Title	Funding Agency	Scheme Under Funding Agency	PI Name	Co-PI Name	Co -PI (Other Unive	School	Sanction Order	Date of sanction	Sanction Order Value-INR	Duration Month	Project Status	Brief description	Key highlights	Societal impact of the project
Data-Driven Approaches for Enhanced Detection of Fetal Arrhythmia	Science and Engineering Research Board-SERB		Muthukumar Ka (UPES)			SOCS	EEQ/2023/000315	22-01-2024	22,15,004	36	Project Ongoing	This project focuses on enhancing the detection of fetal arrhythmias and assessing the quality of fetal electrocardiogram (FECG) signals through advanced techniques. By leveraging deep learning methodologies, the initiative aims to classify FECG signals into normal or arrhythmic conditions without heavily relying on precise heartbeat detection. This is achieved by segmenting the FECG signals and analyzing them through a deep learning model that categorizes the segments based on the estimated heartbeat interval. Additionally, the project introduces an innovative approach for signal quality assessment using the Earth Mover's Distance (EMD) to compare the observed FECG signals against a reference distribution, facilitating the identification of signal segments according to their quality. This dual approach not only aims to improve the accuracy of fetal arrhythmia detection but also enhances the overall quality of FECG signal analysis.	1-Deep Learning for Arrhythmia Detection: Utilization of a deep learning framework for the classification of FECG signals into normal and arrhythmic categories, reducing the dependency on accurate heartbeat detection and increasing the reliability of fetal arrhythmia identification 2-Signal Quality Assessment Using EMD: Introduction of the Earth Mover's Distance (EMD) as a metric for comparing the distribution of observed FECG signals with a reference, enabling an objective evaluation of signal quality without the need for labeled training data. 3-Enhanced Signal Analysis Techniques: Application of unsupervised learning methods, such as clustering and self-organizing maps, based on EMD values, to categorize FECG signal segments by quality (high, medium, low), improving the precision of fetal heart rate estimation and arrhythmia detection. 4-Objective and Automated Evaluation: By eliminating the reliance on labeled data for signal quality assessment, the project enables an objective and automated evaluation process, streamlining the identification of low-quality signal segments for improved analysis accuracy	The implications of this project for society are significant, particularly in the context of prenatal care and fetal health monitoring. Early and accurate detection of fetal arrhythmias can have a profound impact on the outcomes of pregnancies by enabling timely interventions and tailored care plans. By improving the reliability and accuracy of fetal arrhythmia detection and signal quality assessment, the project has the potential to: 1-Enhance Prenatal Care: Providing healthcare professionals with advanced tools for monitoring fetal health, leading to improved prenatal care and intervention strategies. 2-Reduce Infant Mortality and Morbidity: Early detection of arrhythmias can lead to interventions that prevent complications, reducing infant mortality and morbidity associated with fetal heart conditions. 3-Ease Parental Anxiety: Improved diagnostic tools and accuracy can alleviate the anxiety and stress of expectant parents by providing clearer insights into the health of the unborn child. 4- Drive Innovation in Fetal Health Monitoring: The project sets a foundation for further research and development in fetal health monitoring technologies, potentially leading to new
Ultra-Sensitive SERB Probing for food and health safety using hybrid plasmonic metasurfaces and dual-beam pump-probe Raman	Science and Engineering Research Board-SERB	Core Research Grant	Prasanta Mandal(UPES)			SOAE	CRG/2023/001170	29-08-2024	53,07,192	36	Project Ongoing	SERS enhancement relies on strong plasmonic near-fields localized around metallic nanostructures caused by surface plasmon resonance. Exact mechanism of high SERS and near-field dependence (reported to be E^4) are still needs to be unveiled. While most of the studies are based on the designation of plasmonic substrates and single beam SERS measurements, no reports are available on the excitation of plasmonic near-fields separately and subsequent measurements to unveil exact influence of plasmonic near-fields. Use of single beam can not be the effective way of utilizing highest near-field and hence highest SERS contribution. A separate beam for SPR excitation is very much needed. Thus, a dual-beam pump-probe Raman can be considered as a potential candidate for high end SERS and can open new route for Raman probing (note: it is not CARS (Coherent Anti-Stokes Raman Scattering)). Novelty: In this project proposal novel dual-beam pump-probe near-field Raman methodology will be employed for ultra-sensitive SERS detection. The separate beam of appropriate wavelength will be used to excite SPR to cause huge near-fields, and hence Raman scattering cross-section and signal. Objectives: ⁉ Design, computation and fabrication of cost effective