Department of Sustainable Energy Engineering
Indian Institute of Technology, Kanpur

# POST GRADUATE PROGRAM

## 2023-2024

Weblink: http://iitk.ac.in/see/pg-programme.php

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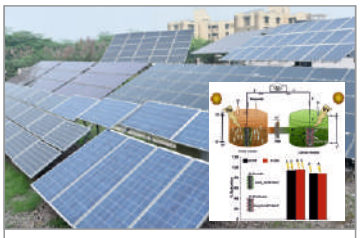
# ABOUT SUSTAINABLE ENERGY ENGINEERING

For societal development and for maintaining the quality of life of citizens of India as well as the rest of the world, energy sustainability is a vital concern. The energy needs of the society need to be met in such a manner that the energy production has a minimal environmental impact and a low carbon footprint. The indigenous development of novel alternative and renewable energy technologies necessitates the development of R&D infrastructure as well as highly qualified human resources through focused academic programs. The Department of Sustainable Energy Engineering or SEE *(www.iitk.ac.in/see)* addresses these challenges by imparting high-quality education and training to its students in various aspects of energy sustainability via vibrant postgraduate programs.

The research portfolio of the Department is envisioned into four broad verticals: **(i)** Energy Generation, **(ii)** Energy Storage, Distribution and Usage, **(iii)** Alternative Fuels, and **(iv)** Energy, Environment, & Policy which align well with the national and global domains in energy sustainability. The research areas in these verticals can be seen in the illustration shown below.

## ILLUSTRATION: RESEARCH VERTICALS OF THE DEPARTMENT AND THE TOPICS THEREIN

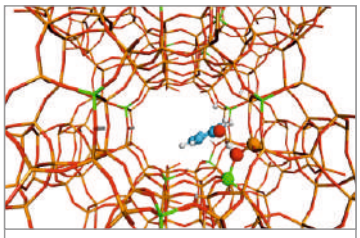


### Energy Generation

- Solar Energy
- Wind Energy
- Fuel Cells
- Hydro Energy
- Geothermal Energy
- Other new forms


### Energy Storage and distribution

- Batteries and Supercapacitors
- Electrical mobility
- Hydrogen storage
- Solar thermal
- Power distribution
- Smart grid



### Alternative Fuels

- Hydrogen
- Methanol and ethanol
- Bio-energy
- Waste-to-energy
- Clean fuels
- New Paradigms

### Energy, Environment and Policy

- Energy and water
- Carbon capture
- Energy policies and economics
- Energy conversation
- Smart buildings

The Department will place special emphasis on **(i)** solar energy conversion and storage via photovoltaics and thermal methods for energy generation, **(ii)** contemporary and novel battery, fuel-cell and supercapacitor materials, devices and architectures, prototypes and system development for electric vehicles, **(iii)** smart grid and power distribution, **(iv)** hydrogen as a clean fuel with emphasis on production and storage, **(v)** carbon capture and **(vi)** clean water. The faculty of the department have core strengths in science and engineering whose research domains are in various aspects of sustainable energy engineering. The aim of the academic programmes will be on developing engineers who will be able to connect the fundamental nuances of science and engineering of energy sustainability with energy systems development. The department also aims to embark on making meaningful international collaborations to benefit its students. In this direction, it already has strong linkages with Rice University in the form of Rice-IITK Collaborative Center (www.iitk.ac.in/rice-iitk/) at IITK. Such initiatives are expected to provide the students opportunities for international exposure and collaborations.

# POST-GRADUATE PROGRAMMES OFFERED

**M.Tech.** | **M.S. (by Research)** | **Ph.D.**

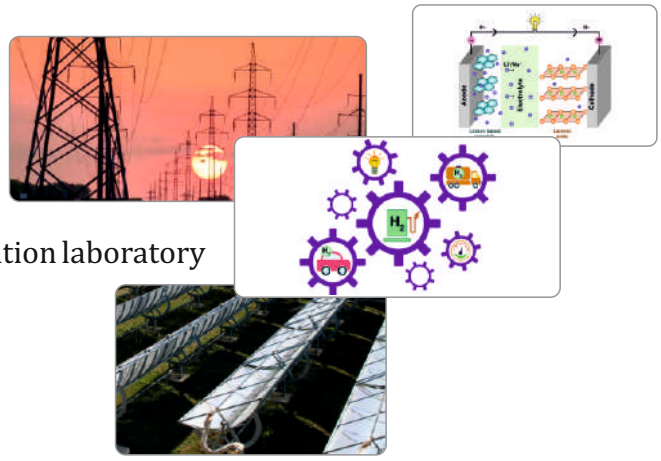
The detailed admission procedure along with the eligibility criteria can be found at:

