



2025

ACCELERATING POSSIBILITIES

IIT KANPUR'S RESEARCH ROADMAP FOR
TRANSFORMING IMAGINATION INTO SOLUTIONS



OVERVIEW

Indian Institute of Technology Kanpur stands as a beacon of scientific excellence, technological innovation, and nation-centric research. As one of India's most prestigious institutes, IIT Kanpur has consistently driven forward the frontiers of knowledge, blending academic rigour with real-world application. The Institute is home to a vibrant research ecosystem that encourages interdisciplinary collaboration, fosters entrepreneurship, and nurtures solutions that are socially relevant and globally scalable. Our research spans critical areas such as public health, affordable diagnostics, clean and renewable energy, climate resilience, artificial intelligence, cybersecurity, water and sanitation, rural empowerment, advanced manufacturing, and sustainable urban development.

Each of these focus areas is thoughtfully aligned with the United Nations Sustainable Development Goals (SDGs), reinforcing our commitment to building a more inclusive, equitable, and sustainable future.

Moreover, our projects are designed to complement and accelerate several key Government of India missions, including the National Health Mission, National Education Mission, Jal Jeevan Mission, National Electric Mobility Mission, Digital India, Atmanirbhar Bharat, and Skill India. By linking scientific progress with societal outcomes, IIT Kanpur ensures that its innovations not only push the boundaries of technology but also deliver measurable impact at the grassroots level.

Through this document, we bring to you a curated selection of impactful, mission-driven research projects that are ready for corporate collaboration and support. These initiatives are backed by dedicated faculty, advanced infrastructure, and a strong translational focus. We believe that industry-academia partnerships are pivotal for scaling innovations and creating sustainable value. We invite you to be part of this journey where your support can accelerate pathbreaking discoveries, empower communities, and contribute to national development goals while fulfilling your corporate social responsibility and Environment, Social & Governance mandates.

**SHAPING THE FUTURE,
TOGETHER.**

HEALTH CARE

03

GOOD HEALTH
AND WELL-BEING



09

INDUSTRY, INNOVATION
AND INFRASTRUCTURE



The Healthcare category is dedicated to research and innovation that enhance medical accessibility, efficiency, and patient outcomes. With a focus on scalable and technology-driven solutions, this domain covers key areas such as non-invasive devices, diagnostic kits, MedTech solutions, portable equipment, assistive devices, and biotechnology. Together, these subcategories represent our commitment to developing affordable, reliable, and impactful healthcare technologies, especially for resource-limited and remote settings.

Indigenous Clinical Stereo Electroencephalography Electrodes for Identifying Epileptic Zones

2
INR Crore
PROJECT COST

Plasma Patch for Skin Therapy and Wound Healing

1.15
INR Crore
PROJECT COST

This research focuses on developing indigenous stereo-electroencephalography (SEEG) electrodes to accurately identify epileptic zones in the brain.

Impact- These cost-effective, locally made electrodes enable precise, minimally invasive brain mapping, aiding in the diagnosis and surgical treatment of epilepsy, especially in resource-constrained healthcare settings.

Capitalizing on cognitive networks for informing seizure onset in epileptic patients

0.68
INR Crore
PROJECT COST

Gene therapy for Age-related Muscular degeneration and blindness

1.00
INR Crore
PROJECT COST

This research focuses on leveraging cognitive brain networks to improve the identification of seizure onset zones in epileptic patients.

Impact- By analysing brain connectivity patterns, the approach aims to enhance precision in epilepsy diagnosis and support more effective, targeted treatment strategies, especially in pre-surgical planning.

This project aims to develop a novel AAV2-mediated gene therapy using codon-optimized human ZFP36 to treat wet age-related Macular Degeneration (AMD). It proposes a one-time, tunable therapy to reduce angiogenesis and inflammation, lowering treatment burden and side effects. Preclinical studies in mice will assess efficacy, safety, and biodistribution.

Impact- Successful outcomes may enable clinical translation for AMD and related ocular diseases.





Multispectral image analysis and algorithm development for wrist stress identification

0.20
INR Crore
PROJECT COST

This project aims to develop a multispectral imaging system combined with custom algorithms to identify stress and strain in the wrist.

Impact- By capturing images across different wavelengths, the system can detect subtle physiological and structural changes, enabling early diagnosis of musculoskeletal issues through non-invasive, image-based assessment.

Development of a portable and safe low frequency ultrasonic based medical imaging tool

0.40
INR Crore
PROJECT COST

This project aims to develop a safe, portable, and cost-effective 3D medical imaging tool using low-frequency ultrasound and Full Waveform Inversion (FWI) algorithms.

Impact- Unlike CT or MRI, it poses no radiation risk and effectively images both soft tissue and bone, making it ideal for broader, faster, and safer diagnostics.

NeuroGuard: Smart Wearable for Early Detection of Brain Disorders

0.65
INR Crore
PROJECT COST

NeuroGuard is a smart, portable wearable device designed for early detection of brain disorders. It enables continuous, real-time monitoring of brain activity, allowing at-home use and significantly reducing hospital visits.

Impact- By replacing traditional multi-day tests with a quick, user-friendly solution, it enhances accessibility and speeds up neurological diagnosis.

Motion planning of magnetically steerable catheters in human arteries

0.15
INR Crore
PROJECT COST

This research focuses on developing magnetically steerable soft catheters for minimally invasive surgeries and targeted drug delivery.

Impact- By using pre-magnetized, shape-morphing polymer composites, the catheter tip can be remotely guided through complex body pathways. A physics-based model and motion planning algorithms will enhance precision and reduce vessel wall contact.

Portable Oxygen Concentrator for Vehicle & Transports

0.25
INR Crore
PROJECT COST

Design and Development of a Hybrid Assistive Device for Transfer Mobility and Rehabilitation

0.52
INR Crore
PROJECT COST

Portable Oxygen Concentrator for Vehicle & Transport is a compact medical device designed to deliver continuous oxygen supply during travel.

Impact- It ensures respiratory support for patients in ambulances or personal vehicles, making oxygen therapy accessible on-the-go, especially in emergencies or remote areas with limited medical infrastructure.

Medicine in the Air: Drones Bridging Healthcare Gaps

0.25
INR Crore
PROJECT COST

TOST: A Temporal Olfactory Stimulus-Based Tool for Early and Effective Alzheimer's Disease Screening

3.19
INR Crore
PROJECT COST

"Medicine in the Air: Drones Bridging Healthcare Gaps" refers to the use of UAVs (drones) in healthcare to deliver essential medical supplies, medicines, and vaccines to remote, underserved areas. In addition to efficient transport, these drones also feature auto-morphing technology, which enables them to adjust their shape for better maneuverability in challenging environments.

Impact- Enhancing their effectiveness in reaching difficult-to-access locations and improving healthcare delivery.

This research explores spatial disorientation in Alzheimer's by studying how the brain encodes temporal features in odour stimuli. Using behavioural tests on AD mouse models, it aims to develop diagnostic tools. Future work includes human trials and investigating neural circuits for therapeutic targets through in vivo electrophysiology.

Impact- Enable early diagnosis and targeted therapy for Alzheimer's by uncovering how the brain processes odour-related spatial cues.



Medical Imaging Using Generative AI for Radiology Reports

0.23
INR Crore
PROJECT COST

AI-Powered Cardiac Digital Twin

0.52
INR Crore
PROJECT COST

This project aims to develop an AI-based system for automatic generation of radiology report impressions using fine-tuned Large Language Models.

Impact- Leveraging AWS infrastructure and the MIMIC-CXR dataset, the system targets efficient summarization of medical imaging, reducing manual effort, enhancing accuracy, and improving healthcare workflow productivity.

HRIDYANTRA

11.0
INR Crore
PROJECT COST

Medical Simulation Device for Cardiac and Neurosurgical Arenas

4.00
INR Crore
PROJECT COST

HRIDYANTRA aims to develop an affordable, indigenous Left Ventricular Assist Device (LVAD) to address heart failure in India. With advanced motor design, haemocompatible materials, and Maglev technology, this high-performance device will undergo rigorous testing.

Impact- It aspires to revolutionize cardiac care and establish India as a leader in med-tech innovation.

3D Printing of Hydroxyapatite/Ag/CeO₂/ZnO Based Slurry for Fabricating Bio-composite for Bone Tissue Engineering

0.39
INR Crore
PROJECT COST

Study of potential fluctuation dynamics and reactive species criticality in an atmospheric pressure plasma jet for biomedical applications

0.99
INR Crore
PROJECT COST

This project focuses on developing a 3D-printed bio-composite scaffold using Hydroxyapatite, Ag, CeO₂, and ZnO for bone tissue engineering. The ink is optimized for printability, biocompatibility, and antibacterial properties.

Impact- The final scaffold mimics bone structure with appropriate porosity and mechanical strength, aiding bone regeneration and reducing infection risks.

This project explores how magnetic fields and ion cyclotron resonance in atmospheric pressure plasma jets affect the generation of reactive oxygen and nitrogen species (RONS). By analyzing electrode configurations and gas environments.

Impact- It optimizes plasma conditions for biomedical uses like sterilization, wound healing, and tissue regeneration.

Development of Triggerable Therapeutic Composite Musculogel as Healthcare Product for Aftercare to SARS-CoV2 Infection Mediated Rhabdomyolysis

0.39
INR Crore
PROJECT COST

Active Cable Driven Parallel Robot (ACDPR) for Rehabilitation of Stroke Patients

0.46
INR Crore
PROJECT COST

This project develops "Musculogel," a potassium-triggered therapeutic hydrogel for post-COVID rhabdomyolysis care. Designed for targeted drug release, it protects skeletal muscles and kidneys from infection-induced damage.

Impact- The system is tested via in-vitro, in-vivo, and patient studies, aiming to offer an effective aftercare solution for long-term COVID complications.

SERS based cancer detection using plasmonic Nano-particles having large surface roughness

0.34
INR Crore
PROJECT COST

Development of a portable and safe low frequency ultrasonic based medical imaging tool

0.40
INR Crore
PROJECT COST

This project focuses on enhancing early-stage cancer detection using Surface Enhanced Raman Spectroscopy (SERS). By developing plasmonic nanoparticles on solid substrates and microfluidic channel walls, the technique enables highly sensitive, non-invasive detection of biomarkers in bodily fluids like saliva and blood.

Impact- SERS overcomes limitations of conventional Raman spectroscopy, offering stronger signals and better accuracy for real-time biomedical diagnostics

Design and development of point of care device for primary detection of malnutrition and anaemia

0.24
INR Crore
PROJECT COST

AI-enabled ear pathology diagnosis using handheld camera-enabled otoscopic images to aid telemedicine practices and teaching learning methods

0.51
INR Crore
PROJECT COST

This project aims to develop a non-invasive point-of-care device for the primary detection of malnutrition and anaemia, focusing on deficiencies in iron, vitamins, and other minerals. Using saliva samples, the device will provide quick, preliminary indications of deficiencies, enabling early detection of conditions like anaemia and malnutrition. The method is designed for easy deployment in rural and underserved areas, requiring no healthcare centre support, making it suitable for use by all age groups.

