Unit 4 - Week 2: Classification of PDEs

Course outline

How does an NPTEL online course work?

Week 0: Prerequisite

Week 1: Introduction to Computational Fluid Dynamics

Week 2: Classification of PDEs

- Lec 1: System of second-order PDEs
- Lec 2: System of first-order PDEs
- Quiz : Assignment 02
- Solution: Assignment 2
- Feedback form for week 2

Week 3: Finite Difference Method

Week 4: Elliptic Equations

Week 5: Parabolic Equations

Week 6: Hyperbolic Equations

Week 7: Stability Analysis

Week 8: Vorticity-Stream Function Formulation

Week 9: MAC Algorithm

Week 10: Finite Volume Method - I

Week 11: Finite volume method - II

Week 12: SIMPLE Algorithm

Download Videos

Download Lecture Notes

Assignment 02

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

Due on 2020-02-12, 23:59 IST.

1) The nature of the second order partial differential equation $\frac{\partial \phi}{\partial t} + \beta \frac{\partial \phi}{\partial x} + \alpha \frac{\partial^2 \phi}{\partial x^2} = 0$ is — *1 point*

- circular
- elliptic
- parabolic
- hyperbolic

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

2) The lines along which a partial differential equation reduces to an ordinary differential equation are called — *1 point*

- transition lines
- parabolic lines
- characteristic lines
- hyperbolic lines

No, the answer is incorrect.
Score: 0
Accepted Answers:
characteristic lines

3) The steady compressible flow defined by $(1 - M_\infty^2)\frac{\partial^2 \phi}{\partial x^2} + \frac{\partial^2 \phi}{\partial y^2} = 0$ becomes hyperbolic under the condition — *1 point*

- $M_\infty = 0$
- $M_\infty = 1$
- $M_\infty > 1$
- $M_\infty < 1$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$M_\infty > 1$

4) The value of α for which the equation $2\frac{\partial^2 \phi}{\partial x^2} + 8\frac{\partial^2 \phi}{\partial x \partial y} + \alpha \frac{\partial^2 \phi}{\partial y^2} = 0$ becomes parabolic — *1 point*

- 2
- 4
- 8
- 16

No, the answer is incorrect.
Score: 0
Accepted Answers:
8

5) Which of these apply to parabolic equations? — *1 point*

- they have one real characteristic line.
- they have two real characteristic lines.
- they have two imaginary characteristic lines.
- they do not have characteristic lines.

No, the answer is incorrect.
Score: 0
Accepted Answers:
they have one real characteristic line.

6) Which of these is/are required to solve a hyperbolic equation? — *1 point*

- initial condition
- boundary condition
- both initial and boundary conditions
- neither initial nor boundary conditions

No, the answer is incorrect.
Score: 0
Accepted Answers:
both initial and boundary conditions

7) The nature of the following system of partial differential equations is (these set of equations represent the shallow water equation). — *1 point*

$\frac{\partial h}{\partial t} + u\frac{\partial h}{\partial x} + h\frac{\partial u}{\partial x} = 0$
$\frac{\partial u}{\partial t} + u\frac{\partial u}{\partial x} + g\frac{\partial h}{\partial x} = 0$

- elliptic
- parabolic
- hyperbolic
- none of the above

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

8) Which of this characteristics apply to parabolic equation? — *1 point*

- finite domain of dependence and infinite domain of influence
- no domain of dependence and no domain of influence
- finite domain of dependence and finite domain of influence
- none of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
finite domain of dependence and infinite domain of influence

9) The following system of equations are classified as — *1 point*

$\frac{\partial u}{\partial t} + 8\frac{\partial v}{\partial x} = 0$
$\frac{\partial v}{\partial t} + 2\frac{\partial u}{\partial x} = 0$

- elliptic
- parabolic
- hyperbolic
- none of the above

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

10) Which of these ODE s are used to classify the following second order PDE — *1 point*

$a\frac{\partial^2 \phi}{\partial x^2} + b\frac{\partial^2 \phi}{\partial x \partial y} + c\frac{\partial^2 \phi}{\partial y^2} + d\frac{\partial \phi}{\partial x} + e\frac{\partial \phi}{\partial y} + f\phi = g$

- $b(\frac{dy}{dx}) - c = 0$
- $a(\frac{dy}{dx})^2 - b(\frac{dy}{dx}) = 0$
- $a(\frac{dy}{dx})^2 - b(\frac{dy}{dx}) + 1 = 0$
- $a(\frac{dy}{dx})^2 - b(\frac{dy}{dx}) + c = 0$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$a(\frac{dy}{dx})^2 - b(\frac{dy}{dx}) + c = 0$