Personal Information

Name: Dr. Shubham Sahay

Date of birth: 23/12/1993

Education:

B.Tech (Hons.), Electronics Engineering, **IIT (BHU) Varanasi**, 2014 (awarded 4 gold medals and several cash prizes for securing highest marks and obtaining first rank in the institute).

Ph.D., Electrical Engineering, **IIT Delhi**, July 2014 to March 2018 (Thesis advisor: Prof. M. Jagadesh Kumar).

Professional / research experience:

Post-doctoral Research Scholar, **University of California, Santa Barbara**, USA, July 2018 to March 2020 (Advisor: Prof. Dmitri Strukov).

Assistant Professor, IIT Kanpur, March 2020 – Present.

Teaching

Courses (UG/PG) taught:

2020-21 Semester I:
ESC201A: Introduction to Electronics (Tutorial/Practical)
ESC370A: Digital Electronics (Tutorial) (Feedback 4.0/4.0)

2020-21 Semester II:
EE210A: Microelectronics-I (Tutorial)
EE698P: Memory Technology and Neuromorphic Computing (Lecture) (Got commendation letter from the director for teaching excellence)

2021-22 Semester I:
ESC201P: Introduction to Electronics (Lab)
EE370A: Digital Electronics (Lecture and Tutorial) (Got commendation letter from the director for teaching excellence)

2021-22 Semester II:
ESC201A: Introduction to Electronics (Tutorial + Practical)
EE380A: Electrical Engineering Lab (Electronics)
EE698P: Memory Technology and Neuromorphic Computing (Lecture) (Got commendation letter from the director for teaching excellence)

2022-23 Semester I:
EE370A: Digital Electronics (Lecture and Tutorial) (will get commendation letter from the director for teaching excellence as announced in the senate meeting)

2022-23 Semester II:
ESC201A: Introduction to Electronics (Tutorial + Practical)
EE687A: Memory Technology and Neuromorphic Computing (Lecture)

New courses introduced:

EE687A: Memory Technology and Neuromorphic Computing (Got commendation letter from the director for this course twice)

Supervision of Bachelor's/Master's thesis

M.Tech Students:

Completed:
1) Tanveer Kaur (2019-21, joint supervision with Prof. Yogesh Chauhan)
2) Raushan Kumar (2019-21)
3) Rahul Babar (2019-21)
4) Nikita Ranjan Sinha (2019-21)
5) Kaustubh Deepak Chakkarwar (2019-21)
6) Himanshu Singh (2019-21)

Ongoing:
1) Anmol Anand (2020-present)
2) Anupam Kumar Jaiswal (2020-present)
3) Rajib Das (2020-present)
4) Praveen Kumar (2020-present)
5) Himanshu Mewara (2020-present)
6) Pritish Sharma (2021-present)
7) Kudipudi Sushma Venkata Lakshmi (2021-present)
8) Tejas Ketkar (2022-present) (BT/MT, joint supervision with Prof. Aloke Dutta)
9) Asish Kumar Mandoi (2023-present) (BT/MT)
10) Ritwik Das (2022-present)
11) Puneet Srivastava (2022-present)
12) Swapnil Kumar (2022-present)

M.S. (R) Students:

1) Apoorva Dixit (Dec. 2020-present)
2) Sharang Dhar Patel (Dec. 2020-present)
3) Saurabh Sahu (Dec. 2020-present)
4) Munoon Jain (Dec. 2020-present)
5) Rahul Kumar Gupta (Dec. 2021-present)

B.Tech Students (UGP):

1) Ayush Saxena (EE, 2018-22)
2) Honey Nikam (ME, 2018-22)
3) Siddharth Satyam (ME, 2018-22)
4) Nakula Neeraje (EE, 2019-23)
5) Shivam Malhrotra (EE, 2019-23)

6) Dhruv Shikhar Gupta (EE, 2019-23)
7) Utkarsh Jha (EE, 2019-23)
8) Kuntal Desai (EE, 2019-23)
9) Rahul Kumar (EE, 2019-23)
10) Saksham Mehra (EE, 2019-23)
11) Shorya Kumar (EE, 2019-23)
12) Vivek Jorewal (EE, 2019-23)
13) B. Anshuman (EE, 2020-24)
14) Aditya Jain (EE, 2020-24)
15) Nitesh Kumar (EE, 2019-23)
16) Yudhveer Singh (EE, 2020-24)
17) Shreyansh Agrawal (EE, 2020-24)
18) Siddharth Sharma (EE, 2020-24)

