AARDO-IIT KGP SCHOLARSHIP PROGRAMME

GENERAL ADMISSION GUIDELINES OF

THE MASTER OF SCIENCE (MS) BY RESEARCH PROGRAMME

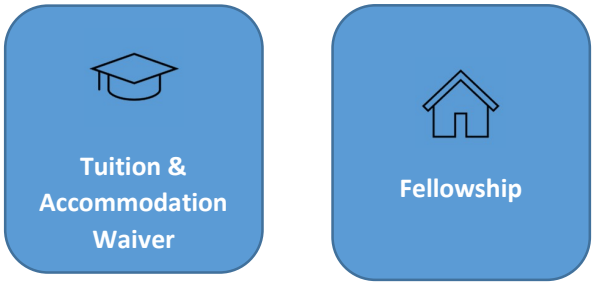
AFRICAN-ASIAN RURAL DEVELOPMENT ORGANIZATION (AARDO)

INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR (IITKGP)

IITKGP and AARDO Scholarships

The Indian Institute of Technology Kharagpur (IITKGP) and the African-Asian Rural Development Organization (AARDO) are pleased to invite applications through the IITKGP and AARDO scholarships to the Master of Science by Research (MS) Programme offered by IITKGP. This programme is offered by the Department of Agricultural and Food Engineering along with the Center for Rural Development and Innovation Sustainable Technology. This course will exclusively be focused on the On- and Off-Farm related technologies that will not only reduce the drudgery of rural communities in the Global South but also help them in attaining self-sustainability.

Scholarship Benefits



Scholarship Eligibility:

*Citizens of an AARDO member country.
*Only applicants living and working in AARDO countries are eligible
*Applicants should be enrolled in the programme full time
*All applications will be screened and evaluated by a selection committee

INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR

Kharagpur- 721 302, India

A General Guide to Admission for July 2025

The Master of Science (MS)
By Research Programme

Academic Information

Programme: The Master of Science by Research (MS)

Duration: 2 years (with the possibility of a 6-month extension)

The medium of instruction & communication: English (Eg. Classes, Reports, Thesis, Seminar Presentation etc.)

Academic Calendar at IIT Kharagpur*:

Joining Semester		**Autumn Semester**
Term		2nd week of July to 3rd week of December (1st and 3rd Sem) 1st week of January to 2nd week of July (2nd and 4th Sem)
Classes		As per the academic calendar
Orientation		3rd week of July
Exams		4th week of November and 4th week of April (as per the academic calendar)

*This timeline is indicative. Dates may vary.

Eligibility:

Minimum qualifications:

Bachelor's degree in Engineering/Technology from a recognized Institute or University for a **minimum of four years duration with at least 60% marks or a CGPA 6.5 (in 10 point scale)**

or

M.Sc. Degree in appropriate Sciences or a relevant discipline from a recognized Institute or University for **a minimum 3 + 2 years duration with at least 60% marks or a CGPA 6.5 (in 10 point scale) in Science subjects or**

55% marks or CGPA 6.0 (in the 10 point scale) in the case of Humanities/Social Science subjects.

Normally the **maximum age of the candidate shall be below 35 years on 1st January of the year in which the admission is applied for.** However, the age limit can be relaxed to 45 years for candidates who have extensive experience in the field.

Please note:

- Foreign students are expected to have a working knowledge of English.
- If the medium of instruction for their qualifying degree was not English, applicants must produce proof of proficiency in English - IELTS with a minimum score of 6.5 (overall) or a TOEFL score of 80 (overall). Test results should be dated no earlier than 3 years before the date of application.
- Foreign nationals can only register as full-time scholars.
- All the applicants should have a good academic record.
- The Selection Committees may set higher evaluation criteria than the minimum eligibility criteria listed.
- The selection, admission, and award of the MS degree shall be governed by the ordinances of the senate of IITKGP.
- The final degree certificate shall be given in the immediate next convocation to the graduating year after the defense seminar is done and final thesis is submitted.

Programme Requirements:

Requirements	Expected time frame
Course work	Within two semesters
Comprehensive Viva-Voce	Immediately after all courses are done, typically in 2nd semester
Research progress seminar 1	In 2nd Semester
Research progress seminar 2	In 3rd Semester
Synopsis	Within 2 years*
Thesis submission	Within one month after acceptance of Synopsis
MS viva voce examination, if recommended by the reviewer(s)	

*Can be extended in certain cases subject to approval

A General Test Committee constituted to assess the scholar's progress will prescribe the required courses.

The thesis will go for external review to maintain the quality of the thesis, which may take upto 6 months of time after the Synopsis Seminar. However, the final defense (or MS Viva-Voce) seminar can be given online with the recommendation of the General Test Committee and the student can go back to their home country after submission of their Thesis and Synopsis Seminar.

Application Guidelines

Applications are invited through the IITKGP and AARDO Scholarships. All candidates seeking admission to the program must submit their application in a prescribed form along with attested copies of relevant testimonials and prescribed fees by such date as may be notified by the Institute.

Selected candidates shall be enrolled for the program only after they have been found medically fit by the SMO of the B.C. Roy Technology Hospital.

