MHRD | Government of India
Ministry of Human Resource Development

सत्यमेव जयते

Global Initiative on Academic Network (GIAN)

Introduction to Spintronics

Overview

Conventional electronics will be gradually replaced by alternatives that envision information variables to be encoded in the quantum mechanical spin degree of freedom of an electron as opposed to the charge degree of freedom. This will allow much more energy-efficient and versatile computing based on spin-based devices and architectures. This course will provide an in-depth understanding of storing, processing and communicating information with spins, starting from the fundamentals of spin, continuing with the physical phenomena that undergird spin-based device operations, and ending with a spin-based vision for classical and quantum computing. A better insight into "spintronics" will be provided to make faculty, students, and industry members learn and explore novel research directions.

The primary objectives of the course are as follows:

1. To develop spintronics fundamentals.
2. To introduce the participants to the novel area of spin based digital switches.
3. To offer insights into spin based classical and quantum computing architectures, and their advantages over other alternatives.
4. To make the participants aware of new research directions, myriad technological challenges, and possible solutions for spin based advanced computing.

Course duration	December 18 – December 22, 2017 (5 days). Number of participants for the course will be limited to 30.
Who can attend	▪ Executives, engineers, and researchers from industry and government organizations including R&D laboratories. ▪ Faculty from reputed academic and technical institutions. ▪ Students at all levels (BTech/MSc/MTech/PhD)
Fees	The participation fees for taking the course is as follows: **Participants from abroad : US $150** **Industry/ Research Organizations: Rs. 5000** **Faculty: Rs. 3000** **Students: Rs. 2000** The above fee include all instructional materials, computer use for tutorials and assignments, laboratory equipment usage charges, 24 hours free internet facility. The participants may be provided with accommodation on payment basis.

The Faculty

Prof. Supriyo Bandyopadhyay is Commonwealth Professor of Electrical and Computer Engineering at Virginia Commonwealth University, Richmond, Virginia, USA. He received a B. Tech degree in Electronics and Electrical Communications Engineering from the Indian Institute of Technology, Kharagpur, India; an M.S degree in Electrical Engineering from Southern Illinois University, Carbondale, Illinois; and a Ph.D. degree in Electrical Engineering from Purdue University, West Lafayette, Indiana. He spent one year as a Visiting Assistant Professor at Purdue University, West Lafayette, Indiana (1986-87) and then nine years as a faculty of University of Notre Dame. In 1996, he joined University of Nebraska-Lincoln as Professor of Electrical Engineering, and then in 2001, moved to Virginia Commonwealth University as a Professor of Electrical and Computer Engineering, with a courtesy appointment as Professor of Physics. His research interests include spintronics, straintronics, nanoelectronics, spin based quantum computing and classical logic circuits, spin transport in nanostructures, spin-based devices and general topics in spintronics. He directs the Quantum Device Laboratory in the Department of Electrical and Computer Engineering. Prof. Bandyopadhyay has authored and co-authored nearly 400 research publications and presented nearly 150 invited or keynote talks at conferences and colloquia/seminars across four continents. He is a Fellow of IEEE, APS, IoP, ECS and AAAS. Prof. Bandyopadhyay received the College of Engineering Research Award (1998), the College of Engineering Service Award (2000) and the Interdisciplinary Research Award (2001) given jointly by the College of Engineering, College of Science, and Institute of Agricultural and Natural Resources at University of Nebraska-Lincoln. At Virginia Commonwealth University, he was honored with the Distinguished Scholarship Award given annually to one faculty member in the University (2012). It is the highest award given by the University for scholarship. His department gave him the Lifetime Achievement Award for sustained contributions in research, education and service in 2015. In 2016, he was named Virginia's Outstanding Scientist by Governor Terence R. McAuliffe (one of two from across the State and encompassing all areas of physical science, life science, social science, technology, mathematics and medicine). That same year, his alma mater the Indian Institute of Technology, Kharagpur, gave him the Distinguished Alumnus Award. In 2017, Prof. Bandyopadhyay received the University Award of Excellence from Virginia Commonwealth University, which is the highest honor bestowed by the University on a faculty member.

Dr. Brajesh Kumar Kaushik received his Doctorate of Philosophy (Ph.D.) in 2007 from Indian Institute of Technology, Roorkee, India. He joined Department of Electronics and Communication Engineering, Indian Institute of Technology, Roorkee, as Assistant Professor in December 2009; and since April 2014 he has been an Associate Professor. He has served as General Chair, Technical Chair, and Keynote Speaker of many reputed international and national conferences. Dr. Kaushik is a *Senior Member* of IEEE and member of many expert committees constituted by government and non-government organizations. He is Associate Editor of *IET Circuits, Devices & Systems*; Editor of *Microelectronics Journal*, Elsevier; Editorial board member of *Journal of Engineering, Design and Technology*, Emerald; and Editor of *Journal of Electrical and Electronics Engineering Research*, Academic Journals. He also holds the position of Editor-in-Chief of *International Journal of VLSI Design & Communication Systems*, and *SciFed Journal of Spintronics & Quantum Electronics*. He has received many awards and recognitions from the International Biographical Center (IBC), Cambridge. His name has been listed in Marquis Who's Who in Science and Engineering® and Marquis Who's Who in the World®. Dr. Kaushik has been conferred with *Distinguished Lecturer* award of IEEE Electron Devices Society (EDS) to offer EDS Chapters with quality lectures in his research domain. His research interests are in the areas of high-speed interconnects, low-power VLSI design, memory design, carbon nanotube-based designs, organic electronics, FinFET device circuit co-design, electronic design automation (EDA), spintronics-based devices, circuits and computing, image processing, and optics & photonics based devices.

Course Co-ordinator: Dr. Brajesh Kumar Kaushik

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