

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, April, 2017

Program Name: B.Tech. Mechatronics

Course Name : MEMS

Course Code : MEEL441

No. of page/s: 02

Semester – VIII

Max. Marks : 100

Duration : 3 Hrs

Note: 1.) Section A has five questions of 4 marks each.

2.) Section B has four questions of 10 marks each.

3.) Section C has three questions with an internal choice of 20 marks each.

4.) All the questions in Section A and Section B are compulsory. Attempt two questions from section C.

5.) Assume any missing data.

SECTION- A (20 MARKS)

Q.1: Give four properties of Si that make it suitable as substrate material.

Q.2: What are the three principal uses of silicon oxide in microsystems? Write down the chemical reaction for wet oxidation reaction for the production of SiO_2 .

Q.3: State the mathematical relationships that can be used to design the piezoelectric transducers in unidirectional loading situations.

Q.4: Briefly describe the two popular techniques used in etch stop.

Q.5: Provide the designation of normal, diagonal and inclined planes of a cubic crystal. Also represent the orientations of these planes using Miller indices.

SECTION- B (40 MARKS)

Q.6: Compare between wet and dry etching. Describe the deep reactive ion etching process with a neat diagram.

Q.7: Summarize the various micromanufacturing processes used for producing microsystem devices. Explain with the help of suitable references and neat diagrams.

Q.8: Explain the mechanical problems associated with surface micromachining.

Q.9: Describe the construction and working of microvalves and micropumps with neat sketches and technical specifications.

SECTION-C (40 MARKS)

Q.10 a): Describe the process used for producing single-crystal silicon and wafers with neat diagram. Explain the crystal structure of Si.

b): Enlist the various properties gallium arsenide. GaAs is superior to Si, still it is not a popular material for manufacturing microsystems. Why?

Q.11: Explain with the help of diagram-

a) Chemical sensors

b) Optical sensors

OR

Q.11 (internal choice): a) Give the various applications of polymers as materials for MEMS and microsystems. Why are polymers being used as industry materials?

b) What are conductive polymers? How are polymers made conductive? What is an LB film? Give its applications.