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

Autonomous Institute Affiliated to VTU

September / October 2023 Supplementary Examinations

Programme: B.E. **Semester: VII**
Branch: ES – Cluster Elective **Duration: 3 hrs.**
Course Code: 19EI7CE2ME **Max Marks: 100**
Course: MEMs **Date: 13.09.2023**

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

UNIT - I

1	a)	Explain the various components of MEMs	**06**
	b)	Analyze the functional relationship between the components in microsensors and microactuators using a suitable diagram	**08**
	c)	Microsystems make up an "intelligent" system. Justify with suitable diagram.	**06**

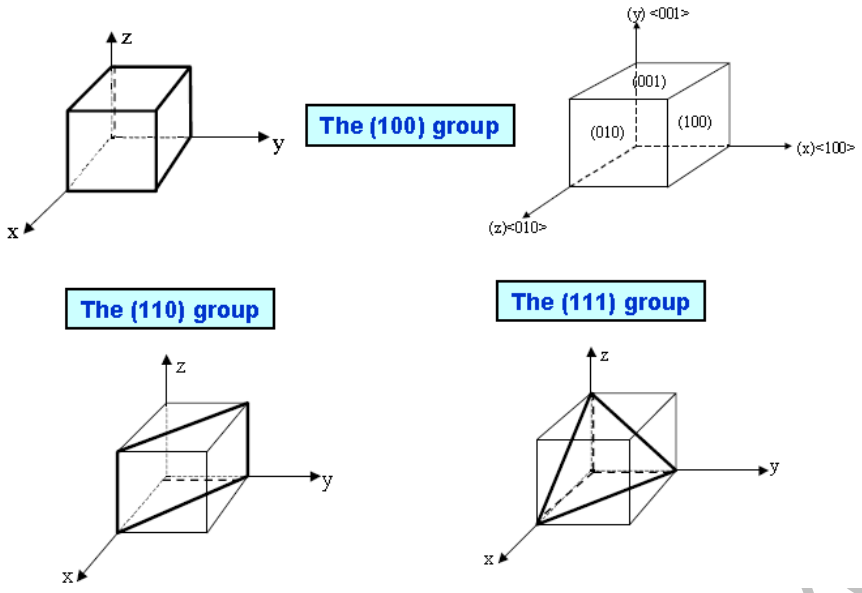
UNIT - II

2	a)	What are the major technical issues involved in the application of MEMS in biomedicine. Explain how the amount of glucose content in the blood of a patient is measured	**07**
	b)	Temperature is measured by the EMF produced between two dissimilar metals when the junction is heated. Justify the statement with suitable diagram	**07**
	c)	"Quartz crystals can be used in actuation devices". Validate the statement.	**06**

UNIT - III

3	a)	A 10 times reduction in the size of the parallel plates will mean 100 times decrease in the induced electrostatic force. Justify the statement.	**08**
	b)	Derive the parameters required for scaling of systems in motion using force scaling vector.	**06**

c) **06**



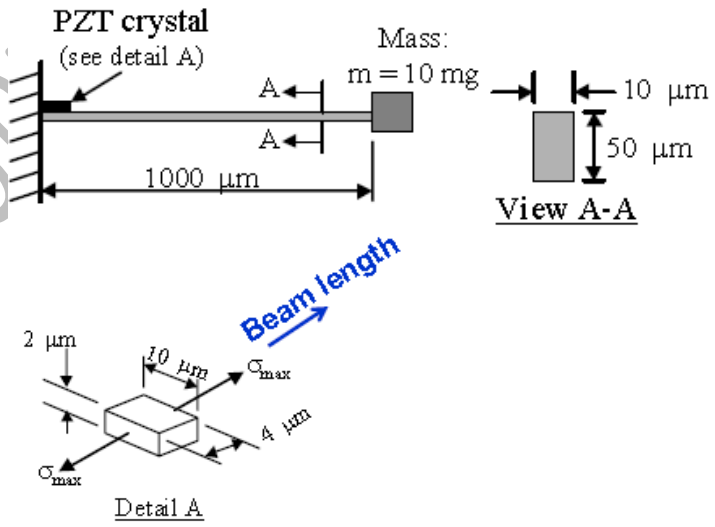
Identify the characteristics of silicon for the principal planes mentioned above.

OR

4 a) Indicate the reason for polymers being used in industrial products. **05**

b) A thin piezoelectric crystal film, PZT is used to transduce the signal in a micro accelerometer involving a cantilever beam made of silicon. The accelerometer is design for maximum acceleration/deceleration of 10 g. The PZT transducer is located at the support of the cantilever beam where the maximum strain exists (near the support) during the bending of the beam as illustrated below. Determine the electrical voltage output from the PZT film at a maximum acceleration/deceleration of 10 g. **08**

Assume C = half-depth of the beam cross section =25X10-6m., I= 0.1042X 10-18 m4, E= 1.9 X 1011 Pa, piezoelectric coefficient of PZT crystals d= 480X 10-12 m/ V, actual length of the PZT crystal l =4X10-6m.



c) What do you mean by Langmuir–Blodgett process. Describe how LB films can be used to detect gases using a suitable diagram. **07**

UNIT- IV

5	a)	A thin film of silicon dioxide is to be formed on a silicon substrate using carrier gas. Suggest an appropriate method(CVD) with diagram to implement the same.	**07**
	b)	A layer of silicon dioxide must be applied to a silicon substrate by thermal oxidation at a very low cost. Suggest a suitable method to realize the task and justify the same with diagram	**07**
	c)	"Plasma generated from high radio frequency sources allows substrate to remain at low temperatures". Validate the statement with diagram and summarize the operation.	**06**

OR

6	a)	Issues related wet etching are resolved using etch stop techniques. Justify the statement using suitable diagrams	**08**
	b)	Explain the specific parameters that differentiate dry etching and wet etching.	**06**
	c)	Describe the mechanical problems associated with surface micromachining.	**06**

UNIT- V

7	a)	As an engineer suggest the general considerations involved in packaging design.	**07**
	b)	As a designer, elaborate on what are the interfacing problems that needs to be addressed in microsystems?	**07**
	c)	Explain the second level of microsystem packaging with suitable diagram	**06**

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