PROSPECTUS 2023-24

INDIAN INSTITUTE OF TECHNOLOGY DELHI

IIT DELHI

VISION

To contribute to India and the World through excellence in scientific and technical education and research; to serve as a valuable resource for industry and society; and remain a source of pride for all Indians.

MISSION

To generate new knowledge by engaging in cutting-edge research and to promote academic growth by offering state-of-the-art undergraduate, postgraduate and doctoral programmes.

To identify, based on an informed perception of Indian, regional and global needs, areas of specialization upon which the Institute can concentrate.

To undertake collaborative projects which offer opportunities for long-term interaction with academia and industry.

To develop human potential to its fullest extent so that intellectually capable and imaginatively gifted leaders can emerge in a range of professions.

VALUES

- Academic integrity and accountability.
- Respect and tolerance for the views of every individual.
- Attention to issues of national relevance as well as of global concern.
- Breadth of understanding, including knowledge of the human sciences.
- Appreciation of intellectual excellence and creativity.
- An unfettered spirit of exploration, rationality and enterprise.

PROSPECTUS
2023-24

INDIAN INSTITUTE OF TECHNOLOGY DELHI

Indian Institute of Technology Delhi
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1. INTRODUCTION

Indian Institute of Technology Delhi is one of the Twenty Three IITs created to be Centres of Excellence for training, research and development in science, engineering and technology in India.

Established as College of Engineering in 1961, the Institute was later declared as an Institution of National Importance under the "Institutes of Technology (Amendment) Act, 1963" and was renamed as "Indian Institute of Technology Delhi". It was then accorded the status of a Deemed University with powers to decide its own academic policy, to conduct its own examinations, and to award its own degrees.

The Institute was declared as an "Institute of Eminence" by the Government of India in 2018.

Since its inception, more than 58,000 students have graduated from IIT Delhi in various disciplines including Engineering, Physical Sciences, Management, and Humanities & Social Sciences. Of these, 6,660 students graduated with Ph.D. degree and 19,387 students graduated with B.Tech. degree. The rest obtained Master's Degree in Engineering, Sciences and Business Administration. These alumni today work as scientists, technologists, business managers and entrepreneurs. There are several alumni who have moved away from their original disciplines and have taken to administrative services, active politics or are with NGOs. In doing so, they have contributed significantly to building of this nation, and to industrialization around the world.

IIT Delhi is situated in Hauz Khas in South Delhi, which is a landmark place in the colourful and chequered history of Delhi. Bounded by the Sri Aurobindo Marg on the east, the Jawaharlal Nehru University Complex on the west, the National Council of Educational Research and Training on the south, and the Outer Ring Road on the north, the Institute campus is flanked by Qutub Minar and the Hauz Khas monuments.

Well connected to the major city centres by open and wide roads, the Institute campus is about 19 k.m. away from the Delhi Main Railway Station, 14 k.m. from the New Delhi Railway Station, 21 k.m. from the Inter-State Bus Terminal (Kashmere Gate) and 10 k.m. from Delhi Airport. Delhi Metro has two gates opening at the Institute Campus.

Campus of the Institute extends to an area of 320 acres. With many topographical features, imaginatively laid out with picturesque landscape, numerous buildings of various nature and stature, and clean and wide roads, the campus presents a spectacle of harmony in architecture and natural beauty.

The campus area is divided into four functional zones : (i) Residential zone for students; (ii) Residential zone for the faculty and other supporting staff; (iii) Academic zone for academic buildings and workshops; and (iv) Cultural-cum-social and recreational zone for students.

The campus also offers amenities like Staff Clubs, Hospital, Shopping Centre, Banks, Post Office, Telecom Centre, Community Centre, Stadium, Playing Fields, etc. The Students Activities Centre provides all facilities for students' extra-curricular activities and physical development.

The central double-storied recreation block with a swimming pool and a gymnasium hall offers amenities such as squash courts, hobbies workshops / seminar rooms, music rooms and other multipurpose rooms for reading and indoor games. The amphitheater with large capacity constructed in modern style is an added amenity to the centre.

IIT Delhi has been extending its boundaries. One extension campus has been established in Sonepat, Haryana over 50 acres of land allocated by Haryana Government. A Technopark filled with high class facilities has been set-up there. Another extension campus will come up in near future in Jhajjar, Haryana over 50 acres of land.

1.1 Administration

IIT Delhi is an autonomous statutory organization functioning within the "Institutes of Technology Act" as amended by "The Institutes of Technology (Amendment) Act, 1963".

The Indian Institutes of Technology are administered centrally by the IIT Council, an apex body established by the Government of India to co-ordinate the activities of these Institutes.

The Hon'ble Minister of Education of the Government of India is the Chairperson of the IIT Council. Each Indian Institute of Technology has a Board of Governors responsible for its overall administration and control.

Chairperson, Board of Governors

Dr. R. Chidambaram

Dr. R. Chidambaram is the Chairperson, Board of Governors of IIT Delhi. Dr. Rajagopala Chidambaram became the Director of the Bhabha Atomic Research Centre (BARC) in 1990. He was Chairperson, Atomic Energy Commission from 1993 to 2000. He was the Principal Scientific Adviser to the Govt. of India and the Chairman of the Scientific Advisory Committee to the Cabinet from 2001 to 2018. He is presently the DAE-Homi Bhabha Professor in BARC.

Dr. Chidambaram has made important contributions to many aspects of our nuclear technology. He has D.Sc. Degrees (h.c) from thirty Universities from India and abroad. He has more than 200 research publications in refereed journals and all his research work has been in India.

He was Chairperson of the Board of Governors of the IAEA during 1994-95. During 1990-99, he was a member of the Executive Committee of the International Union of Crystallography, the last three years as its Vice-President. He has been Chairperson, Board of Governors of IIT Bombay (1994-97) and of IIT Madras (2008-2011) and Member, Space Commission (2009-2014). Dr. Chidambaram is currently Chairperson of the Board of Governors of IIT Jodhpur. He is also a Honorary Visiting Professor in the Department of Physics, Banaras Hindu University.

Dr. Chidambaram is a Fellow of all the major Science Academies in India and also of the National Academy of Engineering and the The World Academy of Sciences Trieste (Italy).

He has received many awards and honours, notable among them are the C.V. Raman Birth Centenary Award of the Indian Science Congress Association in 1995, the Distinguished Materials Scientists of the Year Award of the Material Research Society of India (MRSI) in 1996, R.D. Birla Award of the Indian Physics Association in 1996, Homi Bhabha Lifetime Achievement Award of the Indian Nuclear Society (2006), The Lifetime Achievement Award of the Indian National Academy of Engineering (2009) and the C.V. Raman Medal of the Indian National Science Academy (2013). Lifetime Achievement Award of A.P. Akademi of Sciences (2014), Lifetime Achievement Award of the Council of Power Utilites(2014). Dr. Chidambaram was awarded the ***Padma Vibhushan, the second highest civilian award in India, in 1999.***

His initiatives as Principal Scientific Adviser to Government of India, include the setting up of the Core Advisory Groups for R&D in various technology sectors, the creation of RuTAG (Rural Technology Action Group) centered in 7 IITs, the establishment of SETS (Society for Electronic Transactions and Security), helping nucleate the Centres of Excellence in Nanoelectronics, the National Knowledge Network and initiating an R&D programme on the design of the Advanced Ultra Supercritical Thermal Plant, through a consortium of IGCAR, BHEL and NTPC.

Director, IIT Delhi

Prof. Rangan Banerjee

Prof. Rangan Banerjee is the Director of IIT Delhi since February 2022. He is on lien form IIT Bombay where he served as the Forbes Marshall Chair Professor in the Department of Energy Science and Engineering – a Department that he helped start in 2007. He has done his B.Tech. in Mechanical Engineering and Ph.D. from IIT Bombay. His areas of interest include energy management, modelling of energy systems, energy planning and policy, hydrogen energy and fuel cells.

Prof. Banerjee currently has been on the editorial board of Energy and Sustainable Development, International Journal of Sustainable Energy, International Journal of Sustainable Engineering, International Journal of Thermodynamics, Solar Energy Advances, Global Transitions (Energy Transitions). He has been involved in setting up a MegaWattscale Solar Thermal Power Testing, Simulation, Research Facility sponsored by the Ministry of New and Renewable Energy and was the faculty advisor of Team Shunya- India's first student team in the solar Decathlon Europe finals. He has been involved in advising the city, state regulatory commission and energy agency, Planning Commission, Niti Aayog, Ministry of New and Renewable Energy on energy issues and worked with several Indian and international industries.

Prof. Banerjee has been the Dean (R&D) and received the Excellence in Teaching Award from IIT Bombay and is a Fellow of the Indian National Academy of Engineering. He is also an Adjunct faculty (Honorary) in the Department of Engineering & Public Policy, Carnegie Mellon University.

THE SENATE

The Senate decides the academic policy of the Institute, and approves curriculum, courses & examination results. It appoints committees to look into specific academic matters arising from time to time. The teaching, training and research activities of various departments at the Institute are constantly under review to improve both facilities and standard. The Director of the Institute is the Chairperson of the Senate.

INSTITUTE COMMITTEES

Financial advice to the Institute is rendered by the Finance Committee. Similarly, there is a Buildings and Works Committee to advise on matters relating to buildings and works activity. These committees are appointed by the Board of Governors. In addition, there are a number of other committees like the Board of Academic Programmes, Board of Educational and Research Planning, appointed by the Senate to help the administration in the efficient running of the Institute.

2. ACADEMICS

IIT Delhi provides science-based engineering education with a view to produce quality engineer-scientists. The curriculum provides broad based knowledge and simultaneously builds a temper for the life long process of learning and exploring.

2.1 Academic System

At the undergraduate level, a student needs to do compulsory foundation courses in the areas of basic Sciences, Humanities & Social Sciences, and Engineering Sciences apart from departmental requirements. At postgraduate level, several specializations, in the form of various M.S.(R), M.Tech., M.B.A., M.Des., M.P.P., P.G. D.I.I.T., and M.Sc., are available and the students get an exposure and training in research in their chosen fields. The Institute has strong Ph.D. programmes and the students carry out advanced research under the guidance of the members of the Institute faculty.

The Institute undertakes a major revision of its curriculum periodically. From the academic session 2013-14, a new undergraduate curriculum has been in place and the new postgraduate curriculum has been implemented from the academic session 2015-16. The Institute is in the process of curriculum revision.

The Institute follows the semester system. An academic year runs from July through June next year and comprises two semesters. Typically, the 1st semester starts in the last week of July and ends in the 1st week of December; and the 2nd semester starts in the first week of January and ends in the 2nd week of May. Additionally, the summer semester which starts in the 3rd week of May and ends in the 2nd week of July, is utilised in some exceptional cases. Detailed activities are given in the Semester Schedule that is available before the start of every semester.

2.2 Academic Structure

The major academic units of the Institute are the Departments, Centres, and Schools. Interdisciplinary research is organized in programmes. The various academic units are listed below, and details are given latter in this document. The activities of Departments include teaching at all levels and research. The Centres focus on interdisciplinary research and some teaching mostly at the postgraduate level.

