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Courses » Compliant Mechanisms : Principles and Design

Announcements Course Ask a Question Progress

# Unit 5 - Week 3: Large-displacement analysis of a cantilever beam and pseudo rigid-body modeling



## Assignment Week 3

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

**Due on 2018-02-14, 23:59 IST.**

1) A Pseudo Rigid Body (PRB) model of a compliant parallel-stage mechanism… *1 point*

- is similar to that of a cantilever beam.
- is similar to that of a fixed-fixed beam.
- contains two half-PRBs.
- contains four half-PRBs.

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

**Accepted Answers:**
*contains four half-PRBs.*

2) The complete elliptical integrals $F(k)$ are special cases of the incomplete elliptical integrals $F(\phi, k)$ , when $\phi$ is *1 point*

- $\pi/4$
- $\pi/2$
- $\pi$
- $2/\pi$

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

**Accepted Answers:**
$\pi/2$

3) *Assertion:* The large-displacement behavior of a cantilever beam with end load can be obtained as an elliptical integral solution. *1 point*

*Reasoning:* The beam equation can be converted to a single-variable equation for linearly elastic, inextensible, rigid-in-shear, and of constant-cross-section conditions.

- Assertion is correct but not the reasoning.
- Assertion is incorrect but the reasoning is correct.
- Neither assertion nor reasoning is correct.
- Both assertion and reasoning are correct.

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

**Accepted Answers:**
*Both assertion and reasoning are correct.*

4) A complete integral of I kind is given by: *1 point*

- $F(p, \phi) = \int_0^{\phi} \frac{d\phi}{\sqrt{1-p^2\sin^2\phi}}$
- $F(p, \pi/2\ ) = \int_0^{\pi/2} \frac{d\phi}{\sqrt{1-p^2\sin^2\phi}}$
- $E(p, \phi) = \int_0^{\phi} \sqrt{1-p^2\sin^2\phi}\, d\phi$

- [ ] $E(p, \pi/2\ ) = \int_0^{\pi/2} \sqrt{1 - p^2 \sin^2 \phi d\phi}$

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

**Accepted Answers:**
$F(p, \pi/2\ ) = \int_0^{\pi/2} \frac{d\phi}{\sqrt{1 - p^2 \sin^2 \phi}}$

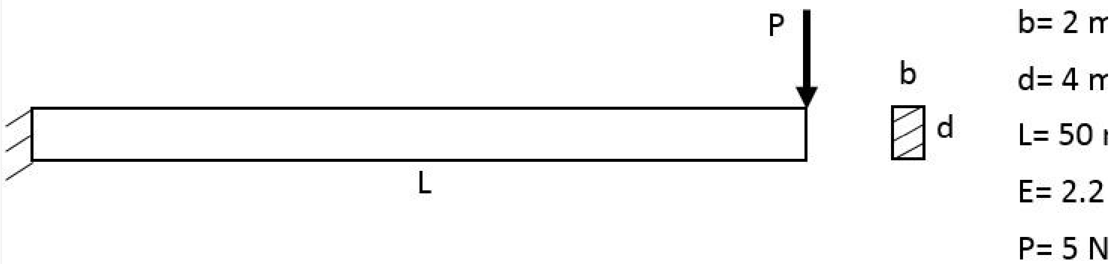
5) The non-dimensional quantity $\eta = \frac{FL^2}{EI}$ is an index of **1 p**

- [ ] Transverse displacement
- [ ] Stretching
- [ ] Bending
- [ ] Axial displacement

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

**Accepted Answers:**
*Bending*

6) The next five questions are based on the following figure. ***1 point***




For a cantilever beam as shown in the figure, the index of bending is

- [ ] 0.2837
- [ ] 0.5326
- [ ] 0.7298
- [ ] 1

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

**Accepted Answers:**
*0.5326*

7) In a pseudo rigid body model of a cantilever beam, the torsion spring is attached at what distance(mm) from the fixed end of the beam ***1 point***

- [ ] 8.33
- [ ] 12.40
- [ ] 41.67
- [ ] 37.50

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

**Accepted Answers:**
*8.33*

8) The torsion stiffness $\kappa$ at the joint in Nm is given by ***1 point***

- [ ] 1.056
- [ ] 3.168
- [ ] 10.56
- [ ] 31.68

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

**Accepted Answers:**
*1.056*

9) The equation of the locus of the loaded tip of the cantilever in a rectangular coordinate system is ***1 point***
Note: Take the origin (0,0) at the fixed end of the cantilever beam.

- [ ] $x^2 + y^2 = 50^2$
- [ ]

$\frac{1}{x^2} + \frac{1}{y^2} = 50^2$

$x^2 + y^2 = \left(\frac{125}{3}\right)^2$

$\left(x - \frac{25}{3}\right)^2 + y^2 = \left(\frac{125}{3}\right)^2$

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

**Accepted Answers:**
$\left(x - \frac{25}{3}\right)^2 + y^2 = \left(\frac{125}{3}\right)^2$

10)The pseudo rigid-body model is based on: *1 point*

A. Kinematic approximation: The locus of deflection of the loaded tip traces a circular arc for small deformations only.
B. Elastostatic approximation: The resistance to deflection of the beam is captured with a torsion spring whose stiffness is constant over a small range only.

- Only A is correct.
- Only B is correct.
- Both A and B are correct.
- Both A and B are incorrect.

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

**Accepted Answers:**
*Both A and B are incorrect.*

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