

Unit 7 - Week 5

Course outline
How to access the portal
Week 1
Week 2
Week 3
Week 4
Week 5
<input checked="" type="radio"/> Simple cases in fluid flow : cylindrical coordinate system <input type="radio"/> Pipe flow and porous medium <input type="radio"/> Transport Phenomena In Materials : Week 5 Feedback <input type="radio"/> Quiz : Assignment 5
Week 6
Week 7
week 8
Week 9
Week 10
Week 11
Week 12
DOWNLOAD VIDEOS

Assignment 5

The due date for submitting this assignment has passed. **Due on 2019-09-04, 23:59 IST.**
 As per our records you have not submitted this assignment.

- Which following relation correctly represent the relation between planar radial velocity (V_r) with radial distance (r) for an incompressible fluid flow radially outward from a line source in a steady manner? **1 point**
 - $V_r \times r^2 = \text{constant}$
 - $V_r \times r = \text{constant}$
 - $V_r \times r^3 = \text{constant}$
 - $V_r/r^2 = \text{constant}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
 $V_r \times r = \text{constant}$
- Consider axial flow in an annular gap between a shaft and a cylindrical cavity. The flow is induced purely through the uniform axial motion of the shaft. What is the shape of the velocity profile in the annular gap as a function of radial distance from the shaft to the inner cylindrical wall? **1 point**
 - Quadratic
 - Linear
 - Logarithmic
 - Exponential

No, the answer is incorrect.
Score: 0
Accepted Answers:
 Logarithmic
- Consider a laminar fully developed axial flow through a circular tube of 10 cm radius. The average velocity is 5 m/s. Determine the velocity at a distance 5 cm from the axis **1 point**
 - 10 m/s
 - 3.75 m/s
 - 2.5 m/s
 - 5 m/s

No, the answer is incorrect.
Score: 0
Accepted Answers:
 3.75 m/s
- For flow through pipes that have non-circular geometry, one generally defines the hydraulic radius. If the wettable surface area is doubled and the volume of the cavity is halved, how would the hydraulic radius change? **1 point**
 - Increases by 4 times
 - Decreases by 4 times
 - Hydraulic radius does not change
 - Increases by 2 times

No, the answer is incorrect.
Score: 0
Accepted Answers:
 $\text{Decreases by 4 times}$
- Consider Couette flow through an annular region between two cylindrical surfaces. The gap between the cylindrical surfaces is negligible compared to the inner and outer radii of the cylindrical surfaces. What is the best approximation for the shape of the Couette flow profile? **1 point**
 - Quadratic
 - Exponential
 - Linear
 - Hyperbolic

No, the answer is incorrect.
Score: 0
Accepted Answers:
 Linear
- Consider a flow regime through a porous medium made of a bed of spheres of uniform size. The flow can be described by the Blake-Kozeny equation. If the parameter S_0 (the surface area per unit volume of solid) is halved keeping all other parameters kept unchanged then how much does the permeability change? **1 point**
 - Decreased by factor of 2
 - Remains the same
 - Increased by a factor of 4
 - Increased by a factor of 8

No, the answer is incorrect.
Score: 0
Accepted Answers:
 $\text{Increased by a factor of 4}$
- What is the volumetric flow rate (in cm^3/s) for laminar flow through a pipe of diameter 40 mm and with an axial velocity of 1.5 m/s at the centre of the pipe? **1 point**
 - 3π
 - 30π
 - 300π
 - 3000π

No, the answer is incorrect.
Score: 0
Accepted Answers:
 300π
- According to Darcy's Law, the flow rate through a porous medium is proportional to the pressure gradient across it. What is the proportionality constant? **1 point**
 - Inverse of permeability coefficient
 - Permeability coefficient
 - Viscosity
 - Inverse of viscosity

No, the answer is incorrect.
Score: 0
Accepted Answers:
 $\text{Permeability coefficient}$
- The pressure drop across a horizontal pipe of 100 mm diameter and 10 m length is 50 kPa. The shear stress at the pipe wall in kPa is **1 point**
 - 0.25
 - 0.125
 - 0.50
 - 25

