	National Institute of Technology Meghalaya An Institute of National Importance	CURRICULUM

Programme	M.Tech/Ph.D	Year of Regulation	2021
Department	Electronics and Communication Engineering	Semester	I

Course Code	Course Name	Credit Structure				Marks Distribution			
		L	T	P	C	INT	MID	END	Total
EC 535	**MICROELECTRONICS & MICROSENSORS**	**3**	**0**	**0**	**3**	**50**	**50**	**100**	**200**

Course Objectives		Course Outcomes		
	Understand the basic fundamentals and working principles of Microelectronic Devices		CO1	Ability to understand the operation of Microelectronic and Microsensor devices and their applications
	Understand the basic operation of Microsensors and their integration with Microelectronics		CO2	Able to analyse and design various Microelectronic, Microsensor and Integrated devices
	Understand technologies for the manufacturing of Microelectronic and Microsensor Devices and Integrated Systems		CO3	Able to identify materials and fabrication processes to develop Microelectronic, Microsensor and Integrated devices

No.	COs	Mapping with Program Outcomes (POs)												Mapping with PSOs			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
1	CO1	2	2	0	0	0	0	0	0	0	0	0	0	2	1	0	0
2	CO2	2	2	0	0	0	0	0	0	0	0	0	0	2	1	0	0
3	CO3	2	2	0	0	0	0	0	0	0	0	0	2	2	1	0	0

SYLLABUS

No.	Content	Hours	COs
I	Fundamentals of Microelectronic Devices: Introduction to Semiconductors, Energy Band Diagrams, Electrons and Holes in Semiconductors; Motion and Recombination of Electrons and Holes; PN Junctions, PN Diode IV Characteristics; MOS Capacitor, Flat-Band Condition and Threshold Condition; MOS CV Characteristics, MOSFET Transistors and IV Characteristics; CMOS.	16	CO1
II	Fundamentals of Microsensor Devices: Introduction to Microsensor devices, Microsensors and Microactuators, Basic Mechanical Structures used in Microsensors (Diaphagms, Cantilever, Bridge structures etc.), Various Transduction Mechanisms for Microsensors (Piezoresistive, Piezoelectric, Capacitive etc.), Basic electronic circuitry for interfacing of Microsensors. Examples and Applications of various Microsensors and Microactuators.	10	CO2
III	Materials and Fabrication Technologies for Microelectronic and Microsensor Devices: Materials - Substrates and Wafers, Active Substrate Materials, Silicon as a Substrate Material, Silicon Compounds, Gallium Arsenide, Quartz, Piezoelectric Crystals, Polymers, Packaging Materials, Fabrication processes - Photolithography, Diffusion, Ion Implantation, Oxidation, Chemical Vapor Deposition, Physical Vapor Deposition, Deposition by Epitaxy, Dry and Wet Etching Techniques, Micromachining processes: Bulk and Surface Micromachining, The LIGA Process.	10	CO3
	Total Hours	36	

Essential Readings

1. Sedra and Smith, “Microelectronic Circuits”, Oxford University Press; 7th edition, 2014.
2. Gardner J.W., Varadan V.K., Awadelkarim O.O., “Microsensors, MEMS and Smart Devices”, John Wiley & Sons Ltd, 1st Ed., 2001.
3. M.J. Madou, “Fundamentals of Microfabrication: The Science of Miniaturization”, CRC Press, 2nd Edition, 2002.

Supplementary Readings

1. Neamen, “Electronic Circuits”, McGraw Hill Education; 3rd Edition, 2006.
2. Hu C. C., “Modern Semiconductor Devices for Integrated Circuits”, Pearson, Education, 1st Edition, 2010.
3. T.R. Hsu, “MEMS and Microsystems: Design and Manufacture”, McGraw Hill, 1st Edition, 2002.
4. M.H. Bao, “Analysis and Design Principles of MEMS Devices”, Elsevier, 1st Edition, 2008.