



# R&D Newsletter

Indian Institute of Technology Kanpur



1.3 peta FLOP  
Supercomputing  
Facility @iitk

more highlight ...

IISF 2020  
SIIC Corner  
Technopark@iitk  
Recent Major Projects  
MoU with Indian Railways  
MoU with Dynamatic Technologies  
Thermal Energy Storage System @iitk

## PARAM Sanganak: new HPC facility being installed at IITK

IIT Kanpur and CDAC signed an MoU on 12 October 2020 to establish a **1.3 peta FLOP supercomputing facility** at the institute under the National Supercomputing Mission (NSM) approved by the Govt. of India. The aim of NSM is to achieve the goals of attaining self-reliance in supercomputing and problem-solving in various domains of scientific and technological endeavours.

One of the supercomputers, called “**PARAM Sanganak**”, is established at IIT Kanpur under the build approach of the NSM with a peak computing power of 1.3 peta FLOPS. This supercomputing facility is designed and commissioned by C-DAC to cater the computational needs of IIT Kanpur, along with various Research establishment and Engineering institutes of the region. The system is built with the latest cutting-edge hardware and software technologies. Substantial components utilized to build this system are manufactured and assembled within India, which is a step towards the *Make in India* initiative of the Government.

PARAM Sanganak is a highly reliable supercomputer that is scalable, and secured with enhanced security features and no single point of failure. The facility will be connected over **National Knowledge Network** and be made available to the scientific and academic community to strengthen the research and development in the country.

MoU was signed in the presence of Shri Sanjay Dhotre, Honourable Union Minister of State of Education, Communications and Electronics & Information Technology, Dr. Rajendra Kumar, Additional Secretary, Ministry of Electronics & Information Technology, and Prof. Ashutosh Sharma, Secretary, Department of Science & Technology were also present in the ceremony and shared their thoughts on the usefulness of supercomputers to advance the research and development activities in the country.



## IISF 2020

The sixth India International Science Festival (IISF 2020) took place from December 22 to December 25. This largest-ever virtual science festival was organized jointly by the Union Ministry of Earth Sciences, the Union Ministry of Science and Technology, and the Vijnana Bharati (VIBHA). The central theme of this year’s festival was “*Science for Self-reliant India and Global Welfare*”. On the occasion of IISF 2020, IIT Kanpur hosted a virtual curtain-raiser on December 21, 2020. Dr. Harsh Vardha, Hon’ble Union Minister for Science & Technology, Earth Sciences, and Health & Family Welfare was the Chief Guest of the event.

IIT Kanpur also displayed a virtual stall on the expo organized as a part of the IISF 2020.



## Recent Project

# 3D Bioprinting for ENGINEERING Biomimetic Tissues and Organoids for Personalized MEDICINE (ENGinMED)

Sponsor: Science and Engineering Research Board  
Intensification of Research in High Priority Areas (IRHPA 2020)

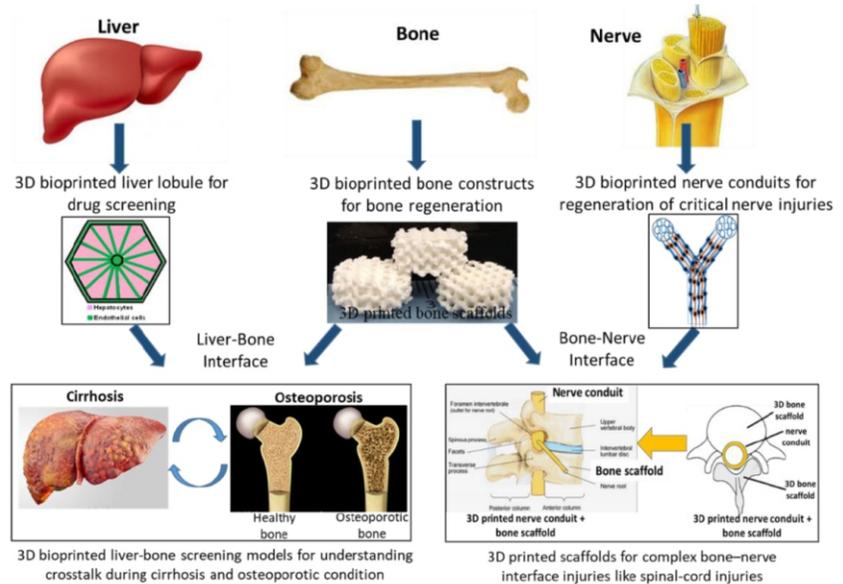
Project Coordinator: Prof. Ashok Kumar ([ashokkum@iitk.ac.in](mailto:ashokkum@iitk.ac.in))