(I) ***www.iitk.ac.in/doaa/admission-procedure***
(ii) ***https://iitk.ac.in/doaa/data/pgmanual-02Sep2015.pdf***

# LABS/FACILITIES

## TEACHING LABORATORY:

Sustainable Energy Technologies lab consisting of experiments related to student training on solar photovoltaics, solar thermal, storage, hydrogen and fuel cells, smart grid, wind energy, basic electronics, temperature and flow measurements, Materials synthesis and characterization



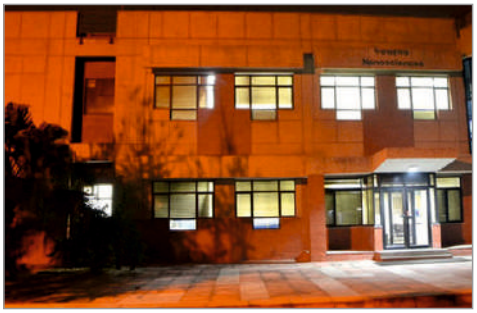
## KEY RESEARCH LABORATORIES:

- Solar photovoltaics fabrication laboratory
- Battery materials and cell development and characterization laboratory
- Hydrogen generation and storage laboratories
- Smart grid facilities
- Solar thermal storage

# INSTITUTE FACILITIES

**Advanced Center for Materials Science**

**Advanced Imaging Center**



**Nanoscience Center**

# FACULTY LIST AND EXPERTISE

**Prof. Aakash Chand Rai**
Expertise: Energy-efficient Buildings, Impact of Climate Change on Heating and Cooling of Buildings, Indoor Air Quality, Airborne Infection Transmission, and Air Pollution

**Prof. Abheejeet Mohapatra**
Expertise: Power system security, Uncertainty modelling

**Prof. Abhishek**
Expertise: Wind Energy, Rotary Wing Aeromechanics

**Prof. Amarendra Edpuganti**
Expertise: Power electronics applications in renewable energy, electric vehicles, and fuel cell vehicles

**Prof. Anand Singh**
Expertise: Energy materials development

**Prof. Ankush Sharma**
Expertise: Power Systems, Smart Grid Technology

**Prof. Anoop Singh**
Expertise: Energy economics

**Prof. Ashish Garg**
Expertise: Perovskite and organic solar cell materials and device development, Battery Materials

**Prof. Ashoke De**
Expertise: Energy Harvesting, Wind & Hydro Energy, Modelling

**Prof. Debopam Das**
Expertise: Wind energy

**Prof. Deepika Swami**
Expertise: Energy Policy and Climate Change

**Gururaj Mirle Vishwanath**
Renewable penetration challenges to the grid, Machine learning applications to power systems, Power Converters for EV and its interfacing challenges

**Prof. Goutam Deo**
Expertise: Catalysis, Carbon capture

**Prof. Himanshu Sharma**
Expertise: Carbon capture, alternative fuels

**Prof. Jayant K. Singh**
Expertise: Materials design, Computational Materials

**Prof. Jishnu Bhattacharya**
Expertise: Storage materials development, modelling

**Prof. Kanwar Singh Nalwa**
Expertise: Solar cells (Device physics, Materials, Characterization), Energy storage materials and devices (Na-ion and Liquid metal batteries)

**Prof. Lalit M. Pant**
Expertise: Electrochemical energy conversion and storage, numerical modelling, porous media transport

**Prof. Laltu Chandra**
Expertise: Heat Transfer and Fluid Flow, Computation and Experiment, Turbulent Flow Simulation and Modelling, Solar Thermal Sub-system Design, Nuclear Reactor Thermal Hydarulics

**Prof. Malay K. Das**
Expertise: CH4 Recovery from gas hydrate, CO2 sequestration, Electrochemical Energy Conversion and Storage

**Prof. Nishith Verma**
Expertise: Adsorption, Synthesis of nanomaterials including adsorbents and catalysts, Environmental Pollution Control (air/water purifications), Carbon-based Electrodes

**Prof. Parthasarathi Sensarma**
Expertise: Power Electronics for Renewable Generation

**Prof.  Prabodh Bajpai**
Expertise: Power Electronics for Renewable Generation

**Prof. Pradip Swarnakar**
Expertise: Environmental Sociology, Climate Change Policy

**Prof. Raja Angamuthu**
Expertise: Storage materials development

**Prof. Rajeev Jindal**
Expertise: Energy Technology and Policy, Carbon Neutrality, c-Si Solar Cells and Metal-ion Batteries

