Name: Enrolment No:	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, May 2019

Programme Name: B.Tech. Mechatronics | **Semester : VIII**
Course Name : MEMS | **Time : 03 hrs**
Course Code : MEEL441 | **Max. Marks : 100**
Nos. of page(s) : 02
Instructions: All questions are compulsory. Any internal choice is mentioned within the question itself.

SECTION A

S. No.		Marks	CO
Q 1	Discuss why silicon is the most popular material for making substrates? Describe the procedure of extraction of Si from its ore with the help of a diagram.	5	CO1
Q 2	Describe DRIE with the help of diagram. What are its advantages/disadvantages over plasma etching?	5	CO4
Q 3	Describe the various types of chemical sensors used in MEMS devices.	5	CO2
Q 4	Differentiate between isotropic and anisotropic etching.	5	CO4
	SECTION B		
Q 5	Explain surface micromachining process along with its limitations.	10	CO4
Q 6	Explain about conductive polymers? What are the various methods of manufacturing conductive polymers?	10	CO3
Q 7	a) Examine the use of piezoelectric crystals in MEMS and microsystems. **OR** b) Examine the various packaging materials used for packaging of devices containing MEMS and microsystems.	10	CO5
Q 8	Consider a microaccelerometer utilizing a Si cantilever beam. Determine the displacement from its neutral equilibrium position of the mass of the microaccelerometer placed at the free end of cantilever, one millisecond after the deceleration from its initial velocity of 40 km/h to a stand still. The beam is made of silicon with a Young's modulus of 190,000 MPa. Assume the mass of payload to be 10 mg. The dimensions of the cantilever beam are: Length = 1000 microns, width = 50 microns and thickness = 10 micron.	10	CO5
	SECTION-C		
Q 9	a) Analyze the various micromanufacturing processes with the help of well labelled and neat diagram. Give the pros and cons of using these methods. **OR** b) Design a pressure sensor using MEMS.	20	CO5

Q 10	a) Design a capillary electrophoresis system for a bioanalytical system. b) Describe a fluidic system? What are the major components of fluidic systems? Discuss the various types of microchannels used in microfluidic systems. Also mention the advantages of microfluidic systems.	**20**	**CO6**