PhD Supervision

1) Amit Kumar (July 2020-present)
2) Bhogi Satya Swaroop (July 2020-present)
3) Sateesh (July 2020-present)
4) MD Salim Equbal (IITK-La Trobe University Ph.D. Fellowship, Dec. 2020-present)
5) Musaib Rafiq (PMRF, July 2020-present, jointly with Prof. Yogesh Chauhan)
6) Naheeda Reshi (July 2021-present, jointly with Dr. Amit Kumar Verma)
7) MD Yasir Basir (July 2021-present)
8) Arka Chakraborty (July 2021-present)
9) Sanjay Sharma (Dec. 2021-present, jointly with Dr. Rik Dey)
10) Jasmine Kaur (July 2021-present, jointly with Dr. Sneh Saurabh, IIIT Delhi)
11) Himanshu Yadav (July 2022-present)

Knowledge Dissemination

Books:
Shubham Sahay and M. Jagadesh Kumar, Junctionless Field Effect Transistors: Design, Modelling and Simulation, **Wiley-IEEE press**, NJ, USA, ISBN: 978-1-119-52353-6,496 pages, Feb. 2019.

Book chapters:

[2021]

Amirtha Varshini and Shubham Sahay, Impact of High-k Dielectrics on the Gate-induced Drian Leakage of Multi-gate FETs, in High-k Materials in Multi-Gate FET Devices, CRC Press, 2021.

[2022]

MD Salim Equbal and Shubham Sahay, Scaling the MOSFET: Detrimental Short Channel Effects, in Nanoelectronics -: Physics, Materials and Devices, Elsevier, 2022.

[2023]

Mamidala Jagadesh Kumar and Shubham Sahay, Lilienfeild's concept on Junction-less Field Effect Transistors, in 75th Anniversary of the Transistor, IEEE-Wiley Press, 2023.`

Publications

Journal papers:

[2015]

1) Shubham Sahay and M. Jagadesh Kumar, Controlling the Drain Side Tunneling Width to Reduce Ambipolar Current in Tunnel FETs Using Hetero-dielectric BOX, **IEEE Transactions on Electron Devices**, vol. 62, no. 11, pp. 3882-3886, Nov 2015. (Appeared in the list of most popular papers in the month of November and December 2015.

[2016]

2) Shubham Sahay and M. Jagadesh Kumar, A Novel Gate-Stack-Engineered Nanowire FET for Scaling to the Sub-10-nm Regime, **IEEE Transactions on Electron Devices**, vol. 63, no. 12, pp. 5055-5059, Dec. 2016. (Appeared in the list of most popular papers in the month of November and December 2016.

3) Shubham Sahay and M. Jagadesh Kumar, Insight into Lateral Band-to-Band-Tunneling in Nanowire Junctionless Field Effect Transistors, **IEEE Transactions on Electron Devices**, vol. 63, no. 10, pp. 4138-4142, Oct. 2016. (Appeared in the list of most popular papers in the month of September (amongst Top 5) and November 2016.

4) Shubham Sahay and M. Jagadesh Kumar, Controlling L-BTBT and Volume Depletion in Nanowire JLFETs Using Core-Shell Architecture, **IEEE Transactions on Electron Devices**, vol. 63, no. 9, pp. 3790-3794, Sep. 2016.(Appeared in the list of most popular papers in the month of August (amongst Top 4) and September 2016.

5) M. Jagadesh Kumar and Shubham Sahay, Controlling BTBT Induced Parasitic BJT Action in Junctionless FETs using a Hybrid Channel, **IEEE Transactions on Electron Devices**, vol. 63, no. 8, pp. 3350-3353, Aug 2016. (Appeared in the list of most popular papers in the month of June, July and August 2016.

6) Shubham Sahay and M. Jagadesh Kumar, Realizing Efficient Volume Depletion in SOI Junctionless FETs, **IEEE Journal of the Electron Devices Society**, vol. 4, no. 3, pp. 110-115, May 2016. (Appeared in the list of most popular papers in the month of February, March, April, May, June, July, August, September and November 2016.,

[2017]

7) Shubham Sahay and Manan Suri, Recent Trends in Hardware Security Exploiting Hybrid CMOS-NVM Circuits, **IOP Semiconductor Science and Technology**, vol. 32, no. 12, pp. 123001, Oct. 2017.

