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NPTEL

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Courses » **Mechanics Of Materials** Announcements **Course** Ask a Question Progress Mentor

Unit 4 - Week 2

Course outline

Week 0

How to access the portal

Week 1

Week 2

Quiz : Assignment 2

Definition of a body

Motion and Displacement field

Traction

Properties of traction

Definition of stress tensor and linear function

Tensor Algebra

Meaning of components of the stress tensor

Transformation of stress components

Mohr's Circle derivation

Week 2 Feedback

Solution for assignment - 2

Week 3

Week 4-Concept of strain

Assignment 2

The due date for submitting this assignment has passed. **Due on 2018-02-07, 23:59 IST.**

Submitted assignment

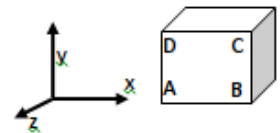
Based on the question 1 answer the following questions upto 6

1)

A unit cube is subjected to the following homogeneous deformation field:

$$x = 1.1X, \quad y = 0.9Y, \quad z = 0.9Z$$

where a_1, a_2, a_3 are constants, (X, Y, Z) denote a typical material particle in the reference configuration and (x, y, z) the same material particle in the current configuration. Then, the component of the displacement field is:



x – component of the displacement field, $u_x =$ _____ in material form

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: String) 0.1X

2 points

2) y – component of the displacement field, $u_y =$ _____ in material form

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: String) -0.1Y

2 points

3) z – component of the displacement field, $u_z =$ _____ in material form

Hint

Week 5-
Constitutive
relation, strain
energy and
potential

Week 6-
Displacement
due to uniaxial
loading,
temperature and
bending

Week 7 -Stresses
and deflection in
homogeneous
beams loaded
about one
principal axis

Week 8 -
Stresses and
deflection in
beams loaded
about one
principal axis

week 9: Stresses
and deflection in
beams not
loaded about
principal axis

Week 10:
Stresses and
displacement
due to torsion or
inflation

Week 11

Week 12 -
Buckling of
columns

DOWNLOAD
VIDEOS

Notes

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: String) -0.1Z

2 points

4) x – component of the displacement field, $u_x =$ _____ in spatial form

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: String) 0.091x

2 points

5) y – component of the displacement field, $u_y =$ _____ in spatial form

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: String) -0.11y

2 points

6) z – component of the displacement field, $u_z =$ _____ in spatial form

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: String) -0.11Z

2 points

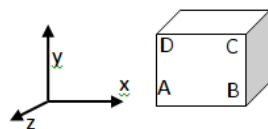
Based on the question 7 , answer the following questions upto 9

7)

A unit cube is subjected to the following homogeneous deformation field:

$$x = 1.1 X, \quad y = 0.9 Y, \quad z = 0.9 Z$$

where, (X, Y, Z) denote a typical material particle in the reference configuration and (x, y, z) the same material particle in the current configuration. Then, the component of the displacement undergone by a material particle that occupied the point (0.5 m, 0.5 m, 0 m) in the reference configuration is:



x – component of the displacement field, $u_x =$ _____ m

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) 0.05

2 points

8) y – component of the displacement field, $u_y =$ _____ m

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) -0.05

2 points

9) z – component of the displacement field, $u_z =$ _____ m

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) 0

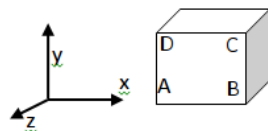
2 points

Based on the question 10 , answer the following questions up to 12

10 A unit cube is subjected to the following homogeneous deformation field:

$$x = 1.1 X, \quad y = 0.9Y, \quad z = 0.9Z$$

where, (X,Y,Z) denote a typical material particle in the reference configuration and (x,y,z) the same material particle in the current configuration. Then, the component of the displacement undergone by a material particle that is currently occupying the point $(0.5 \text{ m}, 0.5 \text{ m}, 0 \text{ m})$ is:



Computed accurately up to third decimal place

x – component of the displacement field, $u_x =$ _____ m

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 0.044, 0.046

2 points

11 y – component of the displacement field, $u_y =$ _____ m

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:*(Type: Range) -0.056, -0.054*

2 points

12 z – component of the displacement field, $u_z =$ _____ m

Hint

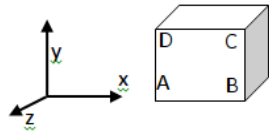
No, the answer is incorrect.**Score: 0****Accepted Answers:***(Type: Numeric) 0*

2 points

Based on the question 13, answer the following questions up to 15

13 A **unit** cube is subjected to the following displacement field expressed in material form:

$$u_x = kY, \quad u_y = 0, \quad u_z = 0$$

where k is a constant and (X, Y, Z) denote a typical material particle in the reference configuration. Then, the position vector of the particle in the current configuration is:13 x – component of the position vector is _____**No, the answer is incorrect.****Score: 0****Accepted Answers:***(Type: String) X+kY*

2 points

14 y – component of the position vector is _____**No, the answer is incorrect.****Score: 0****Accepted Answers:***(Type: String) Y*

2 points

15 z – component of the position vector is _____**No, the answer is incorrect.****Score: 0****Accepted Answers:***(Type: String) z*

