Unit 3 - Week 1

Course outline

How does an NPTEL online course work?

Week 0

Week 1

- Lecture 1: Introduction : Newton's Law of Viscosity
- Lecture 2: Fourier and Fick's Laws
- Lecture 3: Shell Momentum Balance
- Lecture 4: Example of Shell Momentum Balance
- Lecture 5: Example of Shell Momentum Balance (Contd.)
- Quiz : Assignment 1
- Week 1 Feedback Form

Week 2

Week 3

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Assignment Detailed Solution

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Assignment 1

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

Due on 2020-02-12, 23:59 IST.

1) **True or False:** Consider both the statements, and even if one of them is false, then mark the entire question as false, else mark the question as true. *1 point*

An offshoot of studying transport phenomena is not only to understand the processes but also to identify the dimensionless numbers. Additionally, these dimensionless numbers enable us in understanding that it is possible to use the dimensionless numbers from one transport phenomenon to the other, without having to individually calculate them.

a) True
b) False

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

2) **True or False:** Consider both the statements, and even if one of them is false, then mark the entire question as false, else mark the question as true. *1 point*

Any equation that comes out of the differential approach is valid at every point in the flow-field. On the other hand, the integral approach gives us a point-by-point value and not an average value.

a) True
b) False

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

3) **True or False:** Consider both the statements, and even if one of them is false, then mark the entire question as false, else mark the question as true. *1 point*

There is a significant similarity between heat and mass transfer and that is due to the fact that temperature and concentration are scalar quantities, whereas velocity is a vector. Therefore, the shear stress (which is a gradient of a vector quantity) is a 'tensor', and on the other hand, both the heat and mass transfer fluxes are vectors.

a) True
b) False

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

4) Viscosity is a very important property of a fluid, and it is a strong function of temperature. Therefore, for a liquid, the viscosity ___i____ with an increase in temperature, and the SI unit of viscosity is _____ii_____ *1 point*

a. i – Increases, ii – Pa. s
b. i – Increases, ii – Pa/ (m. s)
c. i – Decreases, ii – kg/ (m^3. s)
d. i – Decreases, ii – Pa. s

a
b
c
d

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

5) The shear stress, τ_{yx} is usually denoted with two subscripts, (viz. x and y in the present case). The subscript y signifies which of the following: *1 point*

a. The component of momentum being transported
b. The direction along which the momentum is being transported
c. The direction of the shear stress
d. The unit vector perpendicular to the velocity gradient

No, the answer is incorrect.
Score: 0
Accepted Answers:
b. The direction along which the momentum is being transported

6) The boundary condition of no-shear at the liquid-vapor interface is not valid for which of the following situations: *1 point*

a. High surface tension of the liquid
b. High boiling point of the liquid
c. High relative velocity between the two phases
d. High interfacial slip between the two phases

No, the answer is incorrect.
Score: 0
Accepted Answers:
c. High relative velocity between the two phases

7) **True or False:** Consider both the statements, and even if one of them is false, then mark the entire question as false, else mark the question as true. *1 point*

During the analysis of fluid flow, we are more often interested in obtaining the average velocity, and one of the most common ways of obtaining the average velocity is to take an average across the flow cross-section. This is called the area-averaged velocity, averaged along the direction parallel to the principal direction of flow.

a) True
b) False

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

8) Consider a fluid flowing over an inclined flat plate under the influence of gravity. The fluid has a kinematic viscosity of 2×10^{-3} m^2 s^{-1}, density of 1200 kg m^{-3}, and the angle of inclination of the plate is 30° with the vertical. If the maximum velocity of the falling film is 0.9 m s^{-1}, calculate the area-averaged velocity of the film (in cm s^{-1}). [Hint: Use the relationship between the average and maximum velocities of the fluid] *1 point*

a) 150
b) 120
c) 60
d) 30

No, the answer is incorrect.
Score: 0
Accepted Answers:
c) 60

9) Consider a liquid with kinematic viscosity 4×10^{-3} m^2 s^{-1}, flowing over an inclined plate (angle of inclination = 45° with the vertical). Calculate the film thickness (in m.) at a distance of 0.05 m from the origin, if the film travels at a velocity of 0.1 cm s^{-1}. *1 point*

a) 1.25
b) 0.05
c) 0.01
d) 1.05

No, the answer is incorrect.
Score: 0
Accepted Answers:
b) 0.05

10) For a liquid with a density of 800 kg m^{-3} and viscosity of 0.1 Pa. s, flowing over a vertically oriented flat plate of dimensions (L*W) = 2*3 cm^2, calculate the mass flow rate (in kg s^{-1}) if the film thickness is 1 mm. *1 point*

a. 0.00063
b. 0.000063
c. 0.063
d. 6.3

No, the answer is incorrect.
Score: 0
Accepted Answers:
a. 0.00063