivative of f at $x = 3$; using forward, backward and central differencing of order (Δx). Use a step size of $\Delta x = 0.1$. **[6]**

OR

P.T.O.

Q4) A horizontal pipe having a surface temperature of 67 C and diameter of 25cm is buried at a depth of 1.2 meter in the earth location where k = 1.8 W/m. °C. The earth surface temperature is 15°C. Calculate the heat lost by the pipe per unit length. **[10]**

Q5) Considering first order wave equation, explain first order forward, central difference with respect X derive from Euler explicit form. **[16]**

OR

Q6) a) What is it that makes a given calculation go unstable? Explain considering three types of errors and its correlation state the stability condition. **[10]**

b) What is CFL number? **[6]**

Q7) a) Justify the need of Semi implicit method for pressure linked equations. **[10]**

b) Write steps to write algorithm for Semi Implicit method for pressure linked equations. **[6]**

OR

Q8) a) What are the boundary conditions for the pressure correction method? **[6]**

b) For the pressure correction formula, justify the need of Finite Volume approach. Explain X-momentum equation grid schematic for effective control volume. **[10]**

Q9) a) Explain the impact of Computational Fluid Dynamics in automobile and internal combustion engine applications. **[10]**

b) Illustrate the following steps of pre-processing: **[8]**

i) Creation of geometry.

ii) Mesh generation.

iii) Selection of physics & fluid properties.

vi) Specify boundry conditions.

OR

Q10)a) Explain any two turbulence models; **[10]**

i) RANS.

ii) k - ε and

iii) k-ω.

b) How the graphical plots such as stream-lines; velocity vector plots; and animation are giving a precise picture of the analysis of computational fluid dynamics? **[8]**

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