

INNOVATION INSTINCT

Experiential learning enables students to tackle real-world challenges



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THE INDIAN INSTITUTE of Technology (IIT) Kanpur, established in 1959, is renowned for its excellence in engineering education and research. In this article, we explore the organisational structure, strengths, scope, aspirations, challenges, and recent initiatives of IIT Kanpur, highlighting its rich history and outstanding contributions to the field of engineering and emerging fields of education.

IIT Kanpur, one of India's premier educational institutions, follows a well-defined organisational structure that has been crucial to its growth and success. The institute operates under a Board of Governors, which consists of eminent individuals from academia, industry, and the government. The director, who is responsible for the overall functioning of the institute, leads IIT Kanpur. Under the director, several deans and administrative as well as academic departments work together to ensure efficient operations. They work towards the fulfilment of the institute's objectives. The institute is divided into various departments and Centres of Excellence, each catering to

different fields of study and research.

Since its inception in 1959, IIT Kanpur has been led by visionaries who have set the institute on a path of continual growth and contribution to the nation. Notable leaders like PK Kelkar, MS Muthana, S Sampath, and others played a significant role in defining the institute's vision and mission. These leaders emphasised the importance of academic excellence, innovation, and societal impact, inspiring faculty, staff, and students to strive for greatness.

IIT Kanpur boasts a robust academic framework that provides students with comprehensive education and equips them with essential skills required for success in their chosen fields. We offer undergraduate, postgraduate, eMaster's and doctoral programmes in various disciplines, including engineering, sciences, humanities, and management. The academic curriculum is designed to be interdisciplinary, encouraging students to explore diverse areas of study and pursue research-driven education. The emphasis on project-based learning, practical training, and experiential education ensures that students are well-prepared to tackle real-world challenges.

In its pursuit to provide world-class education, IIT Kanpur has collaborated with several foreign universities. This includes a joint dual PhD programme with the New York University, the Rice-IITK Collaborative Centre with Rice University, and the IIT Kanpur-La Trobe University Research Academy, to name a few.

IIT Kanpur had a comprehensive curriculum overhaul in 2021 based on the recommendations of the Undergraduate and Postgraduate Academic Review Committee Reports. The curriculum reforms align with the National Education Policy (NEP) 2020. We already offer a highly flexible academic programme with options for double majors, minors, dual degrees, and Master's degrees in different fields. As part of the curriculum revamp, new degree options, such as Honours degrees and inter-departmental programmes, were proposed, expanding the scope of study to include Social Sciences, Communication, Humanities, Economics, Management, and Environment (SCHEME).

The undergraduate education framework includes innovative opportunities for student exchange during the Bachelor's-Master's Dual Degree programme.

Special provisions have been made for exceptional students, including direct admission through global Olympiads, recognition of credits for entrepreneurial ventures and industry-based learning, and the option of an exit degree for those who discontinue the programme.

In line with NEP 2020, new departments focusing on interdisciplinary fields, such as Economic Sciences, Cognitive Science, Sustainable Energy Engineering, Design, Space Science and Astronomy, have been established at IIT Kanpur. The institute also houses the Shivani Centre for the Nurture and Re-integration of Hindi & Other Indian Languages (OILs), promoting technical education and innovation in Hindi and other national languages. The English Language Cell, on the other hand, helps students to strengthen their English language skills.

IIT Kanpur prides itself on having a world-class faculty that comprises highly accomplished and dedicated educators, researchers, and industry experts. The institute's research centres and labs provide a conducive environment for experimentation and innovation. The research findings and publications from

THE FLIGHT LABORATORY AT IIT KANPUR



IIT Kanpur have garnered global recognition and have made a substantial impact on the scientific community.

IIT Kanpur offers a wide range of engineering programmes at the undergraduate, postgraduate, and doctoral levels in diverse fields, such as Computer Science and Engineering, Civil Engineering, Mechanical Engineering, Electrical Engineering, Aerospace Engineering, Chemical Engineering, and more.

The recent additions from the institute were two new departments in the fields of Design, and Space Science and Astronomy. With this, IIT Kanpur now has 19 departments, 22 centres, three interdisciplinary programmes and 10 eMaster's degree programmes in Engineering, Science, Design, Humanities, and Management disciplines. The institute also offers interdisciplinary programmes, such as the 5-year BT-MT and BS-MS Dual Degree programmes in various engineering and science disciplines.

