

E X E M P L A R Y



Research
Ecosystem

From the desk of
Dean Research

Universities are the birthplace of knowledge. Transforming this academic knowledge into practical solutions to address major global challenges—such as access to affordable and personalized healthcare, availability of clean water and air, sustainable energy, agriculture, and social equity—is the focus of the Office of Research.

We are committed to ensuring that our work extends beyond theses and academic papers to bring tangible benefits to society. Society is facing increasingly complex challenges that cannot be tackled with quick fixes or narrowly focused interventions. Therefore, we consider the overall environmental, social, and

economic impacts of our work while developing solutions.

Research should be adaptable, sustainable, and focused on addressing the root causes of problems, not merely their symptoms. By closely collaborating with government bodies, corporations, industry leaders, and NGOs, we ensure that our research is not only innovative but also relevant, scalable, and aligned with policy frameworks.

Our interdisciplinary teams—comprising experts from diverse fields—work tirelessly to ensure that our solutions are both technically sound and socially viable. Laboratories such

Research should be adaptable, sustainable and focused on addressing the root causes of problems, and not merely their symptoms

as the Microclimate & Clean Energy Lab, Molecular Cell Biology/CRISPR Tech Lab, Water Technology Research Lab, Dixon IoT Lab, Robotics Lab, and Digital Twin Technology Lab are actively engaged in a full spectrum of work, ranging from basic research to applied innovations.

To nurture this mindset in our students, we foster a culture of innovation and problem-solving from the beginning of their academic journey. Involving undergraduate students early in research equips them with the skills and creativity needed to tackle future challenges. Their fresh perspectives and enthusiasm are invaluable, ensuring that our research remains forward-thinking while staying grounded in real-world applications.



Vishal Garg.

Prof. Vishal Garg
Dean Research

Research Centers



Plaksha has four research centers dedicated to addressing global challenges in clean energy, sustainable agriculture, water security and equitable healthcare. These centers are supported by state-of-the-art research laboratories.

Indorama Ventures Center for Clean Energy

The Indorama Ventures Center for Clean Energy (IVCCE) is dedicated to support India's transition to a net zero-carbon, self-reliant and energy-secure future and contribute to the global effort in reducing carbon emissions. Their goal is to develop industry-relevant professionals and entrepreneurs capable of contributing significantly to the clean energy drive.

