



# RESEARCH AT UPES

Evidence-based insights for a better world



ENGINEERING | COMPUTER SCIENCE | DESIGN | BUSINESS | LAW | HEALTH SCIENCES AND TECHNOLOGY | MODERN MEDIA | LIBERAL STUDIES

## About UPES

Established through the UPES Act, 2003, of the State Legislature of Uttarakhand, UPES is a UGC-recognized private university. UPES has been ranked 243 in QS Asia University Rankings, 2023. As per the 2023 National Institutional Ranking Framework (NIRF), UPES has been ranked 65 in the University Category, while its School of Engineering is 61, School of Law is 21, and the School of Business is 41, nationally. UPES has also been accredited by NAAC with Grade 'A'.

UPES offers graduate and postgraduate programs through its eight schools: School of Advanced Engineering, School of Computer Science, School of Design, School of Law, School of Business, School of Health Sciences & Technology, School of Modern Media and School of Liberal Studies, with about 13,000 students and 1500+ faculty and staff members.

To learn more about UPES, visit our website: <https://www.upes.ac.in>



## Research milestones at UPES

UPES faculty members have made landmark contributions in their respective fields; contributions that have revolutionised research, solved local and global problems, and filled gaps in knowledge. Today, the university stands tall as a hub of exploration and research. UPES research output – from 2 publications in 2021 to 3.5 publications per faculty in 2022 is possibly the highest jump for any university in one year. It is also more than triple the global average of one paper per faculty per year.

SCOPUS (the world's largest abstract and citation database of scientific literature) indexed research output for UPES was 1173 in 2021. In 2022, it was 2098. The university has grown twelve times in research output in the last seven years.

25 UPES faculty members are on the list of top 2% researchers in the world, according to Stanford list and 5 of these researchers have found a place in the one of most coveted 'Highly Cited Researchers' list published by Clarivate.





**Dr. Ashish Mathur**

School of Advanced Engineering

**Primary research area:**

Nanotechnology-based biomedical sensors

**Brief description:**

Dr. Mathur and his team work on developing cutting-edge nanotechnology-based sensors for healthcare, food quality and environmental monitoring. Their primary focus is on developing biomedical sensors for early diagnosis of infections and diseases such as diabetes, foot ulcers, neonatal and cardiac disorders, COVID-19, and some cancers, such as cervical, breast, prostate, lung, and oral cancers. They are also working on a first-of-its-kind device in the world for the early detection of Hirschsprung’s Disease.

**Practical application:**

Dr. Mathur hopes to use his research work to make detection of diseases an affordable and convenient process through the use of technology. According to him, one of the implications of his research would be enhanced doctor-patient interaction, resulting in faster diagnosis and treatment.

**Inspiration behind research:**

Dr. Mathur was inspired to develop sensors to detect cardiac diseases after he lost his mother to a heart condition. That, coupled with his desire to contribute to society, made him launch his research in nanotechnology-based biomedical sensors. ■



### **Dr. Bhawna Lamba**

School of Advanced Engineering

**Primary research area:**

Microalgae-treated wastewater reclamation, with the production of bio-oil and biogas

**Brief description:**

Dr. Bhawna Lamba and her team of researchers work on a novel, zero-waste project that seeks to treat sewage water with different types of microalgae. The treatment process results in the production of significant by-products such as bio-oil, which, according to Dr. Lamba, can be used as fuel in place of diesel; biogas, which can be used for a variety of purposes including heating and cooking; and bio-manure, which is a rich source of organic manure helping improve the quality of soil.

**Practical application:**

Dr. Lamba says that the project can contribute to public hygiene by “converting waste to value”. Emphasizing on the immense benefits of this sustainable technology if replicated across India, Dr. Lamba says that the affordable, zero-cost solution can resolve some of the wastewater challenges in the country.

**Inspiration behind research:**

Dr. Lamba credits her background in Polymer Technology as the inspiration behind the project. When Prime Minister Narendra Modi launched the ambitious Swachh Bharat campaign, she says she drew upon her degree in Polymer Technology to start the wastewater reclamation project. ■



**Dr. Ashish Karn**  
School of Advanced Engineering

**Primary research area:**

Indian Knowledge System (IKS)

**Brief description:**

When not making engineering learning fun for students through novel pedagogical methods such as digital storytelling, Dr. Ashish Karn and his team are busy challenging eurocentric narratives of the history of science. He heads a research project funded by the Ministry of Education on Early Science Technology Engineering Education and Mathematics (ESTEEM) of India. His research seeks to trace the growth of different scientific and technological concepts to India and explore their contemporary relevance in an attempt to question the worldview set by the West.