DEPARTMENTS

- Applied Mechanics
- Biochemical Engineering and Biotechnology
- Chemical Engineering
- Chemistry
- Civil Engineering
- Computer Science and Engineering
- Design
- Electrical Engineering
- Energy Science and Engineering
- Humanities and Social Sciences
- Management Studies
- Materials Science and Engineering
- Mathematics
- Mechanical Engineering
- Physics
- Textile and Fibre Engineering

CENTRES

- Applied Research in Electronics
- Atmospheric Sciences
- Automotive Research and Tribology
- Biomedical Engineering
- National Resource Centre for Value Education in Engg.
- Optics and Photonics
- Rural Development and Technology
- Sensors, Instrumentation and Cyber-Physical Systems Engineering
- Transportation Research and Injury Prevention

SCHOOLS

- Amar Nath and Shashi Khosla School of Information Technology
- Bharti School of Telecommunication Technology and Management
- Kusuma School of Biological Sciences
- School of Public Policy
- School of Interdisciplinary Research
- Yardi School of Artificial Intelligence

INTERDISCIPLINARY RESEARCH PROGRAMMES

- Opto-Electronics and Optical Communication Research Programme
- VLSI Design Tools and Technology

2.3 Research and Innovation

IIT Delhi places strong emphasis on research & development, and innovation. Faculty members undertake research in the fields of their interest. Many postgraduate students and some undergraduate students are also involved in these activities, as the curriculum provides facilities for the same. While some research is funded by the Institute, majority of research activities / projects are funded by sponsoring agencies and / or industries. All projects funded by government agencies and some industry funded projects are managed through the Institute's "Industrial Research and Development (IRD) Unit". Innovative technology development and industrial outreach are also facilitated by the "Foundation for Innovation and Technology Transfer (FITT)", a non-profit society associated with IIT Delhi and located on the campus.

2.4 Collaborations

IIT Delhi is actively involved in collaborative programmes with industry, academia, and governments at the national and international level to remain at the forefront of scientific and technological developments and share knowledge for mutual benefit. The Institute has 99 ongoing International Memorandum of Understanding established with various organisations/institutions from countries worldwide. During the 2022-23 period, Institute has signed 12 International Memorandum of Understandings, including countries like USA, UK, Germany, Australia, France, Italy, Iran etc.

2.5 Student Exchange Programmes

IIT Delhi encourages students to exchange programmes with leading institutions across various countries. Studying abroad allows students to get exposure to multi-cultural and global environments and to experience the host country with incredible new outlooks, customs, and activities. Under numerous exchange programmes, students get an opportunity to visit foreign universities, and students from different foreign universities also visit IITD. Foreign exchange programmes range from a semester exchange to a year-long exchange. During this programme, the students get an insight into how other country works and what features are embedded in their culture. Student exchange exposure enhances students' own decision-making and independent thinking skills. For more information please visit ***https://international.iitd.ac.in/student-exchanges/***

Under Erasmus+ Mobility Programme, IITD students can apply for Erasmus+ scholarships either by applying directly to the course coordinator or through an exchange. Erasmus+ offers short-term mobility to European universities from other parts of the world for students, researchers, and staff.

2.6 Academic Outreach and New Initiatives

The Academic Outreach Initiatives at the IIT Delhi attempts at building meaningful interfaces with academic peers and the society at large. All Outreach initiatives at the Institute are taking care the needs of the academic community and society deeply informed by our obligations. IIT Delhi uses the Outreach platform to share the results of our scientific work with different sections of the society, while also continuously learning and improvising on our own research queries, and methodologies, based on the feedback received from them. The Institute has recently initiated some outreach programmes for school students, with the primary aim to bridge the gap between school education and higher education in India. The initiatives include Sci-Tech Spins Lecture series for the school students (9th to 12th grade), STEM Mentorship Programme for 11th grade school girls, Change Makers for the innovative young minds, Research Blitz for the research fellows etc.

2.7 Academic Programmes

IIT Delhi offers a variety of academic programmes for students with a wide range of backgrounds leading to the degrees listed below:

Doctor of Philosophy (Ph.D.) :

All Departments, Centres, and Schools offer Ph.D. programmes.

Master of Technology (M.Tech.) :

- M.Tech. in Engineering Analysis and Design
- M.Tech. in Biomolecular and Bioprocess Engineering
- M.Tech. in Chemical Engineering
- M.Tech. in Molecular Engineering : Chemical Synthesis & Analysis
- M.Tech. in Geotechnical and Geoenvironmental Engineering
- M.Tech. in Rock Engineering and Underground Structures
- M.Tech. in Structural Engineering
- M.Tech. in Water Resources Engineering
- M.Tech. in Construction Engineering and Management
- M.Tech. in Construction Technology and Management
- M.Tech. in Environmental Engineering and Management
- M.Tech. in Transportation Engineering
- M.Tech. in Computer Science and Engineering
- M.Tech. in Energy & Environment Technologies and Management
- M.Tech. in Renewable Energy Technologies and Management
- M.Tech. in Communications Engineering
- M.Tech. in Computer Technology
- M.Tech. in Control and Automation
- M.Tech. in Integrated Electronics and Circuits
- M.Tech. in Power Electronics, Electrical Machines and Drives
- M.Tech. in Polymer Science and Technology
- M.Tech. in Materials Engineering
- M.Tech. in Power Systems
- M.Tech. in Mechanical Design
- M.Tech. in Industrial Engineering
- M.Tech. in Production Engineering
- M.Tech. in Thermal Engineering
- M.Tech. in Applied Optics
- M.Tech. in Solid State Materials
- M.Tech. in Fibre Science and Technology
- M.Tech. in Textile Engineering

- M.Tech. in Textile Chemical Processing
- M.Tech. in Radio Frequency Design and Technology
- M.Tech. in Electric Mobility
- M.Tech. in Atmospheric-Oceanic Science & Technology
- M.Tech. in Biomedical Engineering
- M.Tech. in Machine Intelligence and Data Science (MINDS)
- M.Tech. in Cyber Security
- M.Tech. in Instrument Technology
- M.Tech. in Optoelectronics and Optical Communication
- M.Tech. in Robotics
- M.Tech. in Telecommunication Technology and Management
- M.Tech. in VLSI Design Tools and Technology

Master of Science (Research) [M.S.(R)] :

- M.S. (R) in Amar Nath and Shashi Khosla School of Information Technology
- M.S. (R) in Applied Mechanics
- M.S. (R) in Automotive Research and Tribology
- M.S. (R) in Bharti School of Telecommunication Technology and Management
- M.S. (R) in Biochemical Engineering and Biotechnology
- M.S. (R) in Chemical Engineering
- M.S. (R) in Civil Engineering
- M.S. (R) in Computer Science and Engineering
- M.S. (R) in Energy Science and Engineering
- M.S. (R) in Electrical Engineering
- M.S. (R) in Mechanical Engineering
- M.S. (R) in Materials Science and Engineering
- M.S. (R) in Kusuma School of Biological Sciences
- M.S. (R) in VLSI Design Tools and Technology
- M.S. (R) in Sensors, Instrumentation and Cyber-Physical Systems Engineering
- M.S. (R) in Machine Intelligence and Data Science (MINDS)
- M.S. (R) in Transportation Safety and Injury Prevention

Masters of Business Administration (M.B.A) :

- M.B.A.
- M.B.A. (with focus on Telecommunication Systems Management)
- M.B.A. (with focus on Technology Management), (part-time evening programme)

Master of Design (M.Des.) :

- M.Des. in Industrial Design

Masters of Science (M.Sc.) :

» M.Sc. in Chemistry
» M.Sc. in Cognitive Science
» M.Sc. in Economics
» M.Sc. in Mathematics
» M.Sc. in Physics

Masters of Public Policy (M.P.P.)

Postgraduate Diploma

» P.G. D.I.I.T (Naval Construction)
(for candidates sponsored by the Indian Navy)
» Joint P.G. Diploma in Visionary Leadership in Manufacturing (VLFM)
(Jointly with NITIE Mumbai)

Dual Degree (B.Tech. and M.Tech.) :

» B.Tech. & M.Tech in Chemical Engineering
» B.Tech. & M.Tech in Computer Science and Engineering
» B.Tech. & M.Tech. in Mathematics and Computing

Bachelor of Technology (B.Tech.) :

» B.Tech. in Biochemical Engineering and Biotechnology
» B.Tech. in Chemical Engineering
» B.Tech. in Computer Science and Engineering
» B.Tech. in Civil Engineering
» B.Tech. in Electrical Engineering
» B.Tech. in Electrical Engineering (Power and Automation)
» B.Tech. in Energy Engineering
» B.Tech. in Engineering and Computational Mechanics
» B.Tech. in Materials Engineering
» B.Tech. in Mathematics and Computing
» B.Tech. in Mechanical Engineering
» B.Tech. in Production and Industrial Engineering
» B.Tech. in Engineering Physics
» B.Tech. in Textile Technology

Bachelor of Design (B.Des.)

The details of these programmes are given under specific Departments, Centres, and Schools in this Prospectus as well as in the Courses of Study 2023-2024.

3. ADMISSIONS

Admission to IIT Delhi is possible through various entrance examinations, like the Joint Entrance Examination (JEE) Advanced, Undergraduate Common Entrance Examination for Design (UCEED), Graduate Aptitude Test in Engineering (GATE), Common Entrance Examination for Design (CEED), Common Admission Test (CAT) and Joint Admission Test in M.Sc. (JAM), for its various degrees and programmes.

3.1 Undergraduate Programmes

Admission to all Undergraduate Programmes listed in Chapter 2 are made through the Joint Entrance Examination (JEE) (Main and Advanced) for B.Tech. (for further information, please visit JEE website: http://jee.iitd.ac.in/) and Undergraduate Common Entrance Examination for Design (UCEED) for B.Des. (for further information, please visit UCEED website: http://www.uceed.iitb.ac.in/2022/).

Visiting Studentship

A student, who is registered for an Engineering / Technology degree in a recognized Institute / University in India or abroad, is eligible for being considered as a visiting student at IIT Delhi, for a maximum period of 6 months / one semester. More details can be obtained from the Academic Section of the Institute.

Summer Research Fellowship

In order to expose students from other Engineering Colleges / Institutes to the ongoing research activities at IIT Delhi, Institute has introduced Summer Research Fellowship programme for undergraduate students from other engineering Institutes. IIT Delhi will offer fellowship or interns can also be supported from budget of sponsored / consultancy projects, through an outside fellowship (eg. KVPY, INSA, INAE, etc.) or institutional MoUs. Further details can be obtained from the Academic Section of the Institute.

Admission of UG students to PG Programmes with Advanced Standing

UG students of IIT Delhi with advanced standing are eligible for admission to PG programmes at IIT Delhi. Details are given in the Courses of Study.

3.2 Postgraduate Programmes

Procedure for Admission

Applications are invited from candidates by advertising the programmes in March/October every year. Subsequently, the candidates have to apply online as specified in the advertisements.

In general, admission are made through the Graduate Aptitude Test in Engineering (GATE) for M.Tech. programmes, Common Entrance Examination for Design (CEED) for M.Des., Common Admission Test (CAT) for M.B.A., and Joint Admission Test (JAM) for M.Sc. programmes. For detailed eligibility conditions and mode of selection, please see section 3.5 on page 13.

Admission to Ph.D. / M.S. (Research) programme is also possible any time during the year through Department Research Committee (DRC) / Centre Research Committee (CRC) / School Research Committee (SRC) with the approval of Dean, Academics. For more details, please visit the Institute website - **www.iitd.ac.in**

IIT DELHI FOLLOWS RESERVATIONS IN ADMISSIONS (BOTH UG AND PG) AND CHARGES FEES AS PRESCRIBED BY GOVERNMENT OF INDIA FROM TIME TO TIME.

Migration from one PG Programme to another PG Programme of the Institute

Provision exists for the PG students of the Institute to move from (i) M.Tech. / M.S. (R) to Ph.D., (ii) M.Tech. to M.S. (R), and (iii) M.S.(R) to M.Tech. The details of the provisions are available in the Courses of Study.

