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NPTEL

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## Unit 3 - Week 1

### Course outline

#### Week 0

#### How to access the portal

#### Week 1

- Quiz : Assignment 1
- Introduction to the course - Why this course?
- Introduction to the course - Concepts and equations in this course
- Introduction to the course - Objectives and prerequisite
- Mathematical Preliminaries - Linear Algebra
- Mathematical Preliminaries - Vector Algebra
- Representation of Vector
- Concept of Force
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#### Week 2

#### Week 3

#### Week 4-Concept of strain

## Assignment 1

The due date for submitting this assignment has passed. **Due on 2018-02-05, 23:59 IST.**

### Submitted assignment

Evaluate the following identities using indicial notation:

1)  $\delta_{ii} =$  \_\_\_\_\_

**No, the answer is incorrect.**  
**Score: 0**

**Accepted Answers:**  
(Type: Numeric) 3

2 points

2)  $\delta_{ij}\delta_{ij} =$  \_\_\_\_\_

**No, the answer is incorrect.**  
**Score: 0**

**Accepted Answers:**  
(Type: Numeric) 3

2 points

3)  $\delta_{ij}a_j =$  \_\_\_\_\_

Hint

**No, the answer is incorrect.**  
**Score: 0**

**Accepted Answers:**  
(Type: String)  $a_i$

2 points

4)  $\delta_{ij}a_{jk} =$  \_\_\_\_\_

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) aik

(Type: String) ajk

5)  $\delta_{ij}a_{kj} =$  \_\_\_\_\_

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: String) aki

(Type: String) akj

6)  $\delta_{ij}a_{ij} =$  \_\_\_\_\_

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: String) aii

(Type: String) aij

7)  $\delta_{ij}\delta_{jk}\delta_{ik} =$  \_\_\_\_\_

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) 3

8)  $\delta_{ik}\delta_{jm}\delta_{ij}\delta_{km} =$  \_\_\_\_\_

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) 3

9)  $\delta_{ij} \in_{ijk} =$  \_\_\_\_\_

2 points

2 points

2 points

2 points

2 points

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) 0

2 points

10)

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) 6

2 points

Evaluate the following identities written using indicial notation for the conditions given:

11 If  $a_{ij} = a_{ji}$ ,  $\epsilon_{ijk} a_{jk} =$  \_\_\_\_\_

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) 0

2 points

12)

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) 0

2 points

13 If  $c_i = A_{ij} b_j - D_{in} b_n = B_{ij} b_j$ , then  $B_{ij} =$  \_\_\_\_\_

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: String)  $A_{ij}-D_{ij}$

2 points

14 Let,  $f(x_i) = m x_i + c_1$  where 'm' is a scalar. If  $f(x_i)$  were to be a linear function of  $x_i$  then

$c_1 =$  \_\_\_\_\_

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) 0

2 points

15 Let,  $f(x_i) = m x_i + c_i$  where 'm' is a scalar. If  $f(x_i)$  were to be a linear function of  $x_i$  then

$c_2 =$  \_\_\_\_\_

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) 0

2 points

16 Let,  $f(x_i) = m x_i + c_i$  where 'm' is a scalar. If  $f(x_i)$  were to be a linear function of  $x_i$  then

$c_3 =$  \_\_\_\_\_

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) 0

2 points

17 Let  $a = 12e_x + 4e_y + 3e_z$ ,  $b = 5e_x + 6e_y + e_z$ , then compute the following:

accurately up to the second decimal place:

Magnitude of a is \_\_\_\_\_

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) 13

4 points

18 Let  $a = 12e_x + 4e_y + 3e_z$ ,  $b = 5e_x + 6e_y + e_z$ , then compute the following:

accurately up to the second decimal place:

Component of the vector a along the direction of b is \_\_\_\_\_

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 10.9, 11.1

4 points

19 Let  $a = 12e_x + 4e_y + 3e_z$ ,  $b = 5e_x + 6e_y + e_z$ , then compute the following:

accurately up to the second decimal place:

Angle between the vectors, a and b is \_\_\_\_\_ degrees

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 31.7, 31.9

4 points

20 Let  $\mathbf{a} = 12\mathbf{e}_x + 4\mathbf{e}_y + 3\mathbf{e}_z$ ,  $\mathbf{b} = 5\mathbf{e}_x + 6\mathbf{e}_y + \mathbf{e}_z$ , then compute the following:

accurately up to the second decimal place:

Length of the diagonal of the parallelogram whose sides are  $\mathbf{a}$  and  $\mathbf{b}$  is \_\_\_\_\_

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 20.0, 20.2

4 points

21 Let  $\mathbf{a} = 12\mathbf{e}_x + 4\mathbf{e}_y + 3\mathbf{e}_z$ ,  $\mathbf{b} = 5\mathbf{e}_x + 6\mathbf{e}_y + \mathbf{e}_z$ , then compute the following:

accurately up to the second decimal place:

The orientation of the diagonal of the parallelogram whose sides are  $\mathbf{a}$  and  $\mathbf{b}$  with respect to the  $\mathbf{e}_x$  direction is \_\_\_\_\_ degrees

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 32.2, 32.4

4 points

22 Let  $\mathbf{a} = 12\mathbf{e}_x + 4\mathbf{e}_y + 3\mathbf{e}_z$ ,  $\mathbf{b} = 5\mathbf{e}_x + 6\mathbf{e}_y + \mathbf{e}_z$ , then compute the following:

accurately up to the second decimal place:

The orientation of the diagonal of the parallelogram whose sides are  $\mathbf{a}$  and  $\mathbf{b}$  with respect to the  $\mathbf{e}_y$  direction is \_\_\_\_\_ degrees