IIT Kanpur fosters an environment that nurtures innovation and entrepreneurship, resulting in a significant number of successful startup initiatives. The institute topped the National Institutional Ranking Framework (NIRF) 2023 list of best colleges in the category of innovation. IIT Kanpur's Incubation Centre, Startup Incubation & Innovation Centre (SIIC) includes startups working in cutting-edge technologies, such as Cyber Security, Blockchain, Defence, AI/ML, CleanTech, GreenTech, AgriTech, and Fintech.

We offer a Student Entrepreneurship Policy to promote startup incubation among students, which is a pioneering initiative in accordance with the National Innovation & Startup Policy (NISIP) and NEP 2020. This policy offers students two pathways to engage in entrepreneurship activities with the guidance of faculty or external mentor. The first route involves registering for the semester and choosing 'Innovation and Entrepreneurship Credits' (IEC) as an option, while the second route allows students to take a semester off to focus on innovation and entrepreneurship without the need for IEC credit registration.

The institute has established a robust management system for Intellectual Property Rights (IPR) protection and technology commercialisation. We've filed more than 960 IPRs to date and it includes a record-breaking 109 IPRs in 2022. Along with these, 132 technologies have been licensed to industry partners.

IN TERMS OF PLACEMENTS, TOO, we have had a good track record with our students being placed across large companies and organisations, both nationally and globally. The Students' Placement Office at the institute looks after the entire process. There are student clubs, such as the Toastmasters Club, to guide the students and boost their confidence.

Additionally, IIT Kanpur runs a unique eMaster's degree programme tailored for working professionals and graduates with at least two years of work experience. Courses, such as Data Science and Business Analytics and Economics, Finance & Data Analysis have significant components focused on Artificial Intelligence (AI) and Data Science, equipping learners with relevant tools and techniques. In total, there are 10 eMaster's degree programmes in the fields of Economics, Finance, Data Science, Business Analytics, Cyber Security, Communication Systems, and so on, which help working professionals stay up-to-date with the changing times.

IIT Kanpur has been offering specialised programmes in emerging fields to equip students with the necessary skills to contribute to the growing sectors. For example, it has recently launched two new MTech programmes—Unmanned Aerial Systems Engineering and Cognitive Systems. Unmanned Aerial Systems Engineering, which is the first of its kind course in India, will equip students with the necessary skills and knowledge to become leaders in the field of drone technology which has numerous applications in fields such as agriculture, transportation, and defence. The programme in Cognitive Systems focuses on the development of intelligent systems that can interact with humans, understand their goals

and needs, and make decisions autonomously. It aims to train students in the areas of AI, Machine Learning, Natural Language Processing, and Human-Computer Interaction, among others.

The higher education system in India faces numerous challenges, including funding constraints, limited budgets, attracting and retaining top talent, ensuring equitable access and inclusion, bridging the industry-academia gap, and adapting to evolving technological advancements. In India, the budgetary allocation for higher education and research has been lower than desired, as compared to countries like the US, Japan, and China. Considering that the National Policy on Education 1968 recommended the expenditure of 6 per cent of GDP on education, and NEP 2020 also reaffirms that, the nation's investment in higher education and research needs to be considerably enhanced to improve the sector's overall quality and scope.

Another significant challenge that we face is in attracting and retaining renowned experts and scholars due to significant competition from institutions abroad that offer better facilities, salaries, and research opportunities. This trend is gradually changing as there are better avenues and opportunities coming up in India. Nevertheless, even after 75 years of Independence, equal opportunities for students to access higher education is yet to be fully realised as disparities remain across socioeconomic backgrounds, gender, and regions.

There exists a gap between industry requirements and the skills acquired through traditional higher education. NEP 2020, which emphasises flexible curricular structures that can enable creative combinations and calls for multidisciplinary education, can help in fostering collaboration between academia and industry.

IIT Kanpur firmly believes in the diversity of education and has been continuously revamping its curricula periodically to better suit the changing education ecosystem of the country. As a higher educational institute of repute, we

acknowledge the transformative power of AI, machine learning (ML) and data science (DS) and their impact on various sectors. The faculty from various departments, including Computer Science and Engineering (CSE), Electrical Engineering, Mathematics & Statistics, Industrial & Management Engineering, and Economic Sciences, contribute to teaching a gamut of courses in AI while actively participating in AI/ML/DS projects. The Department of Mathematics and Statistics, for example, now offers BS and BS-MS degree programmes in Statistics and Data Science, starting from the academic

search to solve basic human problems. These developments not only provide students with opportunities to specialise in emerging fields but also contribute to the advancement of knowledge and the country's technological growth.

