# Indian Institute of Technology Kanpur

# INSTITUTE LECTURE SERIES

January 09, 2023 (Monday) | 6.00 pm | L - 17

## Speaker: Prof. T. Venkatesan

## Talk Title: Robust Resistive and Mem-devices for Neuromorphic Circuits

## About the Speaker

Prof. T. Venkatesan is currently the Director of the Center for Quantum Research and Technology at University of Oklahoma, and Scientific affiliate at NIST Gaithersburg. He is the founding Director of the Center of Optimal Materials for Emerging Technologies (COMET) at OU. He was also the Director of the Nano Institute at the National University of Singapore. As the inventor of the pulsed laser deposition process, he has over eight hundred papers and thirty four patents and is globally among the top one hundred physicists in terms of his citations. He is the founder and Chairman of Neocera, and Neocera Magma, companies specializing in PLD and magnetic field imaging systems and co-founder of Blue Wave Semiconductors.

He is a Fellow of the Royal Society, National Academy of Inventors (USA), Singapore National Academy of Science, Asia-Pacific Artificial Intelligence Academy, World Innovation Foundation, American Physical Society (APS), Materials Research Society (MRS), Academician of the Asia Pacific Academy of Materials, winner of the Bellcore Award of excellence, George E. Pake Prize awarded by APS (2012), He was awarded the outstanding alumnus award from IIT Kanpur and IIT Kharagpur.

## Abstract of the Talk


Artificial intelligence (AI) has been heralded as the flagbearer of the fourth industrial revolution but comes with a cost and that is computing power. It is projected that by 2040, more computing energy will be needed. These challenges are being addressed using oxide and molecular-electronic based memristors, which enable us to overcome the von Neuman bottleneck by co-locating the memory and computing functions on the same device, as in neuromorphic computing.

The speaker will discuss a variety of strategies for forming oxide based memristors using different phenomena- band filling and creating a quasi-conduction band, using oxygen vacancies to create conductive percolation, using metal-insulator transitions, or using asymmetric tunneling at a ferroelectric barrier.

In addition, Prof. Venkatesan will touch upon memristive devices and circuits made from an azo-aromatic complex with extra-ordinary reproducibility, robustness, and scalability. These devices have been shown to switch with energies approaching atto-joules with measured switching times shorter than 5 ns. By using a simple cross bar array, it has been shown that these devices perform with an energy-speed product 5000 times that of a state-of-the-art CMOS circuit.


All are cordially invited to attend

**Office of Dean Research & Development**