Impact- This device will be a valuable tool in addressing widespread micronutrient deficiencies, improving health outcomes, and preventing the physical and mental impacts of delayed detection.

This project aims to develop an affordable, non-invasive device for early oral cancer detection using white light and fluorescence imaging combined with machine learning analysis. Designed for large-scale screening, the tool identifies high-risk areas to enable timely diagnosis. Data from 1000 patients will refine the algorithm and validate it against biopsy results. The project also includes rural outreach camps to test the device and train healthcare workers, promoting accessible cancer screening in underserved areas.

Point of Care non-invasive device: Smart Urine closet

0.50

INR Crore

PROJECT COST

Sprayable Lyophobic Integrated Polycoat (SLIP) for urinals and toilets.

0.25

INR Crore

PROJECT COST

This project aims to promote preventive healthcare through Urinalytics, a plug-and-play device that fits into any urinal or toilet. The system analyzes urine using sensors to detect physical, chemical, and biological markers, enabling early diagnosis of chronic conditions such as kidney disease. Users receive health reports via email, with access to nearby clinics and pharmacies. Affordable and accessible, this technology shifts the focus from treatment to early intervention.

Nanomaterials Based Solutions for Removal of Heavy Metals from Mainstream Cigarette Smoke

0.44

INR Crore

PROJECT COST

This project aims to enhance sanitation and reduce water usage through SLIP, an innovative coating for urinals and toilet chambers. SLIP reduces water consumption by up to 90% by repelling liquids, bacteria, and waste. Just 1 ml of the coating can save over 1,000 liters of water. It also promotes hygiene by preventing pathogen buildup, helping reduce urinary tract infections (UTIs), particularly in women. Scalable and effective for both new and retrofitted toilets, SLIP offers a sustainable solution for sanitation challenges.

This project aims to develop boron nitride nanomaterials to enhance the filtration of toxic metals from cigarette smoke, which poses serious health risks to 1.3 billion smokers worldwide. BNNMs offer superior surface area, strength, and chemical stability compared to traditional filters like activated carbon. By targeting hazardous elements such as cadmium, chromium, and arsenic, this innovation promises more effective removal of carcinogens, potentially reducing the harmful impact of smoking through advanced filtration technology.



ENVIRONMENT & SUSTAINABILITY

06

CLEAN WATER AND SANITATION



07

AFFORDABLE AND CLEAN ENERGY



09

INDUSTRY, INNOVATION AND INFRASTRUCTURE



11

SUSTAINABLE CITIES AND COMMUNITIES



12

RESPONSIBLE CONSUMPTION AND PRODUCTION



13

CLIMATE ACTION



Environment and Sustainability is a forward-looking domain that addresses the critical need to harmonize human progress with ecological integrity. It encompasses innovative approaches to combat climate change, safeguard air, water, and soil quality, and ensure the responsible use of natural resources. This domain integrates cutting-edge science, technology, and policy to foster resilient ecosystems, promote circular economies, and support inclusive, low-carbon development. At its core, it is about securing the well-being of both people and the planet now and for generations to come.

Solar-driven manufacturing with geomaterials

2.10

INR Crore

PROJECT COST

The project aims to develop a solar-powered additive manufacturing system that uses geomaterials like sand as the "powder" for creating objects. It will involve three stages: designing a solar concentrator for powder heating, sourcing local binding agents for sand, and integrating the system with an additive manufacturing setup. This initiative targets in-situ manufacturing using solar power and local resources, benefiting remote regions, space exploration, and sustainability by reducing carbon footprints and reliance on Earth-based resources.

Characterization of novel composite phase change material for thermal energy storage systems in solar applications

1.20

INR Crore

PROJECT COST

This project aims to develop novel Phase Change Materials (PCMs) for efficient thermal energy storage in solar applications. It addresses current limitations like low thermal conductivity and high cost by exploring organic and inorganic compounds enhanced with nanoparticles. The research includes comprehensive characterization, lab-scale testing of heat storage and stability, and economic analysis to ensure cost-effective, high-performance PCMs for sustainable energy use.

Cold plasma device for post-harvest sanitization of Fresh horticultural produce

1.25

INR Crore

PROJECT COST

This project aims to develop a flexible plasma device for food packaging, using cold plasma to sanitize and extend the shelf life of horticultural produce. The device will be fabricated using a screen-printing technique, offering flexibility to conform to various shapes. The study will assess the impact of cold plasma on microbial inactivation, food quality, and the safety of treated produce. Additionally, a parametric study will optimize operational conditions. The device aims to reduce postharvest food losses, lower pesticide residues, and contribute to decarbonizing supply chains, boosting global trade.

Prepaid IoT-Enabled Ultrasonic Smart Water Meter with Turbine- Based Energy Harvesting and Remote Flow Control

0.52

INR Crore

PROJECT COST

A Prepaid IoT-enabled ultrasonic Smart Water Meter with Turbine-Based Energy Harvesting and distant Flow Control is a dire need application intended to manage water utilities consumption, invoicing, and distribution, especially in resource-constrained and distant environments.

Development of technology for determination of soil micronutrients Zinc (Zn) using a portable handheld device based on IOT, spectroscopy, and AI/ML technology

0.39

INR Crore

PROJECT COST

Zinc deficiency in crops and humans, along with fertilizer overuse, highlights the need for real-time soil nutrient monitoring. A portable IoT-enabled device using spectroscopy and AI offers instant, cost-effective results without lab analysis. It provides real-time soil health reports with geolocation via mobile phones, enabling large-scale monitoring and informed decision-making.

EVigilant: Capturing Misutilization of EV Subsidized Charging

0.30

INR Crore

PROJECT COST

This project aims to develop a smart EV charging system with modular outlets for public and residential use, enabling real-time tracking of charging activity and GPS-based location data. AI-driven load classification will differentiate EVs from other appliances, aiding demand forecasting, grid management, and energy pricing. The system supports smart grid integration, ensures targeted subsidy use, and enables data-driven EV policy and infrastructure planning.

Development of a solar desalination unit based on Nano-photonics embedded membrane distillation

0.67
INR Crore
PROJECT COST

Hilly terrain specific optimization for PV installation

1.00
INR Crore
PROJECT COST

This project aims to develop a multi-stage Nanophotonic Enabled Solar Membrane Distillation system integrated with a parabolic trough concentrator to tackle water scarcity. Using nanoparticles for localized heating and multi-stage heat recovery, it boosts desalination efficiency while addressing issues like temperature polarization and fouling. The system targets high distillate output up to 15 liters/m²/day while minimizing energy losses.

Comprehensive municipal solid waste management of IIT Kanpur campus

1.87
INR Crore
PROJECT COST

Residue-Free Decentralized Greywater Treatment Based on Cold Plasma for Reclaimed Water Production and Reuse

0.93
INR Crore
PROJECT COST

IIT Kanpur currently lacks an in-house facility to process its large volume of non-biodegradable and construction waste, resulting in high disposal costs and loss of recyclable materials. This project proposes establishing an on-campus material recovery center and implementing comprehensive waste segregation and handling. The initiative will promote environmental sustainability, reduce costs, improve campus aesthetics, and cultivate a culture of waste segregation moving towards a zero-waste campus model that can inspire others.

Cold plasma (CP) creates reactive species that can remove pollutants, but they don't mix well or last long in greywater. To improve this, we're developing a hybrid system that combines a falling film reactor with CP micro-bubbling to boost contact and treatment efficiency. Experiments and models will help optimize it for removing emerging contaminants and micropollutants.





Harnessing the Sun & wind: A Hybrid energy solution for Rural Communities

50

INR Crore

PROJECT COST

Next-Generation Multiport Converter for Solar PV-Integrated EV Charging

0.50

INR Crore

PROJECT COST

This project proposes a solar-wind hybrid setup that combines daytime solar with wind energy, which is more effective in the mornings and evenings. It supports rural electrification, improves access to education and healthcare, and cuts carbon emissions. Using efficient vertical-axis wind turbines (VAWTs), the system is sustainable, cost-effective, and aligned with India's goal of 500 GW clean energy.

A wireless charging solution for electric 3-wheelers

0.28

INR Crore

PROJECT COST

This project aims to develop a smart energy optimization system for battery storage at grid, residential, commercial, and microgrid levels. It will help reduce energy costs, manage peak loads, and shift demand effectively. The system uses adaptive algorithms that factor in weather and load forecasts, running on a custom-built controller. Its flexible design allows easy integration across various energy applications.

Development of dynamic Energy Optimization System using battery storage

0.50

INR Crore

PROJECT COST

Investigation of hydrogen gas evolution using aluminium dross by employing hydrometallurgical processes

0.16
INR Crore
PROJECT COST

Energy and carbon footprint reduction of the built environment

9.60
INR Crore
PROJECT COST

This project aims to produce hydrogen from dross using hydrometallurgical methods. By using alkaline solutions to remove the alumina layer, the aluminium can react with water to release hydrogen. Key process parameters will be optimized, leading to the design and testing of a lab-scale hydrogen production setup.

Automatic and Accurate Identification of Suitable Sites for Surface Rainwater Harvesting (RWH) Structures Using High-Resolution Data and Modern Decision Techniques

0.49
INR Crore
PROJECT COST

Autonomous Water Quality Monitoring and Active River Cleaning System

1.03
INR Crore
PROJECT COST

This project aims to automate and optimize the placement of surface Rainwater Harvesting (RWH) structures using high-resolution LiDAR data, hydrological modelling, and machine learning. A LiDAR-based elevation model will help analyse terrain and runoff using models like TOPMODEL. Unlike traditional methods, machine learning will guide site selection by acting as a decision support tool. The project will also factor in water budgets and socio-economic aspects to determine the ideal number, size, and locations of RWH structures, along with mapping tools for construction planning.

Lab-scale characterization of parameters that affect geothermal energy recovery

0.09
INR Crore
PROJECT COST

The proposal addresses the degradation of river Ghats due to neglect, commercialization, and waste accumulation. It suggests a Cyber-Physical River Cleaning System for continuous water quality monitoring and waste removal. Key components are a multi-link manipulator (Smart Arm), a floating sensor platform, water quality sensors, and a wireless communication system. The plan includes developing the system, deploying sensors, and establishing communication. Challenges involve designing an effective communication system. The goal is to restore the Ghats' integrity and sustainably improve river health.

Circular economy model for environmental and social sustainability

2.73
INR Crore
PROJECT COST

This project aims to develop a lab-scale pilot system to study geothermal energy harvesting in India. It will investigate key factors like temperature gradient, soil properties, and groundwater depth that affect efficiency. Additionally, a numerical model will be created to analyse the system using real geophysical data. The results will help advance sustainable geothermal energy use for heating, cooling, and electricity, reducing reliance on conventional energy sources.

The proposed work aims to promote sustainable fashion by addressing environmental and social issues. Stage one focuses on engaging stakeholders across all stages from cotton cultivation, transportation, ginning, spinning, weaving, processing, to export to minimize carbon, energy, and water footprints. Stage two involves developing a labelling tool to rate clothes from A (highly sustainable) to E(least sustainable), encouraging eco-conscious consumer choices and advancing sustainability nationally and globally.