ADMISSION OF FOREIGN NATIONALS

Applications from foreign nationals for admission to the various postgraduate programmes (M.Sc. / M. Tech. / M.S. (Research) / M.Des. / M.B.A. / M.P.P. / Ph.D.) at the Institute are received directly by the Institute. For more details please visit: ***https://international.iitd.ac.in/***

- **International Ph.D. Fellowship Programme (IPFP):** IIT Delhi has announced the International Ph.D. Fellowship Programme (IPFP), as an effort to attract talented young minds globally. Under this programme, fellowships to international Ph.D. students are given at par with Indian students. (For more details and application process, please visit: ***http://intladm.iitd.ac.in)***
- **International Masters Scholarship Programme:** A limited number of scholarships are available for International M.Tech./M.Des./M.S.(R) Students, who have not qualified GATE/CEED. The assistance is at par with Indian students. However, such students will be selected by a Central Committee on the recommendations made by respective academic units at the time of selection.
- **Applicants under Cultural Exchange Fellowship Programme:** The foreign nationals desiring admission to a postgraduate programme (M.Sc. / M.Des. / M.Tech. / MBA / M.S. (Research) / M.P.P. / Ph.D.) at IIT Delhi under this Fellowship programme, are required to apply to the Indian High Commissions / Embassies, in their respective countries. After examining the case of the applicants, they will recommend / sponsor the names to the Indian Council for Cultural Relations (ICCR), New Delhi, which in turn, will recommend the applicants to this Institute for selection through due process.
- **Students under Memorandum of Understanding:** Admission of foreign nationals to the various postgraduate programmes (M.Sc. / M.Tech. / M.S. (Research) / M.Des. / M.B.A. / M.P.P. / Ph.D.) at the Institute will be made in accordance with the terms and conditions of the MoU agreed to between IIT Delhi and the Country/University / Institution concerned.

3.3 Joint Degree Programmes

IIT Delhi is actively pursuing Joint Degree Programmes at the doctoral level with the following internationally acclaimed institutions:

- IIT Delhi and University of Queensland (UQ) have launched a joint Ph.D. programme recently. Under the programme, Ph.D. students (from India, Australia and elsewhere) will be admitted. IITD/QU faculty will jointly formulate projects and Students will be jointly selected against these projects. Students in this academy will spend 3 years at the parent institution and at least 1 year at the partner. Students who successfully complete all the requirements of the programme will be awarded a joint degree by both institutions. (For more details, please visit: ***https://www.uqidar.org***)
- IIT Delhi and National Yang Ming Chiao Tung University (NYCU), Taiwan have initiated an Industry funded Joint Doctoral Degree Programme (JDP). An academic and student exchange will be developed through the JDP whereby students who successfully complete all the requirements of the programme will be awarded a joint degree by both institutions. Students will be admitted at both institutions, at the time of joining or after they join the regular Ph.D. Programme. (For more details, please visit: ***www.iitd.ac.in***).

3.4 Scholarships

UNDERGRADUATE PROGRAMMES

Institute Merit-cum-Means (MCM) Scholarships

The Institute offers Merit-cum-Means scholarships to undergraduate students in engineering and technology. These scholarships are offered to about 25% of the students whose annual family income is upto 4.5 lakh. The present value of Merit-cum-Means scholarship is ₹1000/- per month for General/OBC/ EWS students and the recipient is exempted from paying tuition fee. For renewal of this MCM Scholarship, students need to maintain minimum CGPA and SGPA i.e. 6.0

Institute Merit Prizes and Certificates

The Institute offers Merit prizes and Certificates to the top 7% of the students of each 4-year B.Tech., and 5-year Dual Degree programmes each semester up to the 8th / 10th Semester. The value of merit prize is ₹2500/-.

Institute Free Studentship-U.G.

The Institute offers free studentship to 10% of the students on the basis of means alone.

Institute Free Messing: It carries basic menu plus ₹250/- per month as pocket allowance for SC and ST category only to get free messing facility, student's annual parental income should not be more than ₹4.5 lakh.

Scholarship provision for SC, ST, & PwD students: Tuition fee exemption is admissible to all SC / ST/PwD students irrespective of their parents' / guardians' income, Institute offers several other benefits to students from these categories.

Donor Scholarships: There are several other scholarships in operation at the Institute. These scholarships have been established by grants from alumni, individuals, trusts and organizations.

POSTGRADUATE PROGRAMMES

M.Sc. and M.P.P. Programmes

Merit-cum-Means scholarship of ₹1,000/- per month and tuition fee waiver are permissible to M.Sc. and M.P.P. Programmes students to the extent of 25% of the sanctioned strength as per Institute rules. Only those students are eligible whose parents' gross income is upto ₹4.5 lakh per annum for all categories of students / as per govt. orders as applicable .

M.Tech., M.S. (Research), and M.Des. Students: The Institute does not award any scholarship to the students of M.Tech., M.S. (Research), and M.Des. Programmes. However, a scheme for financial assistance is in operation. Apart from the teaching / research assistantships, there are a number of fellowships and scholarships Instituted by industries, alumni, and individuals for such students.

Ph.D. Students: Although the Institute does not award any scholarship, a scheme for the award of Teaching / Research Assistantship for providing financial assistance to the students exists. Under this scheme, those students, who are admitted on full-time basis, are offered Teaching/Research Assistantship, provided they are not getting any other equivalent fellowship.

3.5 Admission to Postgraduate Programmes

Degree	Status	Minimum Eligibility for Admission	Selection basis
M.Sc.	Full Time	At least 55%* aggregate marks or 5.5 CGPA/CPI out of 10 without rounding-off (taking into account all subjects including languages and subsidiaries, all years combined) for General/OBC (Non Creamy Layer)/ EWS category candidates (taking into account all subjects, including languages and subsidiaries, all years combined) in the qualifying degree. For Candidates with letter grades / CGPA on other scales, the equivalence will be decided by the Institute. For M.Sc. (Chemistry), Bachelor's degree with Chemistry as a subject for three years / six semesters and Mathematics at (10+2) level. For M.Sc. (Mathematics), Bachelor's degree with Mathematics as a subject for at least two years/four semesters. For M.Sc. (Physics), Bachelor's degree with Physics as a subject for two years / four semesters and Mathematics for at least one year/two semesters. For M.Sc. (Cognitive Science), Qualifying Degree: B.A./B.Sc./B.Com./ B.M.S./B.Tech./B.E./B.Stat./B.Math. or equivalent For M.Sc. (Economics), Qualifying Degree: B.A./B.Sc./B.Com./B.Tech./ B.E./B.Stat./B.Math. or equivalent	JAM (for Maths, Chemistry, Physics, Economics)# COGJET/ GATE/ JAM/ NET & interview (for Cognitive Science)
M.Tech.	Full Time	B.E./B.Tech. / M.Sc. or equivalent with (a) CGPA 6.00 on a 10 point scale or 60% marks in aggregate for General/OBC (Non Creamy Layer)/EWS Category with valid GATE score. B.Tech. from IITs with CGPA of 8.00 without GATE are also eligible for admission. AMIE / Grad. IETE are eligible, subject to condition at Note 7.	GATE
	Part Time	B.E./B.Tech. / M.Sc. or equivalent in relevant field with (a) CGPA 6.00 on a 10 point scale or 60% marks in aggregate for General/OBC (Non Creamy Layer)/EWS Category and minimum experience (as per table 3.5.1). Must submit No Objection Certificate from employer (as per Note 4) Organisation should be located within 50km. of IIT Delhi. Also see Note. 4.	Written test and /or interview
	Sponsored Full Time	Same as for M.Tech. part time requirements and Sponsorship Certificate from the employer as per Note 5.	-Do-
M.Des.	Full Time	B.E./B.Tech. / B.Des. / B.Arch. or equivalent in relevant field with CGPA 6.00 on 10 point scale or 60% marks in aggregate and a valid CEED score.	CEED and interview
M.B.A.	Full Time (Generic)	Bachelor's degree or equivalent (Minimum 3 years after 10+2) with CGPA of 6.00 on 10 point scale or 60% marks in aggregate for General/ OBC (Non Creamy Layer)/EWS Category.	CAT
	Full Time (with focus on Telecom-munication Systems Mgmt.)	Bachelor's degree in Engg. / Technology / Architecture / Pharmacy / B.Sc. Agri. Engg. (Minimum 4 year after 10+2) or Bachelor's degree in any branch of Physical / Chemical / Mathematical Sciences like Physics / Chemistry / Mathematics Statistics / Computer Application / Electronics Sciences / Environmental Science or Computational / Information science / Agriculture or Bachelor's degree in Commerce / Economics / CA/ ICWA with CGPA of 6.00 on 10 point scale or 60% marks in aggregate for General/OBC (Non Creamy Layer)/ EWS Category.	CAT
	Part Time (evening) (with focus on Technology Mgmt.)	Same as M.B.A. full-time (Telecommunication Systems Management) requirements and two-years experience. Also see Note 6.	Selection on Peformance (SoP) and interview

*Passing marks in case of admissions through JAM for the Year 2023-24.

#Some seats are through separate test only for 2023-24.

Degree	Status	Minimum Eligibility for Admission	Selection basis
M.S. (R)	Full Time/ Part Time sponsored Full Time / Part Time	Same as the corresponding M.Tech. requirements • For the currently registered students in Centrally Funded Technical Institutes (CFTIs) having CGPA of 8.0 or above (on a 10 point scale) at the end of 6th semester or later, in B.Tech. / B.E./Integrated M.Tech. / Integrated M.Sc. programmes (or any other programme of minimum four years duration, admission to which is on the basis of JEE), the requirement of GATE / National Examination is waived for consideration of admission the M.S. (R) programme in IIT Delhi. Moreover, such students must have obtained CGPA of 8.0 or above at the time of graduation (and before they formally register for the M.S.(R) programme). • The requirement of GATE / National Examination is waived for consideration for admission to the M.S.(R) programme for all graduated of CFTIs with a B.Tech. / B.E. / Integrated M.Sc. (or any other programme of minimum four years duration, admission to which is on the basis of JEE) with CGPA of 8.0 or above at the time of graduation. • The Requirement of GATE / National Examination is also waived for M.A. / M.Sc. from IITs with CGPA 8.0 or above. However, if a candidate admitted to M.S. (R) programme following the above criterion wanted to convert to M.Tech. programme, he / she should also meet the shortlisting criteria of the M.Tech. programme, in addition to the conversion criteria (including requirement, if any, of a valid examination in GATE / National Examination).	Same as the corresponding M.Tech. requirements.
M.P.P.	Full Time	Five-year bachelor's degree such as M.B.B.S., BA LLB (Hon.), B.Arch. or equivalent; four-year bachelor's degree such as B.Tech., B.Sc. (Ag.), B.V.Sc., or equivalent; postgraduate degrees such as M.A., M.Sc., M.Phil., Integrated M.Sc./M.A., M.Tech. or equivalent with 60% or 6.00 CGPA on a 10 point scale.	Written test and / or interview
Ph.D.	Full Time	Master degree in Engineering / Technology or master degree in Science / Humanities or equivalent in relevant discipline with CGPA 6.00 on 10 point scale or 60% marks in aggregate for General / OBC / EWS category. Full time students who do not possess M.Tech. or equivalent degree are required to have a valid GATE/CEED* Score or UGC / CSIR / DBT / ICMR / INSPIRE fellowship examination for Sciences / Humanities and Social Sciences disciplines. OR B.Tech. or equivalent with CGPA of 6.5 on a 10 point scale or 65% aggregate marks and qualified GATE or UGC / CSIR / DBT / ICMR / INSPIRE fellowship examination for Biomedical Engg., candidates having M.B.B.S. with 60% marks or more are eligible provided they have qualified ICMR. The Candidates having Postgraduate degree of Doctor of Medicine (MD) / Master in Surgery (MS) with 60% marks or more after MBBS will also be eligible for admission to Ph.D. Programme in CBME. • For the currently registered students in Centrally Funded Technical Institutes (CFTIs) having CGPA of 8.0 or above (on a 10 point scale) at the end of 6th semester or later, in B.Tech. / B.E. / Integrated M.Tech. / Integrated M.Sc. programmes (or any other programme of minimum four years duration, admission to which is on the basis of JEE), the requirement of GATE / National Examination is waived for consideration of admission the Ph.D. programme in IIT Delhi. Moreover, such students must have obtained CGPA of 8.0 or above at the time of graduation (and before they formally register for the Ph.D. programme).	Written test and / or interview

