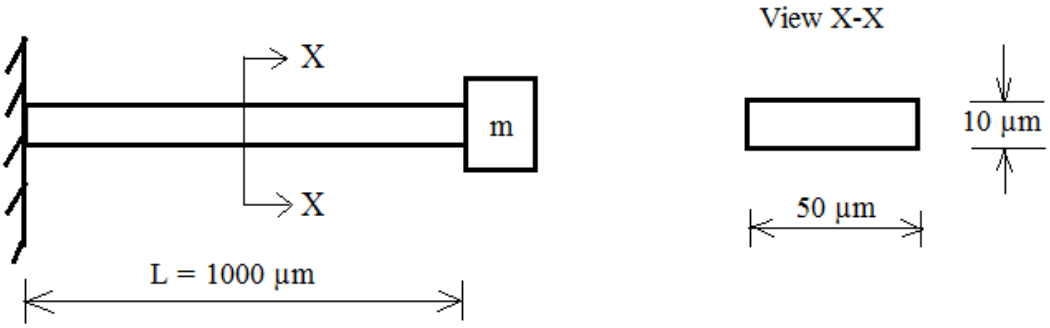
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, April/May 2018

Course: MEMS (MEEL 441)
Semester: VIII
Program: B.Tech. Mechatronics Engineering
Time: 03 hrs. **Max. Marks: 100**

Instructions: Assume the missing data.

SECTION A

S. No.		Marks	CO
Q 1	Define the following: i) Sacrificial layer ii) Aspect ratio iii) Photoresist iv) Etching	4	CO4
Q 2	Analyze the various types of silicon compounds.	4	CO3
Q 3	Describe the working of microgrippers.	4	CO2, CO5
Q 4	A parallel plate capacitor is made of two square plates with the dimensions L = W = 1000 μm. Determine the normal electrostatic force (along'd' direction) if the gap between these two plates is d = 2 μm. The plates are separated by static air. Also find the capacitance of the capacitor.	4	CO2
Q 5	Identify at least four distinct advantages of miniaturization of machines and devices.	4	CO1, CO5
	SECTION B		
Q 6	Summarize the microfluidic systems giving their applications, advantages, major components and types.	10	CO2, CO5
Q 7	Explain the construction and working of microvalves and micropumps.	10	CO2
Q 8	Give the design theory of microaccelerometers.	10	CO2, CO5
Q 9	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	CO3
	SECTION-C		
Q 10	a) Explain the use of polymers as materials for MEMS and microsystems and industrial purpose. Describe briefly the conductive polymers. What is an LB film? OR b) Summarize the various micromanufacturing processes. Give the pros and	20	CO3, CO4, CO5

	cons of using these methods.		
Q 11	A microdevice component, 4 gram in mass, is attached to a fine strip made of silicon, as illustrated in the Figure 1. Both the mass and the strip-spring are made of silicon. The mass is pulled down by 5 µm initially and is released at rest. Determine (a) the natural frequency of the simulated mass-spring system. (b) The maximum amplitude of vibration. Young's modulus of Si, E = 190,000MPa.  Figure 1: Figure for Q 11	**20**	**CO2**