Unit 14 - Week 12

Course outline

How does an NPTEL online course work?

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Week 12

- Lecture 56: Pipe Flow (Part II)
- Lecture 57: Pipe Flow (Part III)
- Lecture 58: Pipe Flow (Part IV)
- Lecture 59: Principle of Similarity and Dynamical Analysis (Part I)
- Lecture 60: Principle of Similarity and Dynamical Analysis (Part II)
- Quiz : Assignment 12
- Week 12 Feedback Form

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Live Interactive Session

Assignment 12

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

Due on 2020-04-22, 23:59 IST.

1) *1 point*

Match the following dimensionless groups with the related physical situations:

P: Compressible flow	U: Reynolds number
Q: Free surface flow	V: Nusselt number
R: Boundary layer flow	W: Weber number
S: Pipe flow	X: Froude number
T: Heat convection	Y: Mach number
	Z: Skin friction coefficient

(a) P-U; Q-X; R-V; S-Z; T-W
(b) P-W; Q-X; R-Z; S-U; T-V
(c) P-Y; Q-W; R-Z; S-U; T-V
(d) P-Y; Q-W; R-Z; S-U; T-X

a.
b.
c.
d.

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

2) *1 point*

Water at 20°C is flowing steadily in a horizontal pipe of 10 cm diameter and 40 m long at a rate of 20 litres/s. The density and dynamic viscosity of water at 20°C are 1000 kg/m^3 and 0.001 N-s/m^2 respectively. If the Darcy's friction factor is 0.015, the pumping power required to maintain the flow is
(a) 389.5 W
(b) 189.3 W
(c) 1.3 kW
(d) 2.3 kW

a.
b.
c.
d.

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

3) *1 point*

Oil (kinematic viscosity, $v_{oil} = 1.0\times10^{-5}\ m^2/s$) flows through a pipe of 0.25 m diameter with a velocity of 10 m/s. Water (kinematic viscosity, $v_{water} = 0.89\times10^{-6}\ m^2/s$) is flowing through a model pipe of diameter 20 mm. For satisfying the dynamic similarity, the velocity of water (in m/s) is :
(a) 100 m/s
(b) 32.5 m/s
(c) 12.5 m/s
(d) 11.123 m/s

a.
b.
c.
d.

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

4) *1 point*

A torpedo-shaped object of 900 mm diameter is to move in air at 60 m/s and its drag is to be estimated from tests in water on a half-scale model. Viscosities: air = 1.86×10^{-5} Pas, water: 1.01×10^{-3} Pas. Densities: air=1.20 kg/m^3, water=1000 kg/m^3. The drag of the model is 540 N. The necessary speed of the model is

(a) 7.82 m/s
(b) 10 m/s
(c) 6.52 ms
(d) 5.06 m/s

a.
b.
c.
d.

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

5) *1 point*

In the previous question the necessary drag of the full scale object is
(a) 301.24 N
(b) 250.56 N
(c) 427.24 N
(d) 152.53 N

a.
b.
c.
d.

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

6) *1 point*

When a physical phenomenon is described by n number of variables (both independent and dependent) having m fundamental dimensions, using dimensional analysis (Buckingham π theorem), the phenomenon can be described by (n-m) number of independent dimensionless groups called as π terms. The repeating variables in an analysis should
(a) be equal in number to that of the fundamental dimensions involved in the problem variables
(b) include the dependent variable
(c) must form a π-term by themselves.
(d) both (a) and (c)

a.
b.
c.
d.

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

7) *1 point*

A dimensionless group formed with the variables ρ (density), ω (angular velocity), μ (dynamic viscosity), D (Characteristic diameter) is
(a) ρω$_3$μ/ D^2
(b) ρω$_2D^2$/μ
(c) μD^2ρω
(d) ρω$_3$μD

a.
b.
c.
d.

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

8) *1 point*

The power P required to run a centrifugal pump depends on the impeller diameter D, the rotational speed N, the rate of discharge Q, density ρ and viscosity μ. The correct independent dimensionless groups that can be formed with these variables are
(a) $\frac{P}{\rho N^2D^4}, \frac{Q}{ND^3}, \frac{\mu}{\rho ND^2}$
(b) $\frac{P}{\rho N^2D^5}, \frac{Q}{ND^3}, \frac{\mu}{\rho ND^2}$
(c) $\frac{P}{\rho N^3D^5}, \frac{Q}{ND^3}, \frac{\mu}{\rho ND}$
(d) $\frac{P}{\rho N^2D^5}, \frac{Q}{ND^3}, \frac{\mu}{\rho ND^2}$

a.
b.
c.
d.

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

9) *1 point*

Two pipes have a length L each. One of them has diameter D_1 and the other a diameter D_2. If the pipes are arranged in parallel, the loss of head when a total quantity of water Q flows through them is H_1. If the pipes are arranged in series and the rate of fluid flows through them, the loss of head is H_2. If $D_2 = D_1/2$, neglecting minor losses and assuming same friction factor the ratio of H_1 to H_2 is:
(a) $\frac{H_1}{H_2} = 25.8$
(b) $\frac{H_1}{H_2} = 1/25.8$
(c) $\frac{H_1}{H_2} = 1/45.8$
(d) $\frac{H_1}{H_2} = 45.8$

a.
b.
c.
d.

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