8) N. K. Saini, Shubham Sahay, R. S. Saxena and M. Jagadesh Kumar, In0.53Ga0.47As/InP Trench Gate Power MOSFET based on impact ionization for

improved performance: Design and Analysis, **IEEE Transactions on Electron Devices**, vol. 34, no. 11, pp. 4561-4567, Nov. 2017.

9) Shubham Sahay and M. Jagadesh Kumar, Comprehensive Analysis of Gate-Induced Drain Leakage in Emerging FET Architectures: Nanotube FETs vs. Nanowire FETs, **IEEE Access**, vol. 5, pp. 18918-18926 Dec. 2017.

10) Shubham Sahay and M. Jagadesh Kumar, Spacer Design Guidelines for Nanowire FETs from Gate Induced Drain Leakage Perspective, **IEEE Transactions on Electron Devices**, vol. 64, no. 7, pp. 3007-3015, July 2017.

11) Shubham Sahay and M. Jagadesh Kumar, Physical Insights into the Nature of Gate Induced Drain Leakage in Ultra-Short Channel Nanowire Field Effect Transistors, **IEEE Transactions on Electron Devices**, vol. 64, no. 6, pp. 2604-2610, June 2017.(Appeared in the list of most popular papers in the month of April, July, August and September 2017 and January, February, April (amongst top 10), May (amongst top 10), June (amongst top 3) and July 2018.

12) Shubham Sahay and M. Jagadesh Kumar, Nanotube Junctionless Field Effect Transistor: Proposal, Design and Investigation, **IEEE Transactions on Electron Devices**, vol. 64, no. 4, pp. 1851-1856, Apr. 2017.(Appeared in the list of most popular papers in the month of March, April and August 2017.

13) Shubham Sahay and M. Jagadesh Kumar, Diameter Dependency of Leakage Current in Nanowire Junctionless Field Effect Transistors, **IEEE Transactions on Electron Devices**, vol. 64, no. 3, pp. 1330-1335, Mar. 2017. (Appeared in the list of most popular papers in the month of January, February and April 2017.

14) Shubham Sahay, A. Kumar, V. Parmar, and Manan Suri, OxRAM RNG circuits exploiting multiple undesirable nanoscale phenomena, **IEEE Transactions on Nanotechnology**, vol. 16, no. 4, pp. 560-566, July 2017.(Appeared in the list of most popular papers in the month of January (amongst Top 4) 2017.

15) Shubham Sahay and M. Jagadesh Kumar, Symmetric Operation in an Extended Back Gate JLFET for Scaling to the 5 nm Regime Considering Quantum Confinement Effects, **IEEE Transactions on Electron Devices**, vol. 64, no. 1, pp. 21-27, Jan. 2017.(Appeared in the list of most popular papers in the month of January 2017.)

[2018]

16) A. K. Jain, Shubham Sahay and M. Jagadesh Kumar, Controlling L-BTBT in Emerging Nanotube FETs using Dual-Material gate, **IEEE Journal of the Electron Devices Society**, vol. 6, pp. 611-621, June 2018. (Appeared in the list of most popular papers in the month of April, May and June 2018.

[2019]

17) G. Musalgaonkar, Shubham Sahay, R. S.Saxena, and M. JagadeshKumar, Nanotube Tunneling FET with a Core Source for Ultra-Steep Subthreshold Swing: A Simulation

Study, **IEEE Transactions on Electron Devices**, vol. 66, no. 10, pp. 4425-4432, Oct. 2019.

18) G. Musalgaonkar, Shubham Sahay, R. S.Saxena, and M. JagadeshKumar, A Line Tunneling Field-Effect Transistor Based on Misaligned Core-Shell Gate Architecture in Emerging Nanotube FETs, **IEEE Transactions on Electron Devices**, vol. 66, no. 6, pp. 2809-2816, Jun. 2019.

19) Shubham Sahay, M. Klachko, and Dmitri Strukov, Hardware Security Primitive Exploiting Intrinsic Variability in Analog Behavior of 3-D NAND Flash Memory Array, **IEEE Transactions on Electron Devices**, vol. 66, no. 5, pp. 2158-2164, May 2019.

20) Shubham Sahay, and Dmitri Strukov, A Behavioral Compact Model for Static Characteristics of 3D NAND Flash Memory, **IEEE Electron Device Letters**, vol. 40, no. 4, pp. 558-561, April 2019.