*CEED score is only for the Department of Design

		• The requirement of GATE / National Examination is waived for consideration for admission to the Ph.D. programme for all graduates of CFTIs with a B.Tech. / B.E. / Integrated M.Sc. (or any other programme of minimum four years duration, admission to which is on the basis of JEE) with CGPA of 8.0 or above at the time of graduation. • The Requirement of GATE / National Examination is also waived for MA or M.Sc. graduated from IITs with CGPA 8.0 or above.	
	Part Time	Same as for Ph.D. full time and minimum experience (as per table 3.5-1) and No Objection from the employer.	Written test and / or interview
	Sponsored Full Time or Part Time	Same as for Ph.D. full time and Certificate from employer (as per Note 8.) No GATE / National examination required (Note.11)	-Do-
	Part Time Foreign National Posted in Delhi	Same as for full-time Subject to conditions stipulated in Note 12.	-Do-
	PMRF	Under the Prime Minister's Research Fellowship (PMRF) Scheme, certain number of fellowship are allocated to the Institute. While PMRF fellows are governed by the same academic rules as any other research scholar, the selection of PMRF fellows is through a centralized process across all IITs/IISc. (For more details, please visit: ***https://pmrf.in***)	-Do-
	IITD - QU Joint Ph.D.	For admission in QU and IITD joint Ph.D. programme. (please visit: ***https://www.uqidar.org***)	-Do-
	IITD - NYCU Joint Ph.D.	Under this programme, each Institute would admit students to its HOME Institute as per their own criteria. Students would have to apply for admission to the HOST Institute when they have identified Co-Supervisor. HOST Institute will select as per its own criterion. The students apply to the Host Institute for admission within 12 months of their admission to the HOME Institute.	-Do-

NOTES:

1. 15% seats are reserved for SC candidates, 7.5% for ST candidates, 27% for OBC (non-creamy layer) candidates and 10% for EWS candidates.
2. For SC, ST and PD candidates, relaxation of 5% marks or 0.5 CGPA (on ten point scale) in the qualifying degree will be provided. Relaxation in CGPA to 5.50 or in marks to 55% in the minimum qualifying criteria may be permitted to those General / OBC / EWS candidates who possess M.A. Degree in English for admission to Ph.D. programme in the Department of Humanities & Social Sciences.
3. 5% of the seats allocated for full-time students, excluding sponsored students, students drawing assistantship from other sources and foreign students, are reserved for Persons with Disability (PwD) for admission to various Postgraduate Programmes. The candidates selected against the quota for PwD be placed in the appropriate category viz. SC / ST / OBC / EWS / General Candidates depending upon the category to which they belong.
4. No Objection Certificate should state that the candidate is permitted to pursue studies on part time basis and he / she will not be transferred to any other place during the period of study.

5. Sponsorship letter (on letterhead of the sponsoring organization) should state that period of study will be treated as on duty with usual salary / allowances and he / she would be fully relieved and granted study leave for the period of studies.
6. For part-time MBA programme, the classes are held in the evening.
7. Candidates with AMIE/grad. IETE fulfilling the minimum eligibility criteria can be considered for admission as visiting students for completing 24 earned credits of undergraduate courses as prescribed by the respective programme after which they have to appear for GATE and apply afresh for admission to M.Tech. programme.
8. **Part-time candidates** are required to submit a "No Objection Certificate" (NOC) on a proper letterhead from the appropriate authority in the organization clearly stating the following:
   (i) the candidate is permitted to pursue studies on a part-time basis;
   (ii) he/she will be fully relieved from duty and permitted to reside at the Institute for the period of required residency that is essential for completing the course work (this is not a requirement for candidates who are working in NCR or organizations located within a distance of 50 km from the Institute)
   (iii) that his/her official duties permit him/her to attend required classes as per the Time Table of IIT Delhi;
   (iv) that his/her official duties permit him/her to devote sufficient time for research;
   (v) facilities for research in the candidate's field of research are available at the candidate's place of work, in case the proposed Ph. D. research plan requires him/her to use these facilities when the candidate is physically present at this place of work.
9. Full-time applicants coming on study leave must show proof of at least 3 years (2 years in the case of M.Tech. degree holders) study leave when appearing for the interview.
10. CGPA is Cumulative Grade Point Average. For the purpose of admission at IIT Delhi, the conversion factor of 10 would be used for converting percentage to CGPA (divide by 10). However, this conversion to CGPA will only be applied in case of the primary method of evaluation followed in the graduating institution of the candidate seeking admission is percentage marks.

    For CGPA with scales of other points, a linear interpolation will be used i.e.

$$G=G_X*10/X$$

    where G is the GPA on 10 points scale and G_X is the GPA on 'x' point scale. Conversions worked out using the above formula for some scales are given in the following table:

%	CGPA 10	CGPA 9	CGPA 6	CGPA 4
50	5	4.5	3	2
55	5.5	4.95	3.3	2.2
60	6	5.4	3.6	2.4
70	7	6.3	4.2	2.8
75	7.5	6.75	4.5	3
80	8	7.2	4.8	3.2
90	9	8.1	5.4	3.6

    The minimum prescribed 60 / 55 / 50% marks in aggregate (of all the years / Semesters of the qualifying examinations) is calculated by IIT Delhi as per the following example:-

	1st semester	%	2nd semester	%
1st year	250/400	62.50	290/400	72.50
2nd year	205/400	51.25	280/400	70.00
3rd year	210/400	52.50	350/400	87.50
4th year	240/400	60.00	150/400	75.00
Total	**905/1600**		**1070/1600**	**%**

- Aggregate (%) (of all the years/semesters) 1975 / 3200 = 61.71%

11. Sponsored (Full-time) / Part-time candidates are not required to possess GATE / CEED score for admission to postgraduate / Ph.D. programmes.
12. The registration of foreign nationals, posted in Delhi, to Ph.D. Programme on part-time basis can be made on the terms and conditions as under :-
    (i) The admission will be subject to production of Research Visa for study at IIT Delhi.
    (ii) The candidate should satisfy all the requirement as applicable to part-time scholars.

Table 3.5.1 : Experience required for admission to part-time Ph.D. / M.Tech. / M.S.(R) Programmes.

For admission to part-time programme	Qualifications	Work Experience (Post Qualification)
Ph.D.	M.E./M.Tech./M.S.(R)/M.D. or Equivalent	Nil
Ph.D.	B.E./B.Tech./M.Sc./M.A./M.B.A./MBBS or equivalent, from CFTIs/Central Universities	1 Year
Ph.D.	B.E./B.Tech./M.Sc./M.A./M.B.A./MBBS or equivalent, and working in IIT Delhi* (Project or Regular) *Through proper channel	1 Year
Ph.D.	B.E./B.Tech./M.Sc./M.A./M.B.A./MBBS or equivalent, from institutions other than CFTIs/Central Universities	2 Years
M.Tech./M.S.(R)	B.E./B.Tech./M.Sc. or equivalent, from CFTIs/Central Universities	6 Months
M.Tech./M.S.(R)	B.E./B.Tech./M.Sc. or equivalent, and working in IIT Delhi* (Project or Regular) *Through proper channel	6 Months
M.Tech./M.S.(R)	B.E./B.Tech./M.Sc. or equivalent from institutions other than CFTIs/Central Universities	1 Year

3.6 Medals and Prizes

IIT Delhi also awards numerous medals and prizes to the students on the basis of examination / project and all-round performance in sports, co-curricular activities, etc. At present there are over 100 such medals and awards in operation.

4. FEES

The fees payable by 2023 entry year students are given in Table below:

4.1 Fees Payable by Students of the Entry Year 2023

Tuition Fees (per Semester)		
Programme		**Tuition Fee**
B.Des./B.Tech. / Dual degree[#]		₹ 1,00,000**
M.Sc.		₹ 7,500
M.Tech./ M.S.(R)/ M.Des./ M.P.P. (Receiving Institute / Project Assistantship or Teaching position holders)		₹ 17,500
M.Tech. / M.S.(R) / M.P.P./M.Des. / PG DIIT (Sponsored, FT / PT & Non-teaching position holders)		₹ 75,000
Ph.D. (Full Time)		₹ 7,500
Ph.D. (Part Time / Sponsored)		₹ 17,500
M.B.A. Self-financing	Full Time	₹ 2,80,000
	Part Time	₹ 2,10,000
Foreign National[@] B.Tech./Dual Degree	SAARC Countries	US$ 1,000
	Non SAARC Countries	US$ 2,000

[@]The fee for the foreign nationals joining PG/Ph.D. programme will be at par with Indian students.

Other charges (to be paid every semester alongwith Tuition Fee)

A	**Institute Fees**	
	Examination fees	₹ 1,500
	Registration / Enrolment fees	₹ 750
	Gymkhana	₹ 1,250
	Medical fees	₹ 750*
	Internet and computer access fee	₹ 1,000
	Transport charges	₹ 100*
	Total	**₹ 5,350**

B	**Hostel Fees**	**B.Des./B.Tech./ Dual Degree**	**MBA/M.Sc.**	**Ph.D./M.Tech./M.Des./M.S.(R)/PG DIIT**
	Institute Residence Fee	₹ 13,250	₹ 13,250	₹ 13,250
	Total	**₹ 13,250**	**₹ 13,250**	**₹ 13,250**

C	**Other Payments**	
	Student Distress Fund Scheme (each semester)	₹ 400
	Insurance Scheme (yearly)	₹ 500
	Total	**₹ 900**

D. One Time payment to be paid at the time of admission

	Non Refundable	
	Admission fees	₹ 2,000
	Student welfare fund	₹ 750
	Modernization fees	₹ 1,500
	Benevolent fund	₹ 400
	Alumni fees	₹ 2,000
	Training and Placement charges	₹ 1,500
	Total	**₹ 8,150**

E	**Refundable**	
	Institution security deposit	₹ 4,000
	Library security deposit	₹ 4,000
	Total fees payable at the time of admission	**₹ 8,000**

Updated as per the notification No.: IITD/AREG/2022/72297 issued from Registrar

1. **Total other charges payable for B.Tech., Dual Degree, M.Sc., and MBA (with hostel) ₹35,650, without hostel ₹22,400.**
2. **Total other charges payable for Ph.D. / M.Tech. / M.S.(R) / P.G. D.I.I.T. / M.Des. / M.P.P. (with hostel) ₹35,650, without hostel ₹22,400.**

NOTE :

1. #The tuition fee in 9th semesters and later will be ₹17,500/- per semester for Dual-degree programmes.
2. *Medical fee and transport charges are applicable to full time students only.
3. **1/3rd of tuition fee for student with family income between ₹1 lac to ₹5 lac per annum. Other students (other than SC, ST & PwD) whose family income is less than ₹1 lac per annum will get 100% tuition fee exemption.
4. Thesis fee for M.S.(R) and Ph.D. is ₹500/- and ₹5,000/- respectively and shall be payable at the time of submission of thesis.
5. All SC, ST & PwD students will get 100 % tuition fee exemption.
6. Hostel is available only to full time students subject to availability.
7. Messing and electricity charges will be calculated on completion of each semester and will be notified separately.

4.2 Foreign National Visiting Students

Following are the tuition fees per semester, chargeable from Self-financing foreign National Students including those seeking admission as visiting students :

I) US $ 1,000 for SAARC Countries.

ii) US $ 2,000 for other Countries.

4.3 Mode of Payment

(a) Institute dues:

All Institute dues are to be paid Online through ERP/State Bank of India (SBI) I-collect facility.

Payment by challan slip is allowed only to the following:

(i) students who have taken loan from a bank (for educational purposes), or

(ii) students who are holders of a scholarship from outside sources who directly send cheque(s) for fees in the name of the Institute.

(b) Mess dues: Payment Portal for payment of Hostel Mess Fees:-

Please click on the following URL - **https://ecampus.iitd.ac.in/scorner**

4.4 Deadlines for Payment

(a) Institute dues:

(i) All Institute dues are to be paid in full before the last date for Late Registration (this is typically one week after the first day of classes)

(ii) Students who do not pay the required amount by this date, or those who make partial payments, shall have their registration cancelled. Registration will be restored on payment of fees and a fine as stipulated in the Institute rules.