**Practical application:**

Dr. Karn believes that his project will help unravel the richness of the indigenous systems of education in India and encourage alternative approaches to science and technology that would be deemed more sustainable in the current global climate.

**Inspiration behind research:**

According to Dr. Karn, his desire to remain rooted in the Indian value system sparked this project. Despite having a foreign degree, Dr. Karn came back to India to teach. And he refuses to monetise his work or himself, having rejected offers from IITs to continue teaching at UPES. ■



**Dr. Parteek Prasher**  
School of Advanced Engineering

**Primary research area:**

Treatment for Adenocarcinoma or cancer of the mucus

**Brief description:**

Adenocarcinoma or cancer of the mucus is particularly difficult to treat, as firstly, the disease is hard to detect until it has reached an advanced stage, and secondly, it requires medicines which can pierce through the mucus layer which line the insides of organs. In this context, Dr. Prasher and his team have worked together to formulate a tablet that comes with a coating which is able to penetrate the mucus lining. The team is also working on making electrically-neutral molecules which will be able to lance through the negatively-charged mucus.

**Practical application:**

The research seeks to make treatment for this advanced form of cancer affordable and compliant for patients. Dr. Prasher is particularly keen on making an extended-release tablet that slowly releases the drugs into the patient’s system, rendering high and sustained doses unnecessary.

**Inspiration behind research:**

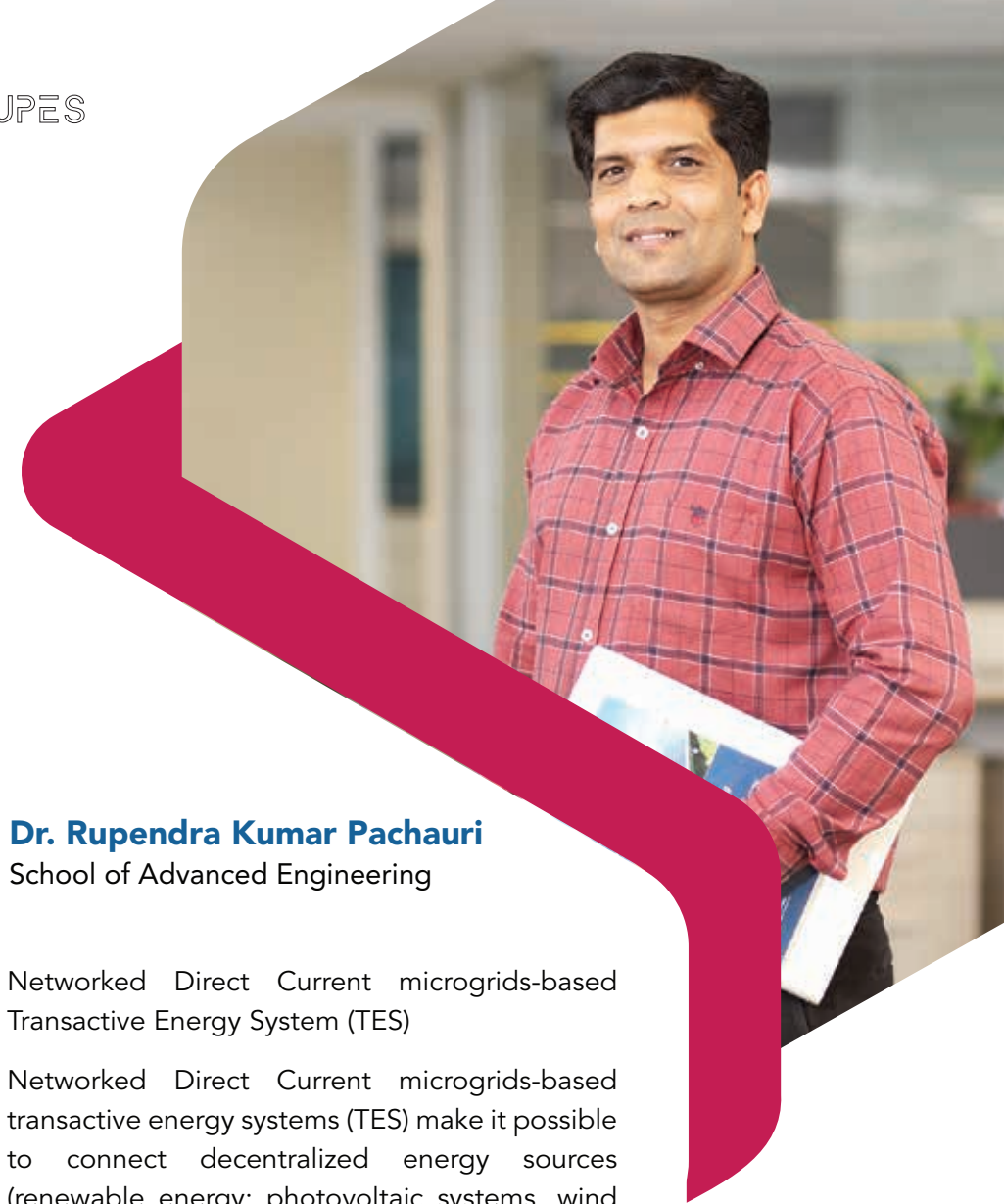
Dr. Prasher was inspired to find a cure to adenocarcinoma as the disease slowly earned the tag of being one of the leading causes of cancer-related deaths. While there were about 500 USFDA-approved drugs for cancer between 2009-2020, most of them were old, repurposed medicines. ■



