Karunya University
(Karunya Institute of Technology and Sciences)
(Declared as Deemed to be University under Sec.3 of the UGC Act, 1965)

End Semester Examinations - 2015-16 Even Semester - May 2016

14AE2019 Computational Fluid Dynamics

Set A

Time : 3 hrs
Total Marks: 100

1. 1. What are the 5 advantages of CFD over Experimental based approaches [2]
   2. State the Spalding's CFD equation and explain each term [2]
   3. Explain in detail how the CFD code works [16]

OR

2. 1. Sketch the Newton's law of viscosity [2]
   2. Differentiate between stress and pressure [2]
   3. a. Derive the conservative form of the equation $\rho \{D\varphi / Dt\}$ [4]
      b. Derive the conservation of mass equation with a neat sketch as applicable to a regular control volume [12]

3. 1. With neat sketch give the zones dependence and influence in the three types of equations [4]
   2. State the three types of equations depending on the physical behavior of their solution and give their prototype equation [8]
   3. Explain with example the two methods by which the physical behavior of the solution of the equations can be predicted [8]

OR

4. 1. What are the important characteristics of velocity perturbations in turbulent flow [2]
   2. Sketch a typical velocity profile at a point with respect to time in turbulent flow [2]
   3. Write notes on (a) Hydrodynamic stability [8] (b) Transition [8]

5. 1. State the Reynolds time averaging equation [2]
   2. Show that the time average of the fluctuation is zero [2]
   3. State the X-directional Navier Stokes equation and derive the time averaged Reynolds equation [16]

OR

6. 1. From the Taylor series show the expression for first differential and identify the truncated terms [2]
   2. With neat sketch explain the finite difference concept [2]
   3. Consider a problem of source free heat conduction in an insulated rod of length .6 m. whose ends are maintained at a constant temperature of 100^0 C and 500^0 C respectively. Calculate the steady state distribution in the rod. Thermal conductivity is 1000 W/m.K, cross sectional area 0.01 sq.m. consider Δx as .2 m. Solve the problem using matrix inversion method [16]

7. 1. What are the disadvantages DNS [2]
   2. Give an example of 4 X 4 TDM [2]
   3. Derive an expression for three dimensional steady state diffusion problem using finite volume method [16]

OR

8. 1. What is explicit and fully implicit scheme in transient diffusion problem [4]
   2. Derive an expression for one dimensional unsteady heat conduction problem using finite volume method with Crank – Nicholson scheme [16]

9. Draw a neat sketch of SIMPLER algorithm and explain each function [20]

Wishing you All the Best