(iii) In case of new entrants, the fees are to be paid on the day of registration at the time of joining the Institute.

(b) Mess dues: All Mess dues are to be paid on or before the allotment of hostels.

4.5 Refund of Fees

The whole amount of fees / other charges deposited by the students will be refundable after deduction of ₹1,000/, if the students do not join the programme after paying the dues and leave the Institute by applying for refund on or before the date of registration. No refund of fees will be permissible to students who have registered for the programme but leave immediately thereafter. In such cases, only security deposit will be refunded.

5. STUDENT LIFE ON CAMPUS

The ambience in the campus and a variety of activities (both co- and extra- curricular) provide an invigorating and creative environment towards a holistic educational experience at IIT Delhi.

Student life at IIT Delhi emphasizes on the importance of working in teams while giving equal importance to the development of independent thinking. Values such as tolerance and respect for diversity are at the core of all interactions. All students enjoy the freedom to develop and nurture their interests – responsible utilization of this freedom is an aspect they learn, and this serves them throughout their lives.

Accommodation that can be offered to students on the campus is limited. However, all students, regardless of whether they reside in the campus or not, have ample opportunities to participate in co- and extra-curricular activities, including access to state-of-the-art academic laboratories, sports, and games facilities, as well as other recreational avenues available on campus. Thus, severe constraints on the available in-campus accommodation that do not allow all students to be offered in-campus residence, do not inhibit their exploration of various interests at IIT Delhi.

Special efforts are also made to promote and strengthen student-teacher interaction. A specific counselling Service is available to assist and support students in their initial adjustments, and to deal with any difficulties, they may have during their stay at the Institute.

The pace and mode of student life in the IIT Delhi campus is planned, implemented, and supported by the following student bodies:

5.1 Student Affairs Council (SAC) and its five Boards:

- 5.1.1 Board for Hostel Management (BHM)
- 5.1.2 Board for Recreational & Creative Activities (BRCA)
- 5.1.3 Board for Sports Activities (BSA)
- 5.1.4 Board for Student Publications (BSP)
- 5.1.5 Board for Student Welfare (BSW)

5.2 National Service Scheme (NSS)

5.3 National Cadet Corps (NCC)

5.4 Counselling Services (CS)

5.5 Student-Teacher Interaction Committee (STIC)

5.6 National Sports Organization (NSO)

5.7 Co-curricular and Academic Interaction Council (CAIC)

5.1 Student Affairs Council (SAC)

The Student Affairs Council is a joint student-faculty Senate Committee to deal with overall policy formulation, coordination, and review of student affairs, which are of non-academic nature.

The SAC co-ordinates the activities of the various student organizations, viz., Boards for Recreational and Creative Activities, Sports, Hostel Management, Students Publications and Student Welfare. It also works to promote the student interests and endeavors to create healthy traditions in campus life.

5.1.1 Board for Hostel Management (BHM)

The Board for Hostel Management is responsible for policy formulation, co-ordination, and review of all matters relating to the management of the Halls of Residence. It implements and manages all decisions, rules and regulations laid down from time to time by the Student Affairs Council and the Authorities of the Institute.

5.1.2 Board for Recreational and Creative Activities (BRCA)

The BRCA is the one-stop destination to get away with college stress and indulge in various recreational and creative activities. It gives a platform to nurture and showcase one's talent in co-curricular hobbies. The Showstopper is Rendezvous, our own cultural fest (one of the largest cultural festivals in India) which sees glamourous pro-nites and competitions on a national level.

The board has a plethora of clubs serving the needs of the diverse IIT Delhi community:

Fine Arts and Crafts Club, Hindi Samiti, Music Club, Wellness Club, Debating Club, Dance Club, Photography and Films Club, Quizzing Club, Literary Club, Dramatics Club, SPIC MACAY.

5.1.3 Board for Sports Activities (BSA)

Sports and games are essential components of human resource development and help in promoting good health and spirit of healthy competition, which, in turn, has a positive and deep impact on the holistic development of personality of the Youth- a potential source of energy, enthusiasm and inspiration. The Board for Sports Activities (BSA) had been looking after this important component for the development of the sports environment on the campus. It ensures that adequate facilities are given to sportspersons.

Some of our facilities are- a cricket field with four turf wickets, four flood-lit cricket practice pitches, flood-lit hockey and football grounds, three flood-lit volleyball and two basketball courts, eight flood-lit tennis courts (four synthetic and four clay courts), tennis practice wall, two squash courts, one badminton hall, two table tennis halls with synthetic flooring, one weight-lifting hall, Olympic size swimming pool, kid's pool, two multi-gyms, a flood-lit stadium with 400 meters athletics track, flood-lit jogging track and ancillary arrangements for all the games.

There is a newly constructed multipurpose hall with facilities for badminton, table tennis and squash courts.

5.1.4 Board for Student Publications (BSP)

The Board for Student Publications covers the viewpoint of the student community in various aspects. It encourages creativity and expression among the students. It's a platform which brings awareness and allows thought-provoking discussions on pertinent issues. It publishes journalistic analyses, holds a book fair, and organizes various competitions throughout the year.

Every year, - the signature Literati Festival is celebrated by BSP. Several speakers from the media, activism and writing space are invited to the festival.

5.1.5 Board for Student Welfare (BSW)

The Board for Student Welfare, IIT Delhi, is a student body set up with the intention to look after the Welfare of the Student Community. BSW has always been dedicated towards helping the Student Community in

every aspect of life in IIT Delhi. The Board adheres to a principle of making itself the organization of the students, for the students, and by the students.

BSW broadly runs two verticals under it: **Mentorship and Operations.**

Mentorship covers all mentoring facilities for freshers. Operations cover the well-being of students, metal health support and some events organized throughout the year.

5.2 National Service Scheme (NSS)

The National Service Scheme IIT Delhi, with a volunteer base of over 2000 students and faculties, believes in growing together with society. It aims at generating empathy in volunteers while serving society. It works in various domains- Education, Health, Environment, Society etc.

Some projects running in these domains, which give ample opportunities to students for participation are Vidya Teaching Project, Food4Thought, Aarohan, Neem School Project, She Codes Project, Teach for India, Blood Donation, Mental Health, Substance Abuse Project, Climate Crusade Project, Green Warriors, Animal Care, Eduride Volunteering, Gender Mainstreaming, Old Age Home and many more.

5.3 National Cadet Corps (NCC)

The National Cadet Corps is an organization aiming at the development of leadership, character, comradeship, and spirit of sportsmanship and the ideal of service, among the youth in educational institutions. The motto of NCC is "Unity and Discipline".

5.4 Counselling Service (CS)

Counselling Services support the students to enhance their efficiency and output to perform better and to cope with various distresses.

Counselling involves therapies based on cognitive, behavioral, rational, emotive, supportive, existential, and interpersonal and intrapersonal and personality domains of an individual.

5.5 Student-Teacher Interaction Committee (STIC)

STIC (Student-Teacher Interaction Committee) facilitates the organization of interactions between individual faculty and students enrolled in their respective courses. Also, many departments organize other events involving all their students and faculty for various courses. Every hostel also organizes an annual "STIC Dinner" that provides an informal avenue for outside-the-classroom interactions between students and their teachers.

5.6 National Sports Organization (NSO)

NSO is a classification in the scheme of education formulated in furtherance of setting a climate of sports consciousness and improvement of physical health (along with mental strength) among the youth during their period of education. Sports are included in the curriculum at IITD.

5.7 Co-curricular and Academic Interaction Council (CAIC)

The council is a joint committee of undergraduate students, postgraduate students and faculty which aims at maximal interaction between students and faculty, a good academic atmosphere and an efficient decision-making process based on consultation; and through these it aims to promote an overall development of students for the maximum realization of their potential. They provide feedback on all academic and allied matters. CAIC has following constituent clubs and societies:

Robotics Club, Axlr8r Formula Racing Club, Aero-modelling Club, Physics and Astronomy Club, Devclub, Economics Club, iGem- Club, Electrical engineering society, Mathematics Society.

5.8 Hostel Allotment and Charges

One important part of student life in IIT Delhi is hostels. The hostels on the campus are run and managed by BHM (Board for Hostel Management).

The number of seats required in the hostels for yearly admitted students is not sufficient to accommodate all. Hence policy for allotment has been made where priority categories are defined. Due to shortage of seats, often only students who are not residing within a certain distance from IIT Delhi can be accommodated in hostels. Others are required to arrange the accommodation on their own.

The hostels on the campus are self-contained with amenities such as a reading room, indoor games room, a lounge area, dining hall with mess facilities, TV in common room and access to internet.

There are twelve boys' hostels, three girls' hostels, one mixed type of hostel and one transit accommodation for girl students running in the campus. These are:

Boys Hostel: Nilgiri, Karakoram, Aravali, Jwalamukhi, Satpura, Zanskar, Kumaon, Vindyachal, Shivalik, Girnar, Udaigiri and Dronagiri (new)

Girls Hostel: Kailash, Himadri, Sahyadiri (new) and Nalanda (transit)

Mixed Hostel: Saptagiri (new)

Applicable hostel charges for regular allotment to full-time students of IIT Delhi is given here:

ONE-TIME CHARGES (for every fresh allotment)			
S.No.	**Category**	**Payable in Account**	**Charges (₹)**
a.	**BHM Deposits** (one time) Seat allotment charges *(Non-refundable)* Security *(Refundable)*	**Hostel Account**	 ₹7,000/- ₹15,000/-
PER SEMESTER CHARGES (No pro-rata applicable due to hostel operations being fully cooperative in nature)			
I	**Old Hostels**		
b.	***Hostel Mess Charges** *(Include food, kitchen consumables, human resources, electricity, IGL and associated costs)*	**Hostel Account**	*₹38,580/-
II a.	**New Hostels Centralized A/C NOT operational**		
b.	***Hostel Mess Charges** *(Include food, kitchen consumables, human resources, electricity, IGL and associated costs)*	**Hostel Account**	*₹41,580/-
II b.	**New Hostels Centralized A/C operational from April to October in a calendar year**		
b.	***Hostel Mess Charges** *(Include food, kitchen consumables, human resources, electricity, IGL and associated costs)*	**Hostel Account**	*₹52,980/-
III	**Nalanda/IP transit accommodation (on 4 students per apartment sharing basis)**		
b.	***Messing Boarding and Lodging Charges** *(Include food, kitchen consumables, human resources, electricity, IGL and associated costs)*	**Hostel Account**	*₹38,580/-
IV	**Family Apartments**		
b.	**Accommodation Charges** *(Caretaking service charges only, individual electricity/gas etc. are paid by respective individual residents directly)*	**Hostel Account**	₹3,000/-

* *The charges given above are tentative based on expenditures incurred during previous semesters (including estimates provided by the infrastructure unit) and may vary as per actuals – these actuals are calculated only at the end of semesters. The charges are also subject to revision from time to time (e.g., depending on electricity, IGL rates, revision of minimum wages by the Government etc.). At the end of the semester, any excess charge paid by the students in a semester will be adjusted towards the charges to be paid for the next semester, i.e., the amount to be paid by students in the next semester will be reduced by any excess charge paid by student in the previous semester.*

Any student leaving/vacating the hostel permanently (due to termination, or due to completion of academic requirements at IIT Delhi or due to exceptional personal circumstances after proper communication and permissions from competent authority), is refunded the excess amount paid in their bank account after duly submitting requisite form(s) with required information.

Note: All residents are expected to arrange their own bedding.

