Course Type	Course Code	Name of Course	L	T	P	Credit
DE	NECD556	Neuromorphic Engineering	3	0	0	3

Course Objective
The objective of the course is to provide information about neuroscientific progress towards modeling and reverse-engineering the brain and develop fundamentals on key hardware building blocks, system level VLSI design and practical real-world applications of neuromorphic Systems.
Learning Outcomes
Upon successful completion of this course, students will: • View neuromorphic computing as a computer architecture research problem • Perform software and hardware implementation of basic biological neural circuits

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	Introduction to Neuromorphic Engineering; Signalling and operation of Biological neurons, neuron models- LIF, IF, HH; Synapses and plasticity rules, Spike-time-dependent plasticity (STDP); Biological neural circuits; Non-von Neumann computing approach, learning rules, retina, cochlea, Neuromorphic design principles	9	Acquire an understanding of the fundamental design principles in Neuromorphic Engineering
2	FETs - device physics and sub-threshold circuits; Analog and digital electronic neuron design	8	Understand the device and circuit design concepts for implementation of Electronic neurons
3	Non-volatile memristive semiconductor devices and circuits; Interconnection schemes for large non-spiking and spiking neural networks	8	Understand and design the interconnection schemes using VLSI devices and circuits
4	Digital neuromorphic VLSI, Electronic synapses and other neuromorphic systems	8	Understand the architecture of Digital Neuromorphic VLSI
5	Analysis of design, architecture and performance characteristics of demonstrated chips employing Analog neuromorphic VLSI; Case studies of large-scale neuromorphic hardware implementations	9	Understand the architecture of Analog Neuromorphic VLSI through case studies
	Total	**42**	

Textbook:

1. Shih-Chii Liu, Jörg Kramer, Giacomo Indiveri, Tobias Delbrück, Rodney Douglas, ``Analog VLSI: circuits and principles", MIT press, 2002, ISBN 0262122553.

Reference Books:

1. Carver Mead, ``Analog VLSI and Neural systems", Addison-Wesley, 1989, ISBN0201059924.
2. Eric Kandel, James Schwartz, Thomas Jessell, Steven Siegelbaum, A.J. Hudspeth, ``Principles of Neural Science", McGraw Hill 2012, ISBN 0071390111.