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Courses » Computational Fluid Dynamics Announcements **Course** Ask a Question Progress FAQ

Unit 4 - Week 3

Week 3 : Assignment

The due date for submitting this assignment has passed. **Due on 2018-09-05, 23:59 IST.**
As per our records you have not submitted this assignment.

1) *1 point*

The governing equation for velocity in a non-dimensional form for one-dimensional steady fully developed fluid is given by

$$\frac{d^2u}{dx^2} + u + x = 0$$

with the boundary conditions $u(0) = u(1) = 0$.

Considering a trial function of $u = a\sin \pi x$, the value of the parameter a by following the Least Square Method is

(a) $a = \frac{1}{(\pi^2 - 1)}$

(b) $a = \frac{1}{\pi(\pi^2 - 1)}$

(c) $a = \frac{2}{\pi(\pi^2 - 1)}$

(d) $a = \frac{2}{(\pi^2 - 1)}$

No, the answer is incorrect.
Score: 0

Accepted Answers:

(c) $a = \frac{2}{\pi(\pi^2 - 1)}$

2) *0 points*

The governing equation for velocity in a non-dimensional form for one-dimensional steady fully developed fluid is given by

$$\frac{d^2u}{dx^2} + u + x = 0$$

with the boundary conditions $u(0) = u(1) = 0$.

Considering a trial function of $u = a\sin \pi x$, u can be expressed following the Point collocation Method is

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(b) $u=\frac{1}{\pi(\pi^2-1)}\sin\pi x$

(c) $u=\frac{2}{\pi^2-1}\sin\pi x$

(d) $u=\frac{1}{\pi^2-1}\sin\pi x$

No, the answer is incorrect.
Score: 0

Accepted Answers:
(d) $u=\frac{1}{\pi^2-1}\sin\pi x$

3) *1 point*

The governing equation for velocity in a non-dimensional form for one-dimensional steady fully developed fluid is given by

$$\frac{d^2u}{dx^2}+u+x=0$$

with the boundary conditions $u(0)=u(1)=0$.

Considering a trial function of $u=a\sin\pi x$, the value of the parameter a by following the Galerkin's Method is

(a) $a=\frac{1}{(\pi^2-1)}$

(b) $a=\frac{1}{\pi(\pi^2-1)}$

(c) $a=\frac{2}{\pi(\pi^2-1)}$

(d) $a=\frac{2}{(\pi^2-1)}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
(c) $a=\frac{2}{\pi(\pi^2-1)}$

4) *1 point*

The governing equation for velocity in a non-dimensional form for one-dimensional steady fully developed fluid is given by

$$\frac{d^2u}{dx^2}+u+x=0$$

with the boundary conditions $u(0)=u(1)=0$.

Considering a trial function of $u=a\sin\pi x$, u can be expressed following the Rayleigh –Ritz Method is

(a) $u=\sin\pi x$

(b) $u=\frac{2}{\pi(\pi^2-1)}\sin\pi x$

(c) $u = \frac{1}{\pi(\pi^2 - 1)} \sin \pi x$

(d) $u = \frac{1}{\pi^2 - 1} \sin \pi x$

No, the answer is incorrect.
Score: 0

Accepted Answers:
(b) $u = \frac{2}{\pi(\pi^2 - 1)} \sin \pi x$

5) **1 point**

Consider a 1 mm diameter, 50 mm long aluminium pin-fin used to enhance heat transfer for the surface wall maintained at 300^0 C. The governing differential equation and boundary equation are given by:

$$k\frac{d^2T}{dx^2} = \frac{Ph}{A_c}(T - T_\infty)$$

$$T(x=0) = T_w = 300^0 C$$

$$\left.\frac{dT}{dx}\right|_{x=L} = 0 \quad \text{(insulated tip)}$$

Let k= 200 w/m°C , h=20 w/m² °C , $T_\infty = 30^0 C$

What is the temperature distribution in the fin using the Galerkin weighed residual method? Assume trial solution is : $T(x) \approx c_0 + c_1 x + c_2 x^2 = \hat{T}(x)$

