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Unit 7 - Week 5

Course outline

How does an NPTEL online course work?

Week 0

Week 1

Week 2

Week 3

Week 4

Week 5

Quiz :
Assignment 5
(assessment?
name=65)

Week 6

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Assignment 5

The due date for submitting this assignment has passed. **Due on 2020-03-25, 23:59 IST.**
As per our records you have not submitted this assignment.

1) What is the critical length (in mm) for a glass cube having density 2500 Kg/m^3 to float on a fluid having surface tension 27.56 mN/m ? Neglect the buoyancy force acting on block (Take $g = 9.8 \text{ m/s}^2$).

No, the answer is incorrect.

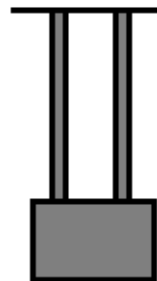
Score: 0

Accepted Answers:

(Type: Range) 1.9,2.3

2 points

2) A block is hanging vertically downwards by 2 parallel beams of width W , length L and depth H . The beam material has elasticity E . What will be the equivalent spring constant of such a system?



$$\frac{WHE}{L}$$



$$\frac{WHE}{2L}$$



$$\frac{2WHE}{L}$$



$$\frac{WHE}{4L}$$

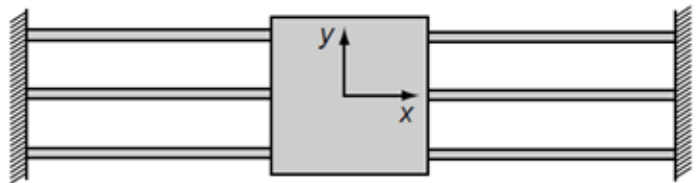
No, the answer is incorrect.

Score: 0

Accepted Answers:

$$\frac{2WHE}{L}$$

3) Suspension of an accelerometer is as shown below. There are three beams on either side of the square proof mass $50 \mu\text{g}$ mass. The beams are identical. They are $150 \mu\text{m}$ long and have an in-plane width of $8 \mu\text{m}$ and an out-of-plane thickness $2 \mu\text{m}$. They are made of polysilicon with $Y = 169 \text{ GPa}$. How much does the proof mass move in the y -direction for 1 g (9.8 m/s^2) acceleration in that direction (in nm)?



No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 1.5, 1.7

3 points

4) The capacitance of two concentric metal shells, with radii a and b (where, $a < b$) is

2 points



$$C = 4\pi\epsilon_0 \frac{ab}{(b-a)}$$



$$C = 4\pi\epsilon_0 \frac{ab}{(b+a)}$$



$$C = 4\pi\epsilon_0 \frac{a^2b^2}{(b^2-a^2)}$$



$$C = 4\pi\epsilon_0 \frac{a^2b^2}{(b^2+a^2)}$$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$$C = 4\pi\epsilon_0 \frac{ab}{(b-a)}$$

5) If the plates of a parallel plate capacitor move closer together by a distance ' Δ ', what will be the magnitude work done in terms of the field ' E ' and area of the plates ' A ' **1 point**



$$\frac{(\epsilon_0 E^2 A^2 \Delta^2)}{2}$$



$$\frac{(\epsilon_0 E^2 A \Delta)}{2}$$



$$\frac{(\epsilon_0 E^2 \Delta^4)}{2A}$$



$$\frac{(\epsilon_0 E^2 A)}{2\Delta}$$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$$\frac{(\epsilon_0 E^2 A \Delta)}{2}$$

6) Which of the following is isotropic etchant?

1 point

30% KOH solution

HNA etchant



EDP at 115⁰C



TMAH at 70⁰C to 90⁰C

No, the answer is incorrect.

Score: 0

Accepted Answers:

HNA etchant

7) Which of the following methods cannot control the etching rate of silicon substrate?

1 point

Concentration of KOH solution

Temperature at which etching takes place

Thickness of the masking layer

Boron doping concentration of Si substrate

No, the answer is incorrect.

Score: 0

Accepted Answers:

Thickness of the masking layer

8) Choose the correct statement :

1 point

i. Boron doping concentration at certain regions can be increased so that, those regions will act as mask and will not be etched away and structures like diaphragm and cantilevers could be obtained.

ii. There is no etching in 111 direction of a single crystal Si wafer using KOH solution.

Only i is correct

Only ii is correct

Both i and ii are correct

Both i and ii are wrong

No, the answer is incorrect.

Score: 0

Accepted Answers:

Only i is correct

9) A <100> silicon wafer is 500 μm thick. A mask consists of rectangular window of unknown size. The sides of the window are parallel to <110>. After wafer etching a hole size of 50 μm × 80 μm is formed on the other side of the wafer (50 μm along X axis, and 80 μm along Y axis). What will be the size of the mask window, along X axis? The undercut rate is negligible. (inward slope = 54.74⁰)

_____ μm

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 740,770

2 points

10) What will be the burst pressure (in bar) for the membrane with dimensions (young's modulus 170GPa) – side $2a = 500 \mu\text{m}$ and thickness $h = 10 \mu\text{m}$, if maximum strength of silicon is 7 GPa?

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 100,125

3 points

11) Which of the following is most preferred as the sensing element in a piezoresistive sensors? **1 point**

- Metal foils
- Thin metal films
- Diffused semiconductor
- Polycrystalline silicon

No, the answer is incorrect.

Score: 0

Accepted Answers:

Diffused semiconductor

12) For a square membrane of side $2a$ and thickness h , choose the correct relation, where σ is the **1 point** stress due to pressure

-
- $\sigma_{max} = P_{max} \left(\frac{a}{h}\right)^3$
-
- $\sigma_{max} = P_{max} \left(\frac{a}{h}\right)^2$
-
- $\sigma_{max} = P_{max} \left(\frac{h}{a}\right)^2$
-
- $P_{max} = \sigma_{max} \left(\frac{a}{h}\right)^2$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$\sigma_{max} = P_{max} \left(\frac{a}{h}\right)^2$