21) G. Musalgaonkar, Shubham Sahay, R. S.Saxena, and M. Jagadesh Kumar, An Impact Ionization MOSFET with Reduced Breakdown Voltage Based on Back-Gate Misalignment, **IEEE Transactions on Electron Devices**, vol. 66, no. 2, pp.868-875, Feb 2019.(Appeared in the list of most popular papers in the month of February 2019;

[2020]

22) Shubham Sahay, M. Bavandpour, M. R. Mahmoodi and Dmitri Strukov, Energy-Efficient Moderate Precision Time-Domain Mixed-Signal Vector-by-Matrix Multiplier Exploiting 1T-1R Array, **IEEE Journal on Exploratory Solid-State Computational Devices and Circuits**, vol. 6, no. 1, pp. 18-26, June 2020.

23) M. Bavandpour, Shubham Sahay, M. R. Mahmoodi and Dmitri Strukov, Efficient Mixed-Signal Neurocomputing Via Successive Integration and Division, **IEEE Transactions on VLSI systems**, vol. 28, no. 3, pp. 823-827, Mar. 2020.

[2021]

24) H. Nikam, S. Satyam and Shubham Sahay, Long Short-Term Memory Implementation Exploiting Passive RRAM Crossbar Array, **IEEE Transactions on Electron Devices,** vol. 69, no. 4, pp. 1743-1751, April 2021.

25) M. Bavandpour, Shubham Sahay, M. R. Mahmoodi and Dmitri Strukov, 3D-aCortex: An Ultra-Compact Energy-Efficient Neurocomputing Platform Based on Commercial 3D-NAND Flash Memories, **IOP Neuromorphic Computing and Engineering**, Vol. 1, pp. 014001, July 2021.

[2022]

26) S. Pal, S. Sahay, W. -H. Ki and C. -Y. Tsui, "A 10T Soft-Error-Immune SRAM With Multi-Node Upset Recovery for Low-Power Space Applications," in **IEEE Transactions on Device and Materials Reliability**, vol. 22, no. 1, pp. 85-88, March 2022, doi: 10.1109/TDMR.2022.3147864.

27) D. Sen, S. D. Patel and S. Sahay, "Dielectric Modulated Nanotube Tunnel Field-Effect Transistor as a Label Free Biosensor: Proposal and Investigation," **IEEE Transactions on NanoBioscience**, vol. 22, no. 1, pp. 163-173, Jan. 2023, doi: 10.1109/TNB.2022.3172553.

28) Amit Kumar, Himanshu Singh, Shubham Sahay, K. Balasubramanian, "Charge Injection into Electrodeposited Cu_2O From Metallic Stacks and Graphene", **IEEE Transactions on Electron Devices**, vol. 69, no. 10, pp. 5755-5759, Oct. 2022, doi: 10.1109/TED.2022.3197380.

29) Amol Gaidhane, Raghvendra Dangi, Shubham Sahay, Amit Verma, and Yogesh Singh Chauhan, A Computationally Efficient Compact Model for Ferroelectric FinFETs Switching with Asymmetric Non-Periodic Input Signals, **IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems**, *vol. 42, no. 5, pp. 1634-1642, May 2023, doi: 10.1109/TCAD.2022.3203956.*

30) Amit Kumar, Raushan Kumar and Shubham Sahay, Analytical Modeling of 3D NAND Flash Cell with a Gaussian Doping Profile, **IEEE Access**, vol. 10, pp. 85854-85863, 2022, doi: 10.1109/ACCESS.2022.3198398.

31) Jasmine Kaur, Sneh Saurabh and Shubham Sahay, Muller C-Element Exploiting Programmable Metallization Cell for Bayesian Inference, **IEEE Journal on Emerging and Selected Topics in Circuits and Systems**, vol. 12, no. 4, pp. 750-761, Dec. 2022, doi: 10.1109/JETCAS.2022.3206479.

32) Musaib Rafiq, Yogesh Chauhan and Shubham Sahay, Efficient Implementation of Max-Pooling Algorithm Exploiting History-effect in Ferroelectric-FinFETs, **IEEE Transactions on Electron Devices**, vol. 69, no. 11, pp. 6446-6452, Nov. 2022, doi: 10.1109/TED.2022.3207114.

