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VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
 [AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]
 Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 120019

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – NOV. / DEC. 2024

Fifth Semester

Biomedical Engineering

U19BMV51 – BIO MEMS

(Regulation 2019)

Time: Three Hours

Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels	K1 – Remembering	K3 – Applying	K5 - Evaluating
(KL)	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Differentiate between positive and negative photo resist.	2	K2	CO1
2.	State the significance of dry etching.	2	K1	CO1
3.	State the working principle of an actuator? Give examples.	2	K1	CO2
4.	Mention the two primary phases of shape memory alloys, and how do they differ?	2	K2	CO2
5.	A parallel plate capacitor is made of two parallel plates with dimensions $L=W=1000\mu\text{m}$. Find the normal electrostatic force if the gap between the two plates is $d=2\mu\text{m}$. The plates are separated by static air.	2	K2	CO3
6.	Give any two applications of tactile sensor and flow sensor.	2	K2	CO3
7.	Water has a coefficient of viscosity of 0.001 Pas at 20°C. What is the pressure difference that is necessary to keep water moving with a volume flow rate of 0.025m ³ /s through a 5m long pipe with a radius of 2cm.	2	K2	CO4
8.	What are the commonly used components in a microfluidic system?	2	K1	CO4
9.	List the advantages of Lab on chip devices in medical field.	2	K2	CO5
10.	Mention the applications of implantable microelectrodes.	2	K1	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.	Questions	Marks	KL	CO
11. a)	Describe the working principle, chemical reactions and rate of deposition of the Chemical vapour deposition technique. (OR)	13	K2	CO1
b)	Explain the step by step processes involved in photolithography with suitable schematic.	13	K2	CO1
12. a)	State the difference between a thermocouple and thermopile. Why thermopile is preferred for MEMS devices? Explain the working of the thermopile with a schematic diagram. (OR)	13	K2	CO2
b) i.	Describe the working of Bimetallic strips and how it could be used as a thermal sensor.	6	K2	CO2
ii.	Describe the working of Shape memory alloys and how it could be used as a micro actuator.	7	K2	CO2
13. a)	Why are electrostatic forces required to run micro motors than conventional electromagnetic forces? Explain the working principle of electrostatic micromotors with suitable schematic diagram. Explain why this technique is not used to run macro machines and motors. (OR)	13	K3	CO3
b) i.	Explain the working of a comb drive actuator with schematic.	7	K2	CO3
ii.	For a comb driven actuator, determine the voltage supply required to pull the moving electrodes $10\mu\text{m}$ from the unstretched position of the spring. The spring constant K is 0.05N/m . The comb drive is operated in air, the gap d between the electrodes and the width W of the electrodes are $2\mu\text{m}$ and $5\mu\text{m}$ respectively.	6	K3	
14. a)	Derive the equations of motion pertaining to fluid flow through a micro channel. Explain their significance. (OR)	13	K3	CO4
b)	Draw the different types of micro-mixers and brief the working and applications of i. microneedles and ii. micromixers.	13	K2	CO4

15. a) Elaborate in detail about the general structure of CAD for Microsystems design. 13 K2 CO4
- (OR)
- b) Do you think that the DNA microarray technology is better for diagnosing genetic defects and mutations? Give one example of implementing microarray sensing with suitable schematic. Explain about it in detail. 13 K4 COC4

PART – C

(1 x 15 = 15Marks)

Q.No.	Questions	Marks	KL	CO
16. a)	Can you design a microcantilever beam using polysilicon material? What is the fabrication technology involved? Discuss the problems associated with the mechanical stability with appropriate diagrams.	15	K4	CO1
(OR)				
b)	Case Study: Parkinson's disease is a neurodegenerative disorder that affects movement. Patients with Parkinson's often experience difficulties with gait, balance, and overall motor function. Accurate monitoring of gait and movement patterns is crucial for diagnosing, tracking disease progression, and tailoring personalized treatment plans.		K3	CO3
	i. Identify the kind of sensors that you can use for capturing the forces experienced during the movement of the patient.	5		
	ii. Explain the principle of working of these sensors with suitable schematic diagrams.	10		