No, the answer is incorrect.
Score: 0
Accepted Answers:
 0.125
- Axial velocity of a laminar, steady and fully developed flow through a smooth and rigid pipe measured at the centre is found to be 2 m/s. Reynolds number for this flow regime is around 800. What is the average flow velocity in m/s? **1 point**
 - 2
 - 1
 - 400
 - 0.0025

No, the answer is incorrect.
Score: 0
Accepted Answers:
 1
- In what regime of Reynolds number (redefined as Re_E) is the Blake-Kozeny equation valid to describe the flow through a porous body? **1 point**
 - $Re_E \gg 2$
 - $Re_E > 2400$
 - $Re_E \rightarrow \infty$
 - $Re_E \rightarrow 0$

No, the answer is incorrect.
Score: 0
Accepted Answers:
 $Re_E \rightarrow 0$
- Consider axial flow in an annular gap (δ) between a shaft and a stationary cylindrical cavity. The diameter of the shaft is D . The flow is induced purely through the uniform axial motion of the shaft through the cylindrical cavity. If the velocity of the shaft is U_0 then which of the following statements is false? **1 point**
 - Velocity of the fluid at the surface of the shaft is U_0
 - Velocity of the fluid at the inner surface of the cylindrical cavity is 0
 - Velocity profile is linear when $\delta \approx D$
 - Velocity profile is linear when $\delta \ll D$

No, the answer is incorrect.
Score: 0
Accepted Answers:
 $\text{Velocity profile is linear when } \delta \approx D$
- Consider creeping flow of a liquid through a porous medium comprised of a bed of spheres of uniform size. If the diameter of the spheres is halved, how does the surface area per unit volume of solid change? **1 point**
 - Increased by 4 times
 - Increased by 2 times
 - Decreased by 2 times
 - Decreased by 8 times

No, the answer is incorrect.
Score: 0
Accepted Answers:
 $\text{Increased by 2 times}$
- Consider creeping flow of a liquid through a porous medium comprised of a bed of spheres of uniform size. What happens to the superficial flow velocity when both the pressure drop and sphere diameter are doubled? **1 point**
 - Decreased by a factor of 8
 - Increased by a factor of 8
 - Decreased by a factor of 2
 - Increased by a factor of 2

No, the answer is incorrect.
Score: 0
Accepted Answers:
 $\text{Increased by a factor of 8}$
- Choose the quantity that is balanced in the Navier Stoke's equation. **1 point**
 - Energy
 - Mass
 - Pressure
 - Momentum

No, the answer is incorrect.
Score: 0
Accepted Answers:
 Momentum
- Consider the definition of hydraulic radius for a porous medium. If the wettable surface area per unit volume of the solid (S_0) is kept constant, how does the hydraulic radius change when the void fraction is increased from 0.3 by 10? **1 point**
 - Increases by 5 %
 - Increases by 15 %
 - Decreases by 5 %
 - Decreases by 10 %

No, the answer is incorrect.
Score: 0
Accepted Answers:
 $\text{Increases by 15 \%}$
- Consider axial, steady, fully developed flow through a tube due to a body force F_z . If the body force is increased by a factor of 2 keeping all other parameters constant, how does the mass flow rate change? **1 point**
 - Decreases by a factor of 2
 - Increases by a factor of 2
 - Decreases by a factor of 4
 - Increases by a factor of 4

No, the answer is incorrect.
Score: 0
Accepted Answers:
 $\text{Increases by a factor of 2}$
- In Hagen-Poiseuille flow through a cylindrical tube, the radial profile of shear stress is **1 point**
 - Parabolic
 - Constant
 - Linear
 - Cubic

No, the answer is incorrect.
Score: 0
Accepted Answers:
 Linear
- What will be the shape of a free surface for the situation in which a vertical cylindrical container, partly filled with liquid, is rotated with an angular velocity ω about its axis? **1 point**
 - Linear
 - Cubic
 - Parabolic
 - Hyperbolic

No, the answer is incorrect.
Score: 0
Accepted Answers:
 Parabolic
- The average superficial velocity through a porous body is 3 m/s. If the void fraction is 0.3, what is the average actual velocity in m/s? **1 point**
 - 0.1
 - 0.9
 - 3
 - 10

No, the answer is incorrect.
Score: 0
Accepted Answers:
 10