[2023]

33) MD Salim Equbal, Tejas Ketkar and Shubham Sahay, Hybrid CMOS-RRAM True Random Number Generator Exploiting Coupled Entropy sources, accepted for publication in **IEEE Transactions on Electron Devices**, *vol. 70, no. 3, pp. 1061-1066, March 2023, doi: 10.1109/TED.2023.3241122.*

34) Manas Chanda, Sharang Dhar Patel. Amit Bhattacharya and Shubham Sahay, Impact of Transport Mechanism on Binding Kinematics and Sensitivity of FET Biosensors, **IEEE Transactions on Electron Devices, doi: 10.1109/TED.2023.3281539**

35) Sanjay Sharma, Shubham Sahay and Rik Dey, Parasitic Capacitance Model for Stacked Gate-all-around Nanosheet FETs, **IEEE Transactions on Electron Devices, doi: 10.1109/TED.2023.3281530**

Refereed conference papers:

[2016]

1) Shubham Sahay, M. Suri, A. Kumar and V.Parmar, Hybrid CMOS-OxRAM RNG circuits, in IEEE NANO - 16th International Conference on Nanotechnology, Sendai, Japan, Aug. 2016.

[2018]

2) A. Kumar, Shubham Sahay and M. Suri, Switching-Time Dependent PUF Using STT-MRAM, in IEEE VLSI-D 17th International Conference on Embedded systems and 31st International Conference on VLSI Design, Pune, India, 2018.

[2019]

3) M. Bavandpour, Shubham Sahay, M. R. Mahmoodi and Dmitri Strukov, Mixed-Signal Neuromorphic Processors: Quo Vadis?, in IEEE SOI-3D-Subthreshold (S3S) Microelectronics Technology Unified Conference, San Francisco, Oct. 2019. (Best paper nomination)

4) Shubham Sahay, M. Bavandpour and Dmitri Strukov, Compact Modelling and Computing Applications of 3D NAND Flash Memory, in SRC TECHCON, Austin, Aug. 2019.

[2020]

5) Shubham Sahay, M. Bavandpour, M. R. Mahmoodi and Dmitri Strukov, A 2T-1R Cell Array with High Dynamic Range for Mismatch-Robust and Efficient Neurocomputing, accepted for publication in IEEE International Memory Workshop (IMW), Germany, May 2020.

6) M. Bavandpour, Shubham Sahay, M. R. Mahmoodi and Dmitri Strukov, Mixed-Signal Vector-by-Matrix Multiplication Circuits based on 3D-NAND Memories for Neurocomputing, accepted for publication in Design, Automation and Test Conference (DATE), France, Apr. 2020.

[2021]

7) Shubham Sahay, Arman Kazemi, Ayush Saxena, Mohammad Mehdi Sharifi, Michael Niemier and X. Sharon Hu, A Flash-Based Multi-Bit Content-Addressable Memory with Euclidean Squared Distance, accepted for publication in ACM/IEEE International Symposium on Low Power Electronics and Design (ISLPED), July 2021.

8) Tejas Ketkar and Shubham Sahay, Impact of Non-Idealities in RRAMs on Hardware Spiking Neural Networks, accepted for publication in IEEE Devices Technology and Manufacturing Conference (EDTM), Chengdu, March 2021.

[2022]

9) Anupam Kumar Jaiswal, Sharang Dhar Patel and Shubham Sahay, "Revisiting GIDL in NWFETs for 1T-DRAM" 80th Device Research Conference (DRC), Ohio, USA 2022.

10) Anupam Kumar Jaiswal, Sharang Dhar Patel and Shubham Sahay, "Novel 1T-DRAM based on L-BTBT", IEEE NANO 2022, Palma de Mallorca, Spain.

11) Amit Kumar, and Shubham Sahay, "Analytical Modeling of Intrinsic Threshold Voltage and Subthreshold Slope for 3D NAND Flash Memory with a Gaussian Doping Profile", accepted for publication in 54th International Conference on Solid State Devices and Materials (SSDM), Chiba, Japan, September 2022.

[2023]

12) Abhishek Kumar, Imon Mondal and Shubham Sahay, "An Automatic Leakage Compensation Technique for Capacitively Coupled class-AB Operational Amplifiers" Accepted for publication in 56th IEEE International Symposium on Circuits & Systems (ISCAS).

Development

Patent applications:
1) Time-Domain Mixed-Signal Vector-by-Matrix Multiplier Exploiting 1T-1R Array, US Patent. (provisional application filed with M. Bavandpour and Dmitri Strukov, UC Case No. 2019-426).

