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Total Number of Pages: 02

B.Tech
PEEI5405

8th Semester Regular / Back Examination 2016-17
MICRO ELECTRO MECHANICAL SYSTEMS
BRANCH(S): AEIE, EIE, IEE, MANUFAC, MANUTECH, MECH
Time: 3 Hours
Max Marks: 70
Q.CODE: Z159

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

- Q1 Answer the following questions: (2 x 10)**
- a) Define MEMS. Give some examples.
 - b) Enlist any two basic structures that are employed in the formation of a microsystem device. Mention the main issues that govern the implementation of these structures.
 - c) Draw the schematic of a bulk micromachined micropump.
 - d) Enlist at least four materials used for micromachining.
 - e) Enlist the properties of LPCVD deposited Silicon Nitride films.
 - f) Define Dielectrophoresis. In which domain of MEMS is it applicable?
 - g) Differentiate between Structural and Sacrificial layers. Give one example each for Structural and Sacrificial materials.
 - h) Mention some advantages of sputtering.
 - i) What is the principle of operation of Micromirrors.
 - j) What is Lab-on-Chip? Name one over-the-counter LoC that is available in the market.
- Q2 a) What are the steps involved in Silicon Wafer Preparation? (2)**
b) What is an etch stop? Discuss some etch stop techniques. (8)
- Q3 a) State the Castigliano's Theorem. (3)**
b) What is the numerical spring constant k (units: N/m) of this suspension a double-folded, one-sided suspension Shown in Figure Q3 (a) below. What is the numerical spring constant k (units: N/m) of this suspension? Given: the density of polysilicon is 2330 kg/m^3 and the area of the shuttle and comb fingers is $700 \mu\text{m}^2$; you can neglect the effective mass of the suspension beams. (7)

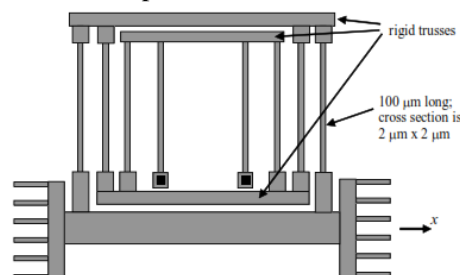


Figure Q3 (a)

- Q4 With proper illustrations detail the various steps included in Photolithography. What is the lift-off technique? (10)**

- Q5** a) How do polymers find use in the area of microsystem design? Which characteristics of polymers make it suitable for use in microsystem design? Give some examples. **(5)**
- b) Enlist the steps involved in LTCC process. Use suitable illustrations to aid your answer. Name two functional ceramics. **(5)**
- Q6** a) Fabricate a Cantilever beam using Bulk Micromachining and Surface Micromachining technique and compare between the two techniques. Use suitable illustrations. **(5)**
- b) What is the principle of operation and types of MEMS resonator? Use diagrams to aid your answer. **(5)**
- Q7** Discuss the various Reliability and key failure mechanisms of MEMS packaging. What are the important considerations that must be kept in mind while doing packaging in MEMS? **(10)**
- Q8** **Write short answer on any TWO:** **(5 x 2)**
- a) Application of Smart systems in different fields.
- b) CVD and its types
- c) Ion Implantation Process
- d) HexIL