Code No: 56070 **R09**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year II Semester Examinations, April - 2018
COMPUTATIONAL AERODYNAMICS
(Aeronautical Engineering)

Time: 3 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
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1.a) What is difference between computational plane and physical plane?
b) Derive an expression for substantial derivative. [7+8]

2.a) Show that the net rate of work done on the moving fluid element is the sum of the surface force contributions in the x, y, and z directions, as well as the body force contribution.
b) Discuss the Boundary layer Approximation using Practical examples. Justify your answer. [9+6]

3.a) Apply cramer's rule to quasi linear partial differential equation for mathematical classification as elliptic, parabolic and hyperbolic forms of equation.
b) Differentiate between Forward, Backward and Central finite difference scheme with mathematical expressions and examples. [9+6]

4.a) Justify the statement with the help of suitable examples -"If we neglect viscosity and heat conduction, Euler's equations are obtained''.
b) Explain in brief about the CFL condition with mathematical expression. [7+8]

5.a) Explain in detail about Lax-Wendroff schemes for the linear convection equation with mathematical expressions.
b) What is reflection boundary condition? Explain the midpoint leap frog method. [9+6]

6.a) Draw the suitable mesh required to carry out analysis over the aircraft wing and identify the regions of fine mesh on the grid.
b) Explain in brief about the hybrid grids and adaptive grid. [8+7]

7.a) Explain the concept of Maccormack's techniques steps i.e. predictor and corrector steps with the help of suitable example.
b) Explain in brief about the important aspects of numerical dissipation and dispersion techniques. [8+7]

8.a) Explain in brief about different Over relaxation methods. Specify each method with numerical expressions.
b) Explain the mathematical and physical nature of flows governed by parabolic equation with an illustration of steady boundary layer flow. [8+7]

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