Scanned Documents required with the online application

1. Educational Qualifications – All Degree Certificates and Mark sheets
2. Proof of Nationality - Passport
3. Curriculum Vitae
4. Statement of Purpose (800-1000 words)
5. Two Letters of Reference
6. If employed, a Relieving Certificate from your employer
7. Proof of Language Proficiency
8. Photo (Passport size)
9. Endorsement from AARDO

Please note:

- Incomplete applications or those submitted after the deadline will not be accepted.
- Documents submitted in a foreign language should be accompanied by a full English language translation. The translation should be certified by the translator and bear their certification credentials
- If you have a long-term health condition, disability, specific learning difficulty or mental health condition we encourage you to disclose this in your application with any relevant information.

Scholarship Details

Students selected to the IITKGP and AARDO Scholarship will be offered the following

1. International Student Tuition Fee Waiver
2. One-time admission charges and hostel charges (Excluding mess food charges)
3. Monthly Living Allowance equivalent to the MS (by research) stipend given to domestic students*

*For 2 years from the start of the program or till the submission of the thesis, whichever is earlier, subject to terms and conditions.

Please refer to the Research Admission Brochure for details of the stipend paid to domestic students currently.

Links for further information:

IITKGP Website: https://www.IITKGP.ac.in/

Office of International Relations, IITKGP website:
https://international.iitkgp.ac.in/howtoapply/

Department of Agricultural and Food Engineering:
http://www.iitkgp.ac.in/department/AG

Center for Rural Development and Innovative Sustainable Technology:
http://www.iitkgp.ac.in/department/RD

MS Rules: Please refer Annexure 2

Contacts:

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Annexure 1

About AARDO

The AFRICAN-ASIAN RURAL DEVELOPMENT ORGANIZATION (hereinafter referred to as "AARDO"), a rural centric inter-governmental autonomous organization located at 2, State Guest Houses Complex, Chanakyapuri, New Delhi 110 021, India and represented by the Secretary General, AARDO and shall include its lawful representatives and permitted assignees.

African Asian Rural Development Organization, New Delhi is mandated to develop understanding among members for better appreciation of each other's problems and to collectively explore, opportunities for coordination of efforts for the welfare and eradication of thirst, hunger, illiteracy, disease and poverty amongst rural people in the African-Asian region. The Organization comprises thirty five (35) members, which include thirty one (32) countries namely, Burkina Faso, Egypt, Eswatini, Ethiopia, Gambia, Ghana, Kenya, Liberia, Libya, Malawi, Mauritius, Morocco, Namibia, Nigeria, Sierra Leone, Sudan, Tunisia and Zambia from Africa, and Bangladesh, R.O. China (Taiwan), India, Iraq, Jordan, R.O. Korea, Lebanon, Malaysia, Oman, Palestine, Pakistan, Sri Lanka, Syria and Yemen from Asia, as the full members, and Korea Rural Community Corporation (KRC), R.O. Korea, The Agricultural Bank of Sudan (ABS), Sudan and Ekiti Chambers Of Commerce, Industry, Mines And Agriculture (EKICCIMA), Ekiti State, Nigeria as Associate Members.

AARDO is devoted to developing understanding among members for better appreciation of others' problems and to explore collectively, opportunities for coordination and efforts for promoting welfare and eradication of thirst, hunger, illiteracy, disease and poverty among rural people.

About the Agricultural and Food Engineering Department & Centre for Rural Development and Innovative Sustainable Technology

The Agricultural and Food Engineering (AgFE) Department was established in 1952, as the Agricultural Engineering Department on the recommendation of the Dhar Committee appointed by the Board of Governors, IIT Kharagpur in 1950. Subsequently, on the up-gradation of its academic programme, the department was renamed as the Agricultural and Food Engineering Department in 1994. It has been regularly working on creating technology-based solutions for sustainable development.

Among the 23 IITs, IIT Kharagpur has the sole distinction of having an Agricultural and Food Engineering Department and Centre for Rural Development, Innovation and Sustainable Technologies (CRDIST). CRDIST was established in 1975 with the aim of becoming an

outreach center of IIT Kharagpur to address challenges confronted by rural communities and to improve their quality of life. The center has made significant achievements in Intensive Crop Farming, Forestry, Horticulture, NTFP-based crafts, Women and Child Welfare programmes etc. Ever since its establishment, the AgFE department has pioneered Agricultural Engineering education and research in the country. Keeping pace with the technological and agricultural developments, the department has continuously upgraded its academic programs. Today it offers a 4-year B. Tech. (Hons) course in Agricultural and Food Engineering, six Joint M.Tech. - Ph.D. programmes in different specializations of agricultural engineering and sciences, and 5-year integrated M. Tech. programmes in all four engineering specializations. Also, the department offers M.S. (by research) and Ph. D. programmes in all areas of specialization.

