B.E. (Electronics & Telecommunication / Electronics & Communication Engineering)
Seventh Semester (C.B.S.)

Elective - I : Micro-Electro-Mechanical Systems & Systems on Chip

P. Pages : 2 **TKN/KS/16/7543**

Time : Three Hours Max. Marks : 80

Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Due credit will be given to neatness and adequate dimensions.
9. Assume suitable data whenever necessary.
10. Diagrams and chemical equations should be given whenever necessary.
11. Illustrate your answers whenever necessary with the help of neat sketches.
12. Use of non programmable calculator is permitted.
13. Due credit will be given for explanation with neat diagrams.

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1. a) Explain the difference between MEMS and microsystems. What are the principle applications of micro sensors? **7**

b) Explain miniaturization. Give at least four distinct advantages of miniaturization of machines and devices. **6**

OR

2. a) Describe the role of quantum physics in the design of MEMS and microsystems. **7**

b) Explain with a block diagram the components of a microsystem. **6**

3. a) With neat diagrams explain the different etching processes in detail. **7**

b) Explain in brief different types of CVD. **3**

c) The equation of a plane is given by y 7x+3y=2. Obtain the Miller indices for a plane that is normal to this plane. **4**

OR

4. A silicon substrate is doped with boron ions at 100KeV. Assume the maximum concentration after the doping is 30 x $10^{18}/cm^3$. Find **14**

i) The dose Q.

ii) The dopant concentration at a depth 0.15 μm ,and

iii) The depth at which the dopant concentration is 0.1 percent of the maximum value.

Given data:

The projected range for boron ion is 307nm at 100KeV or R_P =307nm and the straggle, $\Delta R_P = 69$nm.

5. a) Explain the working principle of thermal transducer and magnetic transducer. **7**

b) What are different types of biosensors used in MEMS. Explain each one in brief. **7**

OR

6. a) Explain different types of pressure sensors used in microsystems. Explain each one in detail. **7**

b) Determine the capacitance of a parallel – plate capacitor. The two plates have identical dimensions of $L = W = 100\,\mu m$ with a gap $d = 2\ \mu m$. Air is the dielectric medium between the two plates. (Permittivity of air, $\in = 1$). **7**

7. a) List the applications of RF-MEMS devices. **6**

b) Explain the basic modeling methods that can be used in RF MEMS design. **7**

OR

8. a) What are the characteristic features of the methods that can be used in RF MEMS devices? **7**

b) Describe the analytic modeling of a parallel plate capacitor and the pull - in effect. **6**

9. a) Explain different types of packaging used in MEMS devices. **6**

b) What are the different types of packaging material used in MEMS packaging technology. Explain in brief? **7**

OR

10. a) Explain the role of MEMS packaging in the MEMS devices. **7**

b) Explain the process of microsystem packaging by taking example of a case study of pressure sensor. **6**

11. a) What are the design considerations for a microsystem design? Explain in brief. **7**

b) Explain the process of photolithography in respect of microsystem design. **6**

OR

12. a) Write a short note on Glucometer. **6**

b) What are the different methods of signal transduction in the microsystem's design? What is the criteria for selection of these methods? **7**

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