

UCSD NANOENGINEERING/CHEMICAL ENGINEERING  
*Virtual* **SEMINAR SERIES**Wednesday April 27th, 2022  
Seminar Presentation: 11:00am - 12:00pm PDT*"Neuromorphic Devices with Two-Dimensional Materials"***Dr. Tania Roy, PhD***Assistant Professor, University  
of Central Florida*

**Abstract:** Advances in machine learning and artificial intelligence has been mainly from the architecture and software levels, with the basic building blocks still being CMOS transistors. This causes the hardware to be bulky and power-hungry. Roy's group is developing neuromorphic devices functioning similar to the neurons and synapses of the human brain, which can serve as the basic building blocks of neural network hardware, making the systems energy-efficient, scalable and compact. In this talk, Roy will discuss her use of novel semiconducting two-dimensional materials to make artificial neurons and synapses which can perform pattern recognition. The layered structure of 2D materials allows great control over the synaptic characteristics. Having designed both synaptic and neuron devices with 2D materials, she will present the integration of these devices to implement Boolean logic as a first step towards in-memory computing. She will also discuss her efforts in developing optoelectronic synapses using 2D materials which, similar to optic nerves, combine the functions of photodetectors with analog memory. These devices can provide an avenue towards inference tasks at the edge in an era of data deluge.

**Biosketch:** Dr. Tania Roy is an Assistant Professor at NanoScience Technology Center and Department of Materials Science and Engineering at the University of Central Florida. Her current research interests lie in developing hardware for artificial intelligence applications using novel functional materials including two-dimensional materials. She also works on energy-harvesting devices, particularly advanced photon management systems in ultra-thin solar cells. She won the NSF CAREER award in 2019, UCF Luminary award in 2021. She was nominated as a "Rising Star in EECS" in 2014. Prior to joining UCF in 2016, Roy was a postdoctoral researcher at University of California, Berkeley and Georgia Institute of Technology. She obtained her PhD and MS degree in Electrical Engineering from Vanderbilt University.