2) Neurocomputing Platform Based on Commercial 3D-NAND Flash Memories, US Patent. (provisional application filed with M. Bavandpour, M. R. Mahmoodi and Dmitri Strukov, UC-2019-425).

3) Efficient Mixed-Signal Neuromorphic Computing via Successive Integration and Division, US Patent. (provisional application filed with M. Bavandpour, M. R. Mahmoodi and Dmitri Strukov, UC Case No. 2020-053).

4) Hardware Security Primitive Exploiting Intrinsic Variability in Analog Behavior of 3D NAND Flash Memory Array, US Patent,. (provisional application filed with Dmitri Strukov, UC Case No 2019-401)

Funding

[2020]

PI: Hardware Security Primitives Exploiting 3D Nand Flash Memory; Agency: IIT Kanpur; Amount: Rs. 25,00,000; Duration: 2 years.

[2021]

PI : Compact Modeling and Design Exploration of 3D NAND flash Memory for Hardware Security Primitives; Agency: Science and Engineering Research Board (SERB) ; Amount: Rs. 31,40,500; Duration: 2 years.

PI : IoT-Embedded Light-weight Hardware Security Primitives Utilizing Emerging Non-volatile Memories for Privacy Preserving Mutual Authentication; Agency: Centre for Cyber

Security and Cyber Defence of Critical Infrastructure Innovation Hub (C3I Hub), IIT Kanpur ; Amount: Rs. 75,00,000; Duration: 3 years.

PI : Neuromorphic Accelerators Utilizing Passive RRAM Crossbar Arrays; Agency: IIT Kanpur ; Amount: Rs. 65,00,000; Duration: 1 year.

Co-PI : Special Manpower Development Programme For Chips To System Design (SMDP C2SD); Agency: Department of Electronics & Information Technology (DEITY) ; Amount: Rs. 1,47,51,000; Project Duration: 5 years; Duration as Co-PI: 29/07/21 to 30-11-2021;

[2023]

Co-PI: Development of energy-efficient nanoscale molecular memristors, Agency: Scheme for Transformational and Advanced Research in Sciences (STARS), Amount: Duration: 3 years.

Co-PI: In-Memory Computing Utilizing Ferroelectric Transistors, Agency: Scheme for Transformational and Advanced Research in Sciences (STARS), Amount: Duration: 3 years.

Consultancy

PI : Neuromorphic Accelerators and Neuro-Optimizers Based on Hybrid CMOS-RRAM Circuits; Agency: Semiconductor Research Corporation (SRC), USA ; Amount: $36,000; Duration: 3 years.

PI: -------------------NDA------------------------------, Agency: EMD Electronics/Versum Materials, USA, Amount: $1,15,000; Duration: 7 months.

Peer Recognition

1) INAE Young Associate 2023.
2) Editor of IETE Technical Review.
3) Review Editor of Frontiers on Neuroscience - Neuromorphic Engineering.
4) Review Editor of Frontiers in Electronics - Integrated Circuits and VLSI.
5) Senior Member, IEEE.
6) Chair, IEEE Electron Devices Society, Kanpur Chapter.
7) Member of Technical Working Group (Digital processing), NIST Microelectronic and Advanced Packaging Technologies (MAPT) Roadmap, USA
8) Golden Reviewer, IEEE Transactions on Electron Devices.
9) Golden Reviewer, IEEE Electron Device Letters.
10) Received commendation letter from the Director, IITK for Excellence in Teaching for all the courses taught at IITK so far.
11) Recipient of I.I.T. (B.H.U.), Varanasi Gold Medal.
12) Recipient of Late Prof. Nagesh Chandra Vaidya Gold Medal.
13) Recipient of Dr. (Late) Nandita Saha Roy Memorial Gold Medal.
14) Recipient of C. Raja Gopal Memorial Gold Medal.
15) Recipient of Dr. Ayyagari Sambasiva Rao Prize.
16) Recipient of Late Prof. Manoranjan Sengupta Platinum Jubilee Merit Award.

