	National Institute of Technology Meghalaya An Institute of National Importance	CURRICULUM

Programme	**Master of Technology in VLSI and Embedded Systems**	Year of Regulation	**2018-19**
Department	**Electronics and Communication Engineering**	Semester	**II**

Course Code	Course Name	Credit Structure				Marks Distribution			
		L	T	P	C	INT	MID	END	Total
EC 512	**NANO ELECTRONICS**	**3**	**0**	**0**	**3**	**50**	**50**	**100**	**200**

Course Objectives		Course Outcomes		
	Understand fundamentals of Nano electronics		CO1	Able to understand the fundamentals of Nano electronics
	Realize the physical concepts using Quantum Mechanics		CO2	Able to explain physical models of nanostructures using Quantum mechanics
	Study Nano structure models and fabrication		CO3	Able to understand the Quantum wells
			CO4	Able to learn fabrication steps of nano structures

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
1	CO1	3	1	0	0	0	0	0	0	0	0	0	0	2	1	0
2	CO2	3	2	3	1	0	0	0	0	0	0	0	0	2	1	0
3	CO3	2	1	2	0	0	0	0	0	0	0	0	2	2	1	0
4	CO4	2	2	2	1	0	0	0	0	0	0	0	2	2	1	0

SYLLABUS

No.	Content	Hours	COs
I	Introduction Introduction to Nanoelectronics, Consequences of the Nanoscale for Technology, Beyond Moore's Law. Advantages of Nano-Scale Miniaturisation, Electron Transport in a Nano-Device, Nanolithography	7	CO1
II	Quantum Mechanics of Electrons Comparison of Classical and Quantum Systems, Origins of Quantum Mechanics, Operators for Quantum Mechanics, Hermitian Operators, Eigenvalues and Eigen functions, Time Independent Schrodinger's Equation, Boundary Conditions on the Wave function, Analogies Between Quantum Mechanics and Classical Electromagnetics	10	CO1, CO2
III	Free and Confined Electrons Free Electrons in One-Dimensional Space and Three-Dimensional Space, Partially Confined Electrons, Finite Potential Wells, Finite Rectangular Well, Parabolic Well, Triangular Well, Quantum Dots, Wires, and Wells, Electrons subject to a periodic potential- Band theory of solids, Kronig—Penney Model of Band Structure, Bloch Theorem, Effect of an Electric Field on Energy Bands, Tunnelling Through a Potential Barrier.	8	CO3
IV	Fabrication of Nanostructure Semiconductor Heterostructures and Quantum Wells, Energy Band Transitions in Quantum Wells, Quantum Wires and Nanowires, Quantum Dots and Nanoparticles; Ballistic Transport Model, Carbon Nanotubes and Nanowires, Transport of Spin and Spintronics, Fabrication Techniques for Nanostructures - Lithography, Nanoimprint Lithography, Split-Gate Technology, Self-Assembly	11	CO4
	Total Hours	36	

Essential Readings

1. N. W. Ashcroft and N. D. Mermin, Solid State Physics, Harcourt College Publisher, 1st Edition, 1976
2. C. W. J. Beenaker and H. V. Houten, Quantum Transport in Semiconductor Nanostructurenes in Solid State Physics, Academic Press, 1st Edition, 1991.
3. D. K. Ferry, S. M. Goodnick and J. Bird, Transport in Nanostructures, Cambridge University Press, 2nd Edition, 2000.

Supplementary Readings

1. Y. Imry, Introduction to Mesoscopic Physics, Oxford University Press, 2nd Edition, 1997.
2. S. Dutta, Electron Transport in Mesoscopic Systems, Cambridge University Press, 1st Edition, 1995.