

Unit 8 - Week 7 : DIMENSIONAL ANALYSIS

Course outline

How to access the portal

Week 1 : INTRODUCTION

Week 2 : FLUID STATICS

Week 3 : FLUID DYNAMICS

Week 4 : FLUID DYNAMICS

Week 5 : APPLICATIONS OF FLUID STATICS AND DYNAMICS

Week 6 : FLUID KINEMATICS

Week 7 : DIMENSIONAL ANALYSIS

 Dimensional Homogeneity

 Dimensional Analysis and Similarity

 Quiz : Assignment 7

 Feedback form

Week 8 : INCOMPRESSIBLE VISCOUS FLOW IN PIPES

Live Session

Assignment 7

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

Due on 2019-10-16, 23:59 IST.

1) Match List 1 and List 2 and select the correct dimension for the properties using the codes given below

1 point

List 1

P. Kinematic Viscosity
Q. Force
R. Surface Tension
S. Density

List 2

1. $M^1L^1T^{-2}$
2. $M^1L^0T^{-2}$
3. $M^1L^{-3}T^0$
4. $M^0L^2T^{-1}$

- a. P-3, Q-4, R-2, S-1
 b. P-1, Q-2, R-4, S-3
 c. P-4, Q-1, R-2, S-3
 a. P-4, Q-2, R-1, S-3

No, the answer is incorrect.

Score: 0

Accepted Answers:
c. P-4, Q-1, R-2, S-3

2) Match List 1 and List 2 and select the correct dimension for the properties using the codes given below. List 1 contains dimensionless parameters and List 2 contains the ratios.

1 point

List 1

P. Mach Number
Q. Reynolds Number
R. Weber Number
S. Froude Number

List 2

a. Ratio of inertial force to gravitational force
b. Ratio of fluid velocity and velocity of sound
c. Ratio of inertial force to viscous elastic force
d. Ratio of inertial force and surface tension force

- a. P-3, Q-2, R-4, S-1
 b. P-3, Q-4, R-2, S-1
 c. P-2, Q-3, R-4, S-1
 d. P-1; Q-3; R-2, S-4

No, the answer is incorrect.

Score: 0

Accepted Answers:
c. P-2, Q-3, R-4, S-1

3) Both Reynolds number and Froude numbers assume significance in one of the following examples

1 point

- a. Motion of submarine at large depths
 b. Motion of ship in deep seas
 c. Cruising of a missile in air
 d. Flow over spillways

No, the answer is incorrect.

Score: 0

Accepted Answers:
b. Motion of ship in deep seas

4) A dimensionless combination of pressure drop δP , dynamic viscosity μ , velocity V and length L is

1 point

- a. $\delta P/\mu^2L$
 b. $V/L \mu$
 c. $\delta P/\mu VL$
 d. $\delta PL/\mu V$

No, the answer is incorrect.

Score: 0

Accepted Answers:
d. $\delta PL/\mu V$

5) The number of π of parameters needed to express the function $F(A, V, t, \mu, L)=0$ is

1 point

- a. 5
 b. 4
 c. 3
 d. 2

No, the answer is incorrect.

Score: 0

Accepted Answers:
d. 2

6) Dynamic similarity is said to exist between two fluid flows when at corresponding points there are

1 point

- a. Geometric similarity and similarity of forces involved
 b. Kinematic similarity and geometric similarity
 c. Interactions of inertia and viscous forces
 d. Interaction between inertia, viscous and pressure forces

No, the answer is incorrect.

Score: 0

Accepted Answers:
a. Geometric similarity and similarity of forces involved

7) In a model experiment with weir, if the dimensions of the model weir are reduced by a factor of K , the flow rate through the model weir is the following fraction of the flow rate through the prototype.

1 point

- a. $K^{5/2}$
 b. K^2
 c. 1
 d. K^{-2}

No, the answer is incorrect.

Score: 0

Accepted Answers:
a. $K^{5/2}$

8) The relationship between the length scale ration (L_r) and velocity scale ration (v_r) in hydraulic model in which Froude dynamic similarity model is maintained is

1 point

- a. $V_r=L_r$
 b. $L_r=\sqrt{v_r}$
 c. $v_r=L_r^{1.5}$
 d. $V_r=\sqrt{L_r}$

No, the answer is incorrect.

Score: 0

Accepted Answers:
d. $V_r=\sqrt{L_r}$

9) Model analysis of pipe flow are based on

1 point

- a. Reynolds number
 b. Froude number
 c. Mach Number
 d. Euler Number

No, the answer is incorrect.

Score: 0

Accepted Answers:
a. Reynolds number

10) Model analysis of aeroplanes moving at supersonic speed is based on

1 point

- a. Reynolds Number
 b. Froude Number
 c. Mach Number
 d. Euler Number

No, the answer is incorrect.

Score: 0

Accepted Answers:
c. Mach Number

11) A 1:30 model of an ogee spillway crest records an acceleration of 1.3 m/s² at a certain location. The homologous value of acceleration in the prototype in m/s² is

2 points

- a. 0.043
 b. 0.237
 c. 1.30
 d. 7.2

No, the answer is incorrect.

Score: 0

Accepted Answers:
c. 1.30

12) A 1:50 scale model of a spillway is to be tested in laboratory. The discharge in the prototype is 1000 m³/s. The discharge to be maintained in the model test is

2 points

- a. 0.057 m³/s
 b. 0.08 m³/s
 c. 0.57 m³/s
 d. 5.7 m³/s

No, the answer is incorrect.

Score: 0

Accepted Answers:
a. 0.057 m³/s

13) The drag force F on a sphere kept in a uniform flow field depends on the diameter of the sphere D ; flow velocity V ; fluid density ρ and dynamic viscosity μ . Which of the following options represent the non-dimensional parameters which could be used to analyze the problem?

2 points

- a. $F/\rho V D$ and $\mu/\rho V D$
 b. $F/\rho V D^2$ and $\rho V D/\mu$
 c. $F/\rho V^2 D^2$ and $\rho V D/\mu$
 d. $F/\rho V^2 D^3$ and $\mu/\rho V D$

No, the answer is incorrect.

Score: 0

Accepted Answers:
c. $F/\rho V^2 D^2$ and $\rho V D/\mu$

14) Water is flowing through a pipe of 30 cm diameter at a velocity of 4 m/s. Find the velocity of oil flowing in another pipe of diameter 10 cm, if the condition of dynamic similarity is satisfied between the two pipes. The viscosity of water and oil is given as 0.01 poise and 0.025 poise. The specific gravity of oil is 0.8.

2 points

- a. 3.75 m/s
 b. 37.5 m/s
 c. 0.375 m/s
 d. 375 m/s

No, the answer is incorrect.

Score: 0

Accepted Answers:
b. 37.5 m/s

15) The flow of glycerine (kinematic viscosity = 5×10^{-4} m²/s) in an open channel is to be modeled in laboratory flume using water (kinematic viscosity = 10^{-6} m²/s) as the flowing fluid. If both gravity and viscosity are important, what should be the length scale (i.e., ratio of prototype to model dimensions) for maintaining dynamic similarity?

2 points

- a. 1
 b. 22
 c. 63
 d. 500

No, the answer is incorrect.

Score: 0

Accepted Answers:
c. 63