

Code No: 56070

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD****B. Tech III Year II Semester Examinations, December - 2017****COMPUTATIONAL AERODYNAMICS****(Aeronautical Engineering)****Time: 3 hours****Max. Marks: 75****Answer any five questions  
All questions carry equal marks**

---

1. Define Computational Fluid Dynamics (CFD). Explain the advantages and disadvantages of using CFD analysis. Discuss the physical meaning of Divergence of velocity. [15]
2. Derive continuity equation from the flow models of control volume fixed in space and control volume moving with the flow. Explain how to convert continuity equation in conservation form to non-conservation form. [15]
3. Describe the procedure for the classification of the following system of quasi-linear partial differential equations using Cramer's rule:  
 $a_1(\partial u/\partial x) + b_1(\partial u/\partial y) + c_1(\partial v/\partial x) + d_1(\partial v/\partial y) = f_1$   
 $a_2(\partial u/\partial x) + b_2(\partial u/\partial y) + c_2(\partial v/\partial x) + d_2(\partial v/\partial y) = f_2$   
Where  $u$  and  $v$  are dependent variables, continuous functions of  $x$  and  $y$ , and the coefficients  $a_1, a_2, b_1, b_2, c_1, c_2, d_1, d_2, f_1, f_2$  can be functions of  $x, y, u$  and  $v$ . [15]
- 4.a) Explain the explicit and implicit approaches to the numerical solution of fluid flows using sketches and illustrate them for the following one dimensional heat conduction equation using finite-difference method  
 $(\partial T/\partial t) = \alpha (\partial^2 T/\partial x^2)$   
Where  $T$  is temperature and  $\alpha$  the thermal diffusivity.  
b) Discuss the relative advantages and disadvantages of explicit and implicit approaches. [8+7]
5. Explain with the help of diagrams the cell-vertex and cell-centered finite volume configurations for structured and unstructured grids. What are the constraints on the choice of the control volumes that have to be satisfied for a consistent finite volume method? [15]
6. Distinguish between structured and unstructured grids. Explain different types of body-fitted and multi-block grids with the help of sketches. [15]
7. Describe alternating-direction-implicit scheme (ADI) using a model equation based on unsteady, two-dimensional heat conduction equation. [15]
8. Explain the philosophy of the pressure correction method. Discuss the boundary conditions for pressure correction method taking the example of incompressible viscous flow in a constant area duct. [15]