

Unit 3 - Week 0: Prerequisite

Course outline
How does an NPTEL online course work?
MATLAB
Week 0: Prerequisite
Quiz : Assignment 0
Week 1: Variational Calculus and Minimization Problem
Week 2: One dimensional Finite Element Analysis
Week 3: Structural Elements in One Dimensional FEM
Week 4: Structural Elements in One Dimensional FEM
Week 5: Structural Elements in One Dimensional FEM, and Generalized One Dimensional Finite Element Code in Computer Programming
Week 6: Brief Background of Tensor Calculus
Week 7: Two dimensional Scalar field problems
Week 8: Two dimensional Scalar field problems
Week 9: Two dimensional Scalar and Vector field problems
Week 10: Two dimensional Vector field and Eigen value problems
Week 11: Eigen value problems and Transient problem in 1D & 2D Scalar Valued Problems
Week 12: FEM formulation for 3D Elastic problem and challenges
Live session: Dr. Atanu Banerjee, Date : 16/12/2020 Time : 3:15:00 PM

Assignment 0

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

Due on 2020-09-14, 23:59 IST.

Use Gaussian Elimination method to solve following system of equations (Question number 1 and 2)

$$\begin{bmatrix} 12 & 8 & 9 \\ 4 & 5 & 6 \\ 10 & 7 & 3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 22 \\ 12 \\ 30 \end{bmatrix}$$

1) Write the augmented matrix after forward elimination

1 point

- i. $\begin{bmatrix} 12.0000 & 8.0000 & 9.0000 & 22.0000 \\ 0.0000 & 4.5000 & 5.0000 & 7.0000 \\ 0.0000 & 0.0000 & 4.9286 & 10.0000 \end{bmatrix}$
- ii. $\begin{bmatrix} 12.0000 & 8.0000 & 9.0000 & 22.0000 \\ 0.0000 & 4.3333 & 5.0000 & 7.0000 \\ 0.0000 & 0.0000 & -4.9286 & 11.0000 \end{bmatrix}$
- iii. $\begin{bmatrix} 12.0000 & 8.0000 & 9.0000 & 22.0000 \\ 0.0000 & 2.3333 & 3.0000 & 4.6667 \\ 0.0000 & 0.0000 & -4.9286 & 11.0000 \end{bmatrix}$
- iv. $\begin{bmatrix} 12.0000 & 8.0000 & 9.0000 & 22.0000 \\ 0.0000 & 4.3333 & 15.0000 & 2.0000 \\ 0.0000 & 0.0000 & -4.9286 & 11.0000 \end{bmatrix}$

No, the answer is incorrect. Score: 0

Accepted Answers:

iii. $\begin{bmatrix} 12.0000 & 8.0000 & 9.0000 & 22.0000 \\ 0.0000 & 2.3333 & 3.0000 & 4.6667 \\ 0.0000 & 0.0000 & -4.9286 & 11.0000 \end{bmatrix}$

2) Choose the final solution

1 point

- i. $x_1 = 0.2503, x_2 = 5.8694, x_3 = 10.3503$
- ii. $x_1 = 0.2609, x_2 = 4.8696, x_3 = -2.2319$
- iii. $x_1 = 0.2609, x_2 = -5.8694, x_3 = 8.4567$
- iv. $x_1 = 0.2609, x_2 = 3.4876, x_3 = -2.2319$

No, the answer is incorrect. Score: 0

Accepted Answers:

ii. $x_1 = 0.2609, x_2 = 4.8696, x_3 = -2.2319$

3) Let $f(x, y) = \sin(x^4 + 3y)$, where $x = 5t$ and $y = t^2 + 1$, and $F(t) = f(x(t), y(t))$. Evaluate dF/dt

1 point

- i. $(2500t^3 + 6t) \cos(625t^4 + 3t^2 + 3)$
- ii. $(500t^3 + 6t) \sin(625t^4 + 3t^2 + 3)$
- iii. $(500t^2 + 12t) \sin(125t^4 + 30t^2 + 3)$
- iv. $2500t^3 \cos(625t^4 + 3t^2 + 3)$

No, the answer is incorrect. Score: 0

Accepted Answers:

i. $(2500t^3 + 6t) \cos(625t^4 + 3t^2 + 3)$

4) Given a curve $C = r(t) = [5\cos t, 5\sin t, 0]$, find a unit tangent vector at the point $(4, 3, 0)$.

1 point

- i. $[\frac{2}{5}, \frac{4}{5}, 0]$
- ii. $[-3, 4, 0]$
- iii. $[\frac{4}{5}, \frac{3}{5}, 0]$
- iv. $[-\frac{3}{5}, \frac{4}{5}, 0]$

No, the answer is incorrect. Score: 0

Accepted Answers:

iv. $[-\frac{3}{5}, \frac{4}{5}, 0]$

5) You have three vectors $(4, 3, -2, 1), (5, 0, 0, 0), (2, 1, -3, 0)$ in 4-dimensional space. Which is the suitable fourth vector to create the basis?

1 point

- i. $(7, 2, -1, 1)$
- ii. $(2, 2, -1, 1)$
- iii. $(7, 1, -3, 0)$
- iv. $(1, 2, 4, 5)$

No, the answer is incorrect. Score: 0

Accepted Answers:

iv. $(1, 2, 4, 5)$

Solve the question number 6,7,9 and 9 with the help of following statement :

Stress tensor at a point is given by

$$\tau = \begin{bmatrix} 2 & 7 & -4 \\ 7 & 5 & 1 \\ -4 & 1 & 8 \end{bmatrix}$$

6) Find traction vector on the following plane whose normal is $2\hat{i} + 3\hat{j} + \hat{k}$

1 point

- i. $(5.6897, 3.4126, 0.9834)$
- ii. $(3.7867, 9.0234, -2.8765)$
- iii. $(5.6125, 8.0178, 0.8018)$
- iv. $(3.7865, 8.2398, -0.9823)$

No, the answer is incorrect. Score: 0

Accepted Answers:

iii. $(5.6125, 8.0178, 0.8018)$

7) Find shear stress on this plane

1 point

- i. $(0.4582, 0.2864, -1.7754)$
- ii. $(3.7867, 9.0234, -2.8765)$
- iii. $(0.6897, 3.4126, 0.9834)$
- iv. $(1.7865, 0.2398, 0.9823)$

No, the answer is incorrect. Score: 0

Accepted Answers:

i. $(0.4582, 0.2864, -1.7754)$

8) Find all the stress invariants

1 point

- i. $(15, -450, 0)$
- ii. $(10, 450, 20)$
- iii. $(15, -300, 0)$
- iv. $(21, 230, 20)$

No, the answer is incorrect. Score: 0

Accepted Answers:

i. $(15, -450, 0)$

9) Find all the principal stresses

1 point

- i. $(12.7867, 6.8790, 6.7639)$
- ii. $(11.7288, -4.7708, 8.0420)$
- iii. $(5.7890, 8.790, -3.0984)$
- iv. $(23.3892, -5.6390, 0.5620)$

No, the answer is incorrect. Score: 0

Accepted Answers:

ii. $(11.7288, -4.7708, 8.0420)$