

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Seventh Semester B.Tech Degree Examinations (Regular and Supplementary), December 2020

Course Code: AO401**Course Name: COMPUTATIONAL FLUID DYNAMICS**

Max. Marks: 100

Duration: 3 Hours

PART A*Answer any three full questions, each carries 10 marks.*

Marks

- 1 Derive an expression for momentum equation in conservation form expressing in terms of both body and surface forces? (10)
- 2 Describe in detail about source panel method for numerical solution of non-lifting flow over arbitrary bodies and hence derive an expression for coefficient of pressure over an aerofoil. (10)
- 3 Classify the following system of PDE's (10)

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

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

where, u and v are the two dependent variables

- 4 a) What is grid generation? (2)
- b) Strong conservative form of a governing flow equations is (8)

$$\frac{\partial U}{\partial t} + \frac{\partial F}{\partial x} + \frac{\partial G}{\partial y} + \frac{\partial H}{\partial z} = J. \text{ For this unsteady flow in two special dimensions}$$

with no source term. Transform this into computational plane.

PART B*Answer any three full questions, each carries 10 marks.*

- 5 Discuss about the effect of numerical dissipation and dispersion by deriving the modified form of 1-D wave equation. (10)
- 6 Discuss the consistency of 1-D linear conduction equation (10)
- $$\frac{\partial^2 u}{\partial t^2} = c \frac{\partial^2 u}{\partial x^2}$$
- 7 Using Von Neumann Stability Analysis, obtain the criterion for stability of Explicit method of 1D heat equation by using FTCS scheme. (10)

- 8 a) Discuss in detail about different types of errors in numerical scheme? (6)
b) Differentiate between explicit approach and implicit approach for the solution of difference equations. (4)

PART C

Answer any four full questions, each carries 10 marks.

- 9 Explain crank Nicholson Implicit scheme and hence deduce expression for amplification factor. (10)
- 10 State the disadvantages of Lax-Wendroff Technique and explain Mac Cormack's technique (10)
- 11 Explain about Jacobi Iteration method in parabolic equation and discuss about its convergence scheme (10)
- 12 a) Write a note on FVM (5)
b) Explain node centered control volume (5)
- 13 Solve the equation by using Runge kutta method in steps of time ' Δt ' (10)
- $$\frac{\partial u}{\partial t} = - \frac{\partial E}{\partial x}$$
- 14 Distinguish between vortex centered approach and cell centered approach in finite volume method. (10)