highly sensitive hybrid plasmonic metasurfaces using soft lithography/interference lithography. ⁉ Development of dual-beam pump-probe near-field Raman, and ultra-sensitive SERS detection using hybrid plasmonic metasurfaces for food and health safety. ⁉ Understanding the physical origin of high SERS enhancement due to plasmonic near fields caused by surface plasmon resonance excitation by pump beam. Expected outcome/deliverables: Successful developments of dual-beam pump-probe near-field	Ultrasensitive SERS, Food & health safety, Dual-beam pump-probe Raman, soft lithography, interference lithography, cost effectiveness	The research outcome from the proposed project will be documented through research publications, conference publications and patents. The hybrid plasmonic metasurfaces along with dual-beam pump-probe Raman will be assets for potential Raman probing and ultrasensitive SERS detection. This technological development will have fundamental importance on molecular sensing platform for various applications; including spectroscopy, chemical sensing, defence, forensic science, medical science and more. Fundamental constrains of high laser power for Raman sensing may be overcome by using separate pump beam for SPR excitation. This will lead to further development on low cost SERS probing. ⁉ Successful developments of dual-beam pump-probe near-field Raman may take a step ahead of ultrasensitive probing platform and understanding plasmonic near-fields dependence and further developments of effective SERS metasurface substrates. ⁉ The development will potentially be applied in detecting SERS molecular finger printing and chemical analysis in various applied fields including food and health safety, forensic science, defence, biology, medical science etc. ⁉ Novel design concept and ultrasensitive SERS detection, upon successful implementation, will have
Development of Impact Resistive and Thermally Resilient Hybrid Laminated Composite Panel for Personal and Vehicle Armours	Science and Engineering Research Board-SERB	CRG Scheme	Ashish Mishra(UPES)	Subhankar Das(UPES)		SOAE	CRG/2023/007045	03-05-2024	28,84,200	36	Project Ongoing	With the development and maturity of ultra-high-molecular-weight polyethylene (UHMWPE) fibres, the body armour sector, which has been dominated by aramid fiber-based solutions over the previous three decades, is drawing greater attention to UHMWPE fibres. Compared to aramid fibre, UHMWPE fibre has a strength-to-weight ratio of around 40% higher. However, UHMWPE fibre also has drawbacks when employed in a ballistic protection system, including low creep resistance, low melting temperature (144-152 °C), and poor fibre adherence to the polymer matrix due to its smooth surface and absence of polar groups in its structure. Poor bonding of UHMWPE fibre with various polymer resins reduces impact resistance due to severe intra- and interlaminar delamination and localized deformation of the composite against projectile impact. The reduction in energy absorption is further magnified at higher velocities due to localized deformation and fibre softening/melting near the impact site. To overcome these challenges a cost-effective and commercially viable solution is proposed here. Surface-modified graphene oxide will be used simultaneously, to improve the stiffness and thermal resistance of polyurethane resin as well as to modify the surface characteristics of UHMWPE fibre through the patented ultrasonically assisted electrophoretic deposition (EPD) technique. The treated UHMWPE fibre will be systematically stacked with reinforced polyurethane resin to develop a hybrid laminated composite panel. The flat composite panels will be characterized to determine the micro and macro mechanical properties of the laminated structures to develop an orthotropic material model. In addition, the developed composite panels will be investigated against impact velocities between 300 -	•Utilizing a novel EPD method with graphene oxide to enhance the wettability of UHMWPE fiber and improve the thermo-mechanical properties of polyurethane resin. •Development of lightweight composite panels with improved energy absorption capabilities, suitable for protecting against various ballistic threats. •Potential applications in military, law enforcement, and civilian security sectors, offering standalone protection or as backing layers for higher-level protection systems, contributing to enhanced safety and security measures.	The outcome includes the development of lightweight composite panels with improved energy absorption capabilities, suitable for protecting against various ballistic threats. These panels can be utilized in standalone protection or as backing layers for higher-level protection systems, benefiting military, law enforcement, and civilian security applications. Additionally, the research contributes to technological advancement in materials science and engineering, potentially leading to further innovations in composite materials and their applications beyond ballistic protection. This innovation enhances safety and security measures, demonstrating significant social impact by safeguarding lives and critical infrastructure.