In a first-of-its-kind initiative in India, IIT Kanpur has initiated the setting up of the Gangwal School of Medical Sciences & Technology, and the Yadupati Singhania Super Speciality Hospital to bridge the gap between medical and technology disciplines. It aims to accelerate research and innovation in the MedTech domain for ensuring all-round development in



FIELD RESEARCH AT IIT KANPUR

year 2021-22. Similarly, the Department of Computer Science & Engineering offers over 30 courses in AI and ML, along with a minor degree programme for students from other departments.

We have also recently established the Centre for Developing Intelligent Systems (CDIS), dedicated to the rapid development and prototyping of intelligent software systems, specifically meant to address problems within the Indian ecosystem.

The introduction of new departments and initiatives at IIT Kanpur showcases the institute's commitment to staying ahead in technology and re-

the medical sector of the country. Under its aegis, a very ambitious and crucial project to develop an artificial heart is ongoing in collaboration with cardiologists across the country. The equipment that is currently ready for trial in animals will take another 2-3 years for being put in clinical situations.

We are also expanding our research and development activities in various other fields. We have set up new research centres and laboratories to facilitate cutting-edge research in areas such as robotics, renewable energy, cybersecurity, and bioinformatics.

IIT Kanpur changed the face of

computer education in India by installing the first IBM 1620 computer at its premises in August 1963 and initiating computer courses. Now that AI/ML and other emerging technologies are taking centre stage, one recent development is the establishment of the Artificial Intelligence and Innovation Driven Entrepreneurship-Centre of Excellence by IIT Kanpur's Foundation for Innovation and Research in Science & Technology (FIRST) in collaboration with the Federation of Indian Chambers of Commerce & Industry (FICCI), to provide mentorship, networking opportunities, training, research and development, infrastructure, and funding opportunities to startups.

Moreover, IIT Kanpur has been actively collaborating with industry partners and other academic institutions to promote interdisciplinary research initiatives. These collaborations aim to foster innovation and address complex societal challenges by leveraging expertise from different domains.

Recently, IIT Kanpur has signed a Memorandum of Agreement (MOA) with Laurus Labs to introduce groundbreaking gene therapy assets to the market. The memorandum allows IIT Kanpur to transfer several gene therapy assets through in-licensing to Laurus Labs, who will provide a research grant to facilitate their progression through pre-clinical development. Prior to this, we had licensed a pioneering technology to Reliance Life Sciences that has the potential to revolutionise the field of gene therapy, especially for many genetic eye diseases.

IIT Kanpur's continued success can be attributed to its robust organisational structure, diverse programmes, and commitment to innovation. Despite the challenges faced by higher education institutions in India, IIT Kanpur has displayed resilience and a proactive approach to adapting to emerging fields in engineering. Through visionary initiatives and a strong emphasis on research and development, IIT Kanpur remains a dominant force in shaping the future of engineering education and research in India. ■

