

Sardar Patel Institute of Technology Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	Т	P	L	Т	Р	Total
EXC803	MEMS Technology	4			4			4
		Examination Scheme						
		ISE		MSE	ESE			
		10		30	100 (60% Weightage)			

Pre-requisite Course Codes		se Codes EXC 404: Basic VLSI Design			
-		EXC 604: IC Technology			
After successful completion of the course, student will be able to					
Course Outcomes	CO1	Discuss fundamental principles of MEMS devices including physical			
		operation and mathematical modeling.			
	CO2	Outline basic properties of MEMS materials and selection criteria of these			
		materials for MEMS device fabrication.			
	CO3	Apply various fabrication processes for MEMS devices.			
	CO4	Develop different concepts of micro system sensors and actuators for real-			
		world applications.			

Module	Unit	Topics		Hrs.	
No.	No.	T			
1		Introduction to MEMS		04	
	1.1	Introduction to MEMS & Real world Sensor/Actuator examples			
		(DMD, Air-bag, pressure sensors). MEMS Sensors in Internet of			
		Things (IoT), BioMedical Applications			
2		MEMS Materials and Their Properties		10	
	2.1	Materials (eg. Si, SiO2, SiN, Cr, Au, Ti, SU8, PMMA, Pt); Important	6		
		properties: Young modulus, Poisson's ratio, density, piezoresistive			
		coefficients, TCR, Thermal Conductivity, Material Structure.			
		Understanding Selection of materials based on applications.			
3		MEMS Fab Processes – 1		11	
	3.1	Understanding MEMS Processes & Process parameters for: Cleaning,	3,6		
		Growth & Deposition, Ion Implantation & Diffusion, Annealing,	,		
		Lithography. Understanding selection of Fab processes based on			
		Applications			
4		MEMS Fab Processes – 2		10	
	4.1	Understanding MEMS Processes & Process parameters for: Wet &	3,6		
		Dry etching, Bulk & Surface Micromachining, Die, Wire & Wafer			
		Bonding, Dicing, Packaging. Understanding selection of Fab processes			
		based on Applications			
5		MEMS Devices		11	
	5.1	Architecture, working and basic quantitative behaviour of Cantilevers,	1,2,3		
		Microheaters, Accelerometers, Pressure Sensors, Micromirrors in			



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		DMD, Inkjet printer-head. Understanding steps involved in Fabricating above devices		
6		MEMS Device Characterization		06
	6.1	Piezoresistance, TCR, Stiffness, Adhesion, Vibration, Resonant frequency, & importance of these measurements in studying device behavior, MEMS Reliability	6	
			Total	52

References:

[1] N. Maluf, K Williams,"An Introduction to Microelectromechanical Systems Engineering" Artech House Inc, Second Edition.

- [2] Practical MEMS by Ville Kaajakari; Publisher: Small Gear Publishing
- [3] Microsystem Design by S. Senturia; Publisher: Springer
- [4] Analysis and Design Principles of MEMS Devices Minhang Bao; Publisher: Elsevier Science
- [5] Fundamentals of Microfabrication by M. Madou; Publisher: CRC Press; Second edition
- [6] Micro Electro Mechanical System Design by J. Allen; Publisher: CRC Press
- [7] Micromachined Transducers Sourcebook by G. Kovacs; Publisher: McGraw-Hill