

R09

Code: 9A21703

B.Tech IV Year I Semester (R09) Supplementary Examinations, May 2013

COMPUTATIONAL AERODYNAMICS

(Aeronautical Engineering)

Time: 3 hours

Max Marks: 70

Answer any FIVE questions
All questions carry equal marks

1. Explain the physical interpretation of divergence of velocity and substantial derivative.
2. Derive Navier – stokes equation assuming the flow model of an infinitesimally small fluid element moving with the flow.
3. Explain shock capturing and shock fitting techniques with the help of diagrams and discuss their relative advantages and disadvantages.
4. Discuss the classification of the following system of quasi linear partial differential equations using eigen value method:
$$a_1(\partial u/\partial x) + b_1(\partial u/\partial y) + c_1(\partial v/\partial x) + d_1(\partial v/\partial y) = f_1$$
$$a_2(\partial u/\partial x) + b_2(\partial u/\partial y) + c_2(\partial v/\partial x) + d_2(\partial v/\partial y) = f_2$$
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 .
5. Explain explicit and implicit finite difference approaches using one dimensional heat conduction equations with the help of sketches and discuss their advantages and disadvantages.
6. Derive the transformations involving inverse metrics and Jacobians for first order derivatives of independent variables in physical space (x, y, t) to transformed space (ξ, η, τ)
7. Define structured and unstructured grids and give examples. Explain stretched and adaptive grids and highlight the differences between them.
8. Discuss cell area approach for generation of hyperbolic grids and state their advantages and disadvantages over elliptic grids.
