Dr. Shalu Rani

Assistant Professor
Department of Electronics Engineering
Indian Institute of Technology (Indian School of Mines) Dhanbad, Jharkhand, India, 826004.
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- Google Scholar
- Website

Research Interest

Energy storage devices for wearable electronics including Advanced Flexible Supercapacitors/Micro-supercapacitors and their integration with Triboelectric Nanogenerators, Li-ion Batteries, and Neuromorphic Computing.

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 Exam passed (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 Exam passed (72.3% *(first-division)*)

Higher Secondary, 12th (2007-2008)

Institution/Marks	GGSS School, Kurukshetra, Haryana, India Exam passed (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 Exam passed (CGPA: 9.2/10 *(first-division)*)

Courses taught (IIT (ISM) Dhanbad)

Analog Circuits (Winter 2023-2024), (Winter 2024-2025)

Basics of Electronics Engineering (Monsoon 2024-2025)

Research Supervision

PhD (Ongoing)

Adwaita Kundu	Full time	On Development of flexible supercapacitor devices and their application

M.Tech (Ongoing)

Omprakash Kumar	Part time	On Implementation of Analog and Digital Components via Resistive Switching Devices
Satyaprakash Kumar	Full time	On Development of Flexible Supercapacitor for Wearable Electronics
Shubham Kumar	Full time	On Battery modelling and simulations

Publications

Peer-reviewed (SCI) Journal Papers:

1. **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, 2024, DOI: https://doi.org/10.1016/j.ensm.2024.103977. **(IF: 18.9)**
2. 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)**
3. 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)**
4. 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)**
5. **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)**
6. 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)**
7. **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)**
8. **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)**
9. **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)**
10. **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)**
11. **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. 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.

2. **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.
3. **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.
4. **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.

Book Chapters:

1. **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.
2. 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.
3. **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.
4. **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 Talk:

1. 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

- 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

- 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.

Professional Services: Peer-Reviewer

- Chemical Engineering Journal
- IOP Physica Scripta
- IOP Nanotechnology
- IEEE Transactions on Power Electronics
- IOP Flexible and Printed Electronics
- Scientific Reports

Date: 04/01/2025