

IV B.Tech I Semester Supplementary Examinations, November 2005
COMPUTATIONAL AERODYNAMICS
(Aeronautical Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
 All Questions carry equal marks

1. (a) What is substantial derivative. [2]
 (b) Derive the continuity equation in Integral form. [6]
 (c) What is the physical meaning of the divergence of the velocity vector. [8]
2. (a) What is the source of error in the CFD analysis and how it can be removed or minimized. [8]
 (b) Show that Laplace's equation is elliptical in nature. $\frac{\partial^2 \phi}{\partial x^2} + c^2 \frac{\partial^2 \phi}{\partial y^2} = 0$ [8]
3. (a) Given $f(x) = \sin 2n\pi x$: $n=1$
 If $f(0.2)=0.9511$ find the value of $f(0.22)$ by finite differences technique and find the error. [8]
 (b) What are the Pros and cons of higher order accuracy. [4]
 (c) Explain finite differences method of discretization. [4]
4. (a) What do you mean by metrics explain with an example. [5]
 (b) Derive the expression for second partial derivative u with respect to y in terms of metrics and computational coordinates. [11]
5. (a) Compare the generation of grids in physical and computational planes. [6]
 (b) Is it necessary to have the computational plane grid to be of rectangular elements? if yes why? [4]
 (c) Discuss the panel method for compressible subsonic and supersonic flows [6]
6. (a) Derive a discretized form of generic integral form of continuity and energy equations. [11]
 (b) Draw a neat sketch and show vortex lattice along a wing. [5]
7. (a) Prove that the round off error satisfies the difference equation. [6]
 (b) Write down the forward-backward and backward-forward versions of the MacCormack scheme on a Cartesian mesh. Calculate the amplification factors. [10]
8. Write short notes on the following:
 - (a) Round off error [5]
 - (b) Left turning characteristic [5]

(c) Right turning characteristic.

[6]