17) Invited by IoP Semiconductor Science and Technology journal to write a topical review on Hybrid CMOS-RRAM circuits for IoT security and received an honorarium of GBP £300.
18) Invited as mentor in the "IEEE SSCS/EDS Online Mentoring Event" organized as a part of 2020 Symposia on VLSI Technology and Circuits.
19) Technical Program Committee Member: IEEE ICEE'2022, IEEE/ACM DAC 2022, IEEE EDKCON 2022, IEEE IWPSD 2021, VDAT 2021, IEEE DevIC2021, IEEE VLSI DCS 2021.

Contributions to the institute

Member, Departmental Post-Graduate Committee (DPGC)
In-charge, Departmental Time-Table Committee
Member, Departmental Convocation Committee
Member, Departmental Space Committee
Setting up the Neuromorphic Computing and Hardware Security Lab with equipment worth Rs. 1,30,00,000.
Member, Departmental Computing and Network Services Committee
Member, Departmental Annual Report and Director's Convocation Report Committee
Member, Departmental Remote Teaching Cell (RTC)
Member, Departmental Online Program Committee (DOPC)

Contributions outside the Institute

Editor: IETE Technical Review

Review Editor: Frontiers on Neuroscience - Neuromorphic Engineering and Frontiers in Electronics - Integrated Circuits and VLSI

Technical Program Committee Member: IEEE ICEE'2022, IEEE/ACM DAC 2022, IEEE EDKCON 2022, IEEE IWPSD 2021, VDAT 2021, IEEE DevIC2021, IEEE VLSI DCS 2021.

Senior Member: IEEE and Chair, IEEE EDS, IIT Kanpur Chapter, UP section.

Member of Technical Working Group (Digital processing), NIST Microelectronic and Advanced Packaging Technologies (MAPT) Roadmap, USA

Reviewer:

Book Proposals: CRC Press/Taylor and Francis

Journals: IEEE Transactions on Circuits and Systems I: Regular Papers (TCAS-I), Nature Scientific Reports, ACS Applied Materials & Interfaces, IEEE Electron Device Letters (EDL), IEEE Transactions on Electron Devices (TED), IEEE Transactions on Very Large Scale Integration Systems (TVLSI), IEEE Journal of the Electron Devices Society (JEDS), IEEE Transactions on Device and Materials Reliability (TDMR), IEEE Access, IEEE Journal of Exploratory Solid-State Computational Devices and Circuits (JxCDC), IEEE Sensors Journal.

Elsevier Superlattices and Microstructures, Elsevier Microelectronics Journal, Elsevier Cryogenics, IETE Technical Review (TITR), Springer Journal of Computational Electronics (JCEL), Springer Applied Physics A: Materials Science and Processing, IET Circuits, Devices and Systems, IET Micro and Nano Letters.

Conferences: IEEE VLSID'23, IEEE ICEE'22, IEEE EDTM'20, IEEE MWSCAS'18

Invited talks:

[2019]

Hybrid CMOS-Emerging Memory Circuits for Neuromorphic Computing in EICT course on Artificial Intelligence - Devices to Systems, IIT Roorkee, on 29th August 2019.

[2020]

Neuromorphic Computing: Mapping Neural Networks to Hardware in ATAL Academy Faculty Development Program (Neuronal Dynamics and Neuromorphic Computing), IIT Patna, on 23rd October 2020.

Neuromorphic Computing Platforms in IEEE EDS "Technical Talk", IEEE ED MSIT SBC, MSIT and MESON, Kolkata, on 16th October 2020.

Time-domain Neuromorphic Computing Platforms in Faculty Development Program on TCAD simulation for VLSI devices, circuits and systems, Jaypee Institute of Information Technology, Noida, on 21st July 2020.

[2021]

Time-domain neuromorphic computing platforms in ATAL Faculty Development Program on "Neuronal Dynamics and Neuromorphic Computing", IIT Patna, on 10-11th December 2021.

Neuromorphic Computing: Mapping Neural Networks to Hardware in ATAL Faculty Development Program on "Nanoelectronics Devices: Materials to Applications (NDMA-2021)", IIIT Ranchi, on 8th December 2021.

Neuromorphic Computing: Mapping Neural Networks to Hardware in ATAL Faculty Development Program on "Devices and Circuits For Next-Generation Computing Architectures", G B Pant Institute of Engineering and Technology, on 26th October 2021.

Neuromorphic Computing: Mapping Neural Networks to Memristive Crossbars in Faculty Development Program on "Emerging Topics in Computing: Quantum, Microfluidic and Memristors", JIS University, on 13th August 2021.

