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Courses » Fluid dynamics and turbomachines

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## Week #3.

# DIFFERENTIAL ANALYSIS

### Course outline

How to access the portal

Pre-requisite Assignment

Course Content

Week #1.  
INTRODUCTION TO FLUID FLOWS

Week #2.  
INTEGRAL ANALYSIS

Week #3.  
DIFFERENTIAL ANALYSIS

- Lec01 - Differential Analysis
- Lec02 - Navier-Stokes equation for 2D incompressible flow
- Lec 03 - Vorticity, Stream function, Bernoulli's equation
- Lec 04 -

## Assignment 3

The due date for submitting this assignment has passed.

As per our records you have not submitted this assignment. **Due on 2018-09-05, 23:59 IST.**

1) Water flows through a converging-diverging duct. At the throat of the duct the velocity attained by water is close to the local sound speed in water. Then **1 point**

- The flow is incompressible as the fluid is water which is incompressible
- The flow is compressible
- The flow is incompressible as for water, the flow should attain more than double the sound speed to be compressible
- More information is required to assess if the flow is compressible

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

*The flow is compressible*

2) Which of the following equations can be used to analyze boundary layer flow? **1 point**

- Euler equation
- Bernoulli equation
- Both a & b
- None

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

*None*

A flow velocity field is given by  $\vec{V}(x, y, t) = x^2t \vec{i} + (y^2 + t) \vec{j}$ . The value of local acceleration along y direction \_\_\_\_\_(1) and the magnitude of total acceleration

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Practice Problems - Week 3

Week 3 - Presentations

Quiz : Assignment 3

Assignment 3 solution

WEEK 3 - FEEDBACK - Fluid dynamics and turbomachines

**Week #4. VISCOUS FLOW**

**Week #5. INTRODUCTION TO TURBOMACHINES**

**Week #6. PRINCIPLE OF TURBOMACHINES**

**Week #7. PERFORMANCE OF PUMPS AND HYDRAULIC TURBINES**

**Week #8. PERFORMANCE OF STEAM AND GAS TURBINES**

**TEXT TRANSCRIPTS**

**VIDEO DOWNLOAD**

**Score: 0**

**Accepted Answers:**

(Type: Numeric) 1

1 point

4) Fill in the blank \_\_\_\_\_(2)

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

(Type: Range) 5.7,5.9

1 point

5) If stream function is given by  $\psi = xy$  then, potential function ( $\phi$ ) =

1 point

$$(x^2 + y^2)/2$$

$$(x^2 - y^2)/2$$

$$(x^3 + y^3)/2$$

$$(x^3 - y^3)/2$$

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

$$(x^2 - y^2)/2$$

6) If potential function ( $\phi$ ) can be defined for a flow then, which of the following is/are true **1 point**

i) The flow is inviscid

ii)  $\frac{\partial^2 \phi}{\partial x^2} + \frac{\partial^2 \phi}{\partial y^2} = 0$

iii) The flow is irrotational

i

i, ii

i, iii

i, ii, iii

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

i, ii, iii

7) Bernoulli equation can be applied to

1 point

Any two points in a flow

Any two points on a streamline in an inviscid flow

Any two points on a potential line in an inviscid flow

None

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

*Any two points on a streamline in an inviscid flow*

8) A stream function ( $\psi$ ) automatically satisfies

**1 point**

- Laplace equation for any flow
- continuity equation for steady, incompressible flow
- continuity equation for any flow
- Laplace equation for steady, incompressible flow

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

*continuity equation for steady, incompressible flow*

9) An idealized incompressible flow has the proposed three-dimensional velocity

distribution  $\vec{V}(x, y, z) = 4xy^3 \vec{i} + f(y) \vec{j} - zy^2 \vec{k}$  in arbitrary units. If  $\vec{V}(0, 0, 0) = 0$  then the velocity magnitude at (1, 1, 1) is

**No, the answer is incorrect.**

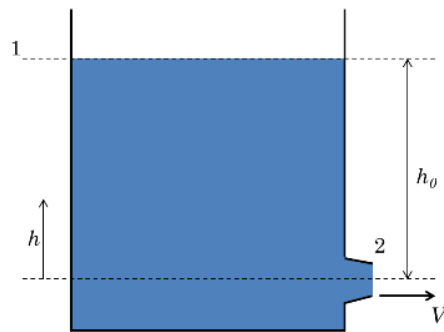
**Score: 0**

**Accepted Answers:**

*(Type: Range) 4.1,4.2*

**2 points**

10) An open tank is completely filled with water (to a height ( $h_0$ ) of 5 m) and has a nozzle (initially closed) at the bottom as shown in the figure. If the nozzle is opened and the height  $h_0$  is maintained constant by appropriately filling the tank through a float valve, find the velocity  $V$  (in m/s at section 2) if the tank cross-sectional area is  $0.5 \text{ m}^2$ , and the nozzle cross-sectional area is  $0.1 \text{ m}^2$ . Neglect friction, pressure losses due to sudden expansion near the nozzle and take  $g = 9.81 \text{ m/s}^2$ .




**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

*(Type: Range) 10,10.2*

**2 points**

11) If  $\vec{V}(x, y) = (3x^3 + y^2) \vec{i} - 5xy \vec{j}$ , then  $\frac{\partial p}{\partial y}$  (in Pa/m) at (1, 1) is (take  $\rho = 1000 \text{ kg/m}^3$  and neglect gravity)

**Hint**

**No, the answer is incorrect.**  
**Score: 0**

**Accepted Answers:**  
*(Type: Numeric) -5000*

*2 points*

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