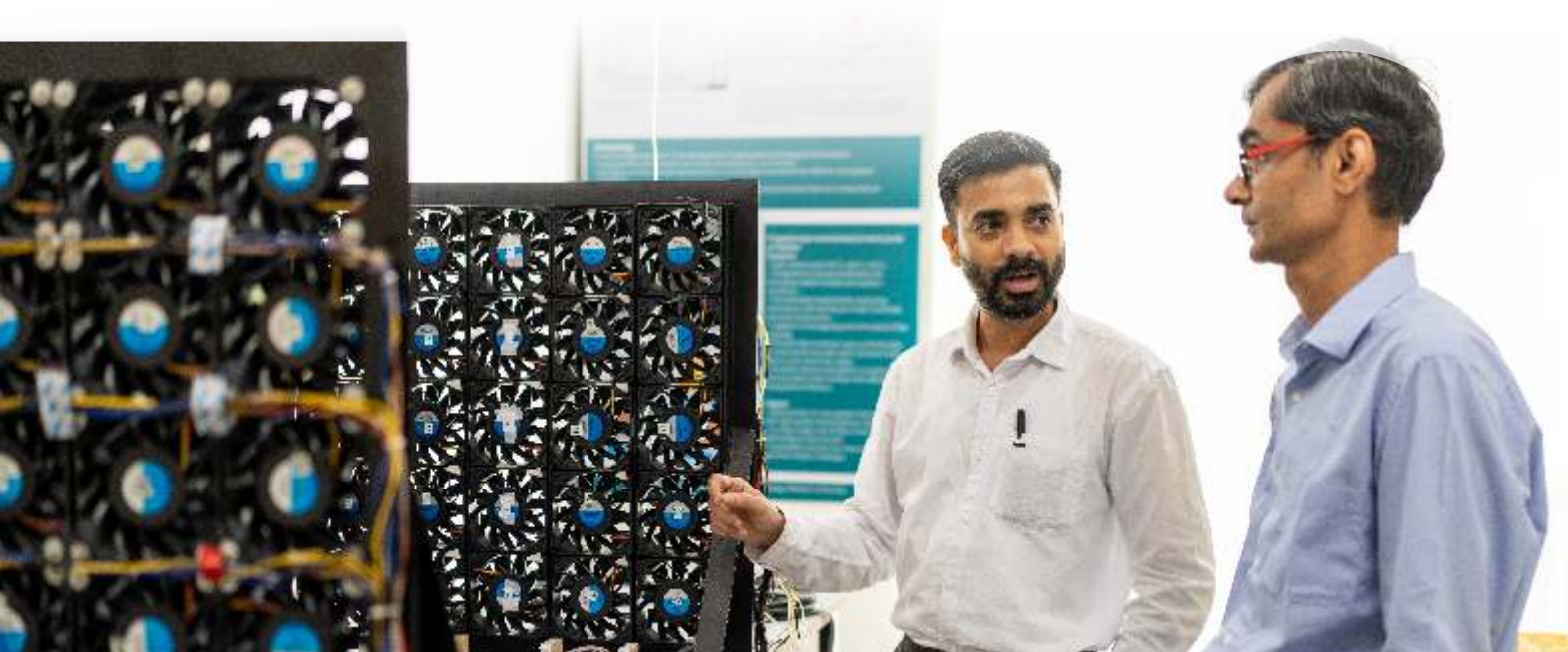
Research areas

Decarbonizing residential cooling

IVCCE has developed a first-of-its-kind living laboratory to comprehensively evaluate the decarbonization potential of centralized cooling and heating systems with thermal storage in Indian residential settings.



Scan to know more about
Indorama Ventures Center
for Clean Energy



At IVCCE, faculty and researchers work to create a sustainable future for all

Mitigation of urban heat island and walkability infra-assessment

To support the implementation of cool surfaces to reduce urban heating. A technology framework has been developed to track the adoption of urban cool roofs and climate change through multi-spectral satellite imagery.

Smart homes energy management

Develop and evaluate the impact of the Smart Home Management System on human behaviour (through nudges) towards energy savings and shifting of demand.



Center for Water Security

India ranks among one of the highly water-stressed countries, facing a significant gap between available water supplies and the rapidly increasing demand. This is compounded by significant water quality issues with both ground and surface water sources being contaminated with multiple pollutants from domestic, agricultural and industrial sources. The Center for Water Security (CWS) is a multidisciplinary research center aiming to develop affordable and scalable solutions for specific water quality challenges in India.

Research areas

Water quality mapping and tools for monitoring

To understand the health of local water bodies, water quality testing of the seasonal stream N-Choe has been initiated. Starting with conventional parameters, the measuring and mapping activity is being expanded to cover a broad range of water quality parameters to help develop customized treatment solutions. The tools for monitoring include autonomous robots and cost-effective sensors. CWS has deployed an underwater vehicle in a controlled environment (swimming facility) and analyzed the navigation and sensing capabilities of the vehicle. The center is also developing a hand-held optical sensor prototype for Chromium (Cr) detection with remote-access feature.



Resource efficient wastewater treatment

CWS is working on membrane separation processes for industrial wastewater treatment targeting reduction of high energy consumption in zero-liquid discharge technologies. Microalgal technologies are also being explored for energy efficient treatment of domestic wastewater.

Application of AI models

The operation of Sewage Treatment Plants (STPs) is often not optimal. CWS has used the Plaksha STP as a testbed and collected data on water quality, chemicals consumed and energy usage, digitized the data, and worked on initial correlations between the operational parameters and treatment performance.



