Code: 9A21703 **R09**

B.Tech IV Year I Semester (R09) Regular & Supplementary Examinations December 2015

COMPUTATIONAL AERODYNAMICS

(Aeronautical Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions
All questions carry equal marks
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1 (a) What is computational fluid dynamics? Explain its advantages and disadvantages.
(b) How computational fluid dynamics is helpful as a research tool? Illustrate with an example.

2 (a) Derive the continuity equation $\frac{D\rho}{Dt} + \rho \nabla \cdot \nabla = 0$ assuming appropriate flow model. Convert this equation to conservation form.
(b) What are the different types of temperature boundary conditions that are generally prescribed on the surface of a body in viscous flow?

3 (a) Explain shock capturing and shock fitting methods for handling shocks in computational fluid dynamics along with their relative advantages and disadvantages.
(b) Explain why conservation form of governing equations is important for calculations using shock capturing method with the help of an example of flow across a normal shock wave.

4 (a) Discuss the physical behavior of flows governed by hyperbolic equations with an example of steady, inviscid supersonic flow over a two dimension circular arc airfoil.
(b) Discuss the physical behavior of flows governed by parabolic equations with an example of steady boundary layer flows. Explain PNS model for high speed flows and explain its merits.

5 (a) Explain the implicit formulation with an example.
(b) What is the use of Thomas algorithm?

6 (a) What is the need of transformation of curvilinear, non-uniform grid in physical plane to rectangular grid in computational plane?
(b) Explain why the governing equations must be transformed from (x, y) to (ξ, η) as the new independent variables with suitable derivations for first and second derivatives.

7 (a) What are the available structured grid generation techniques?
(b) Explain the algebraic grid generation technique.

8 Enumerate grid clustering with any two examples.

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