For more details, you may visit BHM website ***(https://bhm.iitd.ac.in/static/media/chargesNotification.b41761d5.pdf)*** or contact Office of Dean (Student Affairs) or write to adhm@admin.iitd.ac.in

5.9 Entrepreneurship Development Cell (EDC)

Entrepreneurship Development Cell is a student-run body working with an aim to promote, foster and nurture entrepreneurship amongst the student community at IIT Delhi. It works as a primary student body of the institute which helps the young aspiring minds to explore and open the doors of the promising and exciting world of entrepreneurship. The initiatives and activities of the cell are not just aimed at promoting and creating awareness about entrepreneurship as a career choice, they also aim to nurture entrepreneurial skills through different events, workshops and competitions, and provide all kinds of support to budding student entrepreneurs, ranging from mentorship and skill-development to facilitating the process of incubation-related activities. EDC IIT Delhi continuously works towards facilitating entrepreneurship education and developing a comprehensive resource pool.

In this pursuit, it organizes a plethora of events and initiatives, which includes the following:

- Exclusive Townhall Sessions with top entrepreneurs of the world
- Workshops, Guest Lectures and Bootcamps on entrepreneurship
- Mentorship Sessions with experienced entrepreneurs
- Annual Business and Entrepreneurship Conclave
- Facilitate Student - led startups in Legal Services
- Investor Meet-ups and Pitching Sessions
- Online Entrepreneurship Resource Portal
- Facilitate in Incubation Related Activities
- Business Plan Competitions

As an institute, IIT Delhi has always been at the forefront to support entrepreneurship and is proud to be the alma mater of a large number of Indian Unicorn founders, with many luminary alumni who have made their mark in the entrepreneurial sphere. EDC IIT Delhi provides a myriad of opportunities to all the interested students to interact with various entrepreneurs and top industry leaders, while providing them with a great platform to learn, network and gain exposure to the entrepreneurial world. Working along with FITT IIT Delhi, EDC IIT Delhi ensures a smooth support to the budding entrepreneurs, ready to transform their ideas into reality.

5.10 Diversity & Inclusion

The Office of Diversity and Inclusion under the charge of a Dean of Diversity and Inclusion was formally inaugurated by Supreme Court Justice D.Y. Chandrachud on 6th September 2022. The ODI had been functioning earlier under the leadership of the Associate Dean Student Welfare. The ODI brings together 5 distinct sectionalities of exclusion - gender, sexuality, mental health, disability and caste. The offices that work on these individual verticals are respectively, IGES (Initiative for Gender Equality and Sensitisation), Indradhanu (a queer collective), Counselling Services, Office of Accessible Education and the SC/ST Cell.

The vision of this office is to make the IIT Delhi campus a truly inclusive and accessible place for all, where everyone feels they belong and have an equal opportunity to thrive and grow. Our three main endeavours are to sensitise, to advocate and to recommend; we interface with all other units of the institute and work

to create an equitable space on campus in academics, infrastructural resources and co-curricular and extra-curricular activities. We work with student volunteers and faculty advisors who give generously and tirelessly of their time and energy to meet these goals.

Some of the activities that have been carried out by the different sections of the ODI are sensitisation workshops, film screenings, group discussions, art and poster making competitions, advocating for safe spaces to live and work in for all groups and under-represented minorities, advocating for hiring and training people from under-represented groups, auditing of the campus infrastructure for inclusivity and accessibility, training students with disability in various technical courses such as Python and holding awareness camps for the entire community.

IGES - Initiative for Gender Equity and Sensitisation

Formed in 2018, IGES is the gender unit of IIT Delhi and a vertical under the new Office of Diversity and Inclusion. IGES envisions creating a safe, welcoming, and harassment-free campus for everyone at the institute. It is a non-judgmental and safe space for students, staff, and faculty members to share their thoughts, concerns, anxieties, incidents, or dilemmas related to gender and sexuality. It provides support either directly or through referrals while maintaining confidentiality.

IGES frequently organises interactive workshops, film screenings, thematic discussions, and other events on gender-related issues. Workshops for gender awareness and the prevention of sexual harassment are conducted regularly for all cohorts of the institute community.

IGES is a team with representation from students, staff, and faculty members who meet regularly to plan, supervise, and execute gender-related initiatives. Students are encouraged to volunteer with the IGES, contribute to the ongoing activities, and suggest new ideas.

IGES also promotes conversations with multiple stakeholders to understand the gender-related challenges restricting an individual's access, career, and leadership in STEM fields. It works closely with various departments and the administration to recommend gender-inclusive policies and practices. The aim is to mainstream gender and equity perspectives in the institute's vision, planning, and day-to-day functioning.

Indradhanu - The LGBTQIA+ Collective

Indradhanu is an independent LGBTQIA+ (Lesbian, Gay, Bisexual, Transgender, Queer, Intersex and Asexual+) student-driven collective and resource body under the Office of Diversity & Inclusion (ODI). It is committed to raising collective consciousness and sensitization on the lives and struggles of diverse gender and sexual minorities among the IIT Delhi campus fraternity. The objective of the collective is two-pronged - on one hand, it is dedicated to creating a conducive space for diverse gender and sexual minorities on the campus to explore, socialize, learn and unlearn in a safe, comforting, and holistic environment, and on the other, it collaborates with relevant institute-level bodies on policy formulation and decisions that concern the rights, needs and human development of persons belonging to the LGBTQIA+ community. These goals are accomplished through a range of activities like community-level robust support mechanisms, awareness programmes, thematic dialogues, knowledge creation and hosting social events.

Since 2013, the collective has played an instrumental role in mainstreaming conversations on the rights of LGBTQIA+ persons within the campus through talks, pride marches and on the national stage by being a part of the Pan IIT petitioners' group that challenged the constitutional validity of Indian Penal Code 377 (a provision that criminalized homosexuality). In 2023, Indradhanu hosted India's first LGBTQIA+ pride festival on IIT Delhi campus which was attended by more than 38 Queer Collectives and 1000+ participants. Indradhanu endeavours to make IIT Delhi a more gender and sex-positive campus and strives towards the intersectional causes of human dignity, social justice, equality, and freedom.

Indradhanu - The LGBTQIA+ Collective

IIT Delhi is committed to a friendly and unbiased environment for people from diverse communities. Initiative for Caste Equity (ICE) is responsible for educating the campus community about the value of equality and

diversity in order to build such a discrimination-free environment. To ensure this, the Faculty Advisor for SC/ST students will work with both the SC/ST cell and the Dean, Office of Diversity & Inclusion as well as the Advisory Committee of the Office of Diversity & Inclusion.

As a policy, the category status of the students, i.e., SC/ST/OBC/Gen, should not be disclosed either in the hostel or in the classroom. The entire student community resides and dines together. Several measures have been implemented to address historical injustice and to assist students belonging to SC and ST categories. A senior faculty member is appointed as advisor to SC/ST students for advising them on academic and non-academic matters.

ICE organises various outreach programmes like seminars, workshops, film screenings and discussions related to issues of caste discrimination and awareness. In addition to this it organizes mock-interviews for final year SC/ST students to help with their placements, strengthens coordination between the work of the SC/ST Liaison Officer and the Student Advisor, arranges regular activities in student dorms highlighting issues of caste privilege as well as caste discrimination by way of short plays and discussions of stories, and connecting with SC/ST cells of other IITs. Any other activities suitable for this initiative may be undertaken by the Faculty Advisor, the Dean ODI as well as the Advisory Committee.

Accessible Education

The Office of Accessible Education (OAE) aspires to cater to the needs of students with disability, thus aiming to provide a comprehensive and accessible learning environment at IIT Delhi. Special assistance varying from academics to infrastructure requirements is facilitated by the Office. The main objective of the Office is to ensure equal opportunities in all aspects for every student with disability (SwD) on campus. The Office aims to provide various resources and appropriate services to the students, thus enabling an inclusive ecosystem at the campus.

Since OAE is in its full capacity operational and functioning to cater needs of students/faculty/staff with disabilities in all possible ways. The activities of the OAE office include:

1. Disability Awareness Workshop (DAW) seeks to sensitize and build empathy among non-disabled persons by helping them experience the challenges faced by persons with disabilities in their daily life and value their abilities. The Office has conducted 13 sensitization workshops with security staff, BSW mentors, and Zanskar Hostel Staff, an awareness activity for International Day for Persons with Disabilities, and International Week of Deaf People on campus. OAE has planned to conduct more sensitization workshop on campus to create inclusive ecosystems.
2. OAE has been able to facilitate the Installation of Braille Signage in the Humanities Department to promote accessibility for persons with visual impairment.
3. The provision of scribe and compensatory time (20 mins per hour) is offered to all students with disabilities on the campus.
4. As a part of technical training, a Python course is introduced for students with visual impairment. Four students with visual impairment benefitted from the course.
5. The Office has initiated the process for infrastructural and website accessibility audit (building, labs, and IT), regular follow up has been taken up.
6. Students with disability can reach out to the Office for various support services such as availing study material in accessible formats, needs for reasonable accommodation, and assistive aids required on the campus.

Assistive Aids at OAE: The following assistive aids are available with the office. Students with disabilities can use these resources depending on their needs.

1. Refreshable Braille Display – Dot book (ASSISTECH, IIT Delhi)
2. Electric Wheelchairs - 4
3. Smart Cane (ASSISTECH, IITD)-1
4. 5-fold Canes- 4

5. Microphone headsets-2
6. Large print keyboard-1
7. Hand held Magnifier devices with lights-4
8. Sonic Labeler-2
9. Kibo XS scanning and reading device-2
10. Tactile markers-2
11. Bumpons-1

5.11 Departmental Professional Societies

Most of the Departments / Centres / Schools have professional societies managed by the faculty and students to promote academic and professional interests. These societies also facilitate student-teacher interaction outside the classroom.

5.12 Medical Facilities

The Institute Hospital is a 14 bedded well equipped primary Health Care facility providing OPD treatment and admission for minor medical ailments. Being located in the centre of the campus, our patients have easy access to the medical facility. The Hospital has an outsourced Apollo Pharmacy which is open from 8 am to 8 pm providing good quality medicines. The Hospital is managed by a team of full time eight allopathic doctors, one homeopathic doctor, one dental doctor and six doctors on contract basis from outsourced agency for helping in OPD and emergency services and round the clock duties on all weekdays and holidays providing 24X7 availability of doctors in the emergency. The hospital has a physiotherapy unit and basic composite laboratory and one outsourced advanced pathology laboratory. The Dental unit is well equipped and the dental surgeon is managing all dental emergencies including minor oral surgical procedures. The Biomedical waste protocol is followed as per Government guidelines.

The Hospital is also visited by part time specialists from All India Institute of Medical Science (AIIMS) in the field of Cardiology, ENT, Orthopaedics, Ophthalmology, Psychiatry, Neurology, Dermatology, Pulmonology and Pediatrics on some days of the week as per visiting specialists schedule displayed on the hospital website. The doctors are assisted by efficient Nurses, Physiotherapist and other Paramedical staff and manage primary emergencies while serious patients are referred to All India Institute of Medical Science (AIIMS), Safdarjung Hospital (SJH) or IIT empanelled hospitals in an Ambulance which is available 24x7 on all days. The employees also have facility of health insurance which enables the working and retired beneficiaries to seek all the indoor and surgical treatment in good hospitals covered under the insurance scheme..

All UG and PG students can also avail of vidyarthi (group) mediclaim personal accidental insurance policy with M/s. National Insurance Co. Ltd. Details Email- ID: ***support@safewaytpa.in***.

IIT Delhi Hospital is a recognized centre for pulse polio immunization and was government covid vaccination centre for several months. The Hospital provides medical aid during Sports meet, Rendezvous, Annual Convocation, other Cultural functions & other events and free educative and health check-up camps for the IIT community. The group A employees also get the facility of annual health checkup at IIT empanelled hospital. The preventive Health Check up is done throughout the year for staff as well as students. All new appointments undergo medical examination in the hospital before they join the Institute.

The Hospital has developed a triage area in covid pandemic to segregate the fever cases from other patients. There is covid testing facility within the institute where both Rapid Antigen Test and covid RT PCR test are done. The hospital functions round the clock to allay fears related to covid as well as efficiently provide online consultations for patients in quarantine and home isolation. Facility for teleconsultation is also available from 3 pm to 6 pm on all working days. New Hospital equipment has been installed in hospital with the alumini endowment fund.

