

Dr. Shalu Rani

Assistant Professor
Department of Electronics Engineering
Indian Institute of Technology (ISM) Dhanbad, Jharkhand, India, 826004.
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- Google Scholar
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Research Interest

Energy storage devices for wearable electronics including Advanced Flexible Supercapacitors/Micro-supercapacitors, Li-ion Batteries, Biosensors, Memory devices, and Emerging materials and devices.

Work Experience

Assistant Professor (01/12/2023 to Present)
Institution IIT (ISM) Dhanbad, India

Research Associate (24/04/2023 to 14/11/2023)
Institution University of Glasgow, Scotland, United Kingdom

Project Assistant (14/05/2015 to 30/03/2017)
Institution CSIR-CEERI, Pilani, India

Academic Qualification

Ph.D. (Nanotechnology, 2017-2022) (CGPA: 9.143/10)

Institution	Indian Institute of Technology Roorkee, Roorkee, India
Thesis title	Binder-free TiO_2-based Flexible Supercapacitors for Low-power Wearable Electronics
Supervisor	Prof. Yogesh Sharma, Centre for Nanotechnology, Indian Institute of Technology Roorkee, Roorkee, India

M.Tech (Electronics and Communication Engineering, 2013-2015)

Institution/Marks	UIET, Kurukshetra University, Kurukshetra, India (CGPA: 7.75/10 *(first-division)*)
Thesis title	Design and Simulation of MEMS based Capacitive Accelerometer for Avionic Application
Supervisor	Dr. C. C. Tripathi, UIET, Kurukshetra University, Kurukshetra Dr. R. Mukhiya, Scientist, CSIR-CEERI, Pilani, India work held at CSIR-CEERI, Pilani, India

B.Tech (Electronics and Communication Engineering, 2008-2012)

Institution/Marks	UIET, Maharshi Dayanand University, Rohtak, India (72.3% *(first-division)*)

Higher Secondary, 12th (2007-2008)

Institution/Marks	GGSS School, Kurukshetra, Haryana, India (CGPA: 8.4/10 *(first-division)*) in PCM (Physics, Chemistry, Mathematics)

Secondary, 10th (2005-2006)

Institution/Marks	Dashmesh Vidya Mandir School, Bir. Mathana, Haryana, India (CGPA: 9.2/10 *(first-division)*)

Courses taught (IIT (ISM) Dhanbad)

- Analog Circuits (Winter 2023-2024), (Winter 2024-2025), (Winter 2025-2026)
- Basics of Electronics Engineering (Monsoon 2024-2025), (Monsoon 2025-2026), (Monsoon 2026-2027)

Research Supervision

PhD (Ongoing):

S.n	Name	Status	Guidance	Topic
1.	Aarti	Full time/Ongoing	Sole-guide	On Memory devices
2.	Purshottam Kumar	Full time/Ongoing	Sole-guide	On energy storage devices and sensors
3.	Priyanka Choudhary	Full time/Ongoing (Vishvesvaraya)	Sole-guide	On energy storage devices and sensors

M.Tech (Ongoing/Completed):

1.	Shubham Kumar	Full time/Completed	Sole-guide	On Battery modelling and simulations
2.	Paras Tiwari	Full time/Completed	Sole-guide	On Energy Efficient Digital Logic Operations using Memristor
3.	Mayuresh Kumar Mishra	Full time/Completed	Sole-guide	On Neural Circuit Implementation through Memristor Technology
4.	Khashring Dao Jidung	Full time/Completed	Sole-guide	On Physical Modelling of Memristor for Artificial Neuron
5.	Satyaprakash Kumar	Full time/Completed	Sole-guide	On Development of Flexible Supercapacitor for Wearable Electronics
6.	Omprakash Kumar	Part time/Completed	Sole-guide	On Implementation of Analog and Digital Components via Resistive Switching Devices

Project Staff (Ongoing):

1.	Shivang Mishra	JRF in ANRF project	Sole-guide	On Supercapacitors and Electrochemical Biosensors

Projects Sanctioned

Institute funded projects (Ongoing)