AgFE is the largest department of IIT Kharagpur. Over the last seven decades, the department has grown its expertise and competence and produced pioneer research, development and education in the field of agricultural engineering in India. The Department has several state-of-the-art laboratories, field research facilities and an adopted village for transferring the developed technologies. The Department is adequately experienced in creation and dissemination of appropriate rural technologies through its recent flagship initiatives. Rural Technology Action Group (RuTAG) and Design and Innovation Centre (DIC) are such platforms that have successfully translated research ideas into meaningful prototypes that address agricultural and rural issues.

The AgFE Department and CRDIST have been developing technologies and facilities that are directly or indirectly helping the local rural community. These technologies are demonstrated and transferred among the interested rural community.

Aiming in establishing a linkage among academia, agricultural industries and its alumni, the department is bringing out a quarterly newsletter, *Ankur,* which is expected to provide a platform for highlighting the research and development activities of this department. Agricultural Engineering Society (AES) of this department looks after the social and extracurricular activities of its students. The department continues to attract a large number of sponsored and consultancy projects from a number of government agencies, international foundations and industries that deal with Integrated Rainwater Management, Soil Tillage, Ergonomic Database for Agricultural Equipment, Solar Energy Operated Agri-machinery, Integrating Remote Sensing Data with Distributed Hydrological Models, Climate Change Adaptations, Tea Production and Processing, Digital Soil Mapping, Model Pilot Plant for Producing Industrial Enzymes etc. The department has filed several patent applications based on its developmental work.

International research collaborations have been established with UC Davis, Texas A&M University, Texas Tech University, Louisiana State University, Potsdam University, Leibniz University, TU Dresden, TU Stuttgart, TU Braunschweig and Yamaguchi University in recent years. In this century, the department aims at meeting the challenges of production and processing of food by strengthening its teaching and research programmes with the additional inputs of automation, information technology, agricultural biotechnology and environmental technology. Undoubtedly, the Agricultural and Food Engineering Department has played the

most significant role in contributing to the human resources development in the agricultural and food engineering sector in India.

Research and Teaching

In sustaining the high-profile academic programme, the department has developed and modernized its laboratories to encourage frontline research in Farm Machinery and Power, Land & Water Resources Engineering, Food Process Engineering, Aquacultural Engineering, Agricultural Biotechnology, Agronomy and Soil Science. In addition to these specialized laboratories, the department has developed computational facilities in a well-equipped Computer simulation and design laboratory, field testing facilities in a 100-acre experimental farm and a modern library to assist the research and development activities of all the disciplines. The teaching and research strength of the six different specializations are as follows.

Farm Machinery and Power: The discipline aims at developing and disseminating engineering knowledge and skills for the mechanization of agricultural operations with precision technology. It mainly focuses on the application of Artificial intelligence (AI)-Machine learning (ML) techniques in agricultural mechanization; use of drones, robots and unmanned ground vehicles with variable rate technology for precision input management; renewable energy resources for farm power generation; computer aided design and 3D printing technology; and gender friendly small farm tools design using Ergonomics. The discipline supports its stakeholders, such as Tractor Industries, Tyre Industries, Farm Machine Manufacturers and Public Research Centers through the research-consultancy interactions and the student-industrial project internships. The students of this discipline are given in-hand training along with the classroom teaching on tractor systems design, farm machinery design and testing, soil dynamics in tillage and traction, instrumentation and renewable energy systems, computer aided design and simulation, and AI applications in Agriculture.

This discipline has developed Instrumentation, Tractor and Power Systems, Ergonomics, Renewable Energy, Farm Machinery, Tractor Testing, and Tractor ROPS Testing laboratories. These laboratories are housed with up-to-date technology including the Instrumented Tractors, Instrumented Tyre Testing facility, Instrumented Agri-Implement Testing facility, Farm Machinery Testing centre, 3D Printing facility, and Prototyping and Testing Workshop. The laboratories are also equipped with various power range engine test-rigs with dynamometers having sensor based data acquisition, tractor systems cut-models, farm implement and machine models, fuel property testing instruments, exhaust gas analyzer, 3-Point hitch dynamometers, fuel flow measuring instruments, oxygen consumption rate monitoring meters, digitizers, sound and vibration measuring instruments, and force and torque sensors for hand and foot operated machines, and operator work place simulator. These laboratories also include in-house developed lab equipment and instruments such as Rear axle torque sensor, Wheel slip sensor, PTO speed and torque sensor, ROPS Strength Test Rig, Hydrostatic continuously variable transmission system, seed flow and warning system for tractor drawn seed drill, and Digitizer.