Green corrosion inhibitor from plant and Valorization of waste: potential corrosion inhibitor from agricultural waste (manure), expired medicine as well as leather buffering powder

2.58
INR Crore
PROJECT COST

This project aims to develop eco-friendly, green corrosion inhibitors by extracting phytochemicals from industrial and agricultural waste. Building on successful lab results with wastes like cattle manure and pharmaceutical by-products, we plan to scale up through pilot industrial trials under a "Make in India" initiative. The goal is to provide a low-cost, sustainable alternative to toxic traditional inhibitors, supported by our patented technologies and research.

CST-based Thermochemical Water-Splitting for Green Hydrogen Generation

1.5
INR Crore
PROJECT COST

The research aims to develop novel concentrated solar thermal-based hydrogen generation systems by thermochemical water-splitting and catalytic ammonia cracking. These technologies allow efficient use of solar-thermal heating with a net solar-to-hydrogen generation efficiency exceeding 35%. Such innovations and indigenization enable achieving, in the long-term, the target least cost of hydrogen (LCOH) of 1 \$/kg.

Low-cost indigenous PEM electrolyzers for green hydrogen generation

3.0
INR Crore
PROJECT COST

This research focuses on the development of low-cost PEM electrolyzers for generating green hydrogen. These electrolyzers have higher efficiency, higher hydrogen generation rates, higher durability, and pressurization capacity compared to alkaline electrolyzers. They also use less precious materials compared to existing PEM electrolyzers.



Development and Piloting of Engineering Interventions for Drinking Water Safety in Rural Communities

0.80
INR Crore
PROJECT COST

This project aims to develop and demonstrate a low-cost water treatment system to provide safe drinking water in rural areas of Kanpur, Unnao, and Lucknow, where groundwater is contaminated with fluoride, chromium, nitrate, uranium, and pathogens. It includes assessing water quality, piloting treatment solutions in 2-3 villages, training locals for maintenance, raising awareness, and monitoring health impacts. The initiative supports SDG-6 for clean water and sustainable communities.

Heat based solar membrane desalination through sweeping gas contact mode aided by heat recovery

0.72
INR Crore
PROJECT COST

This project aims to explore and optimize Nanophotonics-Enabled Solar Membrane Distillation (NESMD) in Sweeping Gas Membrane Distillation (SGMD) mode. The focus is on improving distillate flux and photothermal efficiency by studying the system under ambient conditions using a solar simulator. A key innovation will be the design of a heat recovery unit compatible with SGMD, targeting over 100% photothermal efficiency compared to the current 53% without heat recovery. Ultimately, the project will lead to the development of a solar-powered seawater desalination prototype.

Ambient air quality Monitoring of Rural Areas using Indigenous Technology (AMRIT) Phase - II

50
INR Crore
PROJECT COST

This project aims to advance air quality monitoring through the CoE-ATMAN at IIT Kanpur, supported by philanthropic partners. Key initiatives include deploying 1400 low-cost air quality sensors (AMRIT) across Bihar and Uttar Pradesh and implementing Dynamic Hyper-local Source Apportionment (DHSA) in Lucknow and Kanpur. Using AI, machine learning, and geospatial models, the CoE develops indigenous sensors and advanced forecasting tools to generate real-time, high-resolution data, supporting informed policymaking to combat air pollution in India.

AI-based Calibration of an Indigenous Low-cost PM Sensor for Clean Air

0.73
INR Crore
PROJECT COST

The project aims to calibrate India's first indigenously developed low-cost PM sensor, addressing the country's heavy reliance on imported, often inaccurate air quality sensors. By enabling real-time, dense air quality monitoring through affordable technology, the project supports innovations like multi-wavelength lasers, bio-aerosol detection, and AI-based sensor optimization, paving the way for scalable tech development and reduced import dependency.

Demonstration of a Four-Wheel Independent Steering Four-Wheel Independent Drive Electric Vehicle

0.30
INR Crore
PROJECT COST

This project aims to demonstrate a full-size 4WIS4WID electric vehicle with independently controlled steering and driving motors on each wheel. Designed for high maneuverability, stability, and energy efficiency, the EV enables advanced movements like crab motion and zero-radius turns. The core focus is to implement and test a simplified coordination algorithm developed at IIT Kanpur, along with an innovative braking system to improve control, reduce tire wear, and enhance overall performance.

Beyond Forecasting: Smart Solutions for Landslide

2.10
INR Crore
PROJECT COST

This project aims to understand and control the dynamics of landslide and avalanche-induced granular flows to improve hazard mitigation. Building on research from IIT Kanpur's Granular Flow Lab, it focuses on enhancing risk assessment, post-event strategies, and protective infrastructure design. Aligned with national programs like NLSM and NDMP, the project supports disaster resilience, environmental protection, and infrastructure safety, contributing to SDGs 11, 13, and 15.



Hydrogen production by water electrolysis

0.89
INR Crore
PROJECT COST

This project aims to develop a cost-effective, binder-less, free-standing nanostructured MoSe₂ electrode to enhance hydrogen production through water electrolysis. By improving catalyst efficiency, the project supports India's goal of meeting 50% of its energy needs from renewables by 2030. The work contributes to decarbonizing key sectors like steel, cement, and transport, advancing affordable and sustainable hydrogen-based clean energy solutions.

Low Cost Grey Water Recycling Machine Shuddham

0.50
INR Crore
PROJECT COST

This project aims to provide a sustainable solution to India's rural water crisis by developing a low-cost, hybrid water purifier. Designed to operate without electricity for purification and requiring just 10W for solar-powered cooling, the system combines a multi-layer gravity-based ultra-filtration unit with a clay pot cooling mechanism enhanced by a mini fan. Capable of removing bacteria and viruses even from highly turbid water, the purifier offers safe drinking water at a maintenance cost of less than ₹10 per month, benefiting millions in underserved communities.

Ensuring Equitable Water Access in Rural India: Identifying Barriers and Solutions through a Holistic Understanding of Feedbacks between Water and Society

1.06
INR Crore
PROJECT COST

This project aims to address water security challenges in rural Uttar Pradesh by studying how climate variability, groundwater decline, and socio-economic factors affect access to water. Through longitudinal field surveys and data-driven modelling, it will simulate human-water interactions under future climate scenarios. The goal is to develop region-specific, equitable, and sustainable water management strategies by integrating hydrologic and social science insights.

Proactive Safety and Mobility Assessment using LiDAR-based Safety Monitoring

0.15
INR Crore
PROJECT COST

This project aims to develop a LiDAR-based system for data collection and analysis to enhance road safety management in India. By combining unsupervised and supervised machine learning, the system can detect and track dynamic road users under diverse lighting and environmental conditions. Unlike fixed infrastructure solutions, this mobile setup can be flexibly deployed at intersections, highways, and pedestrian zones. It provides granular, real-time traffic insights, addressing key gaps in crash data availability and analysis. The outcome will support proactive, data-driven decision-making and enable targeted, localized safety interventions for safer and smarter mobility.

**Charging Without Fear:
ML-Powered BTMS for
Safer, Smarter Thermal
Management in
EV Batteries**

0.40
INR Crore
PROJECT COST

This project aims to improve electric vehicle battery safety by addressing thermal runaway during fast charging. It develops a thermally conductive rubber using exfoliated graphite and functionalized boron nitride for better heat dissipation. Battery packs with this rubber will be tested under fast charging. Alongside, a machine learning-based thermal management system will optimize temperature control, collectively reducing overheating risks and boosting EV reliability and safety.

**Development of Solid-state
Sodium-ion Batteries**

0.95
INR Crore
PROJECT COST

This project aims to develop all-solid-state sodium-ion batteries as a safer, cost-effective alternative to lithium-ion batteries, supporting India's clean energy goals. Utilizing abundant sodium resources and solid electrolytes, the batteries target improved energy density (~150 Wh/kg) and enhanced safety by optimizing interfaces with sodium metal anodes. These batteries will power portable devices, electric vehicles, and grid storage, advancing sustainable energy adoption and aiding in greenhouse gas reduction.

**Recovery of valuables from
End-of-life solar panels**

0.31
INR Crore
PROJECT COST

This project aims to develop an eco-friendly recycling process for first-generation silicon-based end-of-life photovoltaic modules. It focuses on recovering valuable materials silicon wafers, silver, copper, and aluminum using physical separation and chemical recovery methods. By preserving silicon wafers for reuse and extracting metals for commercial use, the project supports a circular economy, reduces environmental impact, creates jobs, and aligns with India's National Solar Mission to tackle solar panel waste.

**Development of a passive
thermal management
system for heavy duty Li-ion
batteries based on PCM and
natural circulation**

0.80
INR Crore
PROJECT COST

This project aims to establish a state-of-the-art characterization facility equipped with an adiabatic rate calorimeter for comprehensive safety testing of lithium-ion batteries. It will simulate abuse conditions like nail penetration, crush, short circuit, and overcharging to precisely measure heat generation and thermal runaway behavior. The facility will provide critical insights to develop safer, more reliable batteries and support the creation of robust safety standards for next-generation energy storage systems.





Sustainable Essential Oil (Vetiver/Khus) Distiller

0.12
INR Crore
PROJECT COST

This project proposes a solar-powered distiller to replace fossil fuels and wood in vetiver oil extraction, eliminating pollution and improving labor safety. Featuring a removable lid and tiltable kettle, the design allows fast residue disposal, reduces burn risks, and shortens extraction cycles. The eco-friendly system offers a safer, efficient alternative to traditional distillation methods.

Zero waste and sustainable craftsmanship for economic growth of local artisans by multi-material 3D printed earthenware, pottery, and decorative artefacts

0.47
INR Crore
PROJECT COST

This project aims to enhance workmanship quality, production speed, and product variety among rural artisans in Kanpur by creating an extrusion-based 3D printer capable of using clay, soil, sand, terracotta, and ceramics. The initiative will empower artisans with modern tools and training, improving their livelihoods and recognition. Additionally, innovative mixing of additives will reduce sintering needs, significantly lowering CO₂ emissions from traditional clay manufacturing processes

Smart Indoor Air Purification: Ultra-Pure Air for a Sustainable Future

0.25
INR Crore
PROJECT COST

This project aims to develop an innovative air purifier that eliminates the need for consumable filters like HEPA or ULPA, reducing costs and maintenance. It captures airborne particles and gaseous pollutants through enhanced condensation of charged water vapor into a water reservoir, offering superior efficiency over existing technologies. Designed for homes and critical environments such as hospitals and semiconductor facilities, this device ensures ultra-pure air, addressing health risks linked to poor air quality.

INFRA STRUCTURE

09

INDUSTRY, INNOVATION
AND INFRASTRUCTURE



Infrastructure forms the foundation for academic excellence, research innovation, and institutional growth. This domain focuses on upgrading laboratories with modern equipment, modernizing campus facilities to create sustainable and student friendly environments, and establishing new departments and research centres aligned with emerging disciplines. It supports the creation of smart, future-ready spaces that foster interdisciplinary collaboration, enhance learning outcomes, and expand the institution's capacity to meet national and global challenges. Through strategic infrastructure development, the aim is to empower institutions to scale their impact in education, research, and innovation.