Department of Biological Sciences & Bioengineering

**Team:** Profs. Sri Sivakumar, Santosh K Mishra, S Ganesh (IIT Kanpur) and Anupam Kumar, Savneet Kaur, S K Sarin (ILBS Delhi)



India, having an ambition to be the powerhouse of drug development and translational medicine urgently requires coordination of different domains and establishment and intensification of the high priority area. The motivation of “**ENGinMED**” is to bring clinical experts, bioengineers and fundamental biologists together to develop affordable and personalised medical systems in the area of tissue regeneration and drug screening. 3D Bioprinting (3DP) will be used to fabricate bioresorbable tissue substitutes and biomimetic drug screening models for bone injuries, nerve transections, vertebral injuries, and liver failure. The objective is to develop clinically relevant nerve guidance channels, 3D printed nanoHAP-based bone scaffolds and liver-on-chip drug screening in-vitro models using advanced bioinks. This project may act as an ignition point from its multi-disciplinary collaborations with different departments and laboratories within IIT Kanpur and ILBS, Delhi . IIT Kanpur has recently established the centre for engineering in medicine that will bring 3DP to the national map in India where advanced technology will be established for health care. The vision is to establish 3DP as an allied subject and common platform to produce high-quality research and clinical therapies for unmet conditions in India as well as at the International level.



*Schematic representation showing the overall aim of the project depicting 3D bioprinting approach for development of complex architectures for tissue regeneration and drug screening and understanding the crosstalk between them*

This project may act as an ignition point from its multi-disciplinary collaborations with different departments and laboratories within IIT Kanpur and ILBS, Delhi . IIT Kanpur has recently established the centre for engineering in medicine that will bring 3DP to the national map in India where advanced technology will be established for health care. The vision is to establish 3DP as an allied subject and common platform to produce high-quality research and clinical therapies for unmet conditions in India as well as at the International level.

## R&D News

### Indian Railways extends MoU with IIT Kanpur



Indian Railways extended the Memorandum of Understanding with IIT Kanpur to

encourage state of the art collaborative research for modernization of Railway Infrastructure and efficient utilization of its scientific assets through the Centre for Railway Research (CRR) at IIT Kanpur.

### MoU with Dynamic Technologies Ltd.

IIT Kanpur signed an MoU with Dynamic Technologies Ltd. Dynamics will collaborate with IIT Kanpur for



joint indigenous development of innovative Unmanned Aerial Systems for wide range of applications for Indian Defence forces. The jointly developed products with superior indigenous technology would enable self-reliance at a reduced cost.

# Integrative Molecular Profiling of Prostate Cancer: Identification of Molecular Signature for Risk Stratification and Advanced-Stage Disease Management

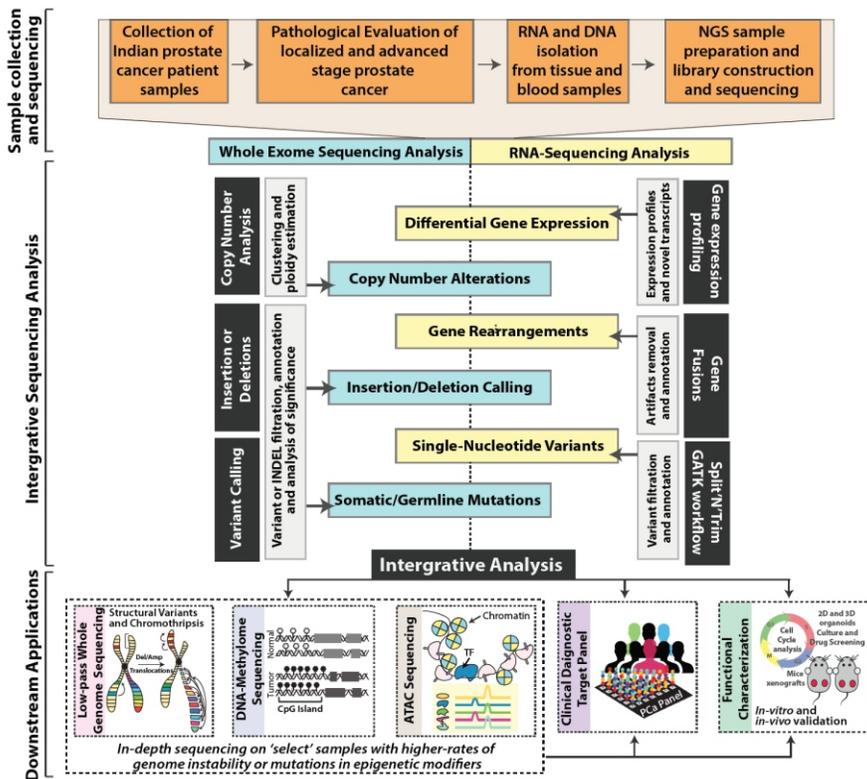
Sponsor: DBT/Wellcome Trust India Alliance