1. Faculty research scheme (FRS) project, Funded by IIT (ISM) Dhanbad: 20 Lacs
2. Special Research grant, Funded by IIT (ISM) Dhanbad: 30 Lacs

External funded projects (Ongoing)

1. Supercapacitors and Electrochemical Biosensors, Funded by ANRF: 67 Lacs

Publications

Peer-reviewed (SCI) Journal Papers:

1. Gaurav Khandelwal, **Shalu Rani**, Venkateswaran Vivekananthan, Shashank Mishra, Kaliyannan Manojkumar, Daniel Mulvihill, Themis Prodromakis, Ajay Giri Prakash Kottapalli, "Biodegradable electronic materials and devices", *Progress in Materials Science*, Volume 165, 2027, 101862, DOI: https://doi.org/10.1016/j.pmatsci.2026.101862. **(IF: 42.9)**
2. Paras Tiwari, Narendra Singh Dhakad, Mohit Kumar Gautam, **Shalu Rani**, Sanjay Kumar, and Themis Prodromakis, "Implementation and Performance Evaluation of CMOS-integrated Memristor-driven Flip-flop Circuits", *Frontiers in Nanotechnology-Nanoelectronics***,** DOI: 10.3389/fnano.2026.1890628**. (IF: 5.8)**
3. **Shalu Rani**, Purushottam Kumar, Abhinav Tandon, Sanjay Kumar, and Themis Prodromakis, "Recent

advancements in supercapacitor-integrated self-powered sensors", *Chemical Engineering Journal*, vol. 530, no. 173558, pp. 1-40, 2026, DOI: 10.1016/j.cej.2026.173558. (**IF: 13.2**)