Upgradation of UG Lab at IIT Kanpur

The project focuses on upgrading undergraduate laboratories with modern equipment and technologies to enhance hands-on learning and align with current industry standards. By improving lab infrastructure, it aims to strengthen practical skills, foster innovation, and better prepare students for evolving career demands.

Department Name	Budget (Cr)
Aerospace Engineering	10.13
Chemical Engineering	6.90
Civil Engineering	2.64
Computer Science & Engineering	2.00
Material Science & Engineering	9.91
Mechanical Engineering	32.07
Mathematics & statistics	3.84
Physics	1.65
Earth Sciences	0.80
Economic Science	0.70
Chemistry	8.00
Humanities and Social Sciences	2.20
Management science	1.00
Electrical Engineering	38.50
Design	3.50
SPASE	10.05
Cognitive	40.00
Sustainability	1.91

Upgradation of the Scientific Glassware Fabrication & Special Water facility (SGF & SWF)

0.50
INR Crore
PROJECT COST

The project aims to secure funding for the modernization of IIT Kanpur's Scientific Glassware Fabrication & Special Water Facility (SGF & SWF), which has been a cornerstone of research support for over six decades. With most equipment outdated, there is an urgent need to replace glass blowing lathes, burners, and upgrade infrastructure with additions like an annealing furnace and a chiller for the distillation plant. As research activities expand, this ₹50-lakh upgrade is essential to maintain the facility's ability to deliver precision scientific glassware and meet the evolving demands of the institute's research community.

Smart Classroom for Enhanced Educational Experience

0.02
INR Crore
PROJECT COST

The proposed smart classroom will be a modular, multi-purpose facility catering to the computational and collaborative needs of students. It will support activities like tinkering labs, journal clubs, training programs, and conferences, while also enhancing classroom learning through smartboards and projectors, ultimately enriching the academic ecosystem of the campus.

To support Center for Continuing Education

28
INR Crore
PROJECT COST

The Center for Continuing Education at IIT Kanpur offers diverse learning opportunities through workshops, short-term and online courses, and internship programs, supporting professional growth across sectors. Managed by the Office of Outreach Activities, these initiatives ensure smooth execution and aim to expand academic reach. The Centre is also working towards achieving long-term self-sustainability through structured mechanisms.

Establishment of Collaborative Robotics System for Teaching, Upskilling, and Research

0.30
INR Crore
PROJECT COST

This project aims to establish a Collaborative Robotics System at IIT Kanpur's Control Engineering Lab to support teaching, upskilling, and advancing research. The facility will feature dual robotic manipulators and structured curricula to bridge the gap between academic learning and industry requirements. It will enable hands-on training, promote inclusivity in STEM, and build a skilled workforce in robotics and automation. On the research front, it will advance studies in human-robot interaction, machine learning, and control systems, fostering innovation, high-quality publications, and global collaborations.



RESEARCH & INNOVATION

Research lies at the heart of academic innovation and national progress. It fuels discovery, advances technology, and addresses complex societal challenges through evidence-based inquiry. The research domain at IIT Kanpur fosters interdisciplinary collaboration, encourages original thinking, and supports both fundamental and applied investigations. By providing world-class infrastructure, expert mentorship, and a vibrant intellectual ecosystem, the institute empowers researchers to push boundaries and create impactful solutions. This domain plays a vital role in strengthening India's position as a global knowledge leader.

TRANSPORTATION & SAFETY

07

AFFORDABLE
AND CLEAN ENERGY



09

INDUSTRY, INNOVATION
AND INFRASTRUCTURE



17

PARTNERSHIPS
FOR THE GOALS



The Transportation & Safety domain at IIT Kanpur focuses on developing innovative solutions to enhance mobility and ensure road safety. Research includes advanced traffic management systems, vehicle safety technologies, and sustainable transportation methods. These initiatives aim to reduce accidents, improve efficiency, and support safer, smarter transport networks.

Characterization of Driving Profiles and Behaviour for Conventional and Electric Two-Wheelers in India

0.75
INR Crore
PROJECT COST

This project aims to study and compare the driving behavior of conventional and electric two-wheelers (ETWs) in real-world Indian traffic. Despite forming a major part of the vehicle population, ETWs remain underrepresented, and their unique dynamics such as rapid acceleration and low noise are poorly understood. Through naturalistic riding experiments using instrumented vehicles and smartphones, and by applying embedded systems and machine learning, the study will uncover behavioral patterns and adaptation mechanisms. These insights will help inform safer and more efficient integration of ETWs into India's transport ecosystem.

Identification of crash contribution factors using first information reports

0.40
INR Crore
PROJECT COST

This project aims to improve road safety in India by creating a structured crash database from FIRs, focusing on two-wheeler accidents. Using spatio-temporal and text analysis, it will identify patterns and high-risk zones often missed due to unstructured data. The insights will guide data-driven policymaking and safety interventions, complementing national initiatives like Punjab Police's AI crash analysis system.

Cargo Hyperloop-Automated Pipe Following Modular Bulk Carrier for Continuous Material Transportation

2.09
INR Crore
PROJECT COST

This project aims to revolutionize coal transport via a fluid-powered cargo-hyperloop pipeline system with sensor-equipped wagons for real-time monitoring. Offering faster, safer, and cleaner alternatives to rail and truck transport, it improves efficiency and reduces environmental impact.

Smart Footpath Mapping: AI & LiDAR-Based Solutions for Safer Urban Walkways

0.80
INR Crore
PROJECT COST

This project aims to enhance pedestrian safety in Indian cities by deploying a LiDAR-based auditing system mounted on bicycles to evaluate footpath conditions, presence, width, height, slope, and connectivity. The system generates scalable geospatial data to guide infrastructure upgrades and supports open-source tools for local agencies. Aligned with Smart Cities and SDG goals, it promotes inclusive, data-driven urban mobility.

Image Processing Based Detection & Monitoring System for Broken Rails

0.51
INR Crore
PROJECT COST

This project aims to analyze and compare driving behavior of electric and conventional two-wheelers in India using sensor data and machine learning. It will identify unique ETW traits and inform safer, data-driven urban mobility strategies.

Physics-based design of public spaces and gatherings using the behavioral knowledge of pedestrians in various controlled scenarios

0.35
INR Crore
PROJECT COST

This project aims to develop a physics-based model to design safer public spaces and prevent stampedes in dense crowds. By simulating pedestrian dynamics through experiments and data analysis, the study will optimize infrastructure design considering behavioral variations and obstacle conditions. AI/ML tools will support predictions, enhancing safety in gatherings and public transit hubs across increasingly crowded urban environments.

**Human Intent Prediction
Using Inferred Activity
Templates and Multimodal
Sensor Observations**

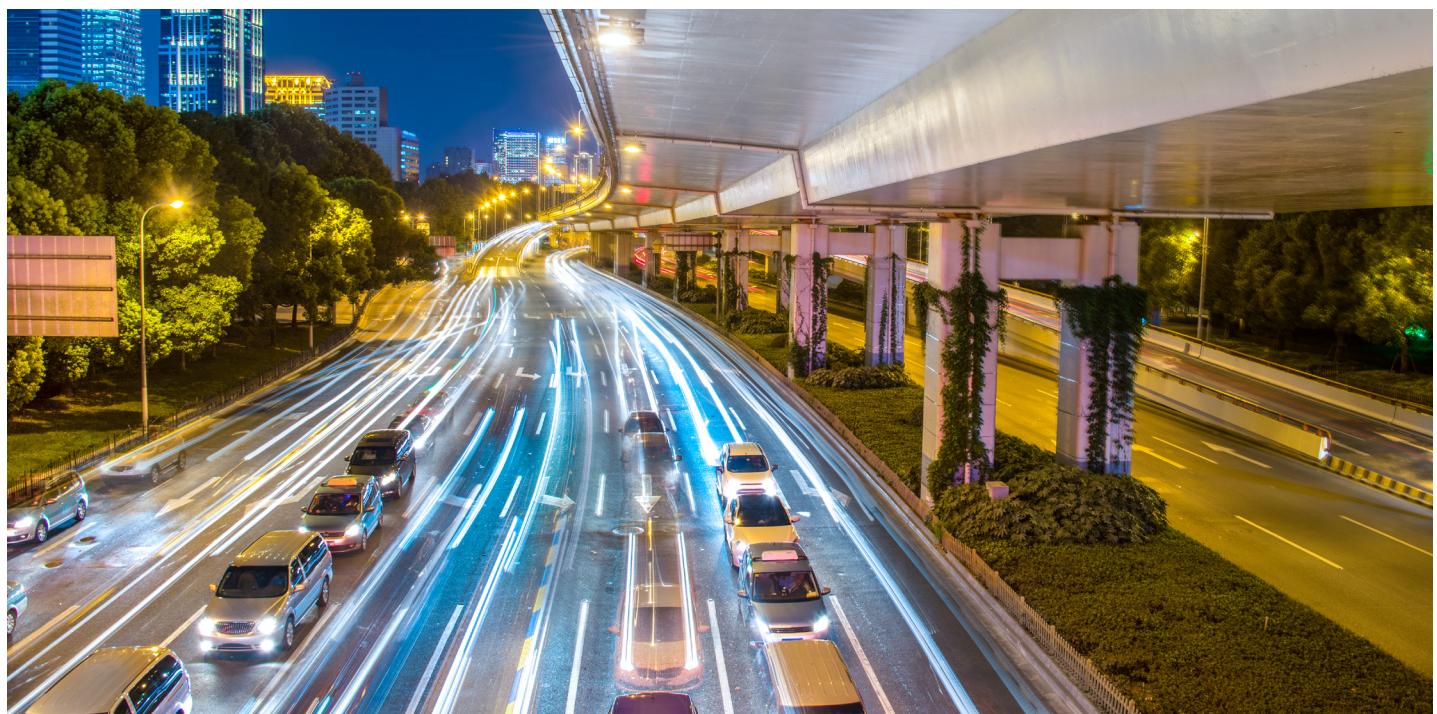
0.73
INR Crore
PROJECT COST

This proposal aims to develop a system for predicting human intent using activity templates and multimodal sensor data, focusing on vehicle operation. The goal is to improve human-robot collaboration, autonomous driving, and defense applications. The approach utilizes Markov Decision Processes (MDPs) to model transitions between human actions, based on real-time sensor readings (e.g., eye-tracker, EEG, and data gloves). Inverse reinforcement learning will be applied to learn optimal action policies.

**Smartphone-based Passive
Sensing for Quantifying
Road User Behaviour and
Infrastructure Condition**

0.90
INR Crore
PROJECT COST

This project focuses on developing a smartphone-based passive sensing system to analyse road user behaviour and monitor infrastructure conditions. By utilizing vehicle telematics, the system captures travel patterns how, where, when, and in what vehicles people move. The approach involves app development, ground truth validation, and inference of key mobility and infrastructure metrics. Real-world data will be collected using both conventional and electric vehicles, enabling a scalable, low-cost solution for advancing smart mobility and infrastructure management.