Thrust research areas:

- AI-ML enabled Precision Applicators for Fertilizer, Pesticide and Insecticide
- Computer Aided Design and 3D printed agri-machines

- Application of Drones, Robots, UGVs in agriculture
- Solar energy operated agri-machines
- Energy efficient tillage machinery
- Biofuels for power generation
- IoT based smart agri-machines

Research outcomes:

- Tractor operated micro-controller based variable rate fertilizer applicator
- Sensor based ultra-sonic pesticide sprayer for orchard crops
- On-the-go position sensing and controller predicted contact-type weed eradicator
- Combined (active-passive and passive-passive) tillage implements
- Hydrostatic continuous variable rate power transmission system
- Embedded system for indicating seed flow and choking in seed delivery tubes of tractor drawn seed drill
- Machine-vision based portable seed flow rate measurement system
- Automatic tractor slip-draft embedded system
- Automatic sugarcane bud cutting-cum-bud planting machine
- Solar energy operated paddy weeder, paddy thresher and boom sprayer
- E-reaper for harvesting paddy
- Biodiesel production

Land and Water Resources Engineering: The discipline emphasizes on the interaction of land and water systems along with changing climate conditions in agricultural production and imparts knowledge and skills necessary for the proper development and management of land and water resources for agriculture. Students are trained in the fundamentals of surface and subsurface hydrology in general with a focus on sustainable land and water resources planning and management, on-farm water management, understanding of extreme weather and climate events, and future climate projections. In-depth knowledge of modern tools and techniques such as simulation and optimization modeling, remote sensing (RS), geographic information system (GIS) and emerging soft-computing techniques, together with their application to land and water resources (both quantity and quality) management is provided.

This discipline has developed several laboratories including GIS and RS, Water quality, Surface and ground water hydrology, Hydro-climatological extreme events, Irrigation and drainage, Soil and water conservation, Non-point source pollution, and Field water management. These laboratories are equipped with High-performance computing facilities, unmanned aerial vehicle (UAV) with thermal and multi-spectral cameras, UV-spectrophotometers, Micro-irrigation equipment test set-up, Pump testing rig, Overland flow hydraulic flume, Particle size analyzer, N-P-K analyzer as well as with various software: Pix4D, ERDAS Imagine 2015, MIKE 11, ArcGIS 10.5.1, Rockworks17, LogPlot, Visual MODFLOW Flex4.2, MATLAB, FEFLOW, AquiferTest, HydroGeoAnalyst, River ware, etc.

Thrust research areas:

- Hydrological Modelling and Watershed Management
- Precision Agriculture

- Climate Change Impact Assessment on Surface and Groundwater Hydrology
- Hydro-climatology and Extreme Weather and Climate Events (Floods, Droughts, Compound Extremes)
- Simulation-Optimization Modeling at a basin scale, Groundwater Pollution Risk Assessment, Sea-Water Intrusion in Coastal Aquifer
- AI/ML Applications in Extreme Events (Floods) Monitoring, Sub-Surface Hydrology
- Crop Modelling and Simulation
- Diffuse Agricultural Pollution, On farm Water Management
- Land-Atmosphere Interactions, Atmospheric Moisture Transport during Monsoon
- Application of Remote Sensing and GIS in Natural Resources Management
- Complex Networks Application to Food-Energy-Water Nexus

Research outcomes:

- Wireless Sensor Networks for irrigation water management
- Satellite based Hydrological Model
- Efficient drainage system for IIT Kharagpur
- Image-based analytics for crop condition monitoring using UAV
- Improving crop productivity using precision irrigation & nutrients under open field and protected cultivation structures
- Scientific Framework for sustainable groundwater management at a basin scale
- Cost-effective techniques and improved management strategies for water conservation, groundwater augmentation and protection, and sustainable management of water and land resources in selected river basins.
- Quantification of human intervention and climate change on natural flow regime

Food Process Engineering: The discipline aimed to disseminate knowledge and technical knowhow to agricultural/mechanical/chemical/biochemical/food engineers for the applications of food process engineering principles and practices in industrial production of high value dairy and food products. To meet the technological demand of dairy and food processing industries, the students are trained in the fundamental of food chemistry and microbiology, dairy and food products and their process technologies, advanced thermal and mechanical operations in food engineering, fats, oils and essential oil technology, refrigeration systems, instrumentation and process control, novel and non-thermal food processing technologies, packaging and quality assurance besides food laws and standards. The students are also trained in mathematical modeling and simulation of various food processing operations for their optimized design.

The core research laboratories of the discipline are Physical and thermal properties, Drying, Grain testing and grading, Dairy engineering, Product development, Food engineering, Grain processing unit, Food science & technology, and Food packaging. These laboratories are equipped with Differential scanning calorimetry, Electronic-nose system, FTNIR system, HPLC system, Thermo gravimetric analyzer, Zetasizer, Rheotron, GC system, Instron universal testing machine, AAS, Microprocessor based single screw extruder, Twin screw lab compounder, CA storage system, Super critical fluid extraction system, Colorimeter, Texture analyzer, Micropulverizer, Brabender wheat mill, Vacuum frying system, Karl Fisher titrator, Freeze dryer, Microwave connective dryer, Spray dryer, Plate freezer, High pressure dairy homogenizer, Retort system for ready to eat foods, Lab model microwave vacuum dryer,

Laboratory evaporator, etc. The discipline has also acquired a state-of-the art High pressure food processing system, Pilot scale extrusion system, Cold Plasma system, Pilot scale RTE food plant, and Prototype Satake rice mill. The discipline has developed recirculatory tray dryer, vacuum dryer, solar dryer, single screw extruder, rising film and scrapped surface evaporator, UHT milk sterilizer, aseptic packaging machine, aloe vera gel filleting machine, continuous chhana, paneer and sandesh making machines, low cost grain storage modules, energy efficient baking ovens, and essential oil extractor.