Development of Soft Armoured Lighteight Nanocomposite Material with enhanced Ballisitic Protection.	Science and Engineering Research Board-SERB	TARE	Piyush Gaur(UPES)			SOAE	SERB/F/12567/2023-2	06-02-2024	18,30,000	36	Project Ongoing	This project is about developing a soft armour graphene reinforced Armour with enhanced ballistic protection.	Light weight, graphene reinforced material with enhanced ballistic protection.	Useful for the Defense and Aerospace sector.
Water Quality assessment of Nainital Springs and remediation using green nanoparticles	G. B. Pant National Institute of Himalayan Environment, Kosi Katarmal, Almora - 263643,Uttarakhand, India	INTGRATED ECODEVELOPMENT RESEARCH PROGRAMME IN HIMALAYAN REGION (IERP)	Madhuben Sharma(UPES)	Sapna Jain(UPES)		SOAE	GBPI/IERP/23-24/13/83	23-02-2024	17,82,930	36	Project Ongoing	Uttarakhand is divided into two geographical areas, namely Garhwal and Kumaon area. The state receives 90% supply of potable water from springs and rivers (indiawaterportal.org/). In the Kumaon region, 60% of rural people depend on natural springs for water supply. The traditional sources of spring water are locally known as Chal, Khals, Naulas, and Gharats (Sharma 2016). Springs are a result of local hydrogeology and rainfall patterns. Prolonged human intervention is affecting the quantity, quality, and accessibility of spring water. In the present research proposal, a comprehensive monitoring and assessment of the spring water quality, present in the vicinity of Nainital Lake, Uttarakhand, will be carried out by using multivariate statistical techniques (MSTs) and water quality index (WQI). The proposed work aims to develop method for water remediation using nanoparticles. Synthesized nanoparticles have gained significant attention for their potential applications in water remediation due to their unique properties that can help in purifying contaminated water.	1) An updated report about the quality of spring water in the area will be prepared. 2)This study aims to develop a site-specific action plan by identifying potential sources of pollution in the study area. 3)A water quality map of the springs near Lake Nainital will be developed. It will serve as reference data for researchers and scientists working in the water sector. 4)Study aims to link water quality and diseases to provide proactive advice. 5)Water filtration system development will improve nearby communities' water quality	The major goal of the study is to discover a link between common diseases and water quality concerns in this area so that preventive advice can be given to the people. Development of green nanoparticle-based water filtration system. This filtration system will help in supplying better water quality to the local communities living in the vicinity of the spring.
