M. TECH.-III (MECHANICAL CAD/CAM) (CBCS – 2015 COURSE) : WINTER - 2017

SUBJECT: ELECTIVE – I: COMPUTATIONAL FLUID DYNAMICS

Day : **Tuesday**
Date : **16/01/2018**

Time: **11.00 AM TO 02.00 PM**
Max. Marks: 60

W-2017-2922

N.B.:

1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Answers to both the sections should be written in **SEPARATE** answer books.

SECTION – I

Q.1 **a)** Describe characteristics of supersonic and subsonic flows with the help of neat sketch. **[05]**

b) Write a short note on Reynolds Transport Theorem. **[05]**

OR

Q.2 Derive an expression for variation of pressure in a static mass of fluid. Also prove that pressure at a point in a liquid is given by relation $P = P_a + w\,h$ where P_a = Ambient Pressure, w = specific weight of liquid, h = Depth of point from free surface of liquid. **[10]**

Q.3 **a)** Explain the concept of water tight geometry. **[05]**

b) Write a short note on: Dependent and Independent errors. **[05]**

OR

Q.4 **a)** Write a short note on: Parametric representation of curves and surfaces. **[05]**

b) Write a short note on: Faceted Boolean operations. **[05]**

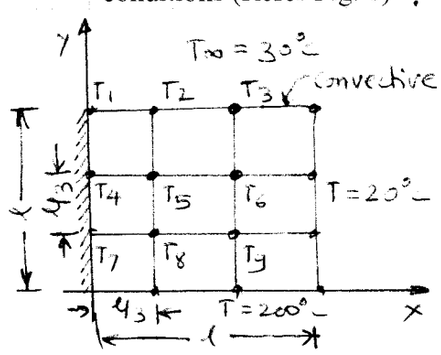
Q.5 Derive an expression for differential form of Navier-Stokes equations in Cartesian coordinates. **[10]**

OR

Q.6 What is law of conservation of mass? Derive an expression for differential form of continuity equation in Cartesian coordinates. **[10]**

SECTION – II

Q.7 Write finite difference formulation for the following nodes at following conditions (Refer Fig. 1) : **[10]**



Where $\frac{l}{3}$ = length of each node

P.T.O.

a) Two dimensional steady state heat conduction without internal heat generation.

b) Governing equation $\frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} = 0$

OR

Q.8 **a)** Explain explicit and implicit methods. **[05]**

b) Explain downwind scheme of discretization. **[05]**

Q.9 **a)** Explain mesh smoothening algorithms. **[05]**

b) What is meaning of surface mesh repair? **[05]**

OR

Q.10 **a)** Explain different types of grids with the help of sketches. **[05]**

b) How surface mesh repair is performed? **[05]**

Q.11 **a)** Explain two equation models in turbulent modeling. **[05]**

b) Explain applications of modeling of multi-phase flows. **[05]**

OR

Q.12 **a)** Explain Volume of Fraction (VOF) approach. **[05]**

b) Explain near wall treatment in turbulence modeling. **[05]**