Thrust research areas:

- Mechanized food processing
- High pressure processing
- Microwave & RF processing
- Mechanization of millets processing and value addition
- Cryogenic grinding of spices
- Nonthermal surface sanitization of foods
- Solar drying
- Functional foods, nutraceuticals and RTE health foods
- Extrusion processing
- Extraction and encapsulation of Bioactives from plant sources
- Modified atmosphere packaging and Intelligent/Smart packaging
- Biodegradable packaging films
- Algal Food Biotechnology
- Microbial food safety
- 3D printing of food
- AI and ML in food processing

Research outcomes:

- Mechanized production of Indian milk sweets
- Ready-to-eat Therapeutic Food for SAM children
- Improved quality fruit pulps and beverages using non-thermal protocols
- Air-recirculatory tray dryer for fruits and vegetables
- RF dryer for tea
- Solar dryer
- Aloe vera gel filleting machine
- Healthy fruit bars
- Iron fortified rice and other fortified food products
- Modified atmospheric packaging for perishable foods
- Bioactive film for food packaging
- Detection of adulteration in milk using FTNIR spectroscopy
- Low cost food processing machineries for rural people
- Essential oil extractor
- Betel leaf based novel food products
- Technology for preservation of fresh betel leaf

Agricultural Biotechnology: The agricultural biotechnology is one of the important disciplines of this department where the basic scientific inputs needed for variety development,

stress resistant varieties, genetically modified cereals and crops, tissue culture, crop breeding, and their metabolomics, genomics and proteomics studies are the major contributions of this discipline to the scientific community. Although this discipline has been originated from applied botany, but with the challenging need of present era has directed the scientists to go for the applied research under the major domain of biotechnology. The programme is primarily oriented to create specialized human resources that would meet the challenges and promises of agri and food based technologies. The core subjects have focused on crop improvements using breeding and recombinant-DNA based technologies. Emphasis has also been given on the separation technologies for plant-based products. The electives that complement the core subjects are modern genetics, advanced plant physiology, pharmacognosy and metabolic engineering, genetic engineering and crop breeding, rDNA technology, waste to wealth, characterization and analysis of biomass and biofuel, environmental biotechnology, protein engineering, seed technology, food biotechnology, statistical techniques and computer programming.

The discipline has developed research laboratories on Microbial biotechnology, Tissue culture and cryo-biology, Algal biotechnology, and Natural product biotechnology. These laboratories are equipped with laminar flow cabinets, plant and algal culture facilities, growth chambers, BOD incubators, Koji room facility, fluorescent, phase contrast light and stereo microscopes with digital photographic facilities, GCMS, LCMS, protein sequencer, FTIR, atomic absorption spectroscopy, bomb calorimeter, fluorescent spectrophotometer, anaerobic chamber, lyophilizer, HPLC, muffle furnance, sonicator, homogenizer, refrigerated centrifuges, cryo-med with planer, vacuum rotary evaporators, VA tracer analyzer, freeze dryers, deep freezers, UV-Vis spectrophotometers, deionized water purification facilities, electrophoresis units, rotary shakers, gradient thermocyclers, gel documentation unit, transilluminator, vacuum rotary concentrator, high performance liquid chromatograph and gas chromatograph-mass spectrometer, temperature-controlled green house, experimental garden for aromatic plants and raceway pond for algal cultures.

Thrust research areas:

- Enzymology and enzyme technology
- Protein and Food biotechnology
- Oleogenious (phyco-myco) biofuel production through biorefinery process
- 1G, 2G and 3G bioethanol production through circular economy
- Microalgal biofuels & algal refinery
- Biodegradable films from cyanobacteria
- Plant volatiles biosynthesis and emission
- Abiotic stress signaling and promoter characterization
- Varietal development through molecular marker
- Variety development of Assam lemons

Research outcomes:

- Technology on different industrial enzymes namely, amylopullulanase, amylase, amyloglucosidase, cellulase, protease, laccase, lipase, xylanase, polygalacturanase, tannase to name a few.
- Technology on 2G ethanol
- Technology on starchy agro residues to lactic acids and PLA
- Technology on microbial cellulose production
- Waste utilization for the production of bioplastic and biodiesel from microalgae
- Scent volatiles emission in evening-blooming flowers
- Impact of light emitting diode on leafy vegetables and medicinal plants

Aquacultural Engineering: This discipline has been started in 1984 with the objective of augmenting engineering inputs in the field of fisheries and aquaculture in the country as a result of the recommendation of the Planning Commission. The course includes the subjects i.e. Open channel hydraulics and coastal engineering, Fishery biology and fish culture techniques, Principles of fishing technology, Water quality management practices, Planning and design of aquacultural projects, Design of aquacultural facilities and equipment, Advanced aquaculture technology and processing, and Preservation of aquacultural products.