Scan to know more about
Center for Water Security



Water balance and water quality in drinking water treatment plant (WTP) and sewage treatment plant (STP) are monitored on campus



Water quality sensors are used for monitoring the N-Choe stream

Center for Sustainable and Precision Agriculture

Agriculture is intricately connected to the nexus of food, water and energy, which is essential for sustainable development. The Center for Sustainable and Precision Agriculture (CSPA) aims to transform the Indian agricultural ecosystem by developing groundbreaking technologies in AI-ML, Robotics, IoT and Biotechnology. The center's mission is to utilize these technologies to sustainably double the yield of Indian farms.



Drone-based monitoring can make a positive impact on farming with potential towards improving crop yields and environmental sustainability

Research areas

Remote sensing for crop stress and yield assessment

CSPA is employing drone and satellite-based remote sensing to estimate sugarcane yield and detect plant water and nitrogen stress. By providing farmers with objective data on soil and crop conditions, the center enables timely actions to enhance productivity.

Development of low-cost IoT sensors and biopesticides

CSPA is developing affordable IoT sensors for sucrose measurement in sugarcane, making them 100 times cheaper than current lab instruments. This aids farmers and sugar mills in optimizing harvest times and reducing post-harvest losses. Additionally, it is creating viable biopesticide alternatives to reduce the overuse of chemical pesticides in Punjab, promoting safer farming practices.

Impact of biochar on soil health

Studies assess how different concentrations of biochar, with or without legume plants, affect soil health indicators like pH, moisture content, electrical conductivity, soil organic carbon, and nutrient availability. This research aims to enhance soil structure, nutrient retention, and microbial activity, contributing to sustainable agriculture.



Center for Equitable and Personalized Healthcare

The Center for Equitable and Personalized Healthcare (CEPH) is on a mission to spawn the next epoch in bio-informed technologies to improve disease diagnosis and elucidate individualized susceptibility to enable personalized treatment decisions.



CEPH researchers are focused on improving human and planetary health

Research areas

Next generation point-of-care diagnostics

CEPH aims to develop cost-effective precision diagnostic devices and early detection platforms for non-communicable disease (NCD) management that are on the rise in India and globally. The current studies assess biomarkers in body fluids that analyze accurately multiple disease conditions, besides designing multimodal sensors for their sensitive and selective detection, and the corresponding lab-on-chips. Integrating the advancements in omics data analysis, building AI tools to annotate, identify and summarize medical procedures are expected to improve disease diagnosis and management.



CEPH engages in interdisciplinary research to gain insights in complex health challenges

Disease mechanism and susceptibility elucidation at individual level

Identifying molecular signatures for cancer, rare diseases, heart and neurodegenerative disorders that can be developed into novel biomarkers for NCDs enabling personalized diagnostics is targeted here. Integrative multiomics and functional validation of biomarkers are integral to this approach.

Mechanism guided personalized therapeutics

Impact of small molecule inhibitors and chemical moieties for cancer therapeutics will be undertaken using proteomics-based assays. This will be followed by predicting their pharmacokinetic properties and modelling drug response in association with molecular marker presence.

Natural biomaterial based implantable bio-grafts will also be developed for rapid healing of diabetic foot ulcers in terms of revascularization, tissue integration and facilitate drug release. Along with non-invasive real-time monitoring, this should revolutionize the treatment of chronic wounds, reducing the necessity of amputations and decreasing healthcare costs globally.

Research Labs & Facilities



Dixon IoT Lab

Dixon IoT Lab is a state-of-the-art facility supported by Dixon Technologies (India) Limited. It has been set up to play a pivotal role in advancing research and innovation in the field of IoT and aspires to design affordable and scalable IoT solutions through collaboration with industry partners. The Dixon IoT Lab provides IoT support to research centers such as CSPA, IVCCE and CWS. At CWS, tools for monitoring is a key theme and has synergy with the lab.

The Punjab Police signed an MoU with Plaksha to leverage research and innovation at the Dixon IoT Lab for enhanced road safety and sustainable transport practices in Punjab.