PI: Prof. Bushra Ateeq ([bushra@iitk.ac.in](mailto:bushra@iitk.ac.in))

Department of Biological Sciences & Bioengineering



Cancer is a genetic disease, triggered by abnormalities in the genes that control the normal functioning of the cells. Cancers of different tissue-types, and even different individuals with the similar-type of cancer, can differ greatly genetically. Therefore, cancer patients can have specific molecular “gene signature”, and hence on the basis of this information can be classified into different molecular subtypes. Integrative genomic profiling has revealed key-molecular drivers or gene signatures involved in prostate cancer. However, a comprehensive understanding of these genetic aberrations remains unknown for Indian patients.



This project aims to identify the **gene aberrations prevalent** in Indian prostate cancer patients, and explore their functional relevance in **disease advancement**, and **drug-resistance**. Using integrative genomics and functional-genomics approaches, the goal is to identify actionable driver alteration(s), which will provide a solid framework to introduce precision medicine for prostate cancer.

Overall findings from this project will further propel prostate cancer research into the genomic and precision medicine era and would foster development of invaluable tools to enable future therapeutic management.

*Pipeline for the integrative genome profiling and functional characterization of lead alterations prevalent in prostate cancer patients from India.*

**Collaborator:** Dr. Apul Goel, King George's Medical University, Lucknow, Dr. Kumar Prabhaskar, Tata Memorial Hospital, Mumbai, Dr. Deepak Dabkara, Tata Medical Centre, Kolkata, Dr. Hamim Zafar, IIT Kanpur, Dr. Nallasivam Palanisamy, Henry Ford Hospital and Health System, Detroit, USA, Dr. Himisha Beltran, Dana-Farber Cancer Institute, Boston, USA, Dr. Anita Grigoriadis, King's College London, London, UK

**Proposed Research facilities:** Targeted Next-generation Sequencing Facility; Preclinical Patients-Derived Xenograft Facility.

## Recent Projects

### Realizing Large-Scale And Fully Autonomous UAV Swarms

Sponsor: Science and Engineering Research Board

PI: Prof. Ketan Rajawat ([ketan@iitk.ac.in](mailto:ketan@iitk.ac.in))

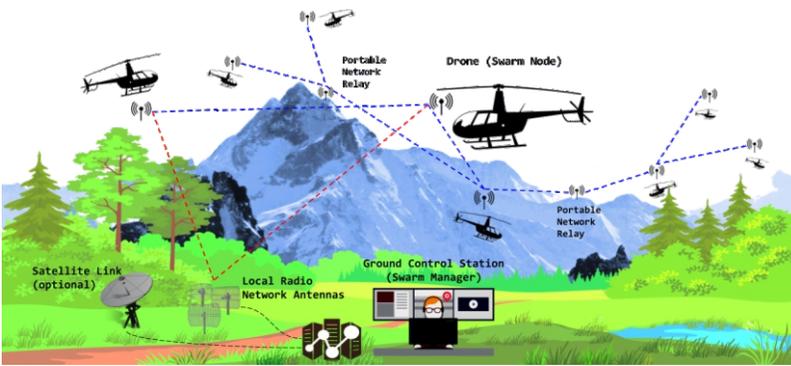
Department of Electrical Engineering

Co-PI: Prof. Abhishek ([abhish@iitk.ac.in](mailto:abhish@iitk.ac.in)), Prof. Mangal Kothari ([mangal@iitk.ac.in](mailto:mangal@iitk.ac.in))

Department of Aerospace Engineering



Rapid advances in low-power processors, miniaturized sensors, low-cost manufacturing systems, and artificial intelligence (AI) algorithms are transforming the Unmanned Aerial Vehicle (UAV) landscape worldwide. With the advent of low-cost UAVs, we are already witnessing early attempts at the development of fully autonomous swarms, where multiple UAVs collaborate and coordinate among themselves to autonomously map and navigate complex and uncertain environments, exhibiting emergent behavior.



