Unit 9 - Week 6: Brief Background of Tensor Calculus

Assignment 6

The due date for submitting this assignment has passed. Due on 2020-10-28, 23:59 IST.
As per our records you have not submitted this assignment.

Answer the following question A from "a to b " (i.e 1 to 13) with the help of figure shown.

A.

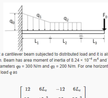

Figure above represent a cantilever beam subjected to distributed load and it is also supported by a roller in the middle. Different dimensions are $L_1 = 0.2$ m, $L_2 = 0.24$ m and $L_3 = 0.16$ m. Beam has area moment of inertia of 8.24×10^{-6} m^4 and Young's modulus E of 90 MPa. It is subjected to end point load of 5 kN and distributed load with parameter q_0 = 300 N/m and q_1 = 200 N/m. For one horizontal beam element we have stiffness matrix $\mathbf{K}_{beam}$ and load vector $\mathbf{f}_{beam}$ beam for uniformly distributed load q as

$$\mathbf{K}_{beam} = \frac{EI}{h_e^3}\begin{bmatrix} 12 & 6L_e & -12 & 6L_e \\ 6L_e & 4L_e^2 & -6L_e & 2L_e^2 \\ -12 & -6L_e & 12 & -6L_e \\ 6L_e & 2L_e^2 & -6L_e & 4L_e^2 \end{bmatrix}, \mathbf{f}_{beam} = \begin{bmatrix} \frac{qL_e}{2} \\ \frac{qL_e^2}{12} \\ \frac{qL_e}{2} \\ -\frac{qL_e^2}{12} \end{bmatrix}$$

where I, E, L_e are area moment of inertia, Young's modulus and element length respectively for the element

(a) If the domain is discretized with three elements then answer the following:

1) The rotation θ at the fixed end of the propsed cantilever beam is *1 point*

0
0.5
2
2.5

No, the answer is incorrect.
Score: 0
Accepted Answers:
0

2) What is the size of the global stiffness matrix? *1 point*

4×4
5×5
8×8
6×6

No, the answer is incorrect.
Score: 0
Accepted Answers:
8 x 8

3) The size of the reduced stiffness matrix is *1 point*

6×6
4×4
3×3
5×5

No, the answer is incorrect.
Score: 0
Accepted Answers:
5 x 5

4) The size of the global load vector is *1 point*

5×1
4×1
3×1
8×1

No, the answer is incorrect.
Score: 0
Accepted Answers:
8 x 1

5) The size of the reduced global load vector is *1 point*

6×1
4×1
3×1
5×1

No, the answer is incorrect.
Score: 0
Accepted Answers:
5 x 1

(b) The finite element equation is given as $[\bar{\mathbf{K}}]\{\mathbf{u}\} = \{\bar{\mathbf{F}}\}$. After the boundary conditions are applied, the reduced stiffness matrix is $[\bar{\mathbf{K}}]$ and reduced force vector is $\{\bar{\mathbf{F}}\}$ then answer the following

6) What is the value of element $\bar{\mathbf{K}}(1,1)$ of the reduced stiffness matrix in N/m?

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 174000000.-17600000

2 points

7) What is the value of element $\bar{\mathbf{K}}(2,2)$ of the reduced stiffness matrix in N/m?

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 2620000.2790000

2 points

8) What is the value of element $\bar{\mathbf{K}}(3,3)$ of the reduced stiffness matrix in N/m?

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 3500000.3150000

2 points

9) What is the value of element $\bar{\mathbf{K}}(4,4)$ of the reduced stiffness matrix in N/m?

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 21000000.-22500000

2 points

10) The bending moment expression at the node located on the roller support can be given as *2 points*

$\frac{-qL^2}{10}$
$\frac{qL^2}{10}$
$\frac{-qL^2}{12}$
$\frac{qL^2}{12}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{-qL^2}{12}$

11) Bending moment at free end of the beam is *1 point*

3.5 N-m
2.0 N-m
1.0 N-m
0 N-m

No, the answer is incorrect.
Score: 0
Accepted Answers:
0 N-m

12) The values of rotation (θ) (in radians) at roller support are

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 0.0209..0.0914

2 points

13) What is the value of rotation (θ) at the free end?