4. Aarti Dahiya, Parthasarathi Pal, **Shalu Rani**, Mohit K. Gautam, Roshani S. Bahu, I. Zeimpekis, Dimitra G. Georgiadou, and Sanjay Kumar, "Two-dimensional Layered Materials-based Energy-efficient Optoelectronic Memories: A Leap Towards Bionic Vision", *Materials Science & Engineering R: Reports*, vol. 168, no. 101146, 2025, DOI: 10.1016/j.mser.2025.101146. (**IF: 26.8**)
5. Aarti Dahiya, **Shalu Rani**, Sanjay Kumar, and Themis Prodromakis, "Low-voltage-Driven Memristor Framework for Efficient Neuromorphic Computation with STDP Functionality", *Frontiers in Nanotechnology-Nanoelectronics*, vol. 7, no. 1723433, pp. 1-15, 2025, DOI: 10.3389/fnano.2025.1723433. (**IF: 3.8**)
6. Aarti Dahiya, Sanjay Kumar, and **Shalu Rani**, "Exploring Multi-level Current and Impedance Spectroscopy Analysis of Atomic Layer Deposited HfO_2/Ta_2O_5 Memristive Devices", *IEEE Transactions on Electron Devices*, vol. 72, no. 12, pp. 1-10, 2025, DOI: 10.1109/TED.2025.3635115. (**IF: 3.2**)
7. **Shalu Rani**, Gaurav Khandelwal, Abhinav Tandon, Sanjay Kumar, Akshaya Kumar Aliyana, Suresh C. Pillai, George K. Stylios, Nikolaj Gadegaard, Daniel M. Mulvihill, "Flexible and twistable $ZnMn_2O_4$-electrodeposited yarn supercapacitors for wearable electronics", *ACS Applied Materials & Interfaces*, 2025, DOI: https://pubs.acs.org/doi/full/10.1021/acsami.5c06545. **(IF: 8.2)**
8. Aarti Dahiya, Sanjay Kumar, **Shalu Rani**, Shaibal Mukherjee, "Progress, Perspectives and Future Outlook of Yttrium Oxide-based Memristive Devices for Data Storage, Multi-bit Programming and Neuromorphic Computing: A Systematic Review", *ACS Applied Electronic Materials*, 2025, DOI: https://doi.org/10.1021/acsaelm.5c01025. **(IF: 4.4)**
9. Sanjay Kumar, **Shalu Rani**, "Improved Performance of Yttrium Oxide-based Memristor through TiN Electrodes and Device Scaling for Neuromorphic and Pattern Recognition", *IEEE Transactions on Materials for Electron Devices*, 2025, DOI: 10.1109/TMAT.2025.3579714.
10. **Shalu Rani**, Gaurav Khandelwal, Sanjay Kumar, Suresh C. Pillai, George K. Stylios, Nikolaj Gadegaard, Daniel M. Mulvihill, "Flexible self-powered supercapacitors integrated with triboelectric nanogenerators", *Energy Storage Materials*, vol. 74, 103977, Dec 2024, DOI: https://doi.org/10.1016/j.ensm.2024.103977. **(IF: 18.9)**
11. Mohit Kumar Gautam, Sanjay Kumar, **Shalu Rani**, Ioannis Zeimpekis, and Dimitra G. Georgiadou, "2D MoS_2 Monolayers Integration with Metal Oxide-based Artificial Synapses", *Frontiers in Nanotechnology-Nanoelectronics*, vol. 6, 2024, DOI: 10.3389/fnano.2024.1400666. **(IF: 4.1)**
12. Abhinav Tandon, **Shalu Rani**, Yogesh Sharma, "A Flexible One-dimensional Woven Supercapacitor for Low-power Smart Electronic Textiles", *Batteries & Supercaps*, 2024, e202400176, DOI: https://doi.org/10.1002/batt.202400176. **(IF: 5.7)**
13. Sanjay Kumar, Mayank Dubey, Megha Nawaria, Mohit Kumar Gautam, Mangal Das, Ritesh Bhardwaj, **Shalu Rani**, and Shaibal Mukherjee, "Investigation of Filament Formation and Surface Perturbation in Nanoscale-Y_2O_3 Memristor: A Physical Modelling Approach", *Journal of Electronic Materials*, vol. 53, pp. 2965–2972, 2024, DOI: https://doi.org/10.1007/s11664-024-10967-4. **(IF: 2.1)**
14. **Shalu Rani**, Yogesh Sharma, "Fabrication of Binder-free and High energy density Yarn Supercapacitor for Wearable Electronics", *IEEE Transactions on Power Electronics*, vol. 37, no. 11, pp. 13022–13029, 2022, DOI: https://doi.org/10.1109/TPEL.2022.3186958. **(IF: 6.1)**
15. Abhinav Tandon, **Shalu Rani**, Yogesh Sharma, "Designing the Binder-Free Conversion-Based Manganese Oxide Nanofibers as Highly Stable and Rate Capable Anode for Next-Generation Li-Ion Batteries", *ACS Applied Energy Materials*, vol. 5, no. 6, pp. 6855–6868, 2022, DOI: https://doi.org/10.1021/acsaem.2c00487. **(IF: 6)**
16. **Shalu Rani**, Nagesh Kumar, Yogesh Sharma, "Fabrication of Binder-Free TiO_2 Nanofibers@Carbon Cloth for Flexible and Ultra-Stable Supercapacitor for Wearable Electronics", *Advanced Electronic Materials*, vol. 8, no. 9, 2200108, 2022, DOI: https://doi.org/10.1002/aelm.202200108. **(IF: 7.2)**
17. **Shalu Rani**, Nagesh Kumar, Abhinav Tandon, Yogesh Sharma, "Electrophoretic Grown TiO_2-Based Interdigitated Microsupercapacitor: Device Fabrication and Characterization for Flexible Electronics", *IEEE Transactions on Electron Devices*, vol. 68, no. 1, pp. 5263-5268, 2021, DOI: https://doi.org/10.1109/TED.2021.3105373. **(IF: 2.9)**
18. **Shalu Rani**, Nagesh Kumar, Yogesh Sharma, "Recent progress and future perspective for the development of

micro- supercapacitors for portable/wearable electronics applications", *IOP Journal of Physics: Energy*, vol. 3, no. 3, pp. 032017, 2021, DOI: https://doi.org/10.1088/2515-7655/ac01c0. **(IF: 5.9)**