Notwithstanding the promise of such large-scale swarm systems, several research problems remain to be completely addressed. These include need for a locally sourced platform, an end-to-end autopilot software, capability to deal with dynamic and uncertain environments, robust and persistent communications, and GPS-free operation. This project aims to resolve all of these issues simultaneously, culminating in the development of a truly autonomous and intelligent multi-UAV swarm with self-learning capabilities.

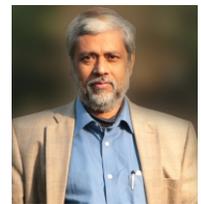
**Research facilities proposed:** Large-scale motion capture system to be installed in Helicopter building

### Design and Development of Autonomous Robot for Crop-Monitoring and Localised Pest Neutralisation

Sponsor: Department of Science and Technology

PI: Prof. Bishakh Bhattacharya ([bishakh@iitk.ac.in](mailto:bishakh@iitk.ac.in))

Department of Mechanical Engineering



Crop loss due to pest infestation is an inevitable phenomenon, and hence large amounts of pesticides are used on the farms to prevent the same. However, the losses incurred in the process are amplified as there is no technology currently available that ensures targeted delivery of the inhibitors, resulting in wasteful applications and increased health risk for the consumers.

The project aims to enhance agricultural productivity by developing a device that autonomously detects the infected areas plant and take preventive action by applying inhibitors to the target areas. A robot development is proposed to aid with the activities. Early detection and necessary action will boost productivity and increase crop yield. In a country like India where agriculture forms the backbone of the economy, implementation of such advanced technology is quintessential to sustain a healthy economic growth.



## Recent Project

# Design, Development, Testing and Evaluation of a Lean Premixed Swirl-Stabilized Gas Turbine Combustor for Stationary Power Generation using High-Hydrogen-Content Fuel



Sponsor: Department of Science & Technology

PI: Prof. Santanu De ([sde@iitk.ac.in](mailto:sde@iitk.ac.in))

Department of Mechanical Engineering

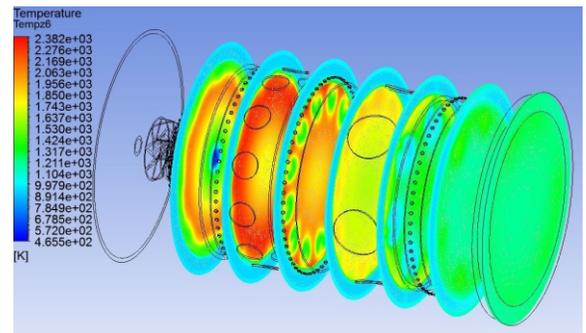
Co-PI: Prof. Ashoke De ([ashoke@iitk.ac.in](mailto:ashoke@iitk.ac.in))

Department of Aerospace Engineering

**Industry Partner:** TurboTech Precision Engineering Pvt. Ltd., Bangalore

**G**as turbines (GT) are expected to play a crucial role in the generation of clean, efficient, and fuel-flexible electricity. Stringent emission norms require modern gas turbines to operate with extremely low emission of NO<sub>x</sub> and other harmful pollutants.

In this project, an **indigenous lean premixed (LP) gas turbine combustor** will be designed and developed for stationary power generation based on high-hydrogen-content (HHC) fuels. Besides fuel-flexible operation, the LP combustor is expected to reduce NO<sub>x</sub> and other harmful contaminants. Initially, a lab-scale LP combustor will be designed and developed. Experiments will be conducted to study the lean blow-off limit and flashback phenomena under various operating conditions. Simultaneous measurement of the flow field and flame is expected to reveal highly complex and nonlinear interactions between turbulent flow and chemical kinetics in turbulent flows. In this project, simultaneous high-speed particle image velocimetry (PIV) and OH – planar laser-induced fluorescence (OH-PLIF) measurements will be performed on the model GT combustor to obtain physical insights on the influence of turbulence on local flame characteristics. Finally, based on the above studies, an LP combustor for 100 kWe MGT will be designed, developed, integrated, and tested with a 100 kWe MGT.



*Iso-contours of temperature from numerical simulation of gas turbine combustion*

## Inauguration of Thermal Energy Storage System

**A** thermal energy storage system of 775 turn/hour capacity has been installed in the Centre for Environmental Science and Engineering (CESE) building. IIT Kanpur is leading a joint Indo-US project, called UI-ASSIST on smart grid and storage technology, funded by the Department of Science and Technology (DST), through IUSSTF. The thermal energy storage system is part of its urban pilot plan. Director, Prof. Abhay Karandikar inaugurated the same on 5 November, 2020.





