CS/M.Tech (EIE)/SEM-2/EIEM-201(D-7)/09

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2.	Signature of the Officer-in-Charge																
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IN	STRUCTIONS TO THE CANDIDATES :																
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- 4. Read the instructions given inside carefully before answering.
- 5. You should not forget to write the corresponding question numbers while answering.
- 6. Do not write your name or put any special mark in the booklet that may disclose your identity, which will render you liable to disqualification. Any candidate found copying will be subject to Disciplinary Action under the relevant rules.
- 7. Use of Mobile Phone and Programmable Calculator is totally prohibited in the examination hall.
- 8. You should return the booklet to the invigilator at the end of the examination and should not take any page of this booklet with you outside the examination hall, which will lead to disqualification.
- 9. Rough work, if necessary is to be done in this booklet only and cross it through.

No additional sheets are to be used and no loose paper will be provided

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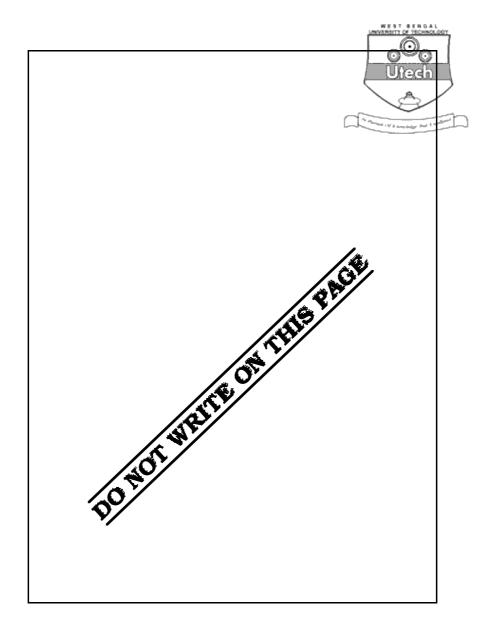
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Head-Examiner/Co-Ordinator/Scrutineer

38018 (30/06)







CS/M.Tech (EIE)/SEM-2/EIEM-201(D-7)/09 SENSORS-SCIENCE AND TECHNOLOGY SEMESTER - 2

Time: 3 Hours [Full Marks: 70

The figures in the margin indicate full marks.

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

Answer any *five* of the following.

 $5 \propto 14 = 70$

- 1. a) What is Minimum Detectable Signal (MDS) in a sensor? Discuss what you know about selectivity and specificity in a sensor. What is selectivity matrix? 6
 - b) How do you define reliability function in case of a sensor ? If M units of produced sensors are checked N times to obtain average of failure at 1.5% at an instant t, what would be the value of the reliability function ?
- 2. a) How do you obtain a single crystal ingot of Si for making wafers? What is the starting material? Draw the flow-chart to demonstrate the process of obtaining the wafer.
 - Why do we need oxidation of Si-wafer and how is it done? Briefly explain with thickness-time relation diagram. How time and temperature can be reduced in such a process to attain the level of oxidation?
- 3. a) What is photoresist? What is its function in pattern transfer? Describe with sketches and flow-charts, the pattern transfer process.
 - b) Distinguish between isotropic and anisotropic etchings.

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- 4. a) Compare the operational principles and performance characteristics between the barrel etcher and plasma etcher. Append sketches.
 - b) What is selectivity in an etching process? How is it enhanced? Discuss with a typical example and reaction equations.
- 5. a) Discuss the terms pre-dep and drive-in in connection with impurity diffusion in semiconducting wafers. How are solid solubility of impurities related to temperature? Explain with curves. What is deglazing?
 - b) How does doping using ion-implantation process differ from diffusion process?

 Give sketches to support your anser. What is ion-channeling?
- 6. a) Name the different metallization techiniques. Sketch a technique where a pressure between 10^{-2} and 10^{-5} Pa of selective vapours is maintained in the chamber. Describe its operation briefly. What are its limitations?
 - b) What are the different wire-bonding techniques? Compare the techniques from implementation point of view. What is 'purple-plague'? How can it be avoided?
- 7. a) Describe with flow-chart the production process of thick-film CO-detector. If hydrogen is to be detected what change would you make is the process?
 - b) What is a cermet? Discuss its operation when:
 - i) Ag is embedded in it
 - ii) Ru-based complex oxide is embedded in it. What is 'percolation threshold'? Can you find it in all types of cermets?

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- 8. a) What are three steps in a thin film production process? Described with sketch a PECVO process. What is its temperature requirement compared to the LPCVD?
 - b) How do you characterize a thin film sensor? What precautions should you take during characterization of a sensor?
- 9. Write short notes on any *two* of the following : 2×7
 - a) Smart Sensors
 - b) Masking and pattern generation
 - c) Sensor modeling
 - d) Ceramic sensors.

END