**Dr. Bitopi Dutta**  
School of Liberal Studies

- Primary research area:** Development Induced Displacement (DID) in northeast India and its impact on gender relations
- Brief description:** The project critically analyses the existing global literature on displacement vis-à-vis the lived experience of displacement in northeast India. Development-induced displacement has been an issue of intense debate in India. While many existing research have studied the general impact of DID on subaltern groups, the politics of displacement in reordering gender relations has not been sufficiently researched. This research will do a gender analysis of DID in northeast India.
- Practical application:** According to Dr. Dutta, the research will seek to engage with the standard Resettlement and Rehabilitation policies and offer critical analysis on their applicability across different contexts, in this case, the northeast India. Also, this investigation could have a wider relevance as it could give an insight into how gender relations respond to stress and social disintegration.
- Inspiration behind research:** Dr. Dutta was inspired to study gender relations after her Masters in the northeast. While her research focused on displacement, her activism centred around gender rights. ■





### **Dr. Rupendra Kumar Pachauri**

School of Advanced Engineering

**Primary research area:**

Networked Direct Current microgrids-based Transactive Energy System (TES)

**Brief description:**

Networked Direct Current microgrids-based transactive energy systems (TES) make it possible to connect decentralized energy sources (renewable energy: photovoltaic systems, wind turbines, and biofuels) to the main power grid. Microgrids can provide a level of resilience to the grid as they can operate independently during power outages or other disruptions. This can be particularly important in disaster-prone areas or for critical infrastructure as well.

**Practical application:**

Networked microgrid topologies play a crucial role in improving grid efficiency and dependability, ensuring continued service during blackouts, and fostering the widespread use of renewable energy sources, thus contributing to a global-scale reduction in carbon footprint.

**Inspiration behind research:**

Dr. Pachauri says that the huge dependence on the pre-existing grid infrastructure and the huge expenditures involved in it inspired him to start his research work in microgrids-based Transactive Energy System when he noticed. ■



**Dr. Melissa Reneaux**  
School of Liberal Studies

**Primary research area:**

Computational Neuroscience - Mathematical modeling of mental illnesses like depression and schizophrenia

**Brief description:**

Dr. Reneaux is actively involved in building mathematical models to understand inflammation-associated depression, and the effect of anti-depressants and antihistamines on alleviating depression.

**Practical application:**

Dr. Reneaux's mathematical model will help in quantifying depression and provide testable predictions for the possible effects of medication on depression.

**Inspiration behind research:**

During her master's thesis, Dr. Reneaux worked on understanding rheumatoid arthritis. As her interest in understanding human diseases grew, she decided to use the concepts of physics and mathematics to understand mental illnesses. She is passionate about her research as she sees her research work having the potential to directly influence the well-being of people. ■





### Dr. Siddharth Jain

School of Advanced Engineering

**Primary research area:**

Biomass and Bioenergy

**Brief description:**

Dr. Jain is working on extracting fuel – solid, liquid or gas – from biomass, specifically waste biomass such as municipal and agricultural waste. When the Government of India launched the National Biodiesel Mission in 2008, they wanted to put jatropha biodiesel for commercial use by 2012. However, that attempt was unsuccessful due to the low quality of the jatropha biodiesel. During his PhD, Dr. Jain worked on stabilising the biodiesel for longer duration of over four months (previously it could be stored for 15 days only as its viscosity increases with time).

**Practical application:**

At present, the world is facing a dual crisis: management of waste and meeting energy needs. The research, according to Dr. Jain, will help in the management of waste to produce useful energy using thermochemical conversion.