Reliable and Legitimate Device Characterization Using Commercial TCAD Simulators in ATAL FDP on "Physics of Nanoelectronics", IIT Kanpur on 5th August 2021.

Brain-inspired computing: mapping neural networks to hardware in International Conference on Recent Innovations in Science, Engineering & Technology, Invertis University, on 23rd July 2021.

Physical Insights into the Nature of Gate-induced Drain Leakage in Emerging Nano-scale FETs in Workshop on VLSI Device and Circuit Design Tools, School of Electronics Engineering (SENSE), VIT-AP University, on 23rd June 2021.

Hardware Security Primitives Exploiting Emerging Non-volatile Memories in Faculty Development Program on "Recent Advances and Challenges in Nanoscale Devices: Design, Materials, and Applications Perspective, NIT Hamirpur on 5th June 2021.

Neuromorphic computing: mapping neural networks to hardware in Emerging Nanoscale Devices, Circuits and Their Applications, Delhi Technological University, Delhi on 11th May 2021.

Transport in Junctionless FETs in QIP course: Transport in Nanoelectronics, IIT Kanpur on 20th March 2021.

Neuromorphic computing: mapping neural networks to hardware in TEQIP-III Sponsored Online Workshop on: VLSI BASED SYSTEM DESIGN, IIIT Guwahati, Guwahati on 13th March 2021.

Compact Modeling of 3D NAND Flash Memory for Diverse Unconventional Analog Applications in MOS-AK Asia/South Pacific Workshop on 26th February 2021.

Neuromorphic computing: mapping neural networks to hardware in SCDT-FlexE Centre Weekly Seminar on 9th February 2021.

[2022]

Exploiting Neuromorphic Networks to predict the future based on the past, FDP on "Next Generation Materials and Devices", SR University Warangal on 7th January 2022.

Neuromorphic Computing Platforms and Hardware Security Primitives in IEEE WDC, Goa, 26th March 2022.

Neuromorphic computing: mapping neural networks to hardware in research conclave on "Recent Trends and Developments in Nanotechnology ", IEEE NTC chapter, IIT Patna on 5th May 2022.

Hardware Neuromorphic Computing Platforms at IIT (BHU) Varanasi, on 22nd June 2022.

Reliable and Legitimate Device Characterization Using Commercial TCAD Simulators in Faculty Development Programme (FDP) on Advancement in VLSI Interconnects and Nanoscale Devices at ABV-IIITM Gwalior on 13th October 2022

Reliable and Legitimate Device Characterization Using Commercial TCAD Simulators in workshop on "Research Opportunities in Semiconductor Materials and Devices (ROSMD)", SRM institute of science and technology, Chennai, on 20th October 2022.

Exploiting Neuromorphic Networks to predict the future based on the past in IEEE EDKCON 2022, Kolkata on 27th November 2022.

Compact Modelling and Unconventional Applications of 3D NAND Flash Memories in IEEE ICEE 2022, Bangalore on 13th December 2022

Neuromorphic Computing: Mapping Neural Networks to 2D Hardware Systems in workshop on "Emerging Nanomaterial-Based Devices for Future VLSI Applications" at IIT (ISM), Dhanbad on 18th December 2022.

Exploiting Neuromorphic Networks to predict the future based on the past in IEEE EDS summer school on "Emerging Devices and Circuits to Mimic Biologically Plausible Neuronal Functionalities for Neuromorphic Computing" at IIITDM Kancheepuram on 20th December 2022.

[2023]

Neuromorphic Bayesian Learning Hardware for Cancer Detection in workshop on "Artificial Intelligence Advancements in Digital Healthcare " at IIIT Una on 4th January 2023.

Neuromorphic Computing: Mapping Neural Networks to Hardware at IEEE EDS SBC IIT Jodhpur on 10th February 2023.

Connecting the Software and Hardware Worlds: Mapping Neural Networks to Hardware in workshop on "Brain-inspired/Neuromorphic Computing for Responsible AI" at IIT Patna on 21st March, 2023.

Time-domain Neuromorphic Computing Platforms in workshop on "Brain-inspired/Neuromorphic Computing for Responsible AI" at IIT Patna on 22nd March, 2023.

Neuromorphic Computing Platforms and Hardware Security Primitives in Faculty Seminar series at IIT Kanpur on 19th August 2023.

Neuromorphic Computing: Mapping Neural Networks to Hardware at IEEE MTT SBC Jadavpur University on 25th August 2023.