5.13 Alumni Relations

The Office of Alumni Relations at IIT Delhi works to foster and maintain lifelong relations between the institute and its alumni. The Office serves as an official point of contact for over 58,000 alumni spread across the globe, building a dependable network of professionals who are proud of their alma mater. Alumni are also an integral part of many of the institute's activities and contribute intellectually, physically and financially in advancing the institute to reach greater heights and in facing future challenges.

The Office of Alumni Relations works towards recognizing the contributions of alumni in the form of distinguished alumni awards, implementing alumni-funded projects & activities, reporting to alumni about the institute and activities through newsletter, organizing alumni reunions and other events etc. Many of the institute faculty are also institute alumni.

IIT Delhi Endowment Office

Worldwide endowment funds were established by global education institutions to secure long-term financial stability and support their programs. They operate by accepting donations or purposeful grants from their alumni, corporates, foundations, and other institutions and invest the proceeds of those donations to generate investment income. The incomes thus generated are utilised to fund activities related to and for the benefit of these institutions, many of them for perpetuity.

On October 31, 2019, India's 1st Endowment Fund for IIT Delhi was inaugurated by the then President of India at the Rashtrapati Bhavan in Delhi, called the IIT Delhi Endowment Fund. The IIT Delhi Endowment Fund was set up along the lines of what one finds at the universities in the USA, such as Harvard, Yale, Stanford, and UK universities, such as Cambridge, Oxford, and others.

IIT Delhi Endowment Fund is governed by its board of directors, which includes eminent alumni from across the globe and the director of IIT Delhi. The activities of the fund are managed through a section 8 company called "IIT Delhi Endowment Management Foundation", which is run by its independent CEO, reporting to its board of directors. The IIT Delhi Endowment Fund, operating for over 2.5 years, aims to grow its 10-year fund size to US $ 1 Billion.

Apart from raising funds from alumni, the Endowment office is responsible for investing those funds to help maximize the returns for the institute and plays a crucial role in ensuring that the income earned through it is utilized both as per the wish of the donors and in supporting various academic and research activities of IIT Delhi, including scholarships, faculty development, infrastructure development, and other avenues, thereby helping to secure the future of IIT Delhi and supporting its mission of excellence in education and research. It also organizes various events, including alumni reunions, mentorship programs and a host of other alumni engagement activities.

Alumni Association

The IIT Delhi Alumni Association (IITDAA) was established in 1966 and fosters alumni relationships. The Association has multiple chapters spread over India and the entire globe. IITDAA is dedicated to bringing together the alumni community on a common platform to build another channel of personal and professional support to members through 'self-help' within the community. IIT Delhi Alumni Association today has a membership of over 54,000 graduates from our alma mater and is growing at about 2,000 members a year. Apart from serving as a base for information about the alumni, it initiates programs and organizes events important to alumni, their alma mater, and in the national interest.

5.14 Conduct and Discipline

A student shall conform to a high standard of discipline and shall conduct himself, within and outside the precincts of the Institute, in a manner befitting the students of an Institution of national importance. He/she shall have the seriousness of purpose and shall in every way, train himself to lead a life of earnest endeavor and co-operation. He/she must follow strict ethical standards. Under no circumstances he/she will adopt

unfair means for completing any component of evaluation in a course. He shall show due courtesy and consideration to the employees of the Institute and Halls of Residence, good neighbourliness to his fellow students, respect to the Wardens of the Halls of Residence and the teachers of the Institute and pay due attention and courtesy to visitors.

5.15 Honour Code

In order to promote ethical behaviour, the Institute requires every student to agree to abide by the Honour Code. At the time of admission, every student has to sign the Honour Code and submit a copy to the respective academic section. Violations of this Code are taken very seriously and may result in suspension or expulsion. The Honour Code is given on the inside back cover of this document.

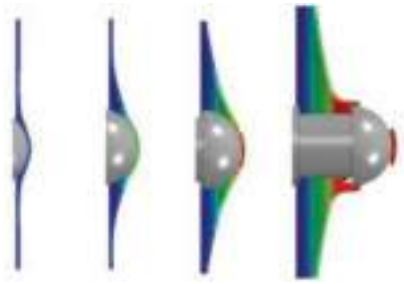
5.16 Institute Policy on Ragging

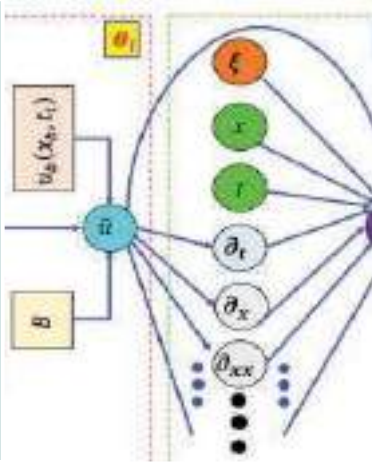
Ragging is banned in the Institute. If a student is found to have indulged in ragging in the past, or if it is noticed later that he / she has indulged in ragging, then he / she may be expelled from the Institute.

5.17 Policy against Sexual Harassment

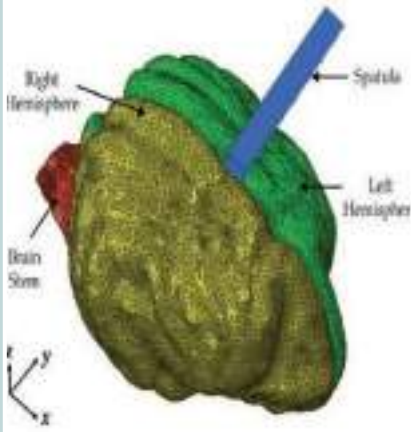
Institute has a policy against sexual harassment and is committed to providing an environment free from sexual harassment of women at the workplace.

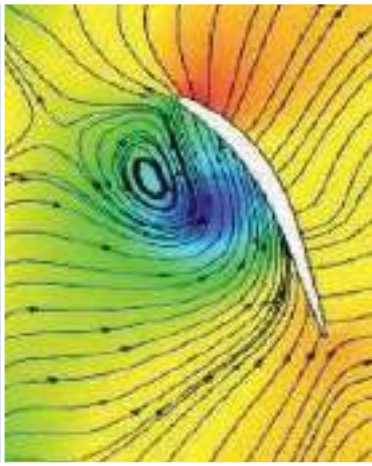
6. ACADEMICS UNITS

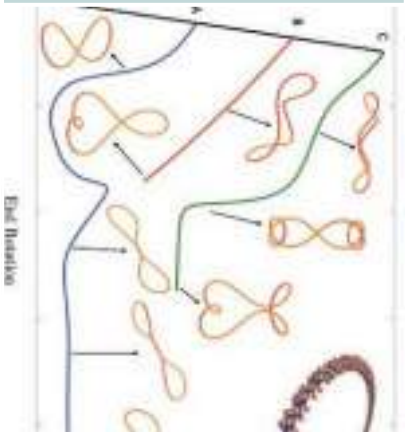


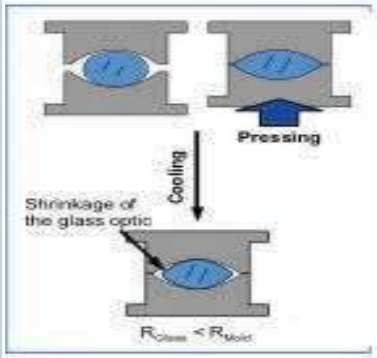


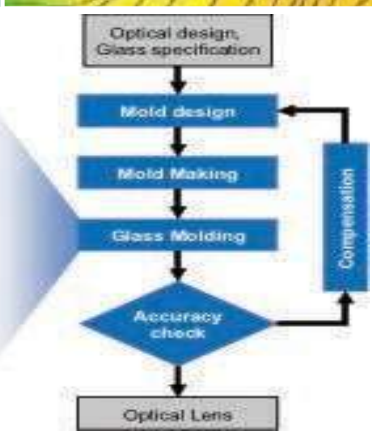
DEPARTMENT OF
APPLIED MECHANICS











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Cdr. Vikram Singh, *M.Tech. (IIT Bombay), PGDIIT (IIT Delhi)*
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Naval Architecture and Ocean Structures, Warship and Submarine Design.

INTRODUCTION

The Departmental activities in teaching and research can be broadly classified under the headings of Solid Mechanics, Fluid Mechanics and Design Engineering.

ACADEMIC PROGRAMMES

UNDERGRADUATE

The Department offers a B.Tech. in Engineering and Computational Mechanics. The B.Tech. Programme focuses on basic as well as the emerging areas of mechanics such as Bio-Mechanics, Nano-mechanics, Multi scale and Multi-physics modelling. The courses in the programme cover recent trends in computational techniques (FEM, CFD, parallel processing), high performance computing, machine learning, Artificial Intelligence (AI) etc. The students are exposed to fundamental and latest techniques in experiments and its importance for model validation. Students from other departments can also obtain minor degree in Applied Mechanics with specialization in Computational Mechanics.

Basic courses in Mechanics, Experimental Methods and Analysis, and Design Engineering that are part of the undergraduate core curriculum. Faculties are also involved in guiding undergraduate students of various programmes in their mini and major projects.

POSTGRADUATE

The Department offers Masters of Technology programmes in – (i) Engineering Analysis & Design. Students admitted to the M.Tech. Programme in Engineering Mechanics can opt for specialization in either (a) Engineering Mechanics (b) Product Design. Within Engineering Mechanics students can choose to work in Solid Mechanics or Fluid Mechanics. A masters of Science (Research) programme is also offered with specialization in Applied Mechanics. A Postgraduate Diploma course in Naval Construction is also offered, in collaboration with the Indian Navy, to officers sponsored by Indian Navy. The course is of one and a half years duration.

RESEARCH AREAS

The Department has been involved in the following broad areas of research:

- Elasticity, Plasticity, Large Deformations, Manufacturing Analysis, Impact and Crash worthiness, Composite Materials, Composite Plates and Shells, Off-shore Structures, Smart Structures, Snow Mechanics, Computational Methods for Stress Analysis and Structures, Structural Optimization, Finite Element Method, Seismic Analysis of Tall Structures, Parallel Computing, Non-linear Dynamics and Chaos, Stability and bifurcation theory, Nano-mechanics, Bio-mechanics, Impact Mechanics, Continuum Damage Mechanics, Probabilistic Mechanics, Structural Health Monitoring and Fracture Mechanics, Machine Learning in Mechanics, Physics-informed Deep Learning, Digital Twins, Stochastic Mechanics, Inverse Problems in Mechanics, Solid Mechanics Inverse Problems in Dynamical Systems, System Identification, Structural Health Monitoring, Creep and Fatigue Resistant Materials, Discrete Dislocation Dynamics, Lightweight Structures Design, Crystal Plasticity, Uncertainty Quantification.
- Hydrodynamic Stability Theory and Turbulence, (Theory Computation and Experimental), Low Dimensional Modelling, Proper Orthogonal Decomposition, Computational Fluid Dynamics; Compressible Flows; Industrial Aerodynamics and Pollution Dispersion, Wind Effects on Structures, Diffusers, Impellers, Combustors, Hypersonic Flows, Renewable Energy, Experimental Fluid Mechanics, Fluid structure interaction, Two-Phase Flows, Polymer Hydrodynamics, Environmental Fluid Mechanics, Biological and Complex/Polymeric Fluid Flows, Machine Learning in Fluid Mechanics, Theoretical and Computational Fluids and Molecular Mechanics, Nonlinear Waves in Fluids, Nonequilibrium

Thermodynamics, Computational Statistical Mechanics, Multiscale Modeling Techniques, Shock Waves, High Order Methods for Fluid Mechanics and PDEs, Electro-hydrodynamics, High Performance Computing, Aeroacoustics, Noise Control.

- Computer Aided Design, Design Engineering, Reliability Engineering.