ZONEWISE GOVERNMENT RANKINGS

NORTH

ZONAL RANK	NAME OF INSTITUTE	CITY
1	INDIAN INSTITUTE OF TECHNOLOGY	NEW DELHI
2	INDIAN INSTITUTE OF TECHNOLOGY	KANPUR
3	INDIAN INSTITUTE OF TECHNOLOGY	ROORKEE
4	INDIAN INSTITUTE OF TECHNOLOGY (BHU)	VARANASI
5	DELHI TECHNOLOGICAL UNIVERSITY	NEW DELHI
6	NETAJI SUBHAS UNIVERSITY OF TECHNOLOGY	NEW DELHI
7	INDIAN INSTITUTE OF INFORMATION TECHNOLOGY ALLAHABAD	PRAYAGRAJ
8	MOTILAL NEHRU NATIONAL INSTITUTE OF TECHNOLOGY ALLAHABAD	PRAYAGRAJ
9	INDRAPRASTHA INSTITUTE OF INFORMATION TECHNOLOGY	NEW DELHI
10	INDIAN INSTITUTE OF TECHNOLOGY	ROPAR
11	INDIAN INSTITUTE OF TECHNOLOGY	MANDI
12	INDIAN INSTITUTE OF TECHNOLOGY	JODHPUR
13	MALVIYA NATIONAL INSTITUTE OF TECHNOLOGY	JAIPUR
14	HARCOURT BUTLER TECHNICAL UNIVERSITY	KANPUR
15	INDIRA GANDHI DELHI TECHNICAL UNIVERSITY FOR WOMEN	NEW DELHI
16	NATIONAL INSTITUTE OF TECHNOLOGY	HAMIRPUR
17	DR BR AMBEDKAR NATIONAL INSTITUTE OF TECHNOLOGY	JALANDHAR
18	NATIONAL INSTITUTE OF TECHNOLOGY	KURUKSHETRA
19	NATIONAL INSTITUTE OF TECHNOLOGY	NEW DELHI
20	ZAKIR HUSSAIN COLLEGE OF ENGINEERING AND TECHNOLOGY	ALIGARH
21	FACULTY OF ENGINEERING AND TECHNOLOGY, JAMIA MILLIA ISLAMIA	NEW DELHI
22	NATIONAL INSTITUTE OF TECHNOLOGY UTTARAKHAND	PAURI GARHWAL
23	UNIVERSITY INSTITUTE OF ENGINEERING & TECHNOLOGY, PANJAB UNIVERSITY	CHANDIGARH
24	PUNJAB ENGINEERING COLLEGE (DEEMED TO BE UNIVERSITY)	CHANDIGARH
25	NATIONAL INSTITUTE OF TECHNOLOGY	SRINAGAR
26	JC BOSE UNIVERSITY OF SCIENCE & TECHNOLOGY, YMCA	FARIDABAD
27	SCHOOL OF ENGINEERING, GAUTAM BUDDHA UNIVERSITY	GREATER NOIDA
28	INSTITUTE OF ENGINEERING AND TECHNOLOGY	LUCKNOW
29	RAJKIYA ENGINEERING COLLEGE	KANNAUJ

WEST

ZONAL RANK	NAME OF INSTITUTE	CITY
1	INDIAN INSTITUTE OF TECHNOLOGY	MUMBAI
2	INDIAN INSTITUTE OF TECHNOLOGY	INDORE
3	COEP TECHNOLOGICAL UNIVERSITY	PUNE
4	INDIAN INSTITUTE OF TECHNOLOGY	GANDHI NAGAR
5	VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY	NAGPUR
6	INSTITUTE OF CHEMICAL TECHNOLOGY	MUMBAI
7	MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY	BHOPAL
8	ATAL BIHARI VAJPAYEE-INDIAN INSTITUTE OF INFORMATION TECHNOLOGY AND MANAGEMENT	GWALIOR
9	VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE (VJTI)	MUMBAI
10	SARDAR VALLABHBHAI NATIONAL INSTITUTE OF TECHNOLOGY	SURAT
11	NATIONAL INSTITUTE OF TECHNOLOGY	PONDA, GOA
12	LD COLLEGE OF ENGINEERING	AHMEDABAD
13	INSTITUTE OF ENGINEERING & TECHNOLOGY, DEVI AHILYA VISHWAVIDYALAYA	INDORE
14	VISHWAKARMA GOVERNMENT ENGINEERING COLLEGE CHANDKHEDA	AHMEDABAD
15	LAXMINARAYAN INSTITUTE OF TECHNOLOGY	NAGPUR
16	GOVERNMENT COLLEGE OF ENGINEERING	KARAD

EAST

ZONAL RANK	NAME OF INSTITUTE	CITY
1	INDIAN INSTITUTE OF TECHNOLOGY	KHARAGPUR
2	INDIAN INSTITUTE OF TECHNOLOGY	GUWAHATI
3	INDIAN INSTITUTE OF TECHNOLOGY INDIAN SCHOOL OF MINES	DHANBAD
4	INDIAN INSTITUTE OF TECHNOLOGY	BHUBANESWAR
5	INDIAN INSTITUTE OF TECHNOLOGY	PATNA
6	INDIAN INSTITUTE OF TECHNOLOGY	SEJBABAHAR
7	NATIONAL INSTITUTE OF TECHNOLOGY	DURGAPUR
8	FACULTY OF ENGINEERING AND TECHNOLOGY, JADAVPUR UNIVERSITY	KOLKATA
9	NATIONAL INSTITUTE OF TECHNOLOGY	JAMSHEDPUR
10	NATIONAL INSTITUTE OF TECHNOLOGY	ROURKELA
11	INDIAN INSTITUTE OF INFORMATION TECHNOLOGY	KALYANI
12	NATIONAL INSTITUTE OF TECHNOLOGY	AGARTALA