**F**IRST's consulting arm signed an MoU with Chhattisgarh State Minor Forest Produce (Trading and Development) Co-operative Federation Limited to assist CGMFPFED in meeting its strategic objectives. This partnership is built to maximize the value for each stakeholder, most importantly the Tribals and the SHGs.

## Success of Start-ups

**Offgrid Energy Labs** was selected among the top-10 entries at Falling Walls Venture 2020, a global competition for startups in Berlin. They were also featured by **YourStory** on October 09, 2020. They have been selected for Shell E4 Energy Challenge Cohort and participated in the demo day recently.

Another portfolio startup **Phool** received the funding of USD 1.4 Million from DRKFoundation and IAN Fund. Phool converts the floral waste into charcoal-free Luxury incense products.

On August 22, **Nocca Robotics** launched High-flow Nasal Oxygen and high-quality ICU-Ventilators in a digital event with the best intensivists of the country.

In the first cohort of IAIN IITK Agri Innovation Fellowship, the best three amongst 100 applicants were selected by an expert panel and the winners are getting INR 50,000 per month as fellowship support.

Under the **SPARSH fellowship program** supported by BIRAC, five fellows were selected. The fellows have been selected in the cohort to find and develop innovative solutions in the domain of Waste to Value and will get INR 50,000 per month for a period of 18 months.

A TechTalk on Cardiothoracic and Chronic Pain by Dr. Subin Sukesan. was organised on 28 August 2020. Under the TechTalk supported by Capri Global, upto INR 1.5 Lacs will be provided to the innovators for selected ideas.



## Fellowship



A digital webinar was organized by SIIC and Nichefin Consulting with industry leaders and experienced entrepreneurs from India and Singapore on September 15, 2020.



National Digital Hackathon supported by the TIDE 2.0 program of MeitY, Hack & Reboot, was organized by SIIC. From hundreds of the applications, the top 3 teams were selected

## Foundation Stone laid for Technopark@iitk New Building



The foundation stone of the new upcoming infrastructure of Technopark@iitk was laid on October 20, 2020. The upcoming Phase I infrastructure is a six-storied green building measuring 2.5 lakh sq. ft., designed carefully to accommodate big, medium and small companies with all state of the art facilities

## Geo Climate Risk Solutions sets up office in Technopark

GCRS specializes in the realm of environment risk evaluation and sustainability and focuses on providing geoinformatics based long term solutions for achieving Global Sustainable Development Goals. GAIL (India) is an investing partner in the company. GCRS has signed an MoU with the highly renowned National Water Company of Israel, Mekorot to work together in the water sector. The company's key clientele include The World Bank, UNDP, GIZ, The World Business Council for Sustainable Development, Oxfam India, Ministry of Jal Shakti, Ministry of Environment and Forest & Climate Change, Aditya Birla Group, Government of Meghalaya, IC Net (Japan) and LWR.

## Two Kanpur-based MSMEs join as Affiliate Members

Technopark@iitk has designed an **Affiliate Membership Model**. The main purpose of this model is to provide an opportunity to MSMEs to leverage IIT Kanpur's R&D strengths without taking any physical space in the research park. The primary goals of the Affiliate Membership Model are:

- to provide support to MSMEs for improving product quality.
- to assist them in skill and technology upgradation.

**TF Agro Technologies:** Having sustainability at its core, the newly started company focuses on innovative biotech processes, sustainable packaging and new age building material. It is coming up with one of the most technologically advanced climate-controlled farms in North India and will further expand into the region. The company has started engaging with our students under ReWoP.

**Jagran Micro Motors:** Jagmini is an Oeko-Tex certified, export-oriented company engaged in the manufacturing of high-quality Socks. The knitting company is a part of the Jagran group and is a leading hosiery manufacturer and exporter. It is engaging with us for product development and brand management.

### Address for Correspondence

Dean, Research & Development  
Indian Institute of Technology Kanpur  
Kanpur 208016  
dord@iitk.ac.in

### Feedback/Suggestions

dord@iitk.ac.in  
adrd@iitk.ac.in  
publications\_dord@iitk.ac.in

### Follow Us

<https://twitter.com/dordatiitkanpur>

<https://www.facebook.com/dordiitk/>

[https://www.youtube.com/channel/UCJMUFAcEXVdg-xRIWzqy-uA?view\\_as=subscriber](https://www.youtube.com/channel/UCJMUFAcEXVdg-xRIWzqy-uA?view_as=subscriber)

### R&D Profile at a glance

<http://www.iitk.ac.in/dord/data/R&D-profile-flyer-2019-16-08-19.pdf>