

2008 JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY**III B.TECH SEMESTER SUPPLEMENTARY EXAMINATIONS
COMPUTATIONAL AERO DYNAMICS
(AERONAUTICAL ENGINEERING)**

AUG/SEP 2008

TIME : 3 HR

MARK : 80

**Answer any FIVE Questions
All Questions carry equal marks**

1. (a) Illustrate with an example from aerospace applications about the importance of computational fluid dynamics in modern analysis of fluid flow problems.
- (b) Explain what are vector processors and parallel processors and explain their role in computational fluid dynamics.
2. Explain conservation and non-conservation forms of governing flow equations with illustrations from continuity equation. Comment on Integral versus differential form of the governing flow equations.
3. Describe the salient features of methods used to handle shocks in computational fluid dynamics along with their relative merits and demerits.
4. Consider the following system of perturbed equations for irrotational, two-dimensional, inviscid steady flow of a compressible gas:
(1 -M²)

$$\frac{\partial u'}{\partial x} + \frac{\partial v'}{\partial y} = 0$$

$$\frac{\partial u'}{\partial y} - \frac{\partial v'}{\partial x} = 0$$
 where u' and v' are small perturbation velocities measured relative to the free stream velocity. Classify this system of equations using eigen-value method.
5. Explain Von Neumann stability analysis with an example.
6. What is the need of transformation of curvilinear, non uniform grid in physical plane to rectangular grid in computational plane? And also explain why the governing equations must be transformed from (x, y) to (ξ, η) as the new independent variables, with suitable derivations for first and second derivatives.
7. (a) What is the difference between structured grid and unstructured grid?
- (b) Write a short note on principle of structured mesh generation.
8. (a) What is hyperbolic grid generation? Explain its advantages and applications.
- (b) How to form hyperbolic grid by using cell area (jacobian) method?