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# Unit 12 - Week 10: Stresses and displacement due to torsion or inflation

## Course outline

Week 0

How to access the portal

Week 1

Week 2

Week 3

Week 4-Concept of strain

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

## Assignment 10

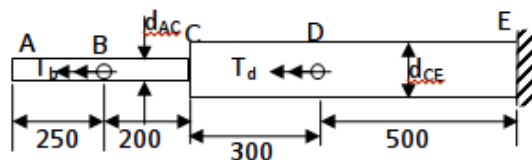
The due date for submitting this assignment has passed. **Due on 2018-04-04, 23:59 IST.**

### Submitted assignment

Based on the data given in question 1, answer the following question up to 5

1)

The shafts AC and CE shown in the figure has a solid circular cross section and is made of different material. Let the diameter of the shaft AC,  $d_{AC}$  be 20 mm and that of the shaft CE,  $d_{CE}$  be 40 mm and the torques,  $T_b = 500$  Nm and  $T_d = 1000$  Nm. The shear modulus for the material with which this shaft AC is made of  $G_{AC} = 120$  GPa and for the shaft CE,  $G_{CE} = 70$  GPa. Neglecting stress concentration effects, compute the following:



All Dimensions in mm

The reaction torque at E \_\_\_\_\_ Nm

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) 1500

5 points

2) The magnitude of angle of twist at section A \_\_\_\_\_ radians

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 0.103,0.105

5 points

3) The magnitude of angle of twist at section B \_\_\_\_\_ radians

**Week 10:**  
Stresses and displacement due to torsion or inflation

- Displacement field
- Torsion equation
- Example problems
- Expression relating angle of twist with torsion and shear stress
- Example problems: Open sections
- Thin walled closed sections
- Example problems: Thin walled sections
- Cylindrical polar coordinate system
- Displacement field
- Governing differential equation and solution
- Quiz : Assignment 10
- Week 10 Feedback
- Solution for Assignment - 10

**Week 11**

**Week 12 - Buckling of columns**

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**Notes**

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 0.103,0.105

5 points

4) The magnitude of angle of twist at section C \_\_\_\_\_ radians

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 0.050,0.052

5 points

5) The magnitude of angle of twist at section D \_\_\_\_\_ radians

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

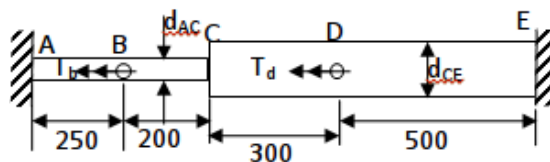
(Type: Range) 0.042,0.044

5 points

Based on the data given in question 6, answer the following question up to 10

6)

The shafts AC and CE shown in the figure has a solid circular cross section and is made of the same material. Let the diameter of the shaft AC,  $d_{AC}$  be 20 mm and that of the shaft CE,  $d_{CE}$  be 40 mm and the torques,  $T_b = 500$  Nm and  $T_d = 1000$  Nm. The material parameters for the material with which this shaft is made are: Young's modulus,  $E = 120$  GPa and Poisson's ratio,  $\nu = 1/3$ . Neglecting stress concentration effects, compute the following:



All Dimensions in mm

The reaction torque at A \_\_\_\_\_ Nm

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 312.4,312.6

5 points

7) The reaction torque at E \_\_\_\_\_ Nm

Hint

**No, the answer is incorrect.****Score: 0****Accepted Answers:***(Type: Range) 1187.4,1187.6*

5 points

8) The magnitude of angle of twist at section B \_\_\_\_\_ radians

Hint

**No, the answer is incorrect.****Score: 0****Accepted Answers:***(Type: Range) 0.109,0.111*

5 points

9) The magnitude of angle of twist at section C \_\_\_\_\_ radians

Hint

**No, the answer is incorrect.****Score: 0****Accepted Answers:***(Type: Range) 0.057,0.059*

5 points

10) The magnitude of angle of twist at section D \_\_\_\_\_ radians

Hint

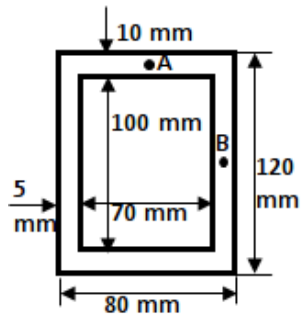
**No, the answer is incorrect.****Score: 0****Accepted Answers:***(Type: Range) 0.051,0.053*

5 points

Based on the data given in question 11, answer the following question up to 13

11)

**A 3000 Nm torque is applied to a thin walled hollow shaft made of a material with shear modulus 70 GPa and having cross sections shown in figure. Neglecting the effect of stress concentration, determine the following:**



Angle of twist per unit length of the shaft \_\_\_\_\_  $\times 10^{-6}$  radians/m

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 9.2,9.4

10 points

12) Shear stress at point A indicated in the figure \_\_\_\_\_ MPa

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 18.1,18.3

10 points

13) Shear stress at point B indicated in the figure \_\_\_\_\_ MPa

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

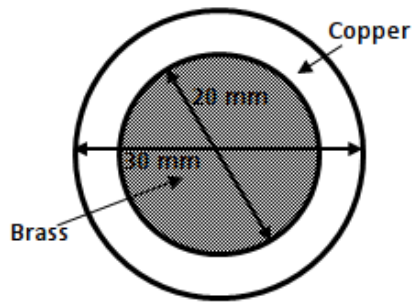
(Type: Range) 36.3,36.5

10 points

Based on the data given in question 14, answer the following question up to 17

14)

A composite shaft made of solid brass core with diameter 20 mm and an outer copper casing of outer diameter 30 mm and inner diameter 20 mm is subjected to a uniform torque 1000 Nm. Assume the shear modulus of brass to be 40 GPa and that of copper to be 45 GPa. For this shaft find the following



Angle of twist per unit length \_\_\_\_\_  $\times 10^{-3}$  radians / m

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 0.28,0.30

5 points

15) The maximum shear stress in brass \_\_\_\_\_ MPa

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 114.2,114.4

5 points

16) The minimum shear stress in copper \_\_\_\_\_ MPa

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 128.5,128.7

5 points

17) The maximum shear stress in copper \_\_\_\_\_ MPa

Hint

No, the answer is incorrect.

Score: 0

**Accepted Answers:**  
(Type: Range) 192.8,193

5 points

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