(a) $\hat{T}(x) = 300 + 38751.43(x^2 - 2Lx)$

(b) $\hat{T}(x) = 300 + 18751.43(x^2 - 2Lx)$

(c) $\hat{T}(x) = 150 + 38751.43(x^2 - 2Lx)$

(d) $\hat{T}(x) = 150 + 18751.43(x^2 - 2Lx)$

No, the answer is incorrect.
Score: 0

Accepted Answers:
(a) $\hat{T}(x) = 300 + 38751.43(x^2 - 2Lx)$

6) **1 point**

For one dimensional steady heat conduction with heat generation, the governing equation is $\frac{d}{dx}\left(k\frac{dT}{dx}\right) + s = 0$

Assume boundary condition $\left.\frac{dT}{dx}\right|_{x=0} = 0$ and $T|_{x=L} = \tilde{T}$

Discretize the domain using F.E.M (finite element method) for temperature distribution using the Galerkin weighted residual method , a trial solution is $T(x) \approx \hat{T}(x) = a + bx$

This trial solution valid over:

(a) Valid over individual nodes
(b) Valid over individual element
(c) Valid over all domain nodes
(d) Valid over all domain elements

No, the answer is incorrect.
Score: 0

Accepted Answers:

(b) Valid over individual element

7) In order to discretize the term $\frac{\partial u}{\partial y}$, the order of accuracy in forward, backward and central difference scheme is respectively regarding finite difference method **1 point**

- (a) 1, 2 and 1
- (b) 2, 1 and 2
- (c) 1, 1 and 2
- (d) 1, 1 and 1

No, the answer is incorrect.
Score: 0

Accepted Answers:
(c) 1, 1 and 2

8) **1 po**

For one dimensional heat conduction governing equation is $k\frac{d^2T}{dx^2}=0$, for domain x =

to x=10 cm. The boundary conditions are:

Boundary condition I: at x=0 cm, heat flux = 1W/m^2 and at x= 10 cm, heat flux = 1W/m^2

Boundary condition II: at x=0 cm, T = 310 K, and at x= 10 cm, heat flux = 1W/m^2

Which of the following statements are correct?

- (a) Solution is inconsistent for both the boundary conditions
- (b) Solution is consistent for both the boundary conditions and for BC I, solution is unique.
- (c) Solution is consistent for both the boundary conditions and for BC II, solution is unique.
- (d) Solution is consistent and unique for both the boundary conditions.

No, the answer is incorrect.
Score: 0

Accepted Answers:
(c) Solution is consistent for both the boundary conditions and for BC II, solution is unique.

9) ***0 points***

For free tip of a fin, the boundary condition at tip is given by:

$-k\frac{dT}{dx}\bigg|_{x=L}=h(T_L-T_\infty)$, here all terms have usual meaning. Regarding this consider following statements:

Statement I: This is valid only for steady case.

Statement II: Valid for transient case at any instant of time.

Statement III: Not valid for transient case at any instant.

Select the correct option regarding these statements

- (a) Statement I and II are correct.
- (b) Statement I and III are correct.
- (c) Only I is correct.
- (d) Only II is correct

No, the answer is incorrect.
Score: 0

Accepted Answers:
(a) Statement I and II are correct.

10) ***1 point***

Consider the example of simply supported bean under uniformly distributed load. The governing equation is $EI\frac{d^4v}{dx^4}-q_0=0$ for x = 0 to x = L. Boundary condition are: $v(0)=0$, $\frac{d^2v}{dx^2}(0)=0$ and $v(L)=0$, $\frac{d^2v}{dx^2}(L)=0$. Assume trial solution as $v(x)\approx\hat{v}(x)=a\sin(\pi x/L)$ for weighted residual approach set residual at L/4 is equal to zero. The solution is:

- (a) $\hat{v}(x)=\frac{\sqrt{2}}{\pi^4}\frac{q_0L^4}{EI}\sin\frac{\pi x}{L}$
- (b) $\hat{v}(x)=\frac{\sqrt{2}}{\pi^4}\frac{q_0L^3}{EI}\sin\frac{\pi x}{L}$
- (c) $\hat{v}(x)=\frac{\sqrt{2}}{\pi^4}\frac{q_0L^2}{EI}\sin\frac{\pi x}{L}$
- (d) $\hat{v}(x)=\frac{\sqrt{2}}{\pi^4}\frac{q_0L}{EI}\sin\frac{\pi x}{L}$

No, the answer is incorrect.
Score: 0

Accepted Answers:

(a) $\hat{v}(x)=\frac{\sqrt{2}}{\pi^4}\frac{q_0L^4}{EI}\sin\frac{\pi x}{L}$

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