The Dixon IoT Lab will drive technological advancements and foster skill development in the IoT domain



The Dixon IoT Lab is equipped with cutting-edge resources including sensor prototyping and precision measurement equipment, edge computing and PCB design tools



Robotics Lab

Plaksha Robotics Lab is a cutting-edge research facility inside the HDFC Innovation Hub. It is equipped with state-of-the-art equipment for pursuing research in aerial, underwater and field robotics. The lab focuses on various research projects like applying advanced drone technology to enhance precision agriculture practices and developing specialized underwater robots designed for monitoring and analyzing aquatic ecosystems. It also provides Plaksha students an inviting atmosphere to immerse themselves in hands-on experiences, engaging in projects that involve building drones and robots, conducting innovative research, and participating in exciting hackathons.



Human-Technology Interaction Lab

The Human-Technology Interaction (HTI) Lab is dedicated to advancing the understanding and optimization of interactions between humans and technology. The mission is to investigate and model these interactions to improve cognitive well-being, develop cost-effective wearable solutions, and provide policy recommendations that enhance human safety, productivity and creativity. Four research papers by HTI have been accepted at prestigious conferences such as the International Conference on Science and Technology Education and the American Society for Engineering Education Conference.

Lab for Economic Behavior in Organizations

The Lab for Economic Behavior in Organizations (LEO) aims to investigate through a social science lens issues pertaining to human resources in public and private organizations. LEO's vision is to innovate in and learn from the latest scientific advances in the areas of personnel, behavioral, experimental and organizational economics to provide actionable insights for addressing the grand challenges of India and the world.

Digital Twin Technology Lab

It is an interdisciplinary research and innovation lab that specializes in digital twinning and simulation of real-world systems. It uses mathematical technology, state of the art AI engines, and advanced computer graphics to create interactive platforms for learning and to develop predictive models for optimal decision-making. The lab is also developing novel strategies for training deep neural network models that will offer a fundamentally new perspective on how machines and humans learn.

Advanced Analytical Characterization Facility

Advanced Analytical and Characterization Facility (AACF) houses instruments for performing chemical analysis. Techniques include spectroscopy, chromatography, polarimetry and fluorescence microscopy. It is a shared facility and is used by all research centers at Plaksha. AACF also houses a Biosafety Level – II lab, which is a microbiology lab. It is currently used for culturing fungal and pathogenic organisms. It is equipped with a BSL2 hood, a chemical hood, a refrigerator, a shaker incubator, a working bench and a sink. Ongoing projects focus on developing biosensors for detection of fungal plant diseases and biopesticides for sustainable management of fungal crop pathogens. In near future, the facility will be expanded to cater to fluorescence spectroscopy and X-ray diffraction analysis.



The Havells Research Building at the Mohali campus houses pathbreaking labs and facilities dedicated to fostering experiential learning and interdisciplinary research

Research Publications

Research Articles

Year 2021

- Guo, N., Bose, S. K., Mukherjee, B., & Shen, G. (2021). Impact of fiber attenuation and effective area on spectrum efficiency of elastic optical networks. *Journal of Lightwave Technology*, 40(8), 2200-2213.
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- Singh, R., Yadav, A., Yadav, B., & Verma, N. K. (2023). A Bibliometric Study Of Desidoc Journal Of Library And Information Technology.

Book Published

Year 2022

- Sinha D, Amaratunga GA. (2022) Symmetry breaking in transformation of force fields. InExplicit Symmetry Breaking in Electrodynamical Systems and Electromagnetic Radiation (Second Edition). IOP Publishing. 2053-2563, 5-11.
- Sandhu, K., & Singh, S. (Eds.). (2022). Food Printing: 3D Printing in Food Industry. Springer.
- Subburaj, K., Sandhu, K., & Ćuković, S. (2022). Revolutions in Product Design for Healthcare. Springer Singapore.
- Rajput, V. D., Verma, K. K., Sharma, N., & Minkina, T. M. (Eds.). (2022). The role of nanoparticles in plant nutrition under soil pollution: Nanoscience in nutrient use efficiency. Springer.

