

**ADVANCED SENSORS
(AEIE 3133)**

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

**Group - A
(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) The etching method having highest aspect ratio is
(a) DRIE (b) RIE (c) Wet etching (d) Dry etching.
- (ii) The sensors preferably use as “band filters” in mobile telephones and base stations are
(a) Chemiresistor sensors (b) SAW sensors
(c) Optical sensors (d) Piezo-resistive sensors.
- (iii) The shape of Quartz crystal is
(a) face centred cube (b) tetrahedron
(c) body centred cube (d) cylindrical.
- (iv) The micro-manufacturing technique having highest aspect ratio is
(a) Bulk micromachining (b) Spin coating
(c) Surface micromachining (d) LIGA.
- (v) In micro-fabrication, lithography is a process used for
(a) mask preparation (b) pattern transfer
(c) removing parts of substrate (d) etching.
- (vi) Scanning Laser Vibrometry is used for the measurement of
(a) Roughness (b) Pressure (c) Velocity (d) Strain.
- (vii) Plasma enhancement is commonly used in
(a) CVD (b) Wet Etching
(c) Ion implantation (d) Oxidation.
- (viii) Identify from the following a material removal method
(a) Surface micromachining (b) Micro stereo Lithography
(c) RIE (d) Epitaxy.

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- (ix) The Gauge factor of Semiconductor strain gauges are in the range of
(a) 2-10 (b) 10-20 (c) 5-20 (d) 50-200.
- (x) Mask is an important part of
(a) Chemical vapour deposition (b) Photolithography
(c) Ion implantation (d) Evaporation.

Group - B

2. (a) What are the factors we have to consider while choosing a sensor? Also write down the characteristics of a sensor those are important while choosing it.
(b) By which sensor, can you measure the speed of a rolling object? Explain the working principle of the said sensor.
 $(4 + 5) + (1 + 2) = 12$
3. (a) What is SAW and how does it work? Explain the working principle of SAW sensors with a neat diagram. State a few application areas of SAW sensors.
(b) State the three major application areas of BioMEMS. What are the foremost technical issues in BioMEMS products?
 $(2 + 4 + 2) + (2 + 2) = 12$

Group - C

4. (a) Name any two silicone compounds with their area of applications. Which material can be used as excellent barrier to diffusion to water and ions?
(b) What are LB films? Why are they so popular in sensor technology? Which property of LB films is applied for development of a gas sensor?
 $(4 + 1) + (2 + 3 + 2) = 12$
5. (a) What is the molecular structure of Quartz? Why is quartz treated as ideal material for sensor? Name at least three synthetic and non-synthetic piezoelectric crystal materials.
(b) What is Van der Waal's force? How does this force vary over intermolecular distance?
 $(3 + 3) + (3 + 3) = 12$

Group - D

6. (a) What is Plasma? How does one produce Plasma in the laboratory? Write at least two applications of Plasma in micro-fabrication technique.
(b) What do you mean by ionization? Describe the ionization technique using electron beam by using a suitable diagram.
 $(2 + 3 + 2) + (2 + 3) = 12$

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7. (a) Explain with suitable diagram the difference between isotropic, anisotropic etching techniques.
- (b) State what do you understand by CVD? What are the various sequential steps involved in a CVD process?
- (3 + 3) + (1 + 4 + 1) = 12**

Group - E

8. (a) What do you understand by bulk micro-machining? List a few points of advantages and disadvantages of bulk micro-machining over surface micro-machining.
- (b) When will you go for LIGA process and why? What are the advantages of LIGA process?
- (2 + 4) + (3 + 3) = 12**
9. (a) State the characteristics of smart sensors. What are the advantages and disadvantages of smart sensors?
- (b) What is the working principle of smart sensor? Identify at least 8 smart sensors present in your smart phone.
- (3 + 3) + (3 + 3) = 12**

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AEIE	https://classroom.google.com/c/MTIyNDU3Mzc5NDY3/a/MjcxNDMyMjgxMjg0/details