CBCS SCHEME

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15AE72

Seventh Semester B.E. Degree Examination, Dec.2018/Jan.2019
Computational Fluid Dynamics

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Derive non conservative form of momentum equation for a infinitesimally small moving fluid element. **(10 Marks)**

b. Explain various physical boundary conditions with suitable examples for CFD problems. **(06 Marks)**

OR

2 a. Explain : i) Shock capturing ii) Shock fitting methods. **(08 Marks)**

b. Derive the expression for divergence of velocity. **(08 Marks)**

Module-2

3 a. A flow field is identified by the following system of PDE's.

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

Classify the PDE based on Cramer's method. **(10 Marks)**

b. Explain unsteady thermal conduction through a semi infinite fluid by writing governing equation and plotting typical solution characteristics. **(06 Marks)**

OR

4 a. Explain eigen value method for classification of PDE's **(08 Marks)**

b. Explain the behaviour of hyperbolic equations and its impact on steady, in viscid supersonic flow field. **(08 Marks)**

Module-3

5 a. Explain different types of Grids. **(10 Marks)**

b. Explain the factors which determine grid quality. **(06 Marks)**

OR

6 a. Explain Adaptive Grids with neat sketch. **(06 Marks)**

b. Explain :

i) Multi-block grid generation

ii) Advancing – front method

iii) Delaunay – Vornoi diagram. **(10 Marks)**

Module-4

7 a. Explain Discretization. (02 Marks)
b. Obtain CFL criterion for a first order wave equation. (08 Marks)
c. Explain Lax Wendroff technique. (06 Marks)

OR

8 a. Derive the generic form of governing flow equation with strong conservative form in transformed space for two dimensional unsteady flows with no source term. (10 Marks)
b. Explain boundary fitted co-ordinate system for a divergent duct. (06 Marks)

Module-5

9 a. Derive an expression for flux vector splitting. (10 Marks)
b. Explain Upwind scheme. (06 Marks)

OR

10 a. Explain finite volume discretization for a steady conduction equation :
$\frac{\partial}{\partial x}\left(K\frac{\partial T}{\partial x}\right)+S=0$ in 1 –d, where K is thermal conductivity and S is source term. (08 Marks)
b. Explain cell centered technique for spatial Discertization process. (08 Marks)

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