19. **Shalu Rani**, Nagesh Kumar, Abhinav Tandon, Yogesh Sharma, "Fabrication of Binder-free TiO_2 Nanofiber Electrodes via Electrophoretic Deposition for Low-Power Electronic Applications", *IEEE Transactions on Electron Devices*, vol. 68, No. 1, pp. 251-256, 2020, DOI: https://doi.org/10.1109/TED.2020.3039948. **(IF: 2.9)**
20. **Shalu Rani**, Ravindra Mukhiya, C.C. Tripathi, B.D. Pant, Ram Gopal, "Design and Simulation of MEMS-based Z-axis Capacitive Accelerometer", *International Journal of Scientific Research in Science and Technology*, vol. 1, no. 4, pp. 112- 115, 2015. **(IF: 3.5)**

International and National Conferences:

1. Aarti Dahiya, **Shalu Rani**, Sanjay Kumar, Themis Prodromakis, "Impact of Pulse Width on Analog Switching Response of ALD-grown HfO_2/Ta_2O_5-based Memristive Device", 2025 IEEE 7th International Conference on Emerging Electronics (ICEE), 1-4, DOI: 10.1109/ICEE67165.2025.11409893.
2. Abhinav Tandon, **Shalu Rani**, Yogesh Sharma, "Temperature Dependent Dielectric Properties of Spinel $MgMn_2O_4$ Nanofibers for LIB Anode", *2022 6th IEEE International Conference on Emerging Electronics (ICEE)*, IISC Bangalore, December 2022, DOI: https://doi.org/10.1109/ICEE56203.2022.10118075.
3. **Shalu Rani**, Nagesh Kumar, Abhinav Tandon, Yogesh Sharma, "Fabrication of Binder-free TiO_2 Nanoparticle Electrodes for Supercapacitor in Low-Power Electronic Applications", *2020 5th IEEE International Conference on Emerging Electronics (ICEE)*, IIT Delhi, November 2020, DOI: https://doi.org/10.1109/ICEE50728.2020.9776669.
4. **Shalu Rani,** Nagesh Kumar, Abhinav Tandon, Yogesh Sharma, "Investigating the Effect of Electrophoretic Deposition Voltage on the Supercapacitor Performance of Binder-free TiO_2 Nanoparticles Electrodes", *13th National Conference on Solid State Ionics (NCSSI-13)*, IIT Roorkee, December, 2019.
5. **Shalu Rani**, Ravindra Mukhiya, C.C. Tripathi, B.D. Pant, Ram Gopal, "Design and Simulation of MEMS Capacitive Accelerometer", *2nd National Conference on Converging Technologies Beyond 2020 (2CTB-2020)*, UIET, KUK, Nov 2014.

Books:

1. "Flexible Supercapacitors: Materials, Fabrication, and Applications in Electronics", authored by **Shalu Rani**, Sanjay Kumar, T. D. Dongale, Pawan Kumar, and Abhinav Tandon, ***Wiley-VCH***, [Accepted, Under press].
2. "Energy Harvesting and Energy Storage technologies: From Fundamentals to Integration", Edited by Gaurav Khandelwal, **Shalu Rani**, Swati Deswal, and Sang-Jae Kim, ***Wiley-VCH***, [Under preparation].

Book Chapters:

1. Pawan Kumar, Sanjay Kumar, Gaurav Siddharth, and **Shalu Rani**, "Energy Storage Solutions: Batteries and Supercapacitors", *Two-Dimensional Nanostructured Semiconductors for Clean Energy Solutions*, Springer Nature, ISBN: 978-3-032-21472-0, Book DOI: 10.1007/978-3-032-21473-7, DOI: 10.1007/978-3-032-21473-7_5.
2. **Shalu Rani**, Sanjay Kumar, Ruchi Singh, and Pawan Kumar, "Surface Engineered 2D TMD Materials for Advanced Wearable Biosensors", *2D Materials: Sensing Applications*, Springer Nature, 2024, DOI: 10.1007/978-981-97-6258-3.
3. Pawan Kumar, **Shalu Rani** and Sanjay Kumar, "Smart Solid Electrolyte Materials in Energy Storage Devices: Batteries", *Smart Materials for Science and Engineering*, John Wiley & Sons, Inc., pp. 173-189, 2023, DOI: 10.1002/9781394186488.ch10.
4. **Shalu Rani,** Sanjay Kumar and Ritesh Bhardwaj, "Role of Carbon Nanotube for Flexible Supercapacitor Application", *Carbon Nanotubes - Recent Advances, New Perspectives and Potential Applications*, INTECHOPEN LIMITED, 2022, ISBN: 978-1-83968-887-4, DOI: https://doi.org/10.5772/intechopen.108022.