MARINE

14

LIFE BELOW WATER



The Marine domain at IIT Kanpur focuses on sustainable exploration and utilization of marine resources. Research includes assessing marine biodiversity, developing eco-friendly technologies for coastal management, and studying oceanographic processes to support environmental conservation. These efforts aim to promote sustainable development and protect marine ecosystems.

**Viability of ultra-stable
emulsions as alternative
marine diesel fuels**

0.63

INR Crore

PROJECT COST

**An environmentally friendly
shock-induced cleaning of
contaminated surfaces in
shipping industry**

0.64

INR Crore

PROJECT COST

This project aims to study the combustion behavior of water-in-diesel emulsions for marine fuel applications by analyzing how varying water content and surfactant ratios affect bubble formation and atomization. It finds that water vapor bubbles form and grow faster than oil ones, with optimal atomization at a 0.2 water volume fraction.

This project aims to develop an eco-friendly shockwave-based technique for surface decontamination, avoiding thermal damage from lasers. Focusing on marine biofilms, it will optimize parameters affecting cleaning and assess results via advanced imaging and spectroscopy.

**Advanced multifunctional metallic surfaces for control of biofouling,
drag and corrosion in marine applications**

0.46

INR Crore

PROJECT COST

This project aims to develop laser-textured surfaces to improve corrosion resistance, reduce hydrodynamic drag, and prevent biological fouling. By optimizing texture size and shape through laser techniques on target materials, the study seeks to create durable, efficient surfaces. The results could offer a long-lasting solution to marine fouling and corrosion, significantly cutting fuel consumption and maintenance costs while boosting vessel performance.



QUANTUM

09

INDUSTRY, INNOVATION
AND INFRASTRUCTURE



The Quantum domain at IIT Kanpur focuses on developing advanced quantum technologies for sensing and industrial innovation. Projects include creating a highly sensitive, calibration-free quantum RF electric field sensor using atomic vapor cells, and exploring quantum behavior of cryo-helium ions to enable precise matter-wave control. These initiatives aim to strengthen India's capabilities in quantum devices and their scientific and industrial applications.

Quantum enhanced radio-frequency electric field sensor

4.73
INR Crore
PROJECT COST

This project aims to develop a highly sensitive, quantum-enhanced radio-frequency (RF) electric field sensor based on Rydberg atom electromagnetically induced transparency (EIT) in atomic vapor cells. Unlike traditional metallic antennas, this sensor offers wide frequency coverage (MHz to THz), calibration-free operation, and SI-traceability. Phase 1 involves a proof-of-concept using Rubidium vapor cells, while Phase 2 focuses on creating a compact, rugged, field-deployable sensor with custom components, advancing India's quantum sensor capabilities.

Development of novel devices using quantum technologies for industrial innovation and scientific applications

0.56
INR Crore
PROJECT COST

This project aims to explore the quantum behavior of cryo-helium ions through diffraction by material gratings. By studying how external factors like bias voltage and electromagnetic fields affect diffraction patterns, the research seeks to enable precise control of matter waves. The outcomes will contribute to developing advanced quantum devices and technologies for scientific and industrial applications.



ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

09

INDUSTRY, INNOVATION
AND INFRASTRUCTURE



The Artificial Intelligence domain at IIT Kanpur focuses on leveraging advanced AI technologies to enhance education, healthcare, legal systems, and accessibility. Projects include developing multilingual multimodal LLMs to support teachers, energy-efficient AI hardware using superconductors, AI integration to speed up judicial processes, and AI agents for predictive maintenance. Additionally, innovations like brain-controlled wheelchairs aim to improve mobility and independence for people with disabilities, reflecting a commitment to impactful, real-world applications.

Prediction of Solid Rocket Propellant Burning Behavior Using Machine Learning

0.10
INR Crore
PROJECT COST

This project aims to develop a machine learning model to predict burn rate and emissions of composite solid rocket propellants, reducing costly experiments. It will aid in identifying safer, more efficient alternatives to toxic materials like RDX and HMX.

Developing Green Brain Inspired AI- hardware circuits using superconductors

0.52
INR Crore
PROJECT COST

This project aims to meet rising AI energy demands by developing superconducting AI circuits that drastically reduce power loss in memory access and signal transmission. Using zero-resistance superconducting materials, the circuits promise over 100x energy efficiency compared to silicon-based hardware. Building on existing superconducting components like memory and switches, the project will scale these for AI workloads, enabling sustainable, high-performance computing for future AI applications.

Artificial Intelligence Agent for Preventive Maintenance

0.50
INR Crore
PROJECT COST

This project aims to develop a Retrieval Augmented Generation (RAG) AI agent that leverages large language models (LLMs) for decision-making. It processes equipment run data through multiple machine learning models to produce outputs like anomaly detection, time-series patterns, and classical model predictions. These outputs are then used to generate prompts for the LLMs to make informed decisions.

Using multi-modal LLMs to improve instruction for teachers

8.72
INR Crore
PROJECT COST

This project aims to build multilingual multimodal Language Models (LLMs) that analyze student behavior and course content to offer instructors real-time, actionable feedback. Integrating videos, slides, and textbooks in Indian languages, the LLMs will predict engagement, rank lectures, and improve teaching quality in online education.

AI Integration into Jharkhand Legal System

12.02
INR Crore
PROJECT COST

This project aims to enhance India's judicial efficiency by integrating AI into the Integrated Litigation Management System (ILMS). With over 59 lakh pending High Court cases causing delays and costs, the proposal leverages a 70-billion parameter Large Language Model to automate case summarization, detect similar cases, predict judgments, and more. This AI-powered system targets reducing case processing times from 15 to 5 days, easing administrative burdens, lowering litigation costs, and enabling faster, more effective delivery of justice.

Driving a Wheelchair through the confluence of human intelligence and artificial intelligence

0.51
INR Crore
PROJECT COST

This project aims to develop a brain-controlled, semi-autonomous wheelchair that allows hands-free navigation using Brain-Computer Interfaces (BCIs). Designed for individuals with severe physical disabilities, the system interprets the user's thoughts to control movement, eliminating the need for a joystick or remote. By integrating BCIs with electric wheelchairs, this innovation empowers brain-active users to regain mobility and communication abilities, significantly improving their independence and quality of life.

COMMUNICATION SYSTEMS

04

QUALITY EDUCATION



09

INDUSTRY, INNOVATION
AND INFRASTRUCTURE



11

SUSTAINABLE CITIES
AND COMMUNITIES



Communication Systems involve the transmission and reception of information through various channels such as radio, optical fibers, and satellite networks. These systems enable reliable data exchange across distances, forming the foundation of modern telecommunication, internet, and wireless technologies.

Investigation and Design of D-band (110 GHz - 170 GHz) Components and Systems for 6G Communication

3.0

INR Crore

PROJECT COST

The proposed research project aims to design the D-band (110 GHz - 170 GHz) components for 6G Applications.

SEMICONDUCTORS AND CIRCUITS MEMOIRS

04

QUALITY EDUCATION



09

INDUSTRY, INNOVATION
AND INFRASTRUCTURE



11

SUSTAINABLE CITIES
AND COMMUNITIES



Semiconductors and Circuits focus on the design, fabrication, and application of electronic components like transistors, diodes, and integrated circuits that form the backbone of all modern electronic devices. This domain enables advancements in computing, communication, healthcare, and automation technologies.

**Next-Gen Neuro-Hardware:
Merging CMOS and
Emerging NVMs for Scalable
Neuromorphic Systems**

2.10
INR Crore
PROJECT COST

Focus on developing innovative schemes and peripheral circuitry for exploring the design of neuromorphic accelerators utilizing hybrid CMOS-NVM circuits. This includes the experimental demonstration of a compact, highly energy-efficient mixed-signal neuromorphic accelerator leveraging 3D-integrated hybrid CMOS-NVM technology. Additionally, the work involves designing and experimentally showcasing an integrated stochastic neuron/dot-product engine that harnesses the unique noise characteristics of hybrid CMOS-NVM neuro-optimizer circuits.

**Spin-orbit torques for
magnetic memory
application**

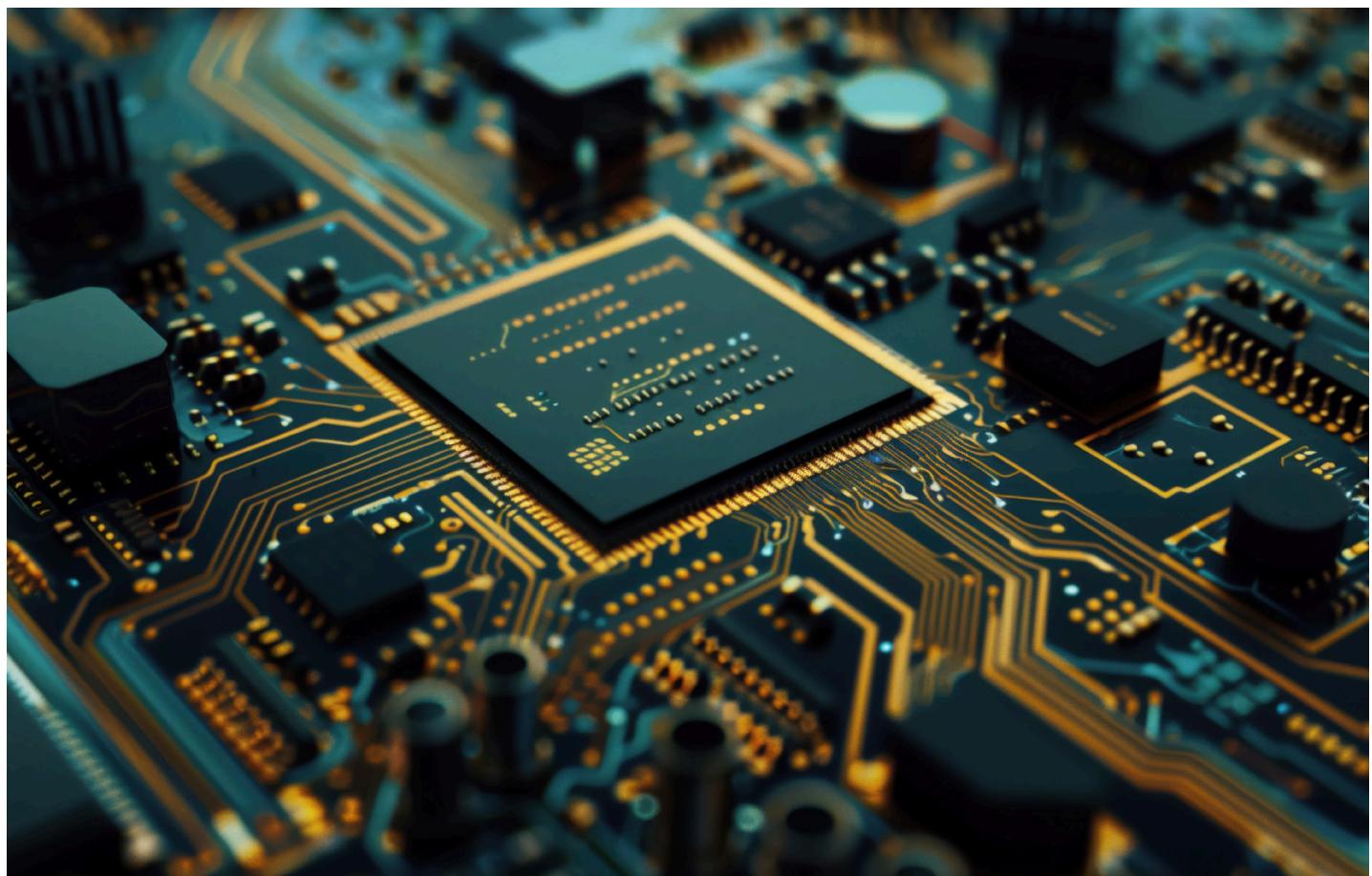
0.80
INR Crore
PROJECT COST

This proposal aims to fabricate prototype devices of non-volatile magnetic memories, which have potential applications in conventional computing, neuromorphic computing, quantum computing, and more.