Design and development of a portable KVIC type biogas plant for colder region	Khadi and Village Industries Commission(KVIC)	NA	Shailey Singhal(UPES)	Amit Kumar Sharma(UPES)		SOAE	SAT/KVIC/HQ/1/2024/3/3353/2023-24/505	20-03-2024	14,95,000	18	Project Ongoing	The project is about the technological upgradation of KVIC type biogas digester.	The present idea proposes two innovative solar techniques: 1. heat trapping within the digester using greenhouse during daylight hours 2. utilizing solar heater with a heat exchanger to elevate digester temperatures	1. Biogas and nutrient rich organic manure generated by the anaerobic digestion of kitchen waste, cattle dung, agriculture waste (Fruit-vegetable waste) 2. Novel technology for converting waste to wealth specifically for colder regions 3. Minimization of LPG requirement for rural areas by its replacement with biogas 4. Upliftment in the socio-economic status of the residents of Uttarkashi and other hilly areas 5. Support to Swatch Bharat Abhiyaan and Gobardhan yojana
Development of flavored yogurt with indigenous Himalayan yellow berries and lactic acid bacterial strains isolated from ethnic fermented food of Uttarakhand	Uttarakhand Council For Biotechnology (UCB)		Piyush Kumar(UPES)			SOHST	UCB/R&D Project/2024/556	27-03-2024	5,80,000	24	Project Ongoing	The majority of Indian Himalayan ethnic fermented foods have yet to be scientifically investigated for potential probiotic properties and their controlled commercial production. The knowledge that is currently available focuses primarily on the microbial diversity in the marketed finished products of the Eastern Himalaya, and there is little data on the microbial diversity, their probiotic properties and production of fermented foods from the Western Himalaya, particularly from Uttarakhand. This proposal develops a value-added product employing underutilized fruit and lactic acid bacteria from ethnic fermented foods of Uttarakhand, contributing to the preservation of traditional knowledge and biodiversity.	This proposal aims to develop a potential probiotic yogurt with a consortium of lactic acid bacteria (LAB) isolated from ethnic fermented food of Uttarakhand for specific health benefits, supplemented with the medicinal goodness of highly nutritious wild fruit of Uttarakhand commonly known as Himalayan yellow berry (Rubus ellipticus Sm., local name – Hisalu or ainselu). Incorporating the extract from Himalayan yellow berries into the yogurt formulation adds unique phytochemicals and antioxidants, further enhancing its therapeutic potential as an emerging functional food. Probiotic characteristics of microorganisms are strain dependent, so the potential benefits associated to specific yoghurt bacterial strains need to be adequately evaluated before making such a claim. We hypothesized that specific lactic acid bacteria (LAB) strains with proven health beneficial properties could be used to prepare a potentially probiotic yoghurt.	Strains isolated from indigenous sources are usually considered more effective in exerting long lasting beneficial effects. Indigenous isolates are well adapted to grow in the ambient environment of their native niches. Hence, in this proposal, we will gather information about indigenous preparations of the Uttarakhand region and their efficacy in the Indian market, which can perform well in the Indian population. This information is crucial for understanding the potential health benefiting enzymes associated with these indigenous strains. In addition, understanding the functional properties (antimicrobial, exopolysaccharide secretion, cholesterol lowering, biogenic amine degradation, antinutritional, anti-cancerous, flavor enhancing activities etc.) can help in utilizing them effectively in various industrial applications, such as developing functional foods or probiotic supplements.

Biomass nanocomposite with reduced volatile matter as the substitution of conventional coal for co-firing operation in thermal power plants	Department of Science & Technology-DST		Nirlipta Priyadarshini Nayak(UPES)		1-Prof.Zishan Husain Khan@PI@Jamia Milia Islamic 2-Dr. Harshal Kumar@PI@Gla University	SOAE	DST/CSE/CERI/RES/BARC/2023/06(G)/1	28-03-2024	40,50,200	36	Project Ongoing	Biomass-derived chars can substitute conventional fossil fuel i.e. Coal in Thermal Power plants for electricity generation. High Carbon content, specific area and porous structure make biochar the best alterative/ add on to offset the load of power plants in terms of consumption of feedstock and emission of greenhouse gases as well. Biochar production is a carbon-negative process, as it reduces CO2 in the atmosphere. In the process of making biochar, the unstable carbon in decaying plant material is converted into a stable form of carbon that is then stored in the biochar. Chars on the contrary to the raw biomass are highly hydrophobic, brittle, more easily fluidizable and agglomerate less. Along with these, Energy consumption, in transportation, storage, milling, densification and feeding. Chars once produced from biomass can be co-fired along with pulversized coal in existing facilities. Particle size of both coal and biochar are somewhat similar, ensuring homogeneous mixture. From a process point of view, the oxidation reactivity of biomass-derived chars is higher than that of bituminous coal, thereby can reduce the dependency on coal and helps in augmentation of natural resource i.e. coal. Besides, combustibility and reactivity of biochar are better than coal. Biochar is high in carbon content and is low in ash, nitrogen, sulfur etc. ensuring minimal release of noxious gases to atmosphere.	•Development and production of Improved/ more-advanced low volatile biomass pellets to minimize the auto-oxidative tendency of coal and thereby minimize the safety hazards. •Substitution of 5-7 % of coal with biomass in coal-based power plants can save 38 million tons of carbon dioxide emissions. •This will reduce power cost by almost 40% and exhaust effluents by 60 % compared to conventional fuels	Waste utilization- Disposal of stubble is a matter of concern. Stubble burning causes severe environmental damage. Consumption of biomass/ stubble in pellet making can curb its damaging effects. Biomass pellets can be made from agricultural waste and forestry byproducts, which reduces waste and promotes resource efficiency. Energy efficiency & security Biomass pellets are highly efficient to burn, which reduces energy consumption and costs. Using locally sourced biomass can reduce dependence on imported fossil fuels, which can improve energy security. Less garbage in landfills Diverting waste to biomass energy plants instead of landfills reduces the size of landfills and the risks of methane and carbon dioxide emissions from decomposing organic matter. It will also increase Employment opportunities, local community development and many more.