The discipline has developed laboratories in Aquacultural engineering, Aqua processing, Fish culture and fish biology, Water quality management, and Advanced aqua-farming practices. These laboratories are equipped with Aerator testing facility, Recirculatory Aquaculture System, Power measurement panel, Variable speed drive system with Thyrister controlled unit, UV Spectro photometer, Kjeldhal nitrogen analyzer, Multi parameter water quality monitoring system, Single screw extruder, Twin Screw Extruder etc.

Thrust research areas:

- Development of recirculatory aquaculture and Biofloc systems
- Development of ready to eat snacks and foods from aquacultural products
- Design, development and testing of different aeration systems
- Aqua- feed development using alternative sources of proteins
- Mechanized systems for aquaculture and processing operations
- Modular-based aquacultural farming practices as sustainable eco-friendly approach
- Advanced smart aquaponics systems
- Seaweed farming and by-product recovery
- Freshwater pearl culture

Research outcomes:

- Aqua wastewater treatment systems using different techniques
- Circular stepped cascade- pump (CSCP) aeration system
- Single screw extruder for fish feed pellets
- Fish filleting system for Rohu
- Mechanized deboning system
- Recirculatory aquaculture system
- Biofloc system
- Smart Aquaponics

Agricultural Systems and Management: This discipline aims at providing a holistic approach for planning, development and management of agricultural production systems. This interdisciplinary academic programme integrates the principles and practices of Agronomy, Soil Science, Agricultural Engineering, Management, and Biological Science. Its research programmes focus on improving agricultural production systems in the perspective of increasing demand for quality produce under limiting resources and degrading environment. It provides fuller understanding of the agricultural system at all phases of its development from planning to execution, management, evaluation, improvement and design of newer system and also helps to identify resource constraints for the optimization of production attuned to the needs of agro-based industries and market. Students from this discipline are trained to solve on-field problems through deeper understanding and technical knowledge on crop and soil system, agricultural systems modeling, precision input management, information technology, cash flow analysis, agricultural finance and marketing.

Core research facilities of the discipline include Agronomy, Soil Physics and Plant Nutrition Laboratories and on-farm experimental facilities with state-of-the-art measurement systems including N analyzers, GC, AAS, EDXRF, p-XRF, CHNS analyzer, pressure-plate apparatus, permeameters, soil moisture sensors, spectroradiometers, and Open Top Chambers for climate change adaptation research. The discipline has contributed to training human resources and developing climate-resilient agricultural production system through crop simulation modeling using DSSAT; water and nutrient management practices through fate and transport modeling; rapid soil and crop sensing approaches through reflectance spectroscopy, X-Ray fluorescence spectrometry, hyperspectral remote sensing, smartphone and AI-ML, and digital soil mapping. The discipline also promotes production and processing of special crops including tea, betel leaf, medicinal and& aromatic plants, etc.

Thrust research areas:

- Crop, water and nutrient uptake modeling & simulation
- Organic farming and sustainable agricultural production
- Soil and soil process assessment
- Hyperspectral soil characterization
- Affordable and portable soil sensor development and smartphone-based soil characterization via AI-ML
- Digital soil mapping
- Climate change adaptations & mitigations
- Water and solute transport
- Tea and betel leaf production & processing
- Economics of agro-production & processing, agricultural cash flow and marketing management

Research outcomes:

- Developed enriched vermicompost production technology and established organic input management for improvement of crop yield and quality in the food chain.
- Crop simulation models are parameterized for yield forecasting, which supported weather-based agro-advisory for farmers for planning agricultural operations as climatic risk management.

- Optimum weather variables for improving hybrid rice production system in subtropical India has been quantified.
- Drip irrigation with SPAD-based precision nitrogen management has been developed for rice and potato crops.
- Diffuse Reflectance Spectroscopy was used to predict soil physical, chemical, and biological properties.
- p-XRF was used to rapidly predict elements in soil, crop, and water.
- Smartphone and AI-ML were used to cost-effectively predict soil texture and soil organic carbon.
- A portable acoustic sensor was developed and validated for in-situ soil moisture prediction.
- Digital soil map of India has been produced using internationally accepted norms.

Center for Rural Development and Innovative Sustainable Technology was established in 1975 with the aim of becoming an outreach center of IIT Kharagpur to address challenges confronted by rural communities and to improve their quality of life. The center has made significant achievements in Intensive Crop Farming, Forestry, Horticulture, NTFP-based crafts, Women and Child Welfare programmes etc. The Centre has 06 eminent faculty members, who are highly committed towards holistic rural development. The infrastructure includes Chemical & Bio-chemical Laboratory, Repair & Fabrication Shop, Experimental Farm & Medicinal Plant Nursery, Field Station & Crafts Training Centres at Kharikamathani and Khariduara Mushroom Shed & Apiary Unit. The sponsored projects undertaken by the centre include Unnat Bharat Abhiyan, Participatory Forest Management Project, Tribal Development Project, Integrated Rural Energy Planning, Agro-Climatic Regional Planning, Lignocellulosics based liquid and gaseous biofuels (bioethanol, biobutanol, biomethane, biodiesel) and by-product utilization leading to zero-wastes process/product development.