**Revolutionizing Communication in the Media Industry with AI-based
Audio Processing Systems**

1.00
INR Crore
PROJECT COST

Develop an advanced AI-driven system for processing audio and video content, capable of automating transcription and translation into multiple Indian languages. This system would enable the generation of live subtitles and AI-crafted video news directly from audio, while also summarizing media news into concise text articles or engaging podcasts



SMART GRID

07

AFFORDABLE
AND CLEAN ENERGY



09

INDUSTRY, INNOVATION
AND INFRASTRUCTURE



13

CLIMATE ACTION



A Smart Grid is an advanced electricity network that uses digital technologies for real-time monitoring, efficient power distribution, and two-way communication between utilities and consumers. It supports the integration of renewable energy sources, enhances grid reliability, and promotes energy efficiency.

**Design and Development
of Multilevel AC-DC
Bidirectional Converter
Based Off-Board Charger
for Electric Bus/Car
Applications**

1.00

INR Crore

PROJECT COST

**Micro-Resolution Phasor
Measurement Unit**

0.30

INR Crore

PROJECT COST

This project proposal aims to design and develop a multilevel AC-DC Bidirectional converter-based charger to charge an electric vehicle (EV) battery.

We propose the development of cost-effective micro-Resolution synchro phasor measurement apparatus designed for monitoring of power transmission and distribution networks.



ROBOTICS AND AUTOMATION

03

GOOD HEALTH
AND WELL-BEING



08

DECENT WORK AND
ECONOMIC GROWTH



09

INDUSTRY, INNOVATION
AND INFRASTRUCTURE



Robotics and Automation involves the design and use of intelligent machines and control systems to perform tasks with minimal human intervention. It enhances precision, productivity, and safety across sectors like manufacturing, healthcare, agriculture, and logistics.

**Collaborative UAV system
with Manipulators for
Precision Agriculture**

0.95

INR Crore

PROJECT COST

**CareBot: A Robotic System
to Feed Impaired Patients
and Frail Citizens**

0.30

INR Crore

PROJECT COST

This project focuses on establishing a collaborative UAV system for precision agriculture. By creating advanced UAVs with manipulators, we aim to solve challenges in precision agriculture.

**NeuraStim:
A Neuromuscular
Stimulation Enabled Orthosis
to Rehabilitate Grasping in
Hemiplegia**

1.00

INR Crore

PROJECT COST

Current rehabilitation practices focus on inhibiting spasticity with stretching and weight-bearing exercises, which is not enough to restore normal hand function. To address these challenges and improve hand mobility, we propose activity-based rehabilitation therapy using our patented functional electrical stimulation (FES) technology. FES is the application of external electrical pulses on the skin surface, to activate underlying nerves and cause muscles to contract.

Design a low-cost robotic system to assist in safely feeding patients and frail individuals, incorporating advanced human-robot collaboration safety features to prioritize user well-being. This system will include social robotics capabilities, such as conversational interactions powered by NLP and ChatGPT, alongside functionalities like food monitoring, meal and medicine reminders. Additionally, it will capture patient data, providing analytics on calorie intake to aid doctors in evaluations and support users in self-planning their nutritional needs.



ECO FRIENDLY HOUSING & CONSTRUCTION

08

DECENT WORK AND
ECONOMIC GROWTH



09

INDUSTRY, INNOVATION
AND INFRASTRUCTURE



10

REDUCED
INEQUALITIES



11

SUSTAINABLE CITIES
AND COMMUNITIES



The Eco-Friendly Housing & Construction domain focuses on sustainable building solutions using recycled industrial and plastic waste. Projects include developing composite bricks and paver blocks from fly ash, leather, and chemically recycled plastics, as well as enhancing asphalt with rubber additives for durability and energy efficiency. Additionally, innovative cold-formed steel structures are being designed for affordable, earthquake-resistant housing, promoting sustainable and resilient communities.

**Trash to Treasure:
Utilisation of Fly Ash,
Leather and Plastic Waste
in Affordable Community
Housing**

0.43
INR Crore
PROJECT COST

This project aims to develop eco-friendly construction materials by reusing industrial wastes, leather waste, fly ash, and plastic. Composite bricks made from fly ash and leather waste will provide thermal insulation, while recycled plastic will be used for durable paver blocks. Supporting circular economy goals, the project focuses on material development, testing, and pilot implementation to create cost-effective, sustainable housing and infrastructure solutions in Kanpur and beyond.

**Microwave Activated
Rubberized Asphalt
containing Warm Mix
Asphalt Additive for
Sustainable Asphalt Roads**

0.32
INR Crore
PROJECT COST

This project aims to improve the use of waste tyre rubber in asphalt by enhancing storage stability through surface activation and reducing energy use with warm mix asphalt (WMA) additives. It will evaluate how different additives affect workability and binder properties, identifying optimal doses for performance and energy savings. Results will be validated on asphalt mixtures using advanced testing methods.

**Development of Low-Cost
Sustainable Paver Blocks
Using Chemically Recycled
Waste Polyethylene for Low
Volume Roads**

0.44
INR Crore
PROJECT COST

This project aims to develop eco-friendly paver blocks by chemically recycling waste polyethylene (PE) plastics using scalable methods like LED irradiation and vegetable oil treatment. The processed PE will be combined with sand or industrial waste to produce durable, thermoset-like paver blocks for road construction. The research includes testing strength, durability, environmental safety, and real-world application, alongside community training for skill development and sustainable infrastructure promotion.

**Development and Validation
of Cold-Formed Steel (CFS)
Moment-Resisting Frame
(MRF) Connections for
Affordable Housing in
Seismic Regions**

0.41
INR Crore
PROJECT COST

This project aims to improve the seismic performance of cold-formed steel (CFS) construction, a lightweight and modular solution for rapid affordable housing in India. By developing optimized CFS sections like the innovative F7 cross-section and seismic-resistant beam-column connections, the study enhances ductility and energy dissipation. Experimental validation, numerical modeling, and seismic analysis of CFS moment-resisting frame buildings will support safe use of CFS technology in earthquake-prone areas, aligning with housing initiatives like PMAY.



NEW MINERALS

07

AFFORDABLE
AND CLEAN ENERGY



The domain focuses on exploring and developing alternative sources of rare earth elements and critical minerals beyond traditional deposits. By combining experimental and geochemical research, it aims to optimize extraction from unconventional materials like mine tailings and electronic waste. This initiative supports India's sustainable resource development and energy security.

Assessment of REE mineralization, Quantification and extraction techniques

0.45
INR Crore
PROJECT COST

This project aims to address the rising demand for rare earth elements (REEs) and critical minerals like lithium by exploring alternative sources beyond India's limited beach placer deposits. It focuses on evaluating primary sources such as carbonatites (Amba Dongar, Kamthai) and unconventional secondary sources including coal fly ash, red mud, phosphor-gypsum, mine tailings, and electronic waste. Combining experimental and geochemical studies, the project seeks to optimize extraction methods and support India's sustainable resource development and energy security goals.



HANDLOOMS

09

INDUSTRY, INNOVATION
AND INFRASTRUCTURE



This domain focuses on innovative solutions to support and preserve India's handloom heritage. Projects include AI-based devices for authentic fabric identification and AR-enabled virtual try-ons to enhance customer experience. These initiatives aim to empower weavers, promote fair trade, and modernize handloom marketing.

**Device and AI based method
for thread quality estimation
via inspecting
microstructures for
handloom vs power loom
product identification**

0.32
INR Crore
PROJECT COST

**Virtual try-ons for Indian
handlooms**

0.66
INR Crore
PROJECT COST

This project aims to develop a device that accurately distinguishes handloom from power loom fabrics using advanced imaging and machine learning. By analyzing fabric microstructures, it helps consumers identify authentic handloom products, supports fair pricing, protects weavers' interests, and promotes the preservation of India's rich handloom heritage.

This project aims to enhance handloom retail by developing an Augmented Reality (AR) virtual try-on system. Customers can digitally explore color and design options without physical samples, improving shopping experience and choice. By enabling on-demand customization and reducing inventory waste, the system supports showrooms in lowering costs and increasing sales efficiency while preserving India's handloom heritage.



DISABILITY

03

GOOD HEALTH
AND WELL-BEING



10

REDUCED
INEQUALITIES



Disability is an important focus area at IIT Kanpur, where research and innovation are being directed towards creating inclusive solutions. From assistive technologies to accessible learning tools, several projects aim to empower individuals with disabilities and improve their quality of life. These efforts reflect a commitment to equity, inclusion, and social impact. By advancing this domain, IITK strives to ensure that technological progress benefits everyone.

AI for Developing Sign Language Technologies: Towards Empowering and Helping Hard of Hearing People

0.56
INR Crore
PROJECT COST

Smart Glasses and VR Headsets for Visually Impaired

0.02
INR Crore
PROJECT COST

India has about 63 million deaf people. The deaf community primarily uses sign language to communicate; however, the community faces several challenges in communicating with the rest of the population. In this project, we aim to narrow this communication barrier by developing AI-based systems for Indian Sign Language understanding and Indian Sign Language generation.

This project aims to develop smart glasses and a VR headset integrated with a smartphone app to assist low-vision individuals. The smart glasses will use dual displays, a central camera, and AI to recognize surroundings and provide real-time auditory feedback. The VR headset will enhance vision through zoom, contrast control, and video features using the phone's camera. These tools will improve independence, learning, and social engagement, significantly enhancing the quality of life for users.



NEW DEPARTMENTS & CENTERS

IIT Kanpur has established new academic departments that now need further strengthening through resources and support. The institute also plans to establish new centres focused on key emerging areas. These ambitious and forward looking initiatives aim to expand academic horizons, foster interdisciplinary collaboration, and address future societal and technological challenges through research, innovation, and education.

