Roll No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. /B. Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, APR / MAY 2024

Materials Science and Engineering

VI Semester

ML5009 & MEMS and Microfabrication

(Regulation 2019)

Time:3 hrs

Max. Marks: 100

CO1	Identify suitable materials for MEMS applications.
CO2	Discuss the micro and nanofabrication techniques.
CO3	Explain the method of etching, surface and bulk micro manufacturing methods.
CO4	Describe the MEMS components and Devices.
CO5	Select and Implement MEMS devices for the required application.

BL – Bloom's Taxonomy Levels

(L1-Remembering, L2-Understanding, L3-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

PART- A (10x2=20Marks)

(Answer all Questions)

Q. No.	Questions	Marks	CO	BL
1	Distinguish MEMS and NEMS.	2	1	L2
2	Give the applications of Smart materials in MEMS technology.	2	1	L1
3	Brief Thermal Oxidation.	2	2	L1
4	Define Nanoimprint.	2	2	L2
5	State Fick's law with respect to diffusion of dopants.	2	3	L2
6	Write short notes on Anisotropic etching.	2	3	L1
7	Enumerate the advantages of Shape memory alloy based MEMS actuator.	2	4	L1
8	List the applications of Radio Frequency MEMS.	2	4	L2
9	Brief Nano Measuring Systems.	2	5	L2
10	Write down the steps involved in the design of MEMS by using intellisuite.	2	5	L2

PART- B (5x 13=65Marks)

(Restrict to a maximum of 2 subdivisions)

Q. No.	Questions	Marks	CO	BL
11 (a)	Explain the significance of MEMS and NEMS in the advancement of miniature devices, and also discuss the key differences and potential applications of each.	13	1	L2
	OR			
11 (b)	Explain in detail about the any two application of MEMS in various industries with suitable example	13	1	L2
12 (a)	(i) Explain the multi – engineering disciplines involved in microsystems design and manufacture. (ii) Discuss about Extreme UV lithography with suitable diagrams.	7 6	2 2	L3 L3
	OR			
12 (b)	Discuss in detail about Electron Beam Lithography with its applications.	13	2	L3

13 (a)	Describe the working principle, advantages, applications and limitations of LIGA process with neat sketch.	**13**	3	L4
	OR			
13 (b)	Discuss in detail the method of depositing silicon dioxide, silicon nitride, and polycrystalline silicon and epitaxy growth over silicon substrate by chemical vapor deposition with neat sketch.	**13**	3	L4
14 (a)	With neat sketch explain the working principle, construction, advantages and applications of Accelerometer.	**13**	4	L4
	OR			
14 (b)	With neat sketches explain the following with its applications. (i)Micro - opto electromechanical systems (ii)Radio Frequency MEMS.	**7** **6**	4 4	L4 L4
15 (a)	Discuss in detail the flow chart for integrated assembly, packaging and testing for mass production of MEMS.	**13**	5	L4
	OR			
15 (b)	Draw and explain the Confocal LASER scanning microscopy with suitable diagrams.	**13**	5	L4

PART- C (1x 15=15Marks)

(Q.No.16 is compulsory)

Q. No.	Questions	Marks	CO	BL
16.	Discuss a detailed case study about the applications of MEMS devices in Bio medical applications with suitable diagrams.	15	5	L6