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# B.M.S. College of Engineering, Bengaluru-560019

**Autonomous Institute Affiliated to VTU**

## January 2024 Semester End Main Examinations

**Programme: B.E.** **Semester: V**
**Branch: ES- Cluster Elective** **Duration: 3 hrs.**
**Course Code: 19EI7CE2ME** **Max Marks: 100**
**Course: MEMS**

**Instructions**: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

**Important Note:** Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

| | | | UNIT - I | *CO* | *PO* | Marks |
|---|---|---|---|---|---|---|
| 1 | a) | | Explain the constituents of a microsystem with a neat block diagram illustrating its interconnections | *CO1* | *PO1* *PO2* | **06** |
| | b) | | Explain the functional relationship between the various components in microsensors and microactuators using a suitable diagram. | *CO1* | *PO1* *PO2* | **08** |
| | c) | | Compare the core functionalities of microelectronics and microsystems | *CO1* | *PO1* *PO2* | **06** |
| | | | **UNIT - II** | | | |
| 2 | a) | | Describe a specific method for analyzing the diverse compounds in a biological sample using electro-osmosis mobility | *CO2* | *PO1* *PO2* | **08** |
| | b) | | "Chemical sensor can be used to measure chemical compositions in a gas". Justify if the statement is true. | *CO2* | *PO1* *PO2* | **05** |
| | c) | | Enumerate the principal means commonly used in actuating motions of microdevices. Justify how the "memory effect" of shape-memory alloys can be used in microactuation. | *CO2* | *PO1* *PO2* | **07** |
| | | | **UNIT - III** | | | |
| 3 | a) | | How does miniaturization affect the interaction of electrostatic forces in MEMS. Justify with suitable expressions | *CO2* | *PO1* *PO2* | **07** |
| | b) | | What do you mean by Force Scaling Factor? Estimate the associate changes in the acceleration (a) and the time (t) and the power supply (P) to actuate a MEMS component if its weight is reduced by a factor of 10. | *CO2* | *PO1* *PO2* | **07** |
| | c) | | Explain how an electromagnetic force would experience a 10,000 times reduction if the size is reduced by a factor of 10 in scaling of MEMS devices. | *CO2* | *PO1* *PO2* | **06** |

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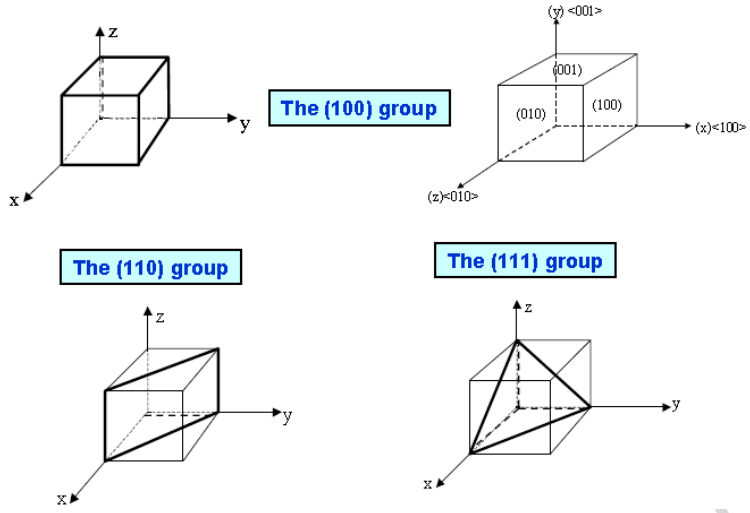
| | | | **OR** | | | |
| | 4 | a) | Identify the characteristics of silicon for the principal planes as shown in Fig 4(a)<br>  <br><br>Fig 4(a) | *CO2* | *PO1*<br>*PO2* | **05** |
| | | b) | Suggest a suitable method to produce pure silicon crystal with suitable diagrams. | *CO2* | *PO1*<br>*PO2* | **08** |
| | | c) | Explain the typical process flow for constructing SU-8 films with a suitable block diagram. | *CO2* | *PO1*<br>*PO2* | **07** |
| | | | **UNIT - IV** | | | |
| | 5 | a) | Explain the various stages involved in the fabrication process with a suitable diagram | *CO3* | *PO2* | **07** |
| | | b) | Suggest a suitable block diagram to illustrate ion implantation and summarize the operation. | *CO3* | *PO2* | **07** |
| | | c) | "Epitaxy deposition process is used to deposit polysilicon films on silicon substrate surfaces". Validate the statement with suitable diagram and summarize the operation. | *CO3* | *PO2* | **06** |
| | | | **OR** | | | |
| | 6 | a) | Elaborate on the removal of substrate materials through dry etching using gaseous etchants detailing various techniques with suitable diagrams. | *CO3* | *PO2* | **08** |
| | | b) | Explain the specific parameters that differentiate dry etching and wet etching | *CO3* | *PO2* | **06** |
| | | c) | Discuss how surface micromachining is different from bulk manufacturing | *CO3* | *PO2* | **06** |
| | | | **UNIT - V** | | | |
| | 7 | a) | Enumerate the major reliability issues and failure mechanisms involved in the microsystem packaging | *CO4* | *PO2* | **06** |

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|---|---|---|---|---|---|---|
| | | b) | Discuss the challenges associated with interfacing in microsystems that require attention and resolution | *CO4* | *PO2* | **07** |
| | | c) | Describe the sequential process flow chart outlining the integrated assembly, packaging, and testing method employed for the large-scale production of micro pressure sensors. | *CO4* | *PO2* | **07** |

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