Unit 2 - Week 1

Week 1 Assignment 1

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2018-08-15, 23:59 IST.

1) In the context of a second order PDE for a 2D problem, a characteristic is defined as (i) a line across which the first order derivatives are discontinuous (ii) a surface across which the first order derivatives are discontinuous (iii) a line across which the second order derivatives are continuous (iv) a line across which the second order derivatives are discontinuous Among the above statements, the following are incorrect *1 point*

- (a) (i), (ii) and (iii)
- (b) (ii) only
- (c) (ii) and (iv)
- (d) (i) and (iv)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(a) (i), (ii) and (iii)

2) The general form of the conservation equation is *1 point*

where r is the density, f is the transport variable, Gis the diffusion coefficient and S is the source term per unit volume.

- (a) $\frac{\partial}{\partial t}(\phi)+\nabla.(\vec{V}\phi)=\nabla.(\Gamma\nabla\phi)+S$
- (b) $\frac{\partial}{\partial t}(\rho\phi)+\nabla.(\rho\vec{V}\phi)=\nabla.(\Gamma\nabla\phi)+S$
- (c) $\frac{\partial}{\partial t}(\rho)+\nabla.(\rho\vec{V})=\nabla.(\Gamma\nabla\phi)+S$

No, the answer is incorrect.
Score: 0

Accepted Answers:

(b) $\frac{\partial}{\partial t}(\rho\phi)+\nabla.(\rho\vec{V}\phi)=\nabla.(\Gamma\nabla\phi)+S$

3) Consider the following statements (i) CFD modelling is cheaper than experiments (ii) CFD modelling can handle any degree of complexity (iii) Multiple solutions can never exist in numerical modelling (iv) CFD deals with a mathematical description and not with the reality Out of these the following are the answers which of them are correct *1 point*

- (a) (i) only
- (b) (i) and (iv)
- (c) (i), (ii) and (iv)
- (d) (ii) and (iii)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(c) (i), (ii) and (iv)

4) Choose the correct statement regarding the nature of the partial differential equations *1 point*

- (a) If the equation has no real characteristics, the equation is elliptic
- (b) If the equation has no real characteristics, the equation is hyperbolic
- (c) If the equation has no real characteristics, the equation is parabolic
- (d) If the equation has one real characteristics, the equation is elliptic

No, the answer is incorrect.
Score: 0

Accepted Answers:
(a) If the equation has no real characteristics, the equation is elliptic

5) *1 point*

A two-dimensional small-disturbance velocity potential equation for compr

as $\left(1-M_\infty^2\right)\frac{\partial^2\phi}{\partial x^2}+\frac{\partial^2\phi}{\partial y^2}=0$, where M_∞ is the Mach number of flow

($M_\infty < 1$), the equation is

- (a) linear
- (b) parabolic
- (c) elliptic
- (d) hyperbolic

No, the answer is incorrect.
Score: 0

Accepted Answers:
(c) elliptic

6) *1 point*

Consider one dimensional unsteady state wave propagation gi

$c^2\frac{\partial^2 T}{\partial x^2}=\frac{\partial^2 T}{\partial t^2}$, where c >0. The type of the equation is

- (a) linear
- (b) parabolic
- (c) elliptic
- (d) hyperbolic

No, the answer is incorrect.
Score: 0

Accepted Answers:
(d) hyperbolic

7) *1 point*

Consider the following systems of partial differential equ

$\frac{\partial\phi}{\partial y}=\theta$, where ϕ and θ are the two dependent variables. The equation

- (a) elliptic
- (b) hyperbolic
- (c) linear
- (d) parabolic

No, the answer is incorrect.
Score: 0

Accepted Answers:
(d) parabolic

8) *1 point*

Consider a general form of the energy conservation equation as:

$$\frac{\partial}{\partial t}\left(\rho C_p T\right)+\nabla.\left(\rho\vec{V}C_p T\right)=\nabla.\left(k\nabla T\right)+S.$$

In a physical problem, one is interested to obtain the transient temp (T as a function of x and t) in a uniform flow field ($u=U_\infty$=c diffusivity ($k/\rho C_p$) of the medium is negligibly small (can be tak analysis). There is a uniform rate of volumetric heat generation (S) and in the physical space the temperature varies only along the x dire properties of the medium can be taken as invariants. Then the nature differential equation is

(a) parabolic
(b) hyperbolic
(c) elliptic
(d) linear

No, the answer is incorrect.
Score: 0

Accepted Answers:
(b) hyperbolic

9) *1 point*

Consider the following equation $\alpha \frac{\partial^2 \phi}{\partial x^2} = \frac{\partial \phi}{\partial t}$. The equation is

(a) linear
(b) parabolic
(c) elliptic
(d) hyperbolic

No, the answer is incorrect.
Score: 0

Accepted Answers:
(b) parabolic

10) *1 point*

Consider the governing differential equation in the :

$\sum_i \sum_j A_{ij} \frac{\partial^2 \phi}{\partial x_i \partial y_j} + B = 0$. The equation is hyperbolic if

(a) any one of the eigen values of A is zero
(b) none of the eigen values of A is zero and all the eigen values are of same sign
(c) none of the eigen values of A is zero and all but one eigen value is of opposite sign
(d) none of the eigen values of A is zero and may be of any sign

No, the answer is incorrect.
Score: 0

Accepted Answers:
(c) none of the eigen values of A is zero and all but one eigen value is of opposite sign

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