**Department of SPASE-
Space Science & Astronomy
Infrastructure Development
@ IIT Kanpur**

100
INR Crore
PROJECT COST

**Robotic telescope for
exoplanet sciences**

2.0
INR Crore
PROJECT COST

This project aims to establish IIT Kanpur's Department of Space Science & Astronomy as a leading center for education and research in space sciences. It plans to develop advanced labs for space instrumentation, data analysis, visualization, and radio astronomy, along with specialized facilities like space qualification testing and mission operations. Supported by expert faculty and national collaborators, the department will offer interdisciplinary programs, foster international exchange, and contribute to India's space missions, positioning IIT Kanpur at the forefront of space research and innovation.

**Free Space Optical
Communication**

2.0
INR Crore
PROJECT COST

1.5
INR Crore
PROJECT COST

Free space optical (FSO) communication is critically important as it offers a high-bandwidth, low-latency alternative to traditional wired and RF communication systems. Its ability to transmit data without requiring physical cables makes it especially valuable in urban environments, disaster recovery zones, and temporary installations. FSO systems are immune to electromagnetic interference, ensuring secure and stable transmission. Moreover, they enable rapid deployment and scalability, making them an essential tool for bridging digital divides and enhancing network resilience in next-generation communication infrastructure.

**CubeSat development for
characterization of
exoplanets**

2.0
INR Crore
PROJECT COST

1.0
INR Crore
PROJECT COST

This project focuses on the development of a CubeSat platform designed for the detection and characterization of exoplanets. By leveraging compact, cost-effective satellite technology, the mission aims to collect photometric data in multiple bands to study exoplanetary atmospheres and transit events. This initiative contributes to the growing field of space-based exoplanet research by providing high-frequency, targeted observations that complement larger observatories.

**Khagolvani: Making
Astronomy Accessible for
Underprivileged Youth**

Khagolvani is an astronomy outreach initiative aimed at sparking scientific curiosity and critical thinking among underprivileged children, especially from migrant and low-income families in Kanpur and rural Uttar Pradesh. Selected for a global seed grant by the IAU-OAD, the project uses hands-on sessions to make astronomy accessible and engaging. It challenges superstitions, promotes evidence-based reasoning, and encourages interest in STEM, empowering young minds to better understand their world and the universe.

Establishing Advanced Laboratories to Strengthen the Department of Space

To advance the Department of Space, it is essential to establish some important advanced laboratories. These labs will accelerate research and development efforts significantly. They will foster innovation and enhance expertise in space technology. This will strengthen the overall capacity and effectiveness of the space department.

- Space Instrumentation Laboratory - 1.75 Cr.
- Planetary Science Laboratory- 2.25 Cr.
- Radio Astronomy Laboratory - 1.80 Cr.
- Optical and Infrared Astronomy Laboratory- 1.75 Cr.
- Data Analysis Facility- 1.00 Cr.
- Data visualization laboratory - 1.5 Cr



DEPARTMENT OF COGNITIVE SCIENCE

The Department of Cognitive Science at IIT Kanpur is at the forefront of exploring how humans think, learn, and interact with profound implications for AI, education, mental health, and human-centered technology. Through interdisciplinary research spanning neuroscience, psychology, linguistics, and computation, we are decoding the human mind to shape a smarter, more empathetic future.

Human Interaction Lab

5.0
INR Crore
PROJECT COST

This lab will focus on studying real-time human behavior, decision-making, and interactive cognition using advanced experimental setups.

Advancing Cognitive Science Infrastructure

The Department of Cognitive Science at IIT Kanpur is enhancing its research infrastructure with several specialized labs like EEG, Brain Stimulation, and Bio Signal labs.

fMRI Facility

20
INR Crore
PROJECT COST

The fMRI facility will support high-resolution brain imaging to explore neural mechanisms underlying perception, memory, and action.

Center for Learning & Educational Technology

9.97
INR Crore
PROJECT COST

The Department of Cognitive Science at IIT Kanpur proposes CLET to revolutionize education via active learning, digital tools, and cognitive research. Focusing on locally relevant challenges, especially in the Hindi heartland, the Center will drive pedagogical innovation, better assessment methods, and educational policy support through interdisciplinary collaboration.

Department of Cognitive Science

40
INR Crore
PROJECT COST

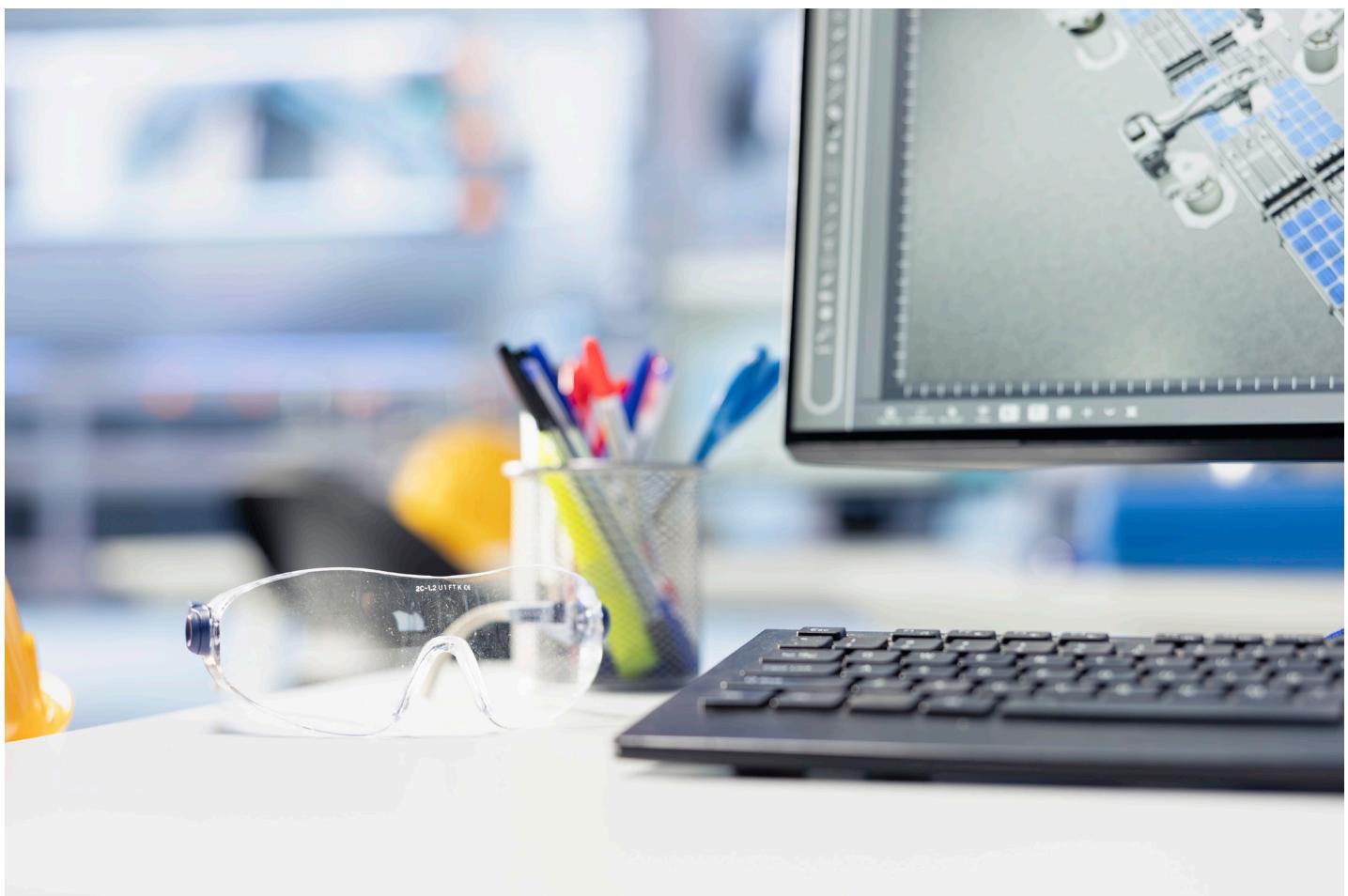
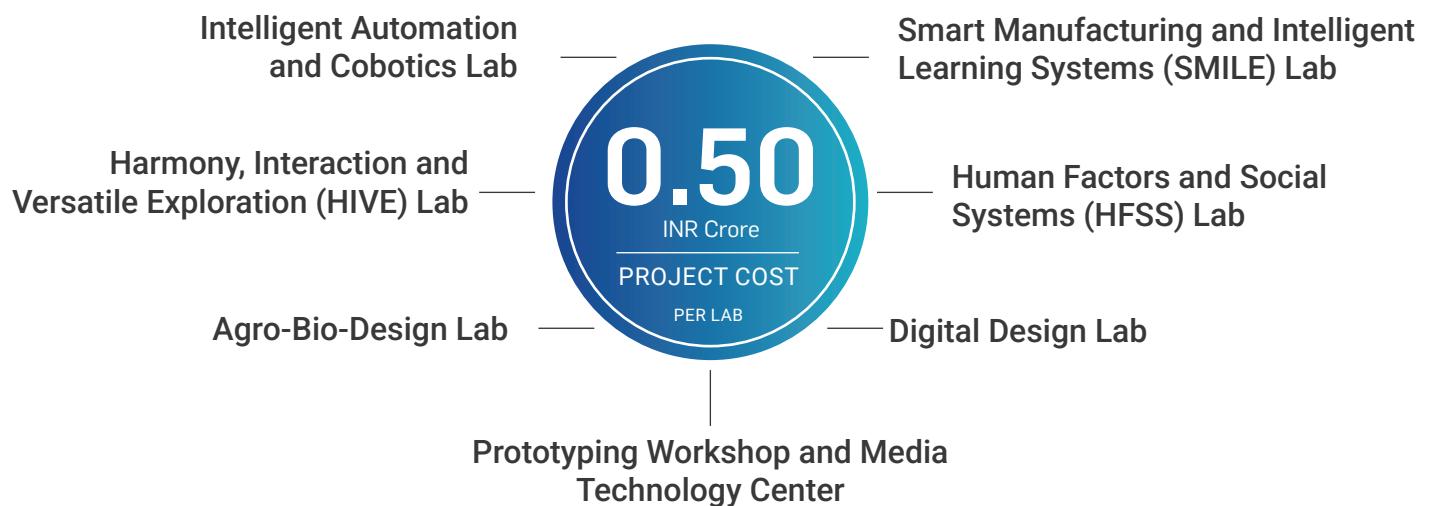
With state-of-the-art infrastructure including EEG labs, eye-tracking systems, immersive VR/AR setups, and behavioral testing suites we provide robust support for cutting-edge research.



DEPARTMENT OF DESIGN

40
INR Crore
PROJECT COST

The Department of Design at IIT Kanpur merges creativity, technology, and user-centered thinking to address real-world challenges across sectors. With advanced labs, AR/VR studios, and digital fabrication tools, we foster innovation at the intersection of design and engineering. To build a leading global department, support will strengthen infrastructure, enable a Design Cell for industry collaboration, fund internships, and offer scholarships empowering students and researchers to create inclusive, impactful solutions for India and beyond.



