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[NPTEL \(https://swayam.gov.in/explorer?ncCode=NPTEL\)](https://swayam.gov.in/explorer?ncCode=NPTEL) » [A brief introduction of Micro-Sensors \(course\)](#)
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Unit 6 - Week 4

Course outline

How does an NPTEL online course work?

Week 0

Week 1

Week 2

Week 3

Week 4

- Pressure Sensor - I (unit? unit=29&lesson=40)
- Pressure Sensor - II (unit? unit=29&lesson=41)
- Pressure Sensor - III (unit? unit=29&lesson=42)
- Accelerometer - I (unit? unit=29&lesson=43)
- Accelerometer - II (unit? unit=29&lesson=44)

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

Quiz :
Assignment 4
(assessment?
name=54)

A brief
introduction of
Micro-Sensors:
Week 4
Feedback form
(unit?
unit=29&lesson=55)

Week 4 Lecture
Materials (unit?
unit=29&lesson=57)

Assignment 4
solutions (unit?
unit=29&lesson=61)

Week 5

Week 6

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VIDEOS**

Text Transcripts

- 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 **1 point** stress due to pressure P .

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

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

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

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

No, the answer is incorrect.
Score: 0

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

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 $2a = 500\ \mu\text{m}$ and thickness $h = 10\ \mu\text{m}$ made a deflection of $2\ \text{nm}$. _____ 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 $7\ \text{GPa}$? _____

No, the answer is incorrect.
Score: 0

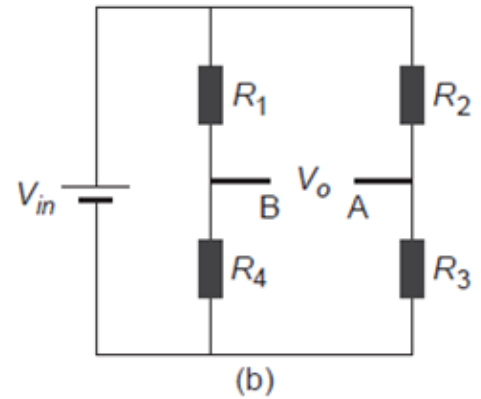
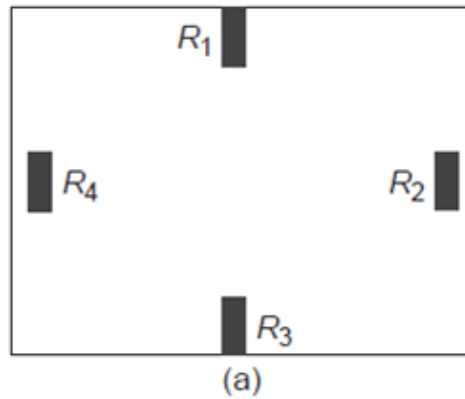
Accepted Answers:

(Type: Range) 100,125

3 points

8) Polycrystalline p-type piezo-resistors R_1 , R_2 , R_3 , and R_4 , each of them equal to $R = 1\text{ k}\Omega$, are arranged as shown in figure below on oxide grown on a single-crystal membrane having lateral dimensions $1\text{ mm} \times 1\text{ mm}$ and thickness = $10\ \mu\text{m}$. 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 $\nu = 0$ and $Y = 150\ \text{GPa}$ for polysilicon, in this pressure sensor, what will be the sensitivity (in mV/Bar) for an input voltage of $10\ \text{V}$?

_____ 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 $0.2\ \text{mg}$ (lumped mass) and an effective spring constant of $400\ \text{N/m}$. _____ 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 $7\ \text{GPa}$. Pressure is applied on a square membrane of side $2a = 500\ \mu\text{m}$ and thickness $h = 10\ \mu\text{m}$. 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

