Unit 8 - Week 6

Assignment 6

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

Due on 2020-10-28, 23:59 IST.

1) A fluid initially at rest is set in motion inside a pipe of inner radius 'R' at a particular time 't'. Before achieving the steady state, the velocity (v_z) profile of the flow in the tube at a certain location in the axial direction, varies with time. Identify, which of the below conditions can be used to study the velocity profile along the pipe. *1 point*

- r = R, $v_z = v_\infty$, at t = 0
- r = 0, $v_z = 0$ at t = 0
- r = R, $v_z = 0$, at t > 0
- r = 0, $v_z = v_\infty$, at t = 0

No, the answer is incorrect.
Score: 0
Accepted Answers:
r = 0, $v_z = 0$ at t = 0
r = R, $v_z = 0$, at t > 0

2) In a turbulent flow through a cylindrical pipe, the ratio of the average velocity ($\bar{v}_z$) to the maximum velocity ($\bar{v}_{z,max}$) is equal to *1 point*

- $(1-\frac{r}{R})^{\frac{1}{7}}$
- $(\frac{r}{R})^{\frac{1}{7}}$
- $(1-\frac{1}{R})^{\frac{1}{16}}$
- $(1-\frac{7}{R})^{\frac{1}{r}}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$(1-\frac{r}{R})^{\frac{1}{7}}$

3) The pressure drop (ΔP) across the cylinder with a fluid in turbulent flow is *1 point*

- $\Delta P \propto Q$
- $\Delta P \propto Q^{-1}$
- $\Delta P \propto Q^{\frac{1}{3}}$
- $\Delta P \propto Q^{\frac{7}{4}}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\Delta P \propto Q^{\frac{7}{4}}$

4) Which of the following is true w.r.to a turbulent flow in a cylindrical pipe? *1 point*

- Near the pipe wall, $\frac{\partial v_z}{\partial z} > \frac{\partial v_z}{\partial r}$
- Near the pipe wall, $\frac{\partial v_z}{\partial z} = \frac{\partial v_z}{\partial r}$
- Near the pipe wall, $\frac{\partial v_z}{\partial z} < \frac{\partial v_z}{\partial r}$
- Flow is random at the centre

No, the answer is incorrect.
Score: 0
Accepted Answers:
Near the pipe wall, $\frac{\partial v_z}{\partial z} > \frac{\partial v_z}{\partial r}$
Flow is random at the centre

5) Define intensity of turbulence *1 point*

- $\frac{\sqrt{v_z'^2}}{\bar{v}_{z,max}}$
- $\frac{\bar{v}_{z,max}}{\sqrt{v_z'^2}}$
- $\frac{\bar{v}_{z,max}\sqrt{v_z'^2}}{\bar{v}_{z,max}}$
- $\bar{v}_{z,max} - \sqrt{v_z'^2}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{\sqrt{v_z'^2}}{\bar{v}_{z,max}}$

6) The velocity profiles in a turbulent flow can be obtained through *1 point*

- Diessler's formula
- Newton's law of viscosity
- Navier–Stokes equations
- Poiseuille equation

No, the answer is incorrect.
Score: 0
Accepted Answers:
Diessler's formula

7) Acetonitrile is used as the solvent phase in a chromatography operation. In the process, acetonitrile flows through an empty cylinder of inner diameter 4.6 mm and length 30 cm. The flow rate maintained is 1 ml/min. The process is operated at 25°C. The density and viscosity of the liquid at this temperature is 786 kg/m^3 and 0.343 mPa. s respectively. Calculate the Reynolds number for the flow. *2 points*

- 10.54
- 100.26
- 1000.54
- 2000

No, the answer is incorrect.
Score: 0
Accepted Answers:
10.54

8) Calculate the friction factor for the flow of acetonitrile mentioned above *1 point*

- 0.52
- 1.50
- 0.02
- 0.01

No, the answer is incorrect.
Score: 0
Accepted Answers:
1.50

9) Now consider the column through which acetonitrile was passed through in the above problem is packed with beads whose sphericity is 0.88 and void fraction 0.40 respectively. The diameter of the beads is 2.1 μm. Calculate the pressure gradient for the flow. *2 points*

- 5.68 kPa
- 2.09 kPa
- 0.89 kPa
- 8.69 kPa

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

10) Calculate the Reynolds number for the flow. *1 point*

- 8.6 x 10^{-3}
- 4.8x 10^{-3}
- 2.1 x 10^{-3}
- 10.6

No, the answer is incorrect.
Score: 0
Accepted Answers:
4.8x 10^{-3}