Academics & Research at IITKGP

IITKGP is internationally renowned for the quality and diversity of its academic and research activities in various fields of science, technology, humanities, social sciences, management, law, agricultural and food engineering, rural technology, Indian knowledge system and academy of folk and arts. These are nurtured through various programmes run by each department and through sponsored programmes funded by national organizations and the industry. The Institute offers undergraduate and post-graduate programmes in a variety of specializations which are structured to develop the highest quality of scientific and engineering talent pool and cater to the needs of industry and R&D organizations.

At IIT KGP, academics is designed to give wings to the students' aspirations - more than teach, we help them to learn and innovate.
A wide variety of disciplines (19 Departments, 13 Schools and 9 Centres of Excellence) are offered which are also amalgamated, thus making available a plethora of multidisciplinary courses.

Students are encouraged to explore the options which suit them the best, irrespective of the discipline to which they have been admitted. This improves their industry worthiness and

knowledge base and helps them emerge as well-rounded graduates, equipped for any career either in academics or the corporate world.

Opportunities for research, fellowships, internships and networking are boundless.
IIT Kharagpur is widely acclaimed for the quality and breadth of its research enterprise, and particularly for its openness to multidisciplinary research. Several highly rated initiatives represent a long IIT Kharagpur tradition of cross-disciplinary research and collaboration.

The institute equips its faculty and students with the best possible facilities to take on the most challenging research problems. IITKGP has advanced research schools and centres in various disciplines of engineering and pure sciences, with numerous state of art laboratories that organizes various national and international programmes. IIT Kharagpur has "IITKGP Research Park", to provide technological inputs to the industries that benefits the student's community. IITKGP also encourages inter/intra disciplinary programmes which has resulted in cutting-edge research, providing solutions in the areas of advance and need-based technological development. The Institute files more than 100 patents each year, and its faculty members and students publish numerous research papers annually in highly acclaimed International and National Journals.

Life at IIT Kharagpur

Kharagpur is an industrial city in Paschim Medinipur district of West Bengal, India. It is the most populated, multicultural and cosmopolitan city of the district. Kharagpur is about 120 km west of Kolkata and is well connected by Road and Rail transport. It has one of the largest railway workshops in India, and the third longest railway platform in the world (1072.5 m).

Indian Institute of Technology Kharagpur (IIT Kharagpur) is a public technical and research university established by the Government of India in Kharagpur, West Bengal, India in 1951. The institute is the first IITs to be established and recognized as an Institute of National Importance. In 2019, IIT Kharagpur was awarded the status of Institute of Eminence by the Government of India. IIT Kharagpur has 19 academic departments, eight multidisciplinary centres/schools, 13 school of excellence and more than 25 research and development units. The institute's tag line is "Dedicated to the service of the Nation".

IIT Kharagpur is a fully residential campus with an area 8.7 square-kilometre (2,100 acre) and about 22,000 residents. It is a self-sufficient mini township that caters to your day to day need while offering a peaceful living in an idyllic setting. You will love the sylvan community, the clean air, the nature parks and the water bodies around you, something beyond imagination in the large cities of India. In keeping with our ethos of self-sufficiency and nation building, we manage all services ourselves - starting with water supply, public health and waste management, managing traffic and our own security, to operating markets, guest houses and our own hospital. In a few years, we plan to produce our entire electricity through solar power. You will love the greenery, the clean air, the nature parks and the water bodies around you, something beyond imagination in the large cities of India, but an ambience that might remind you of the lush campus you would be leaving behind.

IIT Khargpur offers a vibrant campus life. IIT Kharagpur has a lush green campus with the initiatives of all round management and development of the campus in an eco-friendly manner.

People love the greenery and the atmosphere here. It is safe and secure campus. Students will find the beautiful and peaceful campus, a great place to live.

Student Activity Centre: Technology Students' Gymkhana, is the hub of numerous extra-curricular and co-curricular activities ranging from sports to socio-cultural. It hosts a wide variety of societies to promote the various hobbies and interests of the students. The societies include the Dramatics Societies namely, Technology Dramatics Society- Pravah (Hindi), Encore (English), Prasthanam (Telugu), Druheen (Bengali), Technology Robotix Society, Technology Filmmaking and Photography Society, Business Club, Debating Society, the Music Societies namely, Eastern Technology Music Society and Western Technology Music Society, Communique(soft skills), the Quiz Club, Spectra(fine arts), Technology Adventure Society, Technology Dance Society, and Technology Literary Society.

Extra-curricular: IITKGP knows the importance of sports and cultural activities in shaping the students into complete human beings. Notwithstanding the rigorous academic schedule, students indulge in a variety of extracurricular activities such as music, dramatics, debate, dance, case studies, business plans, product design, data analytics and almost every sport you can name from soccer to water-polo. Furthermore, to prove their mettle in whatever they do, students participate and win in the most challenging national and international level competitions apart from their Inter-Hall championships. All these activities are organised and led by the students themselves which provides them with an excellent platform to hone their managerial and leadership skills.