**Inspiration behind research:**

Dr. Jain was born and brought up in Haridwar, Uttarakhand. After his Master’s in Mechanical Engineering, he started working at a reputed German company. However, he soon realised that teaching and research was his calling, and hence decided to return to India. ■





### Dr. Anil Kumar

School of Computer Science

**Primary research area:**

NASA-ISRO Synthetic Aperture Radar or NISAR, a collaborative project between NASA and ISRO

**Brief description:**

Dr. Kumar is involved in the implementation of Evolutionary Computing Algorithm for polarimetric Synthetic Aperture Radar (SAR) data processing and classification. His research will help in capturing data from satellites 24\*7. Dr. Kumar has developed a model that will read the data available by NISAR and implement the optimized algorithm for classification purposes. The collaboration between NASA and ISRO began in 2013, while Dr. Kumar got associated with the project in 2016. The project is scheduled to be launched in 2023.

**Real-world application:**

NISAR's data can help people worldwide better manage natural resources and hazards, as well as providing information for scientists to better understand the effects and pace of climate change. It will also add to our understanding of our planet's hard outer layer, called its crust.

**Inspiration behind research:**

While working as a software developer at an MNC in Chennai, Dr. Kumar felt unsatisfied with the work and decided to explore a more fulfilling career. Hence, he switched to academics, where he could keep learning, innovating and evolving. ■





**Dr. Parswajit Kalita**  
School of Advanced Engineering

**Primary research area:**

Material Science

**Brief description:**

In his research, Dr. Kalita investigates how to make materials more resilient to damage. He works on specific materials that are used in satellites and nuclear reactors and are prone to damage due to radiation, which may lead to accidents. Playing around with numerous factors in the materials, Dr. Kalita has envisioned using a combination of materials to improve the final product. In this area, he has recently been awarded a project by the Department of Atomic Energy, Government of India.

**Practical application:**

The research will help in enhancing the safety, efficiency and life of satellites and nuclear reactors and decrease the damage caused by cosmic and nuclear radiations respectively.

**Inspiration behind research:**

Since a young age, Dr. Kalita had a remarkable clarity about his goals. He always wanted to study Physics and during the initial stages of his PhD, his supervisor guided him towards studying radiation damage, and he hasn't looked back since then. ■



### **Dr. Sarathlal K V**

School of Advanced Engineering

**Primary research area:**

Spintronics Materials

**Brief description:**

All the information technology is based on electronics, and electronics has two properties: charge and spin. Dr. Sarathlal K V is working on spin-based electronics, trying to manipulate spin interactions to increase data storage. While laptops and mobile devices are getting smaller, the need for data storage is increasing. The research deals with the issue of maintaining data stability without heating the device.

**Practical application:**

The research attempts to meet the demand of high data storage across the world by increasing data storage while reducing the size of the device.

**Inspiration behind research:**

It was his Physics teacher in school who changed Dr. Sarathlal K V's life forever. He encouraged him to pursue academics and go for research. The 2007 Noble Prize in Physics for GMR discovery related to data storage industry enthralled him to pursue his work in this domain. Since then, Dr. Sarathlal K V has devoted his life to the field. ■



### Dr. Vipin Gaur

School of Advanced Engineering

**Primary research area:**

Belle and Belle II

**Brief description:**

The Belle II experiment is a particle physics experiment designed to study the properties of B mesons and other particles. Belle II is the successor to the Belle experiment and commissioned at the SuperKEKB accelerator complex at KEK in Tsukuba, Ibaraki prefecture, Japan. The experimental measurements of Belle resulted in the 2008 Noble Prize in Physics. From India, UPES is part of this project along with several IITs, and Department of Atomic Energy, Government of India.

Dr. Gaur is the institutional representative from UPES of these mega-science and technology projects.

**Practical application:**

The purpose of the upgraded Belle II experiment is to search for new physics phenomena that cannot be explained by the particles and forces already included in the Standard Model—the world’s reigning (and well-tested) theory of particle physics—while also making precision measurements of known phenomena.

**Inspiration behind research:**

Dr. Gaur’s love for particle physics began when he realised the significant contributions the field has made to the society such as World Wide Web and ultra-high precision drug delivery. ■



### **Dr. Sravendra Rana**

School of Health Sciences and Technology

**Primary research area:**

Self-healing Materials

**Brief description:**

Dr. Rana seeks to investigate the development of fiber-reinforced self-healing composite materials for aerospace applications, where small cracks, which are caused by stress, should be able to “repair” at low temperature. An untreated crack in an airplane can become deeper and cause safety concerns. The self-healing materials made using biomolecules (derived from naturally-occurring substances instead of poisonous catalysts) will stop the crack from getting deeper and simultaneously heal the crack.