Morphotectonic assessment of structurally induced geohazard potential areas within the MBT Zone: NW of Dehradun, Uttarakhand	Science and Engineering Research Board-SERB	Anusandhan National Research Foundation (ANRF)	Girish Chandra Kothyani(UPES)	Atul Kumar Patidar(UPES)		SOAE	CRG/2023/000555	08-05-2024	26,11,720	36	Project Ongoing	The current research project deals with the mapping of tectonically induced landforms and geohazard potential analysis along the MBT zone, central Himalayan region of Uttarakhand. The state-of-the-art InSAR/GLA/ML/SPIM modeling, and field-based technique will be implemented to map the zone of active deformation. The idea is to generate a potential hazard map and delineate structurally controlled active landform morphology in the study area, which will ultimately help to create the chronology of paleoseismic events along MBT zone. This study will be extremely beneficial for future urban planning and sustainability development in the adjoining region of Dehradun.	1.Fault linkage analysis of Sirmauri Tal Fault (STF), Maiji Fault (MF) and their connectivity with the MBT with respect to landform evolution and hazard potential. 2.Identify and map geological and geomorphic evidence of active deformation and prepare 3D stereographical projection to understand probable causes of stress build-up and vulnerable zones having landslide potential. 3.Analaysis of active ground deformation pattern/ground subsidence, using InSAR/PSINSAR & SPIM modeling techniques. 4.Susceptibility assessment and categorization of landsides (slope instability) investigation of the study area	The proposed project's findings will provide insight into the Quaternary evolutionary history and hazard potential of MBT zones, particularly with respect to the neotectonic and seismic events that led to the formation of the current terrain. The main aim is to provide a precise geohazard potential and active fault map of the densely populated regions located between Dehradun and the eastern part of Himachal. Further, the outcome of the study will be utilized for urban development, town planning, civil engineering works respectively
Human induced pluripotent stem cell-based functional characterizations of novel identified disease causal gene(s)/variant(s) in families with juvenile Parkinson's disease	Science and Engineering Research Board-SERB	Teachers Associateship for Research Excellence (TARE)	Laxmi Kirola(UPES)			SOHST	TAR/2023/000148	17-05-2024	18,30,000	36	Project Ongoing	Parkinson's disease (PD) is the second most devastating neurodegenerative disease after Alzheimer's disease. It affects both motor and non-motor symptoms in humans. The incidences of PD are increasing and an average of ~13.4 per 100,000 individuals are affected worldwide. PD cases with early onset at or before 21 years are known as juvenile PD (JPD). The main cause of JPD includes a combination of genetic and environmental factors, mostly JPD is linked to genetic predisposition (inherited either in autosomal dominant, recessive, or X-linked mode), heterogeneity, and other phenomena. Recently, whole genome sequencing has helped to discover both coding and noncoding regions of the genomic alteration that can be mapped, and novel disease causal gene(s)/variant(s) can be identified. Furthermore, human-induced pluripotent stem cell-based studies may provide additional and novel leads for understanding disease biology/pathways and finding novel putative therapeutic targets. This study aims to identify and characterize novel disease causal gene(s)/variant(s) in families with JPD in the Indian population.	The major outcome of these findings will be immediately useful for early diagnostics/probable predictive medicine, biomarker(s) discovery, and provide leads for personalized therapeutic targets for the next step. The scientific research on discovery genomics and functional characterization of Parkinson's disease (PD) is of paramount importance for several reasons: i) Advancing precision medicine ii) Early diagnosis and prognosis iii) Paving the way for therapeutic innovations iv) Global health impact v) Genetic counseling and family planning vi) Contribution to scientific knowledge vii) Ethical and societal considerations	The international excellence of scientific research on discovery genomics and functional characterization of Parkinson's disease is marked by collaboration, inclusivity, technological advancements, global impact, and the translation of research findings into meaningful applications for patient care. Further, this includes i) Global collaboration ii) Understanding and unraveling disease complexity iii) Access to advanced technologies iv) Interdisciplinary approach v) Data sharing and standardization vi) Translation of research findings and global scientific recognition