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 60.1, 60.3

4 points

23 Let  $\mathbf{a} = 12\mathbf{e}_x + 4\mathbf{e}_y + 3\mathbf{e}_z$ ,  $\mathbf{b} = 5\mathbf{e}_x + 6\mathbf{e}_y + \mathbf{e}_z$ , then compute the following:

accurately up to the second decimal place:

The orientation of the diagonal of the parallelogram whose sides are  $\mathbf{a}$  and  $\mathbf{b}$  with respect to the  $\mathbf{e}_z$  direction is \_\_\_\_\_ degrees

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 78.4, 78.6

4 points

24 Let  $\mathbf{a} = 12\mathbf{e}_x + 4\mathbf{e}_y + 3\mathbf{e}_z$ ,  $\mathbf{b} = 5\mathbf{e}_x + 6\mathbf{e}_y + \mathbf{e}_z$ , then compute the following:

accurately up to the second decimal place:

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 0.25, 0.27

4 points

25 Let  $\mathbf{a} = 12\mathbf{e}_x + 4\mathbf{e}_y + 3\mathbf{e}_z$ ,  $\mathbf{b} = 5\mathbf{e}_x + 6\mathbf{e}_y + \mathbf{e}_z$ , then compute the following:

accurately up to the second decimal place:

The component of the unit vector which is perpendicular to the plane containing the vectors  $\mathbf{a}$  and  $\mathbf{b}$  along  $\mathbf{e}_y$  direction is  $\pm$  \_\_\_\_\_

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 0.04, 0.06

4 points

26 Let  $\mathbf{a} = 12\mathbf{e}_x + 4\mathbf{e}_y + 3\mathbf{e}_z$ ,  $\mathbf{b} = 5\mathbf{e}_x + 6\mathbf{e}_y + \mathbf{e}_z$ , then compute the following:

accurately up to the second decimal place:

The component of the unit vector which is perpendicular to the plane containing the vectors  $\mathbf{a}$  and  $\mathbf{b}$  along  $\mathbf{e}_z$  direction is  $\pm$  \_\_\_\_\_

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 0.95, 0.97

4 points

27 Let  $\mathbf{a} = 12\mathbf{e}_x + 4\mathbf{e}_y + 3\mathbf{e}_z$ ,  $\mathbf{b} = 5\mathbf{e}_x + 6\mathbf{e}_y + \mathbf{e}_z$ , then compute the following:

accurately up to the second decimal place:

Area of the parallelogram whose sides are  $\mathbf{a}$  and  $\mathbf{b}$  is \_\_\_\_\_

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 53.8, 54.0

4 points

28 Let  $\mathbf{a} = 12\mathbf{e}_x + 4\mathbf{e}_y + 3\mathbf{e}_z$ ,  $\mathbf{b} = 5\mathbf{e}_x + 6\mathbf{e}_y + \mathbf{e}_z$ , then compute the following:

accurately up to the second decimal place:

Volume of a parallelepiped whose sides are,  $\mathbf{a}$ ,  $\mathbf{b}$  and  $\mathbf{a} \wedge \mathbf{b}$  is \_\_\_\_\_

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 2908.9, 2909.1

4 points

29)

Let  $\{e_i\}$  and  $\{\tilde{e}_j\}$  represent 2 right handed Cartesian coordinate set of basis vector related through the equations:  $\tilde{e}_x = 0.6e_x + 0.8e_y$ ,  $\tilde{e}_y = -0.8e_x + 0.6e_y$ ,  $\tilde{e}_z = e_z$ . If a vector  $u = 3e_x + 4e_y + 5e_z$ , then the components of  $u$  for the  $\{\tilde{e}_j\}$  basis is:

computed accurately up to first decimal place

$\tilde{u}_x =$  \_\_\_\_\_

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) -1.5, -1.3

5 points

30)

Let  $\{e_i\}$  and  $\{\tilde{e}_j\}$  represent 2 right handed Cartesian coordinate set of basis vector related through the equations:  $\tilde{e}_x = 0.6e_x + 0.8e_y$ ,  $\tilde{e}_y = -0.8e_x + 0.6e_y$ ,  $\tilde{e}_z = e_z$ . If a vector  $u = 3e_x + 4e_y + 5e_z$ , then the components of  $u$  for the  $\{\tilde{e}_j\}$  basis is:

computed accurately up to first decimal place

$\tilde{u}_y =$  \_\_\_\_\_

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 4.7, 4.9

5 points

31)

Let  $\{e_i\}$  and  $\{\tilde{e}_j\}$  represent 2 right handed Cartesian coordinate set of basis vector related through the equations:  $\tilde{e}_x = 0.6e_x + 0.8e_y$ ,  $\tilde{e}_y = -0.8e_x + 0.6e_y$ ,  $\tilde{e}_z = e_z$ . If a vector  $u = 3e_x + 4e_y + 5e_z$ , then the components of  $u$  for the  $\{\tilde{e}_j\}$  basis is:

computed accurately up to first decimal place

$\tilde{u}_z =$  \_\_\_\_\_

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 4.9, 5.1

5 points

32)

Let  $\{e_i\}$  and  $\{\tilde{e}_j\}$  represent 2 right handed Cartesian coordinate set of basis vector related through the equations:  $\tilde{e}_x = 0.6e_x + 0.8e_y$ ,  $\tilde{e}_y = -0.8e_x + 0.6e_y$ ,  $\tilde{e}_z = e_z$ . If a vector  $u = 3e_x + 4e_y + 5e_z$ , then the components of  $u$  for the  $\{\tilde{e}_j\}$  basis is:

computed accurately up to first decimal place

The  $\{\hat{e}_j\}$  basis is obtained by rotating the  $\{e_i\}$  basis by \_\_\_\_\_ degrees in the counter clockwise direction.

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

(Type: Range) 53.0, 53.2

5 points

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