**Practical application:**

There is a growing demand for recyclable and healable composite material in the automobile and aerospace industry. The material has great mechanical strength and has applications in the development of high-class resins to make aircraft components more durable.

**Inspiration behind research:**

Dr. Rana belongs to Meerut, from where he completed his Masters. He moved to South Korea for his PhD in nanoparticles. That experience changed his life, and he realised that he wanted to become a professor and continue his research to solve the problems in the field. ■





### Mr. Saurabh Shanu

School of Computer Science

**Primary research area:**

Intelligent Patrolling Systems

**Brief description:**

Mr. Shanu's research is based on constructing a system for intelligent patrolling. His work has been included in the M-Stripes project by the Ministry of Environment, Forest, and Climate Change, Government of India.

Since forests are large and not fenced, there are certain paths used by poachers that go undetected by patrol guards. This research works on the landscape parameters, using the Global Positioning System (GPS) imagery. It applies algorithms from Artificial Intelligence and can identify all the paths, which poachers might have access to. This software also takes into consideration human fatigue which can occur and the timings of the forest guard movements.

**Practical application:**

Mr. Shanu is working to bring sustainable development using the logics of computation. He is using Computer Science to help Wildlife Sciences by preventing illegal hunting and poaching of species, track the patterns of animal movement, population demographics, habitat utilisation, snaring and poaching incidents.

**Inspiration behind research:**

Mr. Shanu was interested in wildlife since childhood, visiting various national parks, seeing different species, understanding the problems of the field. He has worked with the Wildlife Institute of India on Project Tiger, a Government of India initiative for conserving tigers. ■





**Dr. Manish Kumar**

School of Advanced Engineering

**Primary research area:**

Detection and removal of pollutants, wastewater surveillance, and anti-microbial resistance

**Brief description:**

There are four directions to Dr. Kumar’s research: Fresh water and contaminant pathways, isotope fingerprinting (knowing the source of pollution) in soil and urban dust, finding cost-effective, in-situ removal technology to eliminate pollutants, anti-microbial resistance, and sustainability-research for community participation.

Dr. Kumar detected SARS-Cov-2 gene wastewater, which was a first in the country. He was invited by the United Nations Environment Program to talk about anti-microbial resistance.

**Practical application:**

The research focusses on waste-water surveillance and management, remediation, cleaning water bodies and soil, and preventing anti-microbial resistance.

**Inspiration behind research:**

Dr. Kumar was fascinated by technology since a young age. His father, a Science teacher, always explained to him the ‘why’ behind his questions and introduced him to several technological innovations. His parents wanted him to become a medical doctor, but eventually as fate would have it, he became a Doctor of Engineering. ■



### Dr. Prasoom Dwivedi

School of Business

**Primary research area:**

Sustainability in Business and Society

**Brief description:**

Dr. Dwivedi, in collaboration with his colleagues, works for providing solutions to policy makers, industry and society. Their primary focus is the socio-techno-economic analysis of sustainability projects. They are also working on exploring innovative sources of sustainable finance such as crowdfunding.

**Practical application:**

Dr. Dwivedi is committed to leveraging research outcomes for the benefit of the society. He has been extending help to MSMEs, policy makers, villagers and young entrepreneurs through his research output. Raising support through innovative sustainable finance has been the cornerstone of his research output. He is also actively involved in building capacities of young professionals in India and abroad in the field of sustainability.

**Inspiration behind research:**

Dr. Dwivedi believes that sustainability should be the bedrock of all development initiatives. There is an urgent need to make our societies cognizant of sustainable ways of living. Academics, researchers and thought leaders should lead the way and build frameworks for sustainable development. This has been guiding spirit behind all his research and outreach activities. ■

At UPES – the University of Tomorrow – we are committed to advancing knowledge and pushing the boundaries of human potential. While this research brochure outlines a few key research projects happening at the university, the overall body of research work at UPES is fairly exhaustive, encompassing a range of topics and hypotheses. Our researchers are experts in their respective fields and have been honoured with numerous awards and accolades. They are engaged in an array of research activities, from exploring new frontiers in medicine and technology to unlocking the secrets of the human mind. We are proud to support our faculty members' research and their pursuit of knowledge. Through their ground-breaking work, they are inspiring the next generation of scientists, engineers, and scholars. We invite you to join us in celebrating the achievements of our faculty members and their tireless work to make the world a better place.



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