A Novel Eco-Friendly Nano-Agriculture Strategy for Small-Marginal Farmers of Higher Himalayas: A Nano-Pyrite Based Seed/Root/Shoot Treatment Approach for Improving Potato Yield and Dairy Green Fodder Production	Sree Padmavathi Venkateswara Foundation		Dr. Himanshi Jangir(UPES)			SOHST	Sree PVF/G/AS/24/2	09-09-2024	47,96,000	24	Project Ongoing	Farming in mountainous terrains is labor-intensive since advanced mechanization is challenging. Small- scale farmers engage in subsistence farming as they lack the resources to profit from meager landholdings. Women travel long distances to collect fodder for cattle. Here, we intend to create a self- reliant and profitable food production ecosystem in remote areas for small-scale farmers with minimal investment while maintaining the niche Himalayan ecosystem without polluting with synthetic chemicals.1.2 We propose a fertilizer-free nano pyrite seed/root/shoot priming strategy to increase potato and green fodder crop production to support the Himalayan farming-dairy community and transform the subsistence farming model into profitable agribusiness.3-15	We propose a nano pyrite-based seed/root/shoot priming technology to boost plant growth as a fertilizer replacement strategy. It is a disruptive agronomic strategy to counter the energy-intensive Haber-Bosch process of ammonia fertilizer synthesis. This sustainable strategy maximizes profits while considering various agricultural stakeholders, such as land, water, energy, plants, animals, and humans. Here, seeds will be soaked overnight, roots for 3 hours, and shoots for one to three hours in an aqueous suspension of nano pyrite and washed thoroughly before sowing/transplanting into the field, thus achieving food security and sustainable growth while maintaining genetic diversity and reducing fertiiizer use. 1. A 'fertilizer-free sustainable strategy for the marginal potato growers of Kumaon region' that will preserve the niche ecosystem and improve productivity. We expect both nano pyrite seed and shoot (vegetative) priming of potato will improve its yield. Generation of high-quality seed bank for potato crop. 2. Economic strategies to 'bridge the green fodder production gap' to enhance milk production and quality. Nano pyrite seed priming for four fodder crops and root priming in the propagation of para	In 2018, cost estimation per hectare of land for a pilot study for rice showed that the cost of seed priming with nano pyrite is INR26, whereas that for NPK fertilizer application is INR890. Priming with nano pyrite is a one-time seed/root/shoot treatment strategy, thus reducing the efforts of farmers in comparison to multiple applications of fertilizers at different stages of plant growth. The crop primed with nano pyrite is sturdier than control crops and has a dense root network; this will help plants to hold the soil better in challenging terrains and is expected to sustain better in harsh climatic conditions. Given their significance as human and cattle energy sources, we have chosen potato and four fodder crops. According to the Horticulture Statistics Division, Department of Agri. & Cooperation, in 2017-2018, Uttarakhand's potato productivity was 13.76 MT/ha. This, along with all other states with hilly/mountainous terrains, is far below the national average of 23.96 MT/ha. Uttarakhand state statistics of 2010-11 showed that 91.3% of total land utilized for potato cultivation was mountainous, and plain areas were only cultivated in the Rabi season.19 Only 2.9% of total cultivable land is employed for fodder cultivation, and the state has a deficit of 49.9% in fodder, which is currently obtained from forests and