5. **Shalu Rani**, Pawan Kumar, Sanjay Kumar, "Carbon Nanotubes: A Superior Material for Future Electronics Devices", *Semiconductor Materials (volume-1),* AkiNik Publication, pp. 47-62, 2020, ISBN: 978-93-90420-46-9, DOI: https://doi.org/10.22271/ed.book.946.

Invited Talks

1. Invited talk on Flexible supercapacitors for wearable electronics applications, in Faculty Development Programme (FDP) on "Recent Trends in Physics, Electronics, and Nanoscience", January 2025.
2. Flexible supercapacitors for powering wearable sensors, *Empowering Women in Sensor Technology (EWST'22),* IEEE Sensors Council Student Branch Chapter at IIT Indore, India, December 16, 2022.

Academic Responsibilities

- Warden of Ruby and Rosaline Hostel, IIT (ISM) Dhanbad (01-07-2026 to present).
- Member of Departmental Project Approval Committee (DPAC), Department of Electronics Engineering, IIT (ISM) Dhanbad (16-04-2026 to present).
- Faculty-in-charge (FIC) of Departmental branding for Department of Electronics Engineering, IIT (ISM) Dhanbad.
- Member of Standing Departmental Project Approval Committee (DPAC), Department of Electronics Engineering, IIT (ISM) Dhanbad (01-04-2025 to 16-04-2026).
- Member of Departmental Post Graduate Committee (DPGC), IIT (ISM) Dhanbad (19-10-2024 to present).
- Member of Departmental Grievance Redressal Committee (DGRC), IIT (ISM) Dhanbad (28-02-2024 to present).
- Co-FIC, Pouch Battery Cell Fabrication Lab, NVCTI, IIT (ISM) Dhanbad (14-05-2024 to present).

Memberships/Achievements/Activities

- Organized International Conference on "Trends and Advances in Reforming Green Energy Technologies" (TARGETs-2026), at IIT (ISM) Dhanbad during February 13–15, 2026, on 100 years of its legacy (1926–2026).
- Member IEEE, Membership No. 93095552.
- Received best research paper award in Student Research Symposium (SRS'22) organized by IEEE NTC student chapter IIT Indore.
- Qualified University Grants Commission (UGC)-National Eligibility Test (NET)-(JRF) in 2018 for Ph.D. fellowship and UGC-NET (Assistant Professor): June 2015, December 2015, July 2016, and January 2017, by Govt. of India.
- Qualified Graduate Aptitude Test in Engineering (GATE) in Electronics and Communication Engineering in 2017.

Editorial Assignments

1. Editorial Board Member of "***Chemical Engineering Journal***", Elsevier. (Impact Factor: 12.5). (8^{th} September to present).
2. Executive Guest Editor of Special issue on "Materials for Energy Storage and Conversion" in "***Results in Engineering***" (Impact Factor 9.4). (13^{th} February to Present)
3. Topic Coordinator on Theme "Low-Dimensional Materials and Devices for Sensing, Storage and Computation" "***Frontiers in Materials***" (Impact Factor 3.5).
4. Editor of Book "Energy Harvesting and Energy Storage technologies: From Fundamentals to Integration", **Wiley-VCH**, [Under preparation].

Professional Services: Peer-Reviewer

- Springer Nature
- Chemical Engineering Journal
- IOP Physica Scripta
- IOP Nanotechnology
- IEEE Transactions on Power Electronics
- IOP Flexible and Printed Electronics
- Scientific Reports
- 2D Materials
- ACS Applied Energy Materials
- Sensors and Actuators B: Chemical
- Smart Materials and Structures

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