X

reviewer2@nptel.iitm.ac.in ▼

Courses » **Modeling Transport Phenomena of Microparticles**

Announcements **Course** Ask a Question Progress

Unit 8 - Week 7

Course outline

Week 7: Assignment

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

Due on 2017-03-16, 23:59 IST.

1) *1 point*

Consider the flow of a viscous fluid of viscocity μ in a parallel plate microchannel of height h. The lower wall $(y = 0)$ of the channel is hydrophobic with slip length β. The flow is driven by a constsnt pressure gradient $G = -dp/dx$ along the length of the channel. The expression for the axial velocity, $u(y)$ is

a) $\frac{1}{2\mu}\frac{dp}{dx}(y^2 - h^2) + \frac{h^2}{2\mu(\beta+h)}\frac{dp}{dx}(y - h)$

b) $-\frac{1}{2\mu}\frac{dp}{dx}(y^2 - h^2) - \frac{h^2}{2\mu(\beta+h)}\frac{dp}{dx}(y - h)$

c) $\frac{1}{2\mu}\frac{dp}{dx}(y^2 - h^2) - \frac{h^2}{2\mu(\beta+h)}\frac{dp}{dx}(y - h)$

d) $-\frac{1}{2\mu}\frac{dp}{dx}(y^2 - h^2) + \frac{h^2}{2\mu(\beta+h)}\frac{dp}{dx}(y - h)$

No, the answer is incorrect.
Score: 0

Accepted Answers:
c) $\frac{1}{2\mu}\frac{dp}{dx}(y^2 - h^2) - \frac{h^2}{2\mu(\beta+h)}\frac{dp}{dx}(y - h)$

2) The expression for the volumetric flow at any cross-section for problem 1 is *1 point*

a) $\frac{h^3}{3\mu}\frac{dp}{dx} + \frac{h^4}{4\mu(\beta+h)}\frac{dp}{dx}$

b) $-\frac{h^3}{3\mu}\frac{dp}{dx} + \frac{h^4}{4\mu(\beta+h)}\frac{dp}{dx}$

c) $-\frac{h^3}{3\mu}\frac{dp}{dx} - \frac{h^4}{4\mu(\beta+h)}\frac{dp}{dx}$

d) $\frac{h^3}{3\mu}\frac{dp}{dx} - \frac{h^4}{4\mu(\beta+h)}\frac{dp}{dx}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
b) $-\frac{h^3}{3\mu}\frac{dp}{dx} + \frac{h^4}{4\mu(\beta+h)}\frac{dp}{dx}$

3) *1 point*

Consider an electroosmotic flow which is driven by a constant electric field E_0 along the axis (x-axis) of the par plate microchannel whose height is h with the surface potential $\zeta < \phi_0$ and the walls are hydrophobic with slip β. The Debye layer is considered to thin i.e., $\kappa h >> 1$, where $\kappa^{-1} = \lambda$, the Debye length. Assume Debye-Huck approximation to hold. Consider the lower wall of the channel as the x-axis. The expression for $\frac{du}{dy}$ is :

a) $U_{HS}\kappa e^{-\kappa y}$

$-U_{HS}\kappa e^{-\kappa y}$

$U_{HS}\kappa e^{\kappa y}$

$-U_{HS}\kappa e^{\kappa y}$. Here $U_{HS} = -\frac{\varepsilon_e E_0 \zeta}{\mu}$ is the Helmholtz-Smoluchowski velocity.

No, the answer is incorrect.
Score: 0

Accepted Answers:
a) $U_{HS}\kappa e^{-\kappa y}$

4) The form of axial velocity, $u(y)$ for problem 1 is : *1 point*

a) $U_{HS}(1 + \beta\kappa + e^{-\kappa y})$

b) $U_{HS}(1 - \beta\kappa - e^{-\kappa y})$

c) $U_{HS}(1 - \beta\kappa + e^{-\kappa y})$

d) $U_{HS}(1 + \beta\kappa - e^{-\kappa y})$. Here $U_{HS} = -\frac{\varepsilon_e E_0 \zeta}{\mu}$ is the Helmholtz-Smoluchowski velocity.

No, the answer is incorrect.
Score: 0

Accepted Answers:
d) $U_{HS}(1 + \beta\kappa - e^{-\kappa y})$. Here $U_{HS} = -\frac{\varepsilon_e E_0 \zeta}{\mu}$ is the Helmholtz-Smoluchowski velocity.

5) The second-order forward difference formula for $\frac{df}{dx}$ at $x = x_i$ is *1 point*

a) $\frac{-3f(x_i)+4f(x_{i+1})-f(x_{i+2})}{h}$

b) $\frac{-3f(x_i)+4f(x_{i+1})-f(x_{i+2})}{2h}$

c) $\frac{3f(x_i)-4f(x_{i+1})+f(x_{i+2})}{2h}$

d) $\frac{3f(x_i)-4f(x_{i+1})-f(x_{i+2})}{2h}$, where $x_{i+1} = x_i + h$.

No, the answer is incorrect.
Score: 0

Accepted Answers:
b) $\frac{-3f(x_i)+4f(x_{i+1})-f(x_{i+2})}{2h}$

6) The second-order backward difference formula for $\frac{df}{dx}$ at $x = x_i$ is *1 point*

a) $\frac{f(x_{i-2})-4f(x_{i-1})+3f(x_i)}{2h}$

b) $\frac{-f(x_{i-2})+4f(x_{i-1})-3f(x_i)}{2h}$

c) $\frac{f(x_{i-2})-4f(x_{i-1})-3f(x_i)}{3h}$

d) $\frac{f(x_{i-2})-4f(x_{i-1})+3f(x_i)}{h}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
a) $\frac{f(x_{i-2})-4f(x_{i-1})+3f(x_i)}{2h}$

7) Consider the boundary value problem $\frac{d^2y}{dx^2} = x + y,\ y(0) = y(1) = 0$. Then $y(0.25)$ is *1 point*

a) -0.03488
b) 0.03488
c) 0.06976
d) -0.06976

No, the answer is incorrect.
Score: 0

Accepted Answers:
a) -0.03488

8) For problem 7, $y(0.5)$ is *1 point*

a) 0.05632
b) -0.11264

c) -0.05003
d) -0.03488

No, the answer is incorrect.
Score: 0

Accepted Answers:
c) -0.05003

9) $y(0.75)$ for problem 1 is *1 point*

a) -0.03488
b) -0.01003
c) 0.05003
d) -0.05003

No, the answer is incorrect.
Score: 0

Accepted Answers:
d) -0.05003

10) *1 point*
If the BVP given in problem 7 is computed for $h = 0.01$ then the order of the truncation error and the number of linear algebraic equations to solve are

a) $O(10^{-2})$ and 99
b) $O(10^{-4})$ and 99
c) $O(10^{-4})$ and 49
d) $O(10^{-2})$ and 49

No, the answer is incorrect.
Score: 0

Accepted Answers:
b) $O(10^{-4})$ and 99

Previous Page End