Book Chapters

Year 2022

- Sinha D, Amaratunga GA. (2022) Chapter 5. Symmetry breaking in transformation of force fields. InExplicit Symmetry Breaking in Electrodynamical Systems and Electromagnetic Radiation (Second Edition). IOP Publishing. 2053-2563, 5-11.

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- Gupta, M., Dhinra, G., & Sandhu, K. (2023). Human podiatric disabilities and their correction using a 3D printed technology: a short review. 3D Printing in Podiatric Medicine, 175-194.
- Ambasta, S., & Viswanathan, I. (2023). Ikat Weaving in India: A Case Study of Three Indigenous Traditions. In Indigenous Technology Knowledge Systems: Decolonizing the Technology Education Curriculum (pp. 137-150). Singapore: Springer Nature Singapore.

List of current sponsored projects

Sponsored Research Projects: Extramural Grant

FY 2022-23

- Designing highly specific immunotherapeutic through structure-based cytokine engineering: A combined in silico and deep learning approach – Dr. Monika Sharma (Anusandhan National Research Foundation (ANRF)- formally known as SERB)
- Improvement in silicon uptake, fruit ripening and yield by targeting multiple genes (SINIP2-1, SIAP2a, SP5G, and PL) with CRISPR/CAS9 approach in tomato- Dr. Rupesh Deshmukh [Department of Biotechnology (DBT)]
- Digital Solution to predict optimum time of sugar harvest- Dr. Amruta Ranjan Behera & Dr. Shashank Tamaskar [Software Technology Park of India (STPI)-Mohali]
- Investigations of molecular mechanism and dynamics of splice site recognition in humans - Dr. Monika Sharma (Anusandhan National Research Foundation (ANRF)- formally known as SERB)
- Design and implementation of a Cyber-Physical system for high throughput phenotyping and real time management of crops in the mid-Himalayan region -Dr. Srikant Srinivasan [Department of Biotechnology (DBT)]
- High-throughput phenotyping technologies for agricultural crops - Dr. Srikant Srinivasan (ARNETTA Tech)

FY 2023-24

- Investigating impact of current agricultural practices on planetary health and co-creating sustainable solutions with farming communities- Dr. Navjot Kaur [DST iHub - AWaDH (Agriculture & Water Technology Development Hub)]
- Team Spectral EYE - Dr. Amruta Ranjan Behera (Department of Consumer Affair)
- Understanding the molecular basis of selective transport of silicon and arsenic by modulating Nodulin 26-like Intrinsic protein 2-1 (NIP2-1) in rice (Oryza sativa) - Dr. Rupesh Deshmukh (Anusandhan National Research Foundation (ANRF)- formally known as SERB)
- Optical sensor for chromium detection in remote and rural waterbody and industry water outlet for near zero discharge and their field testing – Dr. Chaitanya Lekshmi Indira [Department of Science and Technology (DST)]
- National Science Day celebration-2024-Dr. Amrik Sen (Punjab State Council for Science and Technology, Punjab)
- Study of neuronal information for navigation- Dr. Subhasis Ray (Anusandhan National Research Foundation (ANRF)- formally known as SERB)
- Setting up of Intellectual Property Management & Commercialization Cell (IPMCC) - Dr Vivek Deulkar [Punjab State Council for Science and Technology, Punjab]

Sponsored Research Projects: CSR

FY 2022-23

- Indorama Ventures Centre for Clean Energy - Prof. Vishal Garg, Dr. Shashikant Pawar, Dr. Anupam Sobti, Dr. Vivek Deulkar (Indorama Ventures)

FY 2023-24

- IOT Lab Development - Dr. Srikant Srinivasan, Dr. Dhiraj Sinha, Dr. Amruta Ranjan Behera (Dixon technologies India Ltd)
- Smart Farm- Dr. Shashank Tamaskar [CNH Industrial (India) Private Limited]

Research Consultancy

FY 2022-23

- Case study for district cooling guideline by Vishal Garg [Foundation for ISHRAE]

