

Registration No:

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Total Number of Pages: 02

M.TECH
P2AECC14

2nd Semester Regular Examination 2016-17

Bio- MEMS & Nanotechnology

BRANCH:APPLIED ELECTRO & INSTRUMENTATION ENGG, ELECTRO & INSTRUMENTATION ENGG, SIGNAL PROCESSING AND ENGG, VLSI & EMBEDDED SYSTEMS, VLSI & EMBEDDED SYSTEMS DESIGN, VLSI DESIGN & EMBEDDED SYSTEMS

Time: 3 Hours

Max Marks: 100

Q.CODE:Z957

Answer Question No.1 which is compulsory and any FOUR from the rest.

The figures in the right hand margin indicate marks.

- Q1** Answer the following questions: **Short answer type** (2 x 10)
- a) Explain the difference between MEMS and Microsystems.
 - b) Which material is used as ideal substrate for MEMS and Why ?
 - c) Explain how LPCVD process is different from PECVD process.
 - d) Why thermocouples are not ideal for micro thermal sensors .
 - e) Explain how micro actuation can be achieved by SMA technique.
 - f) Explain with suitable diagram how magnetic sensor is used for direction sensing for vehicles.
 - g) Write down the advantages of MOEMS over MEMS.
 - h) Which technology is used in DMD devices. Write down the basic units used for DMD based display system.
 - i) What do you mean by Nanocomposites. Write down its applications.
 - j) Explain why silicon nanotubes have gained popularity over its counterpart Fullerenes.
- Q2** a) Explain the Czochralski method for growing single crystal with suitable diagram. (10)
- b) What are the methods used for achieving thin film deposition during MEMS fabrication process. Explain any two methods with suitable diagram. (10)
- Q3** a) Write down the key processes involved during Photolithography. Explain how negative photoresist is different from positive photoresist with suitable diagrams. (10)
- b) Explain how isotropic etching is different from anisotropic etching. (10)
- Q4** a) Explain Ion Implantation process with suitable diagram. If a silicon substrate is doped with boron ions at 100 keV and $R_p = 307 \times 10^{-7} \text{cm}$ at 100keV and $\Delta R_p = 69 \times 10^{-7} \text{cm}$. Assume the maximum concentration after doping is $30 \times 10^8 / \text{cm}^3$. Find i) the dose Q ii) the dopant concentration at a depth 0.15 μm . iii) depth at which the dopant concentration is 0.1 percent of the maximum value. (10)
- b) Compare with suitable diagrams between Bulk and surface micromachining processes. (10)
- Q5** a) Write down the methods used to achieve microactuation in MEMS devices. (10)
- b) Classify magnetic materials used for MEMS. (10)

- Q6** **a)** Explain the construction and principle of operations of Micropumps with suitable diagram. **(10)**
- b)** Explain the application of Bio-MEMS in Drug delivery system. **(10)**
- Q7** **a)** What do you mean by colloidal synthesis of semiconductor Nano- particles. Explain with Examples. **(10)**
- b)** Write down short notes on metal Nanoclusters. **(10)**