Code No: RR322104 **RR** **Set No. 2**

III B.Tech II Semester Examinations,APRIL 2011
COMPUTATIONAL AERODYNAMICS - I
Aeronautical Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Consider the equation $y\frac{\partial U}{\partial x} + \frac{\partial U}{\partial y} = 2$,where U is known along the initial segment defined by y = 0,0 $\leq x \leq$1.Determine the equation of the characteristic curve. [16]

2. Consider a 2-D flow in the physical space with independent variables (x, y, t) . The transformation $\xi = \xi(x, y, t), \eta = \eta(x, y, t)$ and $\varsigma = \varsigma(t)$, maps the variables from physical space to transformed space. Hence transform the equation of continuity $\frac{\partial \rho}{\partial t} + \nabla \cdot (\rho V) = 0$ from physical space to the transformed space. Present your work. [16]

3. The partial differential equation $\frac{\partial T}{\partial t} = K\frac{\partial^2 T}{\partial x^2}$,represents unsteady thermal conduction in 1-Dimension. Establish the type of partial differential equation. [16]

4. How are the conservation and non-conservation forms of the equations of fluid dynamics different from each other in application to the problems of Computational Fluid Mechanics? Hence show with examples significance of integral and differential form of these equations. [16]

5. Consider the function $\phi(x, y) = e^x + e^y$ .Consider the point (x,y) =(1,1).Use first order backward differences, with Δx=Δy=0.1 , to calculate approximate values of $\frac{\partial \phi}{\partial x}$and $\frac{\partial \phi}{\partial y}$ at (1,1).Calculate the percentage difference when compared with the exact solution at (1,1). [16]

6. (a) Why should Computational aerodynamics be termed Numerical experiments? Explain the basis with one example.
   (b) Explain with one convincing example the impact of CFD on the problems of aerodynamics of road vehicles. [16]

7. Explain the approximation method of $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ by an explicit scheme. Also describe a fully-implicit scheme for its approximation. Where is the difference? Which scheme is more stable? Consider the utility of the schemes in the numerical solution of P.D.Es. [16]

8. Obtain the Navier -Stokes equations of motion in fluid mechanics by considering the motion of an infinitesimal small fluid element. Identify body forces and surface forces. Hence write down the complete equation of motion in vector and long hand. [16]

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III B.Tech II Semester Examinations,APRIL 2011
COMPUTATIONAL AERODYNAMICS - I
Aeronautical Engineering

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Code No: RR322104 **RR** **Set No. 1**

III B.Tech II Semester Examinations,APRIL 2011
COMPUTATIONAL AERODYNAMICS - I
Aeronautical Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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Code No: RR322104 **RR** **Set No. 3**

III B.Tech II Semester Examinations,APRIL 2011
COMPUTATIONAL AERODYNAMICS - I
Aeronautical Engineering

Time: 3 hours **Max Marks: 80**

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