FY 2023-24

- Sugarcane health and yield prediction using AI/M - Dr. Shashank Tamaskar & Dr. Amruta Ranjan Behera (CNH-Research Project)
- Estimating Temperature Reduction with Application of Cool Roofs using Dynamic Simulation- Dr. Vishal Garg (HIL India Limited)

Plaksha University Startup Research Grant

FY 2022-23

- Energy Efficient Water Waste Management using Forward Osmosis- Dr. Prashanth Kumar
- Multi-scale Models for Understanding dispersion of atmospheric air pollution and designing energy efficient engineering materials with a periodic order- Dr. Amrik Sen
- Elucidating the mechanisms of alternative splicing in cancer- Dr. Monika Sharma
- Teach Box Proposal: AI-powered tool for faculty to develop deeper insights of the teaching challenges faced by engineering faculty in India and to co-create solutions with, rather than only for the faculty- Dr. Rucha Joshi
- Road and Wheel Monitoring System Using an Integrated Infra-Red, Microwave and Acoustic Sensors- Dr. Dhiraj Sinha
- Controlling overuse of chemical fertilizers and pesticides in Punjab via CRISPR crops- Dr. Navjot Kaur
- Experimental Investigations of the effect of urbanization on micro-climates- Dr. Shashikant Pawar
- Precision Agriculture & Border Surveillance using Unmanned Aerial Vehicles- Dr. Shashank Tamaskar
- Development of Miniaturized Sensing Platforms for Detection and Quantification of Chemicals- Dr. Amruta Ranjan Behera
- Investigation of insect navigation, and its application to biomimetic A.I.- Dr. Subhasis Ray
- Systematic targeting of DNA repair pathways to design novel anti-cancer therapy and in-house development of CasRNPs for genome editing. - Dr. Swagata Halder
- Multirobot systems for better understanding of Environmental Processes- Dr. Sandeep Manjanna
- Topics in Macroeconomic Development- Dr. Kriti Khanna
- Development of Sustainable pipeline for rapid advancement of rice varieties by introducing novel traits with genome editing approach- Dr. Rupesh Deshmukh

FY 2023-24

- Electrochemical Sensing of Catecholamines: A Potential Non-invasive Technique for Early Detection of Hepatocellular Carcinoma (HCC)- Dr. Chaitanya Lekshmi Indira
- Post-Quantum Signatures for Practical Applications- Dr. Tapas Pandit
- Intelligent use of battery storage system for harnessing renewables, managing uncertainties and incorporating demand response services- Dr. Vivek Deulkar
- Trade, Financial Intermediation, and the Macroeconomy- Dr. Tanmoy Majilla
- Scalable Agri Informatics with Computer Vision- Dr. Anupam Sobti
- India's First Human Technology Interaction Lab- Dr. Siddharth S
- Digital Terrascope- Dr. Srikant Srinivasan
- Lab for Economic Behaviors in Organizations (LEO)- Prof. Prakarsh Singh

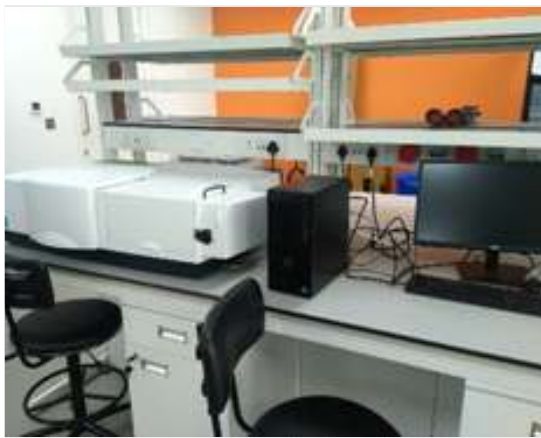
Major research facilities (common / lab wise)



Dixon IoT Lab



Indorama Ventures Center for Clean Energy



Analytical Analysis Characterization facility

PROCESS ROOM

ANALYTICAL ROOM

PHOTOBIOREACTOR ROOM