**Prof. Raju Kumar Gupta**
Expertise: Storage materials and devices, Solar energy materials and devices, Water Remediation, Hydrogen production, Carbon Capture and Conversion

**Prof. Sachhida Nand Tripathi**
Expertise: Climate Issues, Climate Modelling, Environment, Air Pollution

**Prof. Saikat Chakrabarti**
Expertise: Smart grid, Microgrid, Power system dynamics and stability

**Prof. Sameer Khandekar**
Expertise: Phase-change heat transfer, Heat pipes, Electronics thermal management, energy systems

**Prof. Shobhit Omar**
Expertise: Storage and fuel-cells materials and devices development

**Prof. Sudarshan Narayanan**
Solid state batteries (solid electrolytes, anode materials), thin films for energy conversion (transparent conductors, low-emissivity coatings)

**Prof. Suvendu Samanta**
Expertise: Power Electronics, Electric Vehicles, Wireless Power Transfer, Resonant Converters with WBG Devices

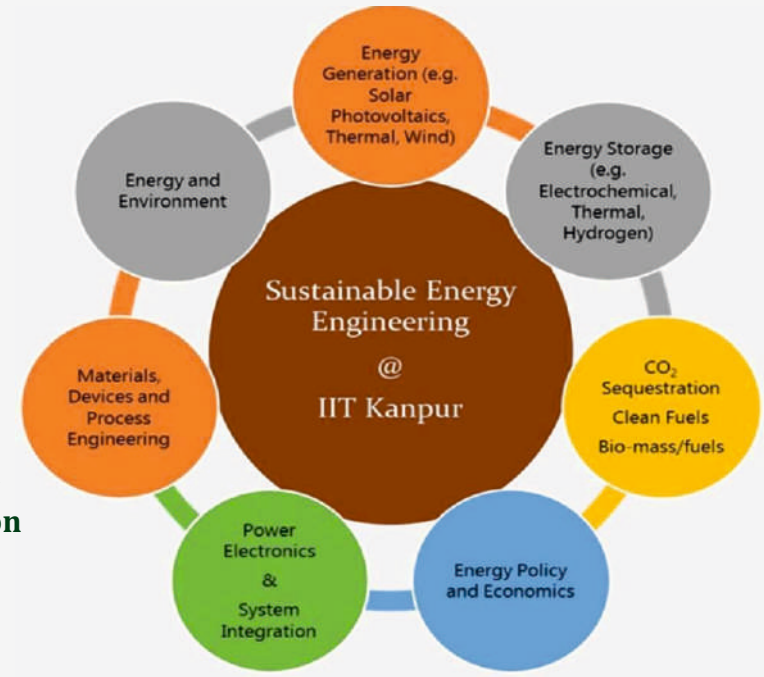
**Prof. Swathi Battula**
Expertise: Electricity Markets, Modelling and Design of Electrical Energy Systems, Transactive Energy System Design, Integrated Transmission and Distribution Systems

**Prof. Vaibhav Arghode**
Expertise: Solar Thermal Energy

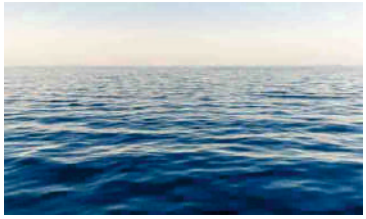
**Prof. Vishal Agarwal**
Expertise: Computational Catalysis, Biofuels and CO2 conversion

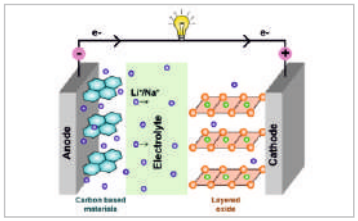
# BROAD RESEARCH AREAS OF THE DEPARTMENT

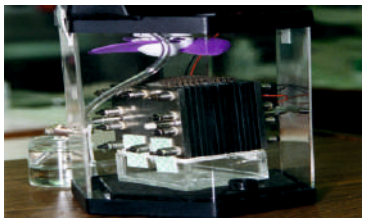

- Solar Photovoltaics
- Solar Thermal
- Wind Energy
- Batteries and Supercapacitors
- Fuel Cells
- Electric Vehicles
- Hydrogen and alternative fuels
- Carbon Capture and Utilization
- Water
- Smart Grid and Renewables Integration
- Energy Economics, Policy and Regulation
- Building design
- Energy Efficiency
- NetZero and Carbon Neutrality













# DEPARTMENT OF SUSTAINABLE ENERGY ENGINEERING

## Indian Institute of Technology, Kanpur

## CONTACT

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