

Register Number .....

**B.E. DEGREE EXAMINATIONS: APRIL/MAY 2012**

Eighth Semester

**AERONAUTICAL ENGINEERING**

U07ARE10: Computational Fluid Dynamics

**Time: Three Hours**

**Maximum Marks: 100**

**Answer All Questions:-**

**PART A (10 x 1 = 10 Marks)**

1. If the equation is elliptic then it should satisfy one of the following.  
A.  $B^2 - 4AC < 0$                       B.  $B^2 - 4AC = 0$                       C.  $B^2 - 4AC > 0$                       D.  $B^2 + 4AC < 0$
2. In computational techniques the systems with algebraic equations are transformed into.  
A. partial differential equations                      B. Ordinary differential equations  
C. energy equations                      D. continuity equations
3. Panel methods are also known as  
A. boundary element method                      B. point method  
C. Kraus method                      D. element method
4. The equation governing inviscid subsonic flow can be transformed using  
A. Carmichael method                      B. Prandtl- Glauret method  
C. Krauss method                      D. Erikson method.
5. Round off error is associated with  
A. computer                      B. experiment                      C. transformation                      D. human error
6. The effect of disturbance is graphically illustrated by  
A. von Neuman method                      B. Discrete perturbation method  
C. vortex panel method                      D. source panel method
7. The shape of sub domains of FEM for two-dimensional application is  
A. tetrahedral                      B. pentahedral                      C. quadrilateral                      D. hexahedral
8. Collocation method is a type of  
A. Galerkin scheme                      B. Weighted residual scheme  
C. Stability analysis                      D. cell vertex Formulation

9. One of the following is finite volume scheme

- A. vector point formulation                      B. node point formulation  
C. scalar point formulation                      D. line point formulation

10. Runge- Kutta schemes are expressed in

- A. implicit schemes    B. explicit schemes    C. variational schemes    D.residual schemes

**PART B (10x 2 =20 Marks)**

11. Define vortex and frozen flow.

12. Differentiate source and sink.

13. What is meant by partial pressure and write the Dalton's law of partial pressure.

14. Give any two applications of panel methods.

15. Define stability.

16. Write the advantages of the upwind differencing methods.

17. Define Finite Element Method.

18. What is a boundary value problem.

19. Differentiate FET and FVT.

20. State the Kutta conditions for flow over an aerofoil.

**PART C (5x 14 =70 Marks)**

21. a) (i) Derive continuity equation for a three- dimensional flow using the partial differential equations (Cartesian co-ordinates). (7)

(ii) Determine the velocity potential and stream function for a doublet. (7)

**(OR)**

b) What are the explicit and implicit methods used to solve elliptic equations. Explain the Explicit methods.

22. a) For a thin cambered aerofoil, using the vortex panel method, prove that the stream function is constant and the velocity vanishes inside the aerofoil.

**(OR)**

b) (i) Derive a source-dipole panel relation for a stream line flow over a flat element with Constant and linear density distribution. (7)

(ii) Write the applications of the panel methods. (7)

23. a) What are the various implicit time dependent methods used to solve incompressible and Compressible flows. Explain the methods used for viscous compressible flows.

**(OR)**

b) (i) Write the stability properties of implicit methods. (7)

(ii) Analyse the stability of two – dimensional heat equation. (7)

24. a) Using the generalized Galerkin formulation give the relation between FEM and FDM.

**(OR)**

b) Write the types of residual methods and explain any two methods.

25. a) (i) What are the time step methods used to solve non-linear hyperbolic equations. (7)

(ii) Solve inviscid Burger's equation using Lax – Wendroff method. (7)

**(OR)**

b) (i) Differentiate between cell centered and cell vortex scheme. (7)

(ii) Explain the cell centered scheme for solving overlapping control volumes. (7)

\*\*\*\*\*