Week 12: Assignment 12

The due date for submitting this assignment has passed.

Due on 2021-10-20, 23:59 IST.

As per our records you have not submitted this assignment.
Please note that the question number 8, 9 and 12 can have one or more than one right choice.

1) Consider the 1-D energy equation $\frac{\partial T}{\partial t} + u\frac{\partial T}{\partial x} = \alpha\frac{\partial^2 T}{\partial x^2} + \mu\phi$. Find the conduction and dissipation heat transfer terms. *1 point*

- $u\frac{\partial T}{\partial x}$ and $\mu\phi$
- $\alpha\frac{\partial^2 T}{\partial x^2}$ and $\mu\phi$
- $\frac{\partial T}{\partial t}$ and $u\frac{\partial T}{\partial x}$
- $\frac{\partial T}{\partial t}$ and $\alpha\frac{\partial^2 T}{\partial x^2}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\alpha\frac{\partial^2 T}{\partial x^2}$ and $\mu\phi$

2) For the uniform grid spacing, $\left(\frac{\partial^2 u}{\partial x^2}\right)_{i,j}$ the central difference second-order approximation can be represented by *1 point*

- $\frac{u(i+1,j)-2u(i,j)+u(i+1,j-1)}{\Delta x^2}$
- $\frac{u(i+1,j)-2u(i,j)+u(i+1,j-1)}{2\Delta x}$
- $\frac{u(i+1,j)-2u(i,j)+u(i+1,j-1)}{\Delta x}$
- None of these

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{u(i+1,j)-2u(i,j)+u(i+1,j-1)}{\Delta x^2}$

3) The difference between the exact analytical solution of PDE and exact solution of FDE is referred as *1 point*

- Round off error
- Discretization error
- Iteration error
- Modeling error

No, the answer is incorrect.
Score: 0
Accepted Answers:
Discretization error

4) Which is/are the statement/statements valid regarding the finite difference method? *1 point*

i. It is restricted to a structured grid.
ii. It is generally applicable for a rectangular domain.
iii. It uses partial differential forms of governing equations.
iv. It used the integral forms of governing equations.

- i,ii
- ii,iii
- iii,i, iv
- i,ii and iii
- i, ii, iii & iv

No, the answer is incorrect.
Score: 0
Accepted Answers:
i,ii and iii

5) For the solution of Navier-Stokes equations in a rectangular domain, following kinds of grids may be preferred, *1 point*

i. Triangular cells.
ii. Rectangular cells
iii. Structured grid.
iv. Unstructured grid.

Desirable response would be,

- i and iii
- ii and iii
- i, ii and iii
- i and iv
- i, ii, iii and iv

No, the answer is incorrect.
Score: 0
Accepted Answers:
i, ii, iii and iv

6) Following statements are the features of the finite volume method (FVM), *1 point*

i. FVM can be used on both structured grids and unstructured grids.
ii. FVM can tackle flow with discontinuities, e.g., shocks.
iii. FVM can be applicable to complex and irregular geometry.
iv. It uses differential form of the governing equations

Desirable response would be,

- i and ii
- ii and iii
- iii alone
- i, ii and iii
- i, ii, iii and iv

No, the answer is incorrect.
Score: 0
Accepted Answers:
i, ii and iii

7) Which are the features of Beam and warming method, *1 point*

i. larger time step.
ii. unconditionally stability.
iii. conditionally stability.
iv. factorization errors.
v. faster convergence.

Desirable response would be,

- i, ii and iv
- i, ii and iii
- ii, iii and iv
- ii, iv and v
- i, ii, iv and v
- i, ii, iii and v

No, the answer is incorrect.
Score: 0
Accepted Answers:
i, ii, iv and v

8) Which are the features for the MacCormack Scheme? *1 point*

- It can be used for the boundary layer equation.
- It is used for a hyperbolic equation.
- It is conditionally stable.
- It is unconditionally stable.
- It does not lead to spurious oscillation in predicting flow with discontinuity.
- It can be used for compressible flows.

No, the answer is incorrect.
Score: 0
Accepted Answers:
It is used for a hyperbolic equation.
It is conditionally stable.
It can be used for compressible flows.

9) Choose appropriate statements related to turbomachines, *1 point*

- The flow is three-dimensional and suffers from the rotation, curvature, shock-boundary layer interaction and phase changes.
- The stator-rotor interaction results in a highly unsteady flow.
- Finite difference method is a preferred method for discretization for turbomachinery flows.
- Rectangular Grids are used for to simulate flows over the turbomachinery blades.
- Curvilinear grids are the preferred one to simulate flows over the turbomachinery blades.

No, the answer is incorrect.
Score: 0
Accepted Answers:
The flow is three-dimensional and suffers from the rotation, curvature, shock-boundary layer interaction and phase changes.
The stator-rotor interaction results in a highly unsteady flow.
Curvilinear grids are the preferred one to simulate flows over the turbomachinery blades.

10) When Navier-stokes equation for a turbomachine is put in the vector form & cylindrical cordinate system, then the centrifugal and Coriolis forces appear in, *1 point*

- Solution vector
- Source term vector
- Flux vector.
- none of these.

No, the answer is incorrect.
Score: 0
Accepted Answers:
Source term vector

11) The $k-\varepsilon$ model is employed as a turbulence closure of RANS equations. For the solution, the values of k and ε are *1 point*

- needed to be imposed at all boundaries.
- needed to specify only at inlet and exit.
- needed to specify only on the surface.
- need no specification of boundary values.

No, the answer is incorrect.
Score: 0
Accepted Answers:
needed to be imposed at all boundaries.

12) The non-uniform grids for turbomachinery flow are often required to *1 point*

- reduce the computation time.
- capture sharp gradients of flow variables.
- enforce boundary conditions.
- none of these.

No, the answer is incorrect.
Score: 0
Accepted Answers:
reduce the computation time.
capture sharp gradients of flow variables.