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 0.0317..0.0923

2 points

Answer the following question B from "a to b " (i.e 14 to 26) with the help of figure shown.

B.

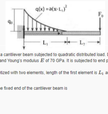

Figure above represent a cantilever beam subjected to quadratic distributed load. Different dimensions are $L_1 = 0.8$ m, $L_2 = 0.6$ m. Beam has area moment of inertia of 8.1×10^{-6} m^4 and Young's modulus E of 70 GPa. It is subjected to end point load of $P_0 = 1$ kN and distributed load with parameter q_0 = 1000 N/m.

(a) The domain is discretized with two elements, length of the first element is L_1 and length of the second element is L_2 then answer the following:

14) The rotation(θ) at the fixed end of the cantilever beam is *1 point*

0
1
2
3

No, the answer is incorrect.
Score: 0
Accepted Answers:
0

15) The deflection(y) at the fixed support of the beam is *1 point*

1
0
2
3

No, the answer is incorrect.
Score: 0
Accepted Answers:
0

16) In the expression $q(x) = a(x - L_1)^2$ constant a can be given as *2 points*

$\frac{q_0}{L_1^2}$
$\frac{q_0}{L_1}$
$\frac{q_0}{L_2^2}$
$\frac{q_0}{L_2}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{q_0}{L_2^2}$

17) What is the size of the global force vector? *1 point*

4×1
5×1
8×1
6×1

No, the answer is incorrect.
Score: 0
Accepted Answers:
6 x 1

18) The size of the global stiffness matrix after boundary conditions are applied is *1 point*

6×6
4×4
3×3
5×5

No, the answer is incorrect.
Score: 0
Accepted Answers:
4 x 4

19) The size of the reduced load vector is *1 point*

5×1
2×1
4×1
3×1

No, the answer is incorrect.
Score: 0
Accepted Answers:
4 x 1

20) What is the value of q at $x = 0$?

$0\,N/m$
$-qL_1\,N/m$
$q_0\,N/m$
$q_0L_1\,N/m$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$q_0\,N/m$

(b) The finite element equation is given as $[\bar{\mathbf{K}}]\{\mathbf{u}\} = \{\bar{\mathbf{F}}\}$. After the boundary conditions are applied, the reduced stiffness matrix is $[\bar{\mathbf{K}}]$ and reduced force vector is $\{\bar{\mathbf{F}}\}$ then answer the following

21) What is the value of element $\bar{\mathbf{K}}(1,1)$ of the reduced stiffness matrix in N/m?

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 44700000.-54750000

2 points

22) What is the value of element $\bar{\mathbf{K}}(2,2)$ of the reduced stiffness matrix in N/m?

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 861400.861500

2 points

23) What is the value of element $\bar{\mathbf{K}}(3,3)$ of the reduced stiffness matrix in N/m?

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 31500000.31800000

2 points

24) What is the value of element $\bar{\mathbf{K}}(4,4)$ of the reduced stiffness matrix in N/m?

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 3740000.3820000

2 points

25) What is the value of $\bar{\mathbf{F}}(3)$?

0 N
1000 N
0 N-m
1000 N-m

No, the answer is incorrect.
Score: 0
Accepted Answers:
1000 N

26) The value of deflection (in mm) at free end of the beam?

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 1.56..1.67

2 points

27) The bending moment at free end of the beam is *2 points*

0 N-m
0.54 N-m
0.44 N-m
0.64 N-m

No, the answer is incorrect.
Score: 0
Accepted Answers:
0 N-m

28) The value of rotation at $x = -L_1$ is

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 0.0314..0.0914

2 points