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Unit 6 - Week 4

Assignment 4

The due date for submitting this assignment has passed. Due on 2020-02-26, 23:59 IST.
As per our records you have not submitted this assignment.

1) Pressure sensor measuring pressure relative to vacuum is ***1 point***

- Differential pressure sensor
- Absolute pressure sensor
- Gauge pressure sensor
- Both absolute and gauge pressure sensor

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

2) I need to calculate pressure without any input voltage. Which of the following materials could be used as a sensing element in the pressure sensor? ***1 point***

- Piezo resistive
- Piezo electric
- Capacitive
- None of the above

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

3) 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

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

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

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\sigma_{max} = P_{max}(\frac{a}{h})^2$

5) Mark the correct order in fabricating a piezo resistive pressure sensor : ***2 points***
1) Implanting boron for the piezo resistors.
2) Connecting the resistors to form a Wheatstone bridge.
3) Anisotropic etching of silicon to obtain the membrane.
4) Bond bottom wafer to obtain the pressure port.

- 1-2-3-4
- 2-1-3-4
- 3-1-2-4
- 3-2-1-4

No, the answer is incorrect.
Score: 0
Accepted Answers:
3-1-2-4

6) Find the applied pressure (in Pa) so that the membrane made of silicon with young's modulus 170GPa, side 2a = 500 μm and thickness h = 10 μm made a deflection of 2 nm. _____Pa

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 380,410

2 points

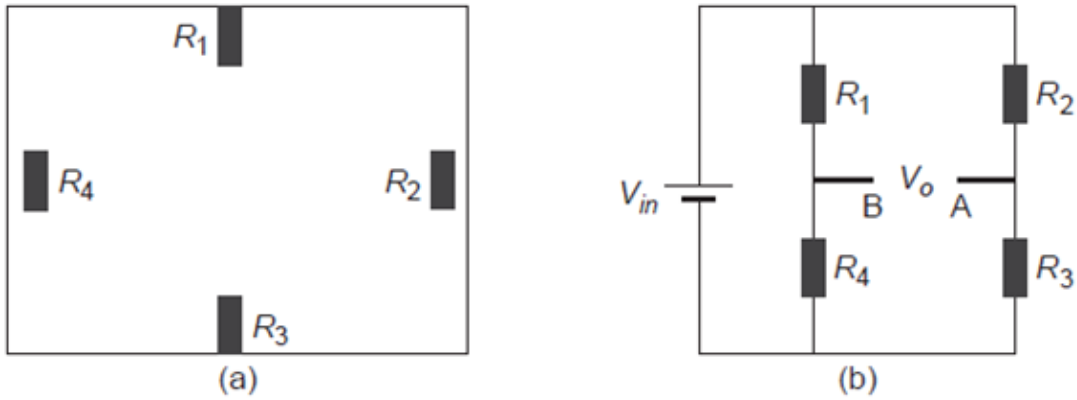
7) What will be the burst pressure (in bar) for the membrane mentioned in question 6 if maximum strength of silicon is 7 GPa?_____

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

(Type: Range) 100,125

3 points

8) Polycrystalline p-type piezo-resistors R1, R2, R3, and R4, each of them equal to R = 1kΩ, are arranged as shown in figure below on oxide grown on a single-crystal membrane having lateral dimensions 1mm × 1mm and thickness = 10 μm. The polysilicon resistor has longitudinal gauge factor = 30 and the transverse gauge factor is negligibly small (= 0). These resistors are connected in the form of a Wheatstone bridge as shown below.
Assuming v = 0 and Y = 150 GPa for polysilicon, in this pressure sensor, what will be the sensitivity (in mV/Bar) for an input voltage of 10 V?



_____ mV/Bar

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 490,510

4 points

9) Find the natural frequency (in KHz) of an accelerometer having a proof mass of 0.2 mg (lumped mass) and an effective spring constant of 400 N/m. _____KHz

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 6.5,7.6

2 points

10) The maximum stress a Si pressure sensor can withstand is 7 GPa. Pressure is applied on a square membrane of side 2a = 500 μm and thickness h = 10 μm. What should be the maximum operating range (in bar) of this pressure sensor for a safe application?

_____ bar

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 20,25

3 points