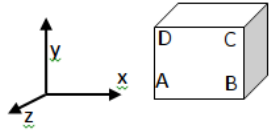
2 points

Based on the question 16, answer the following questions up to 18

16 A unit cube is subjected to the following displacement field expressed in material form:

$$u_x = 0.1Y, \quad u_y = 0, \quad u_z = 0$$

where, (X, Y, Z) denote a typical material particle in the reference configuration. Then, the component of the displacement undergone by a material particle that occupied the point $(0.5 \text{ m}, 0.5 \text{ m}, 0 \text{ m})$ in the reference configuration is:



x – component of the displacement field, $u_x =$ _____ m

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 0.05

2 points

17 y – component of the displacement field, $u_y =$ _____ m

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 0

2 points

18 z – component of the displacement field, $u_z =$ _____ m

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 0

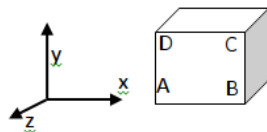
2 points

Based on the question 19, answer the following questions up to 21

19 A unit cube is subjected to the following displacement field expressed in material form:

$$u_x = 0.1Y, \quad u_y = 0, \quad u_z = 0$$

where (X, Y, Z) denote a typical material particle in the reference configuration. Then, the component of the displacement undergone by a material particle that is currently occupying the point $(0.5 \text{ m}, 0.5 \text{ m}, 0 \text{ m})$ is:



x – component of the displacement field, $u_x =$ _____ m

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 0.05

2 points

20 y – component of the displacement field, $u_y =$ _____ m

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 0

2 points

21)

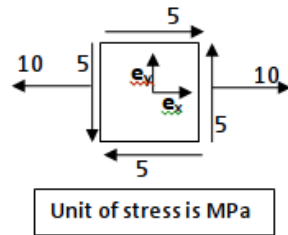
No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 0

2 points

Based on the question 22, answer the following questions up to 30

22) For the plane stress state shown in the figure the Cartesian components of the stress tensor is:



No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 10

1 point

23 $\sigma_{yy} =$ _____ MPa

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 0

1 point

24 $\sigma_{xx} =$ _____ MPa

No, the answer is incorrect.
Score: 0

Accepted Answers:

(Type: Numeric) 0

1 point

25 $\sigma_{xy} = \underline{\hspace{2cm}} \text{ MPa}$

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) 5

1 point

26)

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) 5

1 point

27)

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) 0

1 point

28 $\sigma_{xx} = \underline{\hspace{2cm}} \text{ MPa}$

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) 0

1 point

29 $\sigma_{yz} = \underline{\hspace{2cm}} \text{ MPa}$

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) 0

1 point

30 $\sigma_{xy} = \underline{\hspace{2cm}} \text{ MPa}$

No, the answer is incorrect.

Score: 0

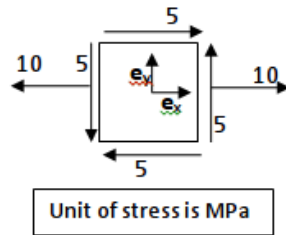
Accepted Answers:

(Type: Numeric) 0

1 point

Based on the question 31, answer the following questions up to 33

- 31 For the plane state of stress shown in the figure the traction acting on a plane whose normal makes equal angle with the coordinate basis i.e., $\mathbf{n} = (\mathbf{e}_x + \mathbf{e}_y + \mathbf{e}_z)/\sqrt{3}$ is:



computed accurately up to first decimal place

x – component of the traction on this plane is _____ MPa

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 8.56, 8.76

2 points

32y – component of the traction on this plane is _____ MPa

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 2.79, 2.99

2 points

33z – component of the traction on this plane is _____ MPa

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

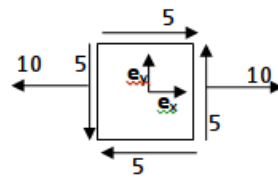
(Type: Numeric) 0

2 points

Based on the question 34, answer the following questions up to 42

34)

For the plane stress state shown in the figure, find the components of the stress tensor in a new Cartesian basis $\{\mathbf{e}_x^*, \mathbf{e}_y^*, \mathbf{e}_z^*\}$ accurately up to first decimal place. The new basis is obtained by rotating an angle of 30 degrees in the clockwise direction about \mathbf{e}_z axis.



Unit of stress is MPa

$$\sigma_{xx}^* = \underline{\hspace{2cm}} \text{ MPa}$$

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 3.07, 3.27

3 points

$$35 \sigma_{yy}^* = \underline{\hspace{2cm}} \text{ MPa}$$

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 6.73, 6.93

3 points

$$36 \sigma_{zz}^* = \underline{\hspace{2cm}} \text{ MPa}$$

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) 0

3 points

$$37 \sigma_{xy}^* = \underline{\hspace{2cm}} \text{ MPa}$$

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 6.73, 6.93

3 points

38 $\sigma_{yx}^* =$ _____ MPa

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 6.73, 6.93

3 points

39 $\sigma_{xz}^* =$ _____ MPa

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) 0

3 points

40 $\sigma_{zx}^* =$ _____ MPa

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) 0

3 points

41 $\sigma_{yz}^* =$ _____ MPa

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) 0

3 points

42 $\sigma_{zy}^* =$ _____ MPa

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) 0

3 points

43 Fill in the blanks with appropriate single word:
The distributed force acting over a cut surface is called as _____

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: String) traction

2 points

44 The linear function that maps the normal to a cut surface and traction is called _____ tensor

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: String) stress

2 points

45 The component of traction acting normal to a cut surface is called as _____ stress

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: String) normal

2 points

46 The component of traction acting tangential to a cut surface is called as _____ stress

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: String) shear

2 points

47 The function that gives the current position vector of material particles as a function of the position vector of the particle occupied by it in the reference configuration is called _____ or deformation field

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: String) motion

2 points

48) In continuum mechanics a body is a _____ and countless set of material particles

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: String) ordered

2 points

49) The region in space occupied by the body at some time is called _____ of the body

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: String) configuration

2 points

50) The _____ configuration of the body is the configuration in which the material particles are identified by their position vectors

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: String) reference

2 points

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