Unit 3 - Week 2

Course outline

How does an NPTEL online course work?

Week 1

Week 2

- Lecture 6: Forced Convection: High Prandtl Number over a Flat Plate
- Lecture 7: Forced Convection over a Flat Plate: Uniform Heat Flux
- Lecture 8: Natural Convection: Uniform Wall Temperature
- Lecture 9: Natural Convection: Uniform Heat Flux
- Lecture 10: Tutorial: Convection over Flat Plate
- Quiz : Assignment 2
- Solution : Assignment 2

Week 3

Week 4

Text Transcripts

Download Videos

FEEDBACK

Assignment 2

The due date for submitting this assignment has passed. **Due on 2020-03-11, 23:59 IST.**
As per our records you have not submitted this assignment.

1) For flat plate subjected to uniform heat flux, surface temperature can be non-dimensionalized by *1 point*

- q_w/T_∞
- q_wL/k
- $q_w/(T-T_\infty)$
- q_w

No, the answer is incorrect.
Score: 0
Accepted Answers:
q_wL/k

2) Similarity variable for boundary layer in natural convection with constant temperature will be *1 point*

- $y/x^{1/2}$
- y/x
- $y/x^{1/4}$
- $y/x^{1/3}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$y/x^{1/4}$

3) In context of natural convection boundary layer with constant heat flux which boundary condition is not valid *1 point*

- $G'(0) = 1$
- $G(\infty) = 0$
- $F'(0) = 0$
- $F'(\infty) = 0$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$G'(0) = 1$

4) $Nu_x = 0.644\ Ra_x^{(1/5)}\ Pr^{(1/5)}$ is valid for *1 point*

- Natural convection constant heat flux, $Pr \rightarrow \infty$
- Natural convection constant wall temperature, $Pr \rightarrow 0$
- Forced convection constant heat flux, $Pr \rightarrow 0$
- Natural convection constant heat flux, $Pr \rightarrow 0$

No, the answer is incorrect.
Score: 0
Accepted Answers:
Natural convection constant heat flux, $Pr \rightarrow 0$

5) Air at 100 °C and velocity of 0.1 m/s flows over both surfaces of a 1 m long flat plate maintained at 20 °C. Determine local Nusselt number using $Nu_x=0.3387\ Re_x^{(1/2)}\ Pr^{(1/3)}$. Take, $k_{oil}=0.14$ W/mK, $\nu=86.1\times10^{-6}$ m2/s, Pr=1081 *1 point*

- 64
- 118
- 12
- 234

No, the answer is incorrect.
Score: 0
Accepted Answers:
118

6) For the problem mentioned above evaluate local heat flux in W/m^2 *1 point*

- 1327
- 784
- 2059
- 1752

No, the answer is incorrect.
Score: 0
Accepted Answers:
1327

7) Air at 27 °C with a free stream velocity of 10 m/s is used to cool electronic devices mounted on a printed circuit board. Each device, 4 mm by 4 mm, dissipates 40 mW which is removed from the top surface. Estimate the Nusselt number at a location of 15 mm from leading edge for the cooling process. *1 point*
Take k=0.0274 W/mK, Pr = 0.705, $\alpha = 24.7\times10^{-6}$ m2/s
$Nu_x=0.886\ Re_x^{(1/2)}\ Pr^{(1/2)}$

- 111.7
- 13.43
- 57.6
- 69.05

No, the answer is incorrect.
Score: 0
Accepted Answers:
69.05

8) For the above problem estimate the surface temperature of the electronic device at a location of 15 mm from leading edge of the board. *1 point*

- 64.3 °C
- 46.8 °C
- 30.7 °C
- 23.4 °C

No, the answer is incorrect.
Score: 0
Accepted Answers:
46.8 °C

9) Water is heated by a 200 mm×200 mm vertical flat plate which is maintained at 60 °C. Find the following quantities when the water is at 60 °C. Find the average heat transfer coefficient in W/m^2K, when the water is at 20 °C. At mean film temperature of $T_f = (60+20)/2 = 40$ °C, the relevant physical parameters can be taken as k = 0.628 W/mK, Pr = 4.34, ρ= 994.59 kg/m^3, $\nu = 0.658\times10^{-6}$ m2/s, $\beta = 3\times10^{-4}\ K^{-1}$. Use $Nu_L=0.1(Gr_L\ Pr)^{1/3}$ if the flow is turbulent. *1 point*

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 660,667

10) Estimate the rate of heat transfer in W for the previous problem. *1 point*

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 1050,1070