Unit 7 - Week 5

Assignment 5

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

Due on 2020-03-04, 23:59 IST.

1) *1 point*

True or False: Consider both the statements, and even if one of them is false then mark the entire answer as false, else mark the answer as true.

The turbulent viscosity, often known as the eddy viscosity is a strong function of position and intensity of turbulence.
Unlike the dynamic viscosity, the eddy viscosity is a property of the flow, and hence it may even have a negative value in some regions of the flow domain.

a. True
b. False

- a
- b

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

2) *1 point*

True or False: Consider both the statements, and even if one of them is false then mark the entire answer as false, else mark the answer as true.

The Blasius solution for boundary layer flow is often quite restrictive in application, since it is applicable only for the case of laminar boundary layer over a flat plate.
On the other hand, the solution for the general expression derived by von Karman, in the momentum integral method, requires a knowledge of the velocity as a function of the distance from the surface, and the accuracy of the final result will depend on how closely the assumed velocity profile approaches the real one.

a. True
b. False

- a
- b

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

3) *1 point*

True or False: Consider both the statements, and even if one of them is false then mark the entire answer as false, else mark the answer as true.

In a turbulent flow, the fluid and the flow variables do not vary with time, for example, the instantaneous velocity vector, will not differ from the average velocity vector in either magnitude or direction.

In a turbulent flow, while the velocity might appear to be steady in its mean value, small random fluctuations in velocity might occur about the mean value. Therefore, one could express the fluid and the flow variables in terms of a mean value and a fluctuating value.

a. True
b. False

- a
- b

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

4) *1 point*

True or False: Consider both the statements, and even if one of them is false then mark the entire answer as false, else mark the answer as true.

The turbulent contribution to shear stress is called Reynolds stress.
In turbulent flows, the magnitude of the Reynolds stress is comparable to the molecular contributions to stress in the entire flow field.

a. True
b. False

- a
- b

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

5) *1 point*

Consider the flow of a liquid over a flat plate of length 1-meter. The velocity of the liquid is 50 m/s, the kinematic viscosity of the liquid is $5.5\times10^{-6}\ \frac{m^2}{s}$. Using the boundary layer analysis, determine the value of mean skin friction coefficient (approx.) at length x = 1 m.

For Laminar flow:

$$C_{fL} = \frac{1.328}{\sqrt{\mathrm{Re}_L}}$$

For Turbulent flow:

$$C_{fL} = 0.0575\,\mathrm{Re}_L^{-1/5}$$

a. 9×10^{-4}
b. 4×10^{-5}
c. 2×10^{-3}
d. 9.09×10^{-6}

- a
- b
- c
- d

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

6) *1 point*

Choose the correct condition which is best described by the following boundary condition for momentum integral equation over a flat plate: $\eta = 1, \frac{v_x}{U} = 1$,

where U is the free stream velocity, and all other symbols have their usual meaning.

a. No slip at the liquid solid interface
b. At the edge of boundary layer where the velocity approaching is the free stream velocity
c. The entrainment of liquid by vapour at the edge of the boundary layer
d. None of the above

- a
- b
- c
- d

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

7) *1 point*

Determine the wall shear stress for flow over a flat plate using the momentum integral equation if the velocity profile is $\frac{u}{U} = \sin\left(\frac{\pi}{2}\frac{y}{\delta}\right)$, where U is the free stream velocity.

a. $0.12\rho U^2 \frac{d\delta}{dx}$
b. $0.34U^2 \frac{d\delta}{dx}$
c. $0.137\rho U^2 \frac{d\delta}{dx}$
d. $0.128\rho U \frac{d\delta}{dx}$

- a
- b
- c
- d

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

8) *1 point*

Assuming the fluid in Q:7 to be Newtonian, determine the value of $\left(\frac{\delta}{x}\right)$ (choose the closest option)

a. $\frac{5}{\sqrt{\mathrm{Re}_x}}$
b. $\frac{20}{\sqrt{\mathrm{Re}_x}}$
c. $\frac{1}{\sqrt{\mathrm{Re}_x}}$
d. $\frac{7}{\sqrt{\mathrm{Re}_x}}$

- a
- b
- c
- d

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

9) *1 point*

Choose the correct statement

a. Momentum integral equation is a partial differential equation
b. Momentum integral equation cannot be used for non-Newtonian fluid
c. Momentum integral equation can be used for both laminar and turbulent flow
d. All the above statements are true

- a
- b
- c
- d

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

10) *1 point*

True or False: Consider the two statements and even if one of them is false then mark the entire answer as false, else mark the answer as true.

The thickness of the boundary layer, δ, is arbitrarily taken as the distance away from the surface where the velocity reaches 99% of the free-stream velocity.

For the flow of fluids at very low speeds and with large viscosity, it is possible to delete the inertial terms from the Navier-Stokes (NS) equation; however, for flows at high velocity and small viscosity, it is not always logical to delete the viscous term from the NS equation.

a. True
b. False

- a
- b

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