Sports and Games: IIT Kharagpur wishes that students perform the best in every field and hence provides its students with world-class facilities for sports and games as well. The campus has two stadiums namely Jnan Ghosh and Tata Sports Complex for various games like Hockey, Football, Cricket, and Athletics. The campus also has a fully modernized Aquatic Center for sports like Swimming and Water Polo. Technology Students' Gymkhana also hosts, an Indoor Squash Court, Indoor Badminton Courts, Pool Tables, Tennis Courts, and a fully modernized Gymnasium, facilities for Weightlifting, Basketball Courts, Volleyball Court, and Table Tennis.

Library: The Central Library at IITKGP is considered one of the finest and largest in the world. Its 8000 sq.m provides reading space for 2000 people, holds 300000 books and 25000 subscribed journals. It also has access to all major databases and repositories including 3.8 million theses and dissertations. IITKGP has taken library services to the next level, not just by making books available on the campus through the digital library, but by extending digital library service to external readers through the national mission project National Digital Library.

Spring Fest: Spring Fest is the annual Social and Cultural fest of IIT Kharagpur and among the largest student fests in India. It celebrates the true spirit of youth, a celebration with a responsibility, growing bigger and better with every passing year. It is a perfect blend of fun and frolic, of excitement and ecstasy, of devotion and dedication.

Kshitij: It is an Aisa’s largest annual techno-management fest, which encompasses varied fields of science, technology, and management, inviting students from all around the globe to put their ingenuity and aptitude to test at an unparalleled level of competition.

Illumination: Also known as Illu, is a festival unique to IIT Kharagpur. It is inspired by the day of Diwali (the festival of lights) and is held on Diwali itself. It is held as a competition in student halls. All halls build vertical panels of bamboo (called Chatais) on which thousands of lamps (diyas) are mounted. On the same day, the Rangoli Competition is organized as an inter-hall event. Rangolis of exquisite detail and shading are constructed using colored powders, crushed bangles, and pebbles.

Accommodation: Spread over a sprawling 2100 acres, IIT KGP is well known for its extensive residential facilities. There are 21 Halls of Residences (16 for boys, 5 for girls) around campus. Each has its own dining room, canteen, common room, gym, courts and fields, library etc. Halls of Residence are 'the' most important part of IITKGP student life. It is the Halls where the life-long bonding begins with the Hall-mates and the Wing-mates. It transcends socio-economic background, course of study, batch, interests and hobbies and delivers the KGPians in whom IITKGP lives forever. Inter Hall Competitions are conducted round the year and they help build the technical, athletic, and artistic skills of the residents. These competitions form a part of the rich legacy of Hall culture.

Additionally, the International Guest House has furnished accommodation facilities, which are available at a nominal payment. Rents for the rooms at the International Guest House vary depending upon single or double occupancy, semi- furnished or fully-furnished rooms.

Hangouts: There are places in IITKGP that imprint a KGPian with memories of rendezvous, bonding over food, chats, knowledge sharing, activities. Of these Gymkhana tops the list, where student spend considerable time. The eateries in and around the campus also contribute. The futures planned over a cup of coffee at Cafe Coffee Day, the promises of friendship while sharing a sandwich at Subway, the chilling out at Baskin Robbins, the fun frolic at the market place over taste of Indian food, the long-walks in the greeneries of the campus, IITKGP is the place where you always have somewhere to be and someone to be with.

Health and Wellness: The campus hospital provides primary Health Care comprising of curative, preventive and health promotion services to its faculty, employees, and students using modern and cost effective techniques and technologies, and through a dedicated and humane approach. It refers patients to top hospitals in the nearest city for specialized healthcare services and medical treatment. For IIT Kharagpur students, there is a medical insurance scheme. For the referral of the students, there is an arrangement with several hospitals in Kolkata. Students' Counselling Centre assist students who may be experiencing emotional or psychological conditions that pose a hindrance to their regular activities on campus. The campus has its own swimming pool, park, sports complex, gym, exclusively available for the campus community.

Eateries: Numerous on-campus eateries serve the demands of residents. Some eateries are open overnight, while some serve hot food from early morning itself to best cater to the people's' convenience. Each Hall of Residence has its own Canteen apart from the mess. 'Eat-KGP' a virtual collaboration of all the in-campus eateries provides room delivery of food through online orders. The KGP campus also boasts of retail eatery chains such as Cafe Coffee Day, Baskin Robbins and Subway. One can always visit multiple restaurants outside the campus (approx. 5 kms). IIT KGP has its own Food Monitoring Committee that ensures proper quality food is being served hygienically at fair prices at all campus eateries.

How to reach IIT Kharagpur

Arrival by Air

The nearest airport to Kharagpur is the Netaji Subhas Chandra Bose International Airport, Kolkata. It is widely connected to almost all the major destinations of the country.

From Kolkata Airport you can take a taxi from the Airport taxi stand to Kharagpur. The travel time is approximately 2 1/2 hrs. It costs roughly Rs. 3000/- to Rs. 5000/- (depending on the taxi type).

Arrival by train

Kharagpur train station is well connected to the local as well as long-distance trains from major cities like Kolkata, Mumbai, Bhubaneswar etc. IIT KGP is about 15 min drive away from the Kharagpur railway station.