# GUJARAT TECHNOLOGICAL UNIVERSITY
**BE - SEMESTER–VII (NEW) EXAMINATION – WINTER 2018**

**Subject Code: 2170311**                                              **Date: 29/11/2018**

**Subject Name: Biomedical Microsystems**

**Time: 10:30 AM TO 01:00 PM**                                    **Total Marks: 70**

**Instructions:**
1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

|  |  |  | MARKS |
|---|---|---|---|
| **Q.1** | **(a)** | What is difference in manufacturing process between MEMS and microelectronics. | **03** |
|  | **(b)** | Explain the statement "The material structure type is greatly influenced by the interatomic bonds and their completeness". | **04** |
|  | **(c)** | Explain with neat schematic different processes for manufacturing Silicon on insulator (SOI) substrate. Why SOI is preferred in manufacturing microelectronics devices? | **07** |
| **Q.2** | **(a)** | Explain diffusion process used in material doping with equations. | **03** |
|  | **(b)** | Explain Czochralski Growth Process with neat schematic. Also explain role of segregation coefficient in Czochralski Growth Process. | **04** |
|  | **(c)** | With help of neat diagram explain evaporation and sputtering processes used for Physical Vapor deposition. | **07** |
|  |  | **OR** |  |
|  | **(c)** | Explain different type of etching processes with neat diagram. Which process is most suitable for Bio-MEMS? | **07** |
| **Q.3** | **(a)** | Explain Chemical Mechanical polishing techniques used for silicon wafers. | **03** |
|  | **(b)** | With help of neat diagrams explain the different types of crystallographic orientation of silicon wafers. | **04** |
|  | **(c)** | Explain lithography technique used for patterning in MEMS. Mention difference between negative and positive resist. | **07** |
|  |  | **OR** |  |
| **Q.3** | **(a)** | Explain Damascene process with different stages in development. | **03** |
|  | **(b)** | Explain with neat diagram sacrificial surface micromachining. | **04** |
|  | **(c)** | Explain Annealing process used in MEMS processing. | **07** |
| **Q.4** | **(a)** | Explain SCREAM with process flow used in Bulk micromachining. | **03** |
|  | **(b)** | "The evaluation and selection of a fabrication process appropriate for an application requires the assessment of a number of factors"- Explain the statement. | **04** |

1

|       | (c) | Give comparison between LIGA, Bulk micromachining, surface micromachining and conventional machining. | 07 |
|-------|-----|------|----|

**OR**

|       |     |      |    |
|-------|-----|------|----|
| Q.4   | (a) | What is sensor noise? Explain white noise and power spectral density function (PSD). | 03 |
|       | (b) | Explain Electron tunneling transduction principle with neat schematic. | 04 |
|       | (c) | Write Diagnostic and Therapeutic Applications of Metal Nano shells. | 07 |
| Q.5   | (a) | What are vascular targets? Explain delivery of diagnostic and therapeutic agents to vascular targets. | 03 |
|       | (b) | Explain tissue specific ZIP codes in blood vessels. | 04 |
|       | (c) | Explain various Bio Sensing Principles and sensing methods. | 07 |

**OR**

|       |     |      |    |
|-------|-----|------|----|
| Q.5   | (a) | Explain optical properties of quantum dots. | 03 |
|       | (b) | Describe the development of inorganic semiconductor quantum dots(QD) probes for biological and medical applications. | 04 |
|       | (c) | Explain Biosensors arrays and Implantable devices used in MEMS applications. | 07 |

*************