NEW CENTERS

International Center for Space Sciences & Engineering

7.54
INR Crore
PROJECT COST

This project aims to establish the International Center for Space Sciences & Engineering (ICSSE) under IIT Kanpur's newly formed Department of Space, Planetary, and Astronomical Sciences and Engineering (SPASE). Launched in January 2022, SPASE envisions positioning India at the forefront of global space research. The proposed center will serve as a hub for international collaboration, attracting global experts, postdoctoral researchers, and students for advanced research, workshops, and joint space missions. ICSSE will also foster education and outreach in space sciences, helping IIT Kanpur emerge as a premier destination for cutting-edge research and innovation in the field.

Advanced Research Center for Antahkarana Studies (ARCAS)

0.41
INR Crore
PROJECT COST

This center aims to explore consciousness, mind, intelligence, and ego (Antahkarana) by integrating Indian philosophical insights from texts like the Upanishads and Bhagavad Gita with modern scientific perspectives. Addressing the mind-matter dichotomy through dualist and non-dualist theories, it fosters interdisciplinary research to merge ancient wisdom with contemporary science. The initiative seeks to deepen understanding of consciousness across health, science, and philosophy, bridging traditional knowledge and cutting-edge research.

Center for Diversity and Inclusivity (CDI)

1.0
INR Crore
PROJECT COST

The Center for Diversity and Inclusivity (CDI) at IIT Kanpur aims to create a barrier-free, inclusive campus by supporting students with disabilities through accessible infrastructure, flexible academics, assistive technologies, and sensitization programs. It promotes interdisciplinary research and policy development to ensure equitable education and participation across all aspects of campus life.

Center for engineering vaccine and antibody discovery

1.00
INR Crore
PROJECT COST

This project aims to develop vaccines and antibody therapies against emerging viral threats like NIPAH, Dengue, Chikungunya, and COVID at IIT Kanpur's Center for Engineering Vaccine and Antibody Discovery. It integrates immunology, virology, and structural biology for next-gen immunogens and monoclonal antibodies.

Centre of Excellence- Non-Invasive Imaging & Diagnostics

5.0
INR Crore
PROJECT COST

This project aims to strengthen the Centre of Excellence in Non-Invasive Imaging & Diagnostics at IIT Kanpur, which is dedicated to developing accurate, accessible, and patient-friendly diagnostic technologies. By combining optics, AI, and biomedical engineering, the centre focuses on creating advanced imaging tools such as innovative endoscopes and microscopes. These efforts support the development of affordable, indigenous MedTech solutions tailored to India's unique healthcare challenges.

Center on Clean Technologies for futuristic energy systems

100
INR Crore
PROJECT COST

The centre aims to tackle technological challenges in developing efficient, futuristic energy systems with significant societal impact in India. As the country pursues technological advancement and self-reliance, research across sectors is vital. Applications range from extreme environments (e.g., data centres, defence, space) to residential needs like clean water and off-grid power. Planned projects include advanced heat pumps, battery thermal management, solar desalination, novel heat transfer methods, and green hydrogen storage, supporting energy sustainability and innovation across domains.

Center for Ethics & Technology

0.15
INR Crore
PROJECT COST

The proposed Centre for Ethics and Technology, under the Department of Humanities and Social Sciences (HSS), aims to address the ethical challenges posed by disruptive technologies such as AI, social media, and IoT. Its activities will include public lectures, conferences, workshops, collaborative projects with industry, consultations, an ethics lab, academic courses, and fellowship programs to explore and mitigate the ethical implications of these technologies, ensuring responsible and sustainable technological development.

Research Center for Mind-Body Medicine

0.49
INR Crore
PROJECT COST

This center aims to explore the intersection of philosophy, consciousness studies, and clinical medicine by examining how mind-body interactions affect health, disease, and transitional states. It investigates interventional therapies like neuro-biofeedback, deep brain stimulation, and cognitive therapy, while critically analyzing the roles of Nature and Nurture in medicine. The center promotes interdisciplinary research into cognitive science, health, and societal beliefs such as vaccine hesitancy integrating metaphysical and empirical perspectives to deepen our understanding of human health and consciousness.

Just transition research center

1.00
INR Crore
PROJECT COST

The Justice, Transition, and Resilience Centre (JTRC), established on April 1, 2021, aims to integrate public and ethical concerns, such as justice and fairness, into policy-making on critical issues like climate, environment, and energy. Founded by Prof. Pradip Swarnakar of the HSS Department, the center's research spans Uttar Pradesh and West Bengal, with plans for expansion into Assam and Jharkhand. It produces policy reports, peer-reviewed publications, and hosts workshops. JTRC has signed MOUs with CSIS and Princeton University's Behavioral Science and Policy Lab.

Center of electric innovation and entrepreneurship

50
INR Crore
PROJECT COST

IIT Kanpur has built a strong innovation ecosystem driven by advanced research centers, incubation hubs, and industry collaborations. Key entities like SIIC, Technopark, NCFlexE, ACES, CRR, and C3iHub foster applied research, entrepreneurship, and technology transfer. This integrated framework positions IIT Kanpur as a national leader in innovation, enabling lab-to-market transitions and impactful industrial partnerships.

Advanced Research Center for Antahkarana Studies (ARCAS)

0.41
INR Crore
PROJECT COST

This center aims to investigate consciousness, mind, intelligence, and ego (Antahkarana) through Indian philosophical and scientific lenses. Drawing from classical texts like the Upanishads, Bhagavad Gita, and works of Charaka and Sushruth, it will explore both dualist and non-dualist theories of consciousness. The center seeks to integrate ancient wisdom with modern scientific inquiry by bringing together interdisciplinary researchers. It will focus on bridging the mind-matter dichotomy and enhancing our understanding of consciousness across health, science, and philosophy, thereby connecting traditional knowledge systems with contemporary research.

COMMUNITY WELFARE & EDUCATION

04

QUALITY EDUCATION



05

GENDER EQUALITY



10

REDUCED
INEQUALITIES



16

PEACE, JUSTICE AND
STRONG INSTITUTIONS



The Community Welfare & Education domain at IIT Kanpur is dedicated to fostering inclusive development through sustained educational and welfare initiatives. It supports children, youth, and marginalized sections by enhancing access to learning, vocational skills, and community resources. Programs such as the Opportunity School, adult literacy drives, and rural outreach efforts play a central role. These initiatives aim to nurture individual potential while addressing broader societal needs. The domain embodies IIT Kanpur's commitment to equity, empowerment, and meaningful social engagement.

Indian Knowledge System (IKS) Studies and Activities

1.96

INR Crore

PROJECT COST

The newly drafted National Education Policy (NEP2020) has made a compelling case for introducing the Indian Knowledge System (IKS) in institutes of higher education. We propose establishing a study and activity centre for IKS, that will be dedicated to discussions and studies of knowledge in IKS-related domains in the form of lecture series, workshops, digital resources, websites, etc.

Learning By Doing: Imparting Hands-On Education Through Digital Tools And Models

0.71

INR Crore

PROJECT COST

The proposed plan aims to improve education through hands-on learning and teacher training. Modules for science, social science, and computer education will be developed for classes IV-VIII and tested at Swami Vivekananda Vidyalaya (SVV), a self-financed school with strong science and computer labs. These modules will then be introduced to nearby government and public schools. Additionally, biannual teacher training workshops will be conducted to enhance teaching methods. The initiative seeks to foster original thinking and problem-solving among students.

For setting up a skilling center for rural pottery center

0.76

INR Crore

PROJECT COST

Ranjit Singh Rozi Shiksha Kendra (RSK) at IIT Kanpur drives rural empowerment through quality education and skill development. Key initiatives include the Online Rural Education Initiative (OREI), sewing operator and leather stitching courses for youth, and pottery cluster development in Bithoor. RSK blends technology, community participation, and government support to foster sustainable rural transformation.

Kasi Kastha Maker lab

1.80

INR Crore

PROJECT COST

This project aims to establish a 24/7 Maker's Lab that integrates production, learning, and market access for the toy-making ecosystem. It will feature a tool and toy library, NVEQF-recognized skill programs, and support for artisans through mentorship, trend mapping, and direct marketing. The lab will enable toymakers to innovate, grow sustainably, and connect with wider markets.

PadhAI-LikhAI: Advanced Innovative (AI) Lab

0.10

INR Crore

PROJECT COST

The PadhAI-LikhAI Labs initiative aims to bring AI, robotics, coding, drones, and IoT education to rural schools in India. By offering hands-on learning in native languages, it fosters creativity, reduces rote learning, and bridges the digital divide. The program promotes innovation and collaboration, preparing students for future technological opportunities.

Appreciation and Promotion of Arts and Cultural Heritage (APPROACH-IITK)

3.0

INR Crore

PROJECT COST

This project aims to promote cultural and creative growth at IIT Kanpur through the APPROACH-IITK Cell, established in 2022 under the Dean of Students Affairs. It organizes regular events featuring national, regional, and campus artists, with a flagship annual music concert series showcasing Indian and world music.

Academic & Educational support towards Opportunity school

0.12
INR Crore
PROJECT COST

This project supports the Opportunity School at IIT Kanpur, which educates over 300 children of domestic helpers in a safe, well-equipped environment. To expand as a CBSE-affiliated school, it seeks funds for furniture, computers, teacher recruitment, and staff salaries. Your contribution will help bridge critical funding gaps and ensure quality education and better opportunities for these students.

Enhancing Early Education: Infrastructure Support at Kislaya Nursery School

0.16
INR Crore
PROJECT COST

In 2023–24, Kislaya Nursery School used CSR funds from Kewal Engineering to upgrade infrastructure, including furniture, play equipment, fans, and a sound system, benefiting 183 students. These improvements have enhanced safety and learning. Remaining funds will support pending work in 2024–25. The school thanks Kewal Engineering for their impactful support.

Academic & educational support towards Campus school

0.14
INR Crore
PROJECT COST

The project aims to enhance learning at the Campus School by strengthening science, math, and language education through updated materials, interactive modules, and teacher training. It promotes innovative methods, digital access, and holistic student development.

Shiksha Sopan

0.29
INR Crore
PROJECT COST

Shiksha Sopan, an NGO near IIT Kanpur, empowers underprivileged students through education focused on values and self-reliance. This initiative aims to enhance hands-on science learning for classes 6–9, upgrade lab facilities, and train teachers. It promotes experiential, accessible science education for students from economically weaker rural and semi-urban backgrounds.

SNEHAN, Child Care Centre, IITK

0.20
INR Crore
PROJECT COST

The proposal seeks to expand and upgrade SNEHAN, IIT Kanpur's Child Care Centre, to meet growing demand. Key improvements include enhanced safety, better infrastructure, teacher training, and increased community awareness, ensuring continued delivery of quality early childhood education.

JOIN US IN SHAPING THE FUTURE

IIT Kanpur's vision for the future is bold, transformative, and deeply rooted in excellence. The initiatives outlined in this document reflect our unwavering commitment to advancing research, and innovation at a global scale. Achieving these ambitious goals requires collective effort, and your support can make a lasting impact.

We invite you to be a part of this journey whether through contributions, collaborations, or advocacy. Together, we can drive meaningful change and empower IIT Kanpur to continue shaping the leaders and technologies of tomorrow.

For further discussions or to explore ways to contribute, please contact:

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