

# Unit 3 - Week 1: Introduction to Computational Fluid Dynamics

## Course outline

How does an NPTEL online course work?

Week 0: Prerequisite

Week 1: Introduction to Computational Fluid Dynamics

- Lec 1: Applications of CFD
- Lec 2: Basic equations of fluid dynamics and heat transfer
- Lec 3: Initial and boundary conditions

Quiz : Assignment 01

Solution: Assignment 1

Feedback form for Week 1

Week 2: Classification of PDEs

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

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## Assignment 01

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) Viscous Burger's equation is ,

1 point

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

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

$\frac{\partial u}{\partial t} + u \frac{\partial u}{\partial x} = v \frac{\partial^2 u}{\partial y^2}$

$u \frac{\partial u}{\partial t} = v \frac{\partial^2 u}{\partial y^2}$

No, the answer is incorrect. Score: 0

Accepted Answers:

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

2) The momentum equation for low Reynolds number flow ( $Re < 1$ ) can be written as

1 point

$\frac{\partial(\rho \vec{u})}{\partial t} + \nabla \cdot (\rho \vec{u} \vec{u}) = -\nabla p$

$\frac{\partial(\rho \vec{u})}{\partial t} = -\nabla p + \nabla \cdot (\mu \nabla \vec{u})$

$\frac{\partial(\rho \vec{u})}{\partial t} + \nabla \cdot (\rho \vec{u} \vec{u}) = 0$

$\frac{\partial(\rho \vec{u})}{\partial t} = -\nabla p$

No, the answer is incorrect. Score: 0

Accepted Answers:

$\frac{\partial(\rho \vec{u})}{\partial t} = -\nabla p + \nabla \cdot (\mu \nabla \vec{u})$

3) Continuity equation for incompressible flows in Cartesian co-ordinate for  $\vec{u}$ , is

1 point

$\nabla u = 0$

$\nabla \cdot \vec{u} = 0$

$\nabla^2 u = 0$

$\nabla \times \vec{u} = 0$

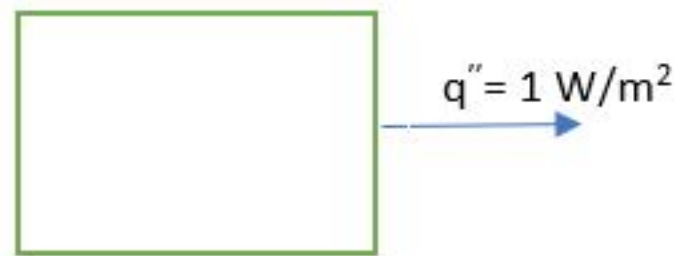
No, the answer is incorrect. Score: 0

Accepted Answers:

$\nabla \cdot \vec{u} = 0$

4) The boundary condition given in the diagram is

1 point



- Dirichlet boundary conditions
- Neumann boundary conditions
- Mixed boundary conditions
- Periodic boundary conditions

No, the answer is incorrect. Score: 0

Accepted Answers:

Neumann boundary conditions

5) Steady heat conduction equation with heat generation in solid body is which type of equation?

1 point

- Fourier Biot equation
- Laplace equation
- Poisson equation
- Tricomi equation

No, the answer is incorrect. Score: 0

Accepted Answers:

Poisson equation

6) Which of these will fall in the post-processing category in CFD ?

1 point

- Defining boundary condition
- Grid generation
- Discretization
- Flow Visualization

No, the answer is incorrect. Score: 0

Accepted Answers:

Flow Visualization

7) Which of these can be taken as Dirichlet boundary conditions for the variable  $\phi$  at a specified boundary ?

1 point

$\frac{\partial^3 \phi}{\partial x^3} = 0$

$\frac{\partial^2 \phi}{\partial x^2} = 0$

$\frac{\partial \phi}{\partial x} = 0$

$\phi = 0$

No, the answer is incorrect. Score: 0

Accepted Answers:

$\phi = 0$

8) What is the law governing momentum equation?

1 point

- Newton's first law of motion
- Newton's second law of motion
- First law of thermodynamics
- Second law of thermodynamics

No, the answer is incorrect. Score: 0

Accepted Answers:

Newton's second law of motion

9) Navier stokes equation is a non linear partial differential equation, the order of the equation is \_\_\_\_\_ (answer should be given in number)

No, the answer is incorrect. Score: 0

Accepted Answers:

(Type: Numeric) 2

1 point

10) Total number of initial and boundary conditions required for solving the equation  $\frac{\partial T}{\partial t} = \frac{\partial^2 T}{\partial x^2}$  are \_\_\_\_\_ (answer should be in number)

No, the answer is incorrect. Score: 0

Accepted Answers:

(Type: Numeric) 3

1 point