Besides, the Department also organizes seminars, symposia, short-term courses and advanced summer schools for faculty of engineering institutes and engineers from industry. It also undertakes industrial consultancy work and has in hand both short and long-term projects sponsored by the government agencies and private industrial organizations.

Doctoral research is currently being carried out in:

Large Deformations, Impact Mechanics, Plasticity, Analysis of Manufacturing Processes, Composite Materials, Composite Plates and Shells, Non-linear Dynamics and Chaos, Off-shore Structures, Smart Structures, Snow Mechanics, Stress analysis and finite element application, Damage mechanics, Computational Methods for Fluid Flows, Pollution dispersion, Flow through Fluid Machines, Pipeline Engineering, Wind Engineering, Hydrodynamic Stability, Transition, Turbulence, Bio-fluid Dynamics, Computer Aided Design, Design Engineering, Reliability Engineering, Availability and Maintainability Engineering, Metal Foams, Nanocomposites, Friction Stir Welding, Pattern Formation in Granular Materials, Fracture Mechanics, Fatigue Crack Propagation, Environmental Cracking, Failure Analysis and Mechanical Properties of Solids, Nano-mechanics, Biomechanics, Stratified Flows, Design under uncertainty, Physics-informed Deep Learning and Stochastic Mechanics, Experimental Fluid Mechanics, Experimental Aeroacoustics, Fluid Structure Interaction, Two-Phase Flows, Polymer Hydrodynamics, Environmental Fluid Mechanics.

LABORATORY FACILITIES

The Department has well-equipped laboratories, workshop and library facilities. The laboratories and their major facilities are as follows:

- **Computation Laboratory:** Graphics Workstations with engineering software such as ANSYS, ABAQUS, COMSOL.

- **Design Optimization Laboratory:** Workstations, Dual Processor–Softwares such as IDEA, ABAQUS, FLUENT, MATLAB, MATHCAD.
- **Fluid Mechanics Laboratory:** Pilot plant test loop for slurry transportation, pilot plant for flow rate measurement up to 8 cusecs, Bohlin viscometer, Weissenberg Rheogoniometer, Water tunnel with advanced measurement techniques.
- **Gas Dynamics Laboratory:** Industrial wind tunnel (1.6m x 1.6m x 10m test section closed loop), Environmental wind tunnel (2m x 2m x10m suction type; is currently being renovated and may qualify for a central facility to be used by Civil Engineering Department, Mechanical Engineering Department and Atmospheric Sciences) and low turbulence wind tunnels, Wide angle diffuser rigs. Instruments: PIV(2D/3D), LDV, Hot wire Ancomometry, Pressure and Strain Scanners.
- **Instruments:** PIV (2D/3D), LDV, Hot wire Ancomometry, Pressure and Stain Scanners.
- **Impact Mechanics Laboratory:** Split Hopkinson Bar apparatus (tension and compression), High velocity projectile launch system, Dynamic three point bend test facility, Ultra high speed cameras, High speed data acq. system.
- **MTS Laboratory:** 250 kN and 25 kN & MTS machine with facilities for mechanical testing, fracture mechanics testing and fatigue testing.
- **Strength of Materials Laboratory:** 25 T Computerized Universal Testing machine (Zwick), 50 T Instron m/c, 10T and 100 T hydraulically operated Universal Testing m/c, Avery machines for hardness, impact, torsion and fatigue testing, Drop hammer facility (Instron 9250 HV) modified for Helmets. Stereo Zoom Microscope (Leica), 50 kN UTM machine with thermal chamber and bending/compression/fracture accessories (Zwick), Camera (Basler).
- **Biomechanics/Soft Material Lab:** 5kN UTM, AFM, Inverted Microscope Optical Bench, Sample preparation facility.
- **Stress Analysis Laboratory:** Photo-elastic bench, Reflection polariscobe, Moire fringe equipment, Digital strain meters, Super data loggers, Stress freezing ovens, etc.

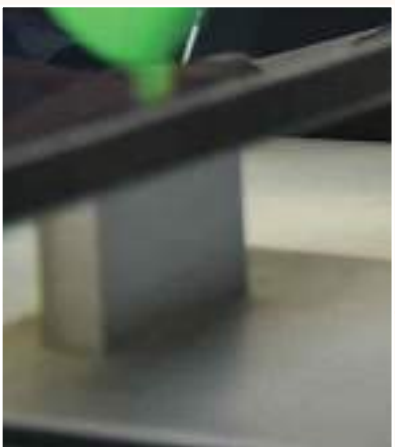
- **Workshop:** The departmental workshop has a number of machines that include Lathe machines, vertical milling machines, shaping machine, drilling machines, bench grinders, high temperature furnace, welding sets etc.
- **Composites Lab:** Vacuum Assisted Resin Infusion Moulding, Fixtures for testing composites and micro-CT scanner.

DEPARTMENT OF

BIOCHEMICAL ENGINEERING AND BIOTECHNOLOGY





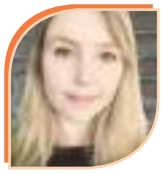



Ritu Kulshreshtha, *Ph.D. (Delhi Univ.)*
Professor
RNAi Technology, MicroRNAs in Cancer Biology, Cancer/Disease Biomarkers, Hypoxia Research.

Head of the Department

Shaikh Ziauddin Ahammad, *Ph.D. (IIT Delhi)*
Professor
Wastewater Treatment-physico-chemical and Biological, Anaerobic Wastewater Treatment.

Amit Das, *Ph.D. (SN Bose National Centre for Basic Sciences)*
Assistant Professor
Biophysics, Cell and Tissue Mechanics, Computational Modeling.



Lucinda Elizabeth Doyle, *Ph.D. (Nanyang Technological University, Singapore)*
Assistant Professor
Electromicrobiology, Microbial electrochemistry, Electrochemically-active Microorganisms.

Ravikrishnan Elangovan, *Ph.D. (Florence University)*
Professor
Single Molecule Biophysics, Fluorescence Spectroscopy, Molecular Motors, Skeletal Muscle Mechanics.

Ishaan Gupta, *Ph.D. (EMBL & University of Heidelberg, Germany)*
Assistant Professor
Biostatistics and Functional Genomics, RNA Biology, Aging, Neurodegeneration and Organ degeneration, Parasitology.

Ashish Misra, *Ph.D. (Rutgers The State University of New Jersey, New Brunswick)*
Assistant Professor
Metabolic Analysis and Engineering, Clinical Diagnostics, Bioprocessing.

Prashant Mishra, *Ph.D. (JNU)*
Professor
Enzyme Science and Engineering, Pharmaceutical Proteins, Bio-nano-technology, Drug Delivery.

K.J. Mukherjee, *Ph.D. (IIT Delhi)*
Professor
Bioprocess Optimization and Scale up; Designing Host Platforms for Over-expressing Metabolites and Recombinant Proteins and Linking then with Bioprocess Strategies for Overproduction.

Atul Narang, *Ph.D. (Purdue Univ.)*
Professor
Systems Biology of Microbial Gene Regulation.

Sunil Nath, *Dr. Ing. (Braunschweig Univ. Germany)*
Professor
Bioseparation, Mechanism and Thermodynamics of ATP-based Molecular Machines, Molecular Systems Biology/Engineering.

Anjan Roy, *Ph.D. (Raman Research Institute, India)*
Assistant Professor
Theoretical Biology, Bacterial Physiology, Statistical Mechanics.

Shilpi Sharma, *Ph.D. (Ludwig Maximilians Univ. of Munich, Germany)*
Professor
Plant-microbiome Interactions, Rhizosphere Engineering, Development of Next Generation Bioformulations, Fabric-microbiome Interactions.

Kumari Priti Sinha, *Ph.D. (IIT Bombay)*
Assistant Professor
Bio-microfluidics, Biophysics, Electrohydrodynamics.

T.R. Sreekrishnan, *Ph.D. (IIT Delhi)*
Professor
Production of Biodegradable Polymers; Development of Biosensors for Monitoring Environmental Pollutants.

Preeti Srivastava, *Ph.D. (IIT Delhi)*
Professor
Biodesulfurization of Petroleum Fractions

D. Sundar, *Ph.D. (Pondicherry Univ.)*
Professor
Bioinformatics, Computational Genomics, Genome Engineering, Synthetic Biology.

INTRODUCTION

The history of the Department of Biochemical Engineering and Biotechnology at IIT Delhi dates back to 1974, when the Biochemical Engineering Research Centre (BERC) was established. In the decades since, the Department has developed an interdisciplinary research and teaching agenda. The Department offers a unique blend of scientific expertise in applied biological sciences, chemical and biochemical engineering. It strives for application of this expertise to evolve various biotechnological products, processes and services through:

- Generation of highly trained human resource capable of quantitative analysis of biological systems to facilitate their role in manning modern bioprocess industries and to provide an integrated approach to research and development in biotechnology.
- Evolving research and development programmes to develop products and provide services in bioenergy, environment and therapeutics.
- Leading global innovations in Bioprocess Technology, Applied Biological Sciences and facilitate participation in industrial consulting and sponsored research.
- Dissemination of knowledge generated through short term courses, workshops and conferences.

Vision: To cultivate an interdisciplinary approach to the understanding and application of biological systems, and to foster the curiosity and expertise of the next generation of scientists and engineers.

ACADEMIC PROGRAMMES

The Department offers a variety of degree programmes: B.Tech. (Biochemical Engineering and Biotechnology), M.Tech. (Biomolecular and Bioprocess Engineering), M.S. (Research) and Ph.D. Each programme has been developed to provide rigorous student training in both the fundamental and applied aspects of the field.

Level	Programme	Duration	Entry Mode
UG	B.Tech. (Biochemical Engineering and Biotechnology)	4 years	JEE (Advanced)
PG	M.Tech.	2 years	GATE
PG	M.S. (Research)	2 years	GATE + Interview
PG	Ph.D.	>= 4 years	CSIR-NET/GATE + Interview

Joint Ph.D. Programmes

Currently Department has a joint Ph.D. programme with University of Queensland, namely UQIDAR. Please visit *https://www.uqidar.org/* for details.

Foreign Nationals are encouraged to apply for the Ph.D. programme at the Department. The fees would be at par with the Indian Nationals. For details about eligibility and process of admission please visit *http://intladm.iitd.ac.in/apply.php*

RESEARCH AREAS

The Department currently has 17 faculty members working in the areas of (i) Bioprocess & Metabolic Engineering, (ii) Systems & Computational Biology, (iii) Environmental Biotechnology and (iv) Molecular Biology of Disease, Diagnostics & Bionanotechnology.

Some of the focal areas of research of the department are:

- Bioprocess Engineering
- Cell and Molecular Biotechnology
- Environmental Biotechnology
- Cancer Research
- Theoretical and Computational Biophysics
- Downstream Processing
- Systems and Computational Biology
- Bionanotechnology
- Functional Genomics
- Microfluidics

LABORATORY FACILITIES

The Department is well equipped for the teaching and research programmes and the equipment and facilities are regularly modernized as per requirements. Major equipment and facilities are:

- **Bioreactors:** Several bioreactors with capacities ranging from 0.5 to 300 litres, equipped with instruments for monitoring and control pH, temperature, dissolved oxygen, measuring & controlling volumetric gas flow rate, and gaseous O^2/CO^2 levels. A pilot plant facility is available for transferring laboratory scale data to industrial scale.
- **Bioseparation:** Ultra-filtration unit, ultracentrifuge, ultrasonic disintegrator.


- **Analytical Equipment:** Multiplexed MS, FTNIR with probe, Spectrofluorimeter with probe, Elemental analyzer, HPLC, IC, GC, FPLC, GC-MS, ICP-MS, LCMS and other chromatography systems; visible and UV spectrophotometer, CD Spectropolarimeter; Spectrofluorimeter; Fluorescene microscope and Flow cytometer.




- **Molecular Biology:** Several molecular biology labs containing standard equipment such as laminar flow chamber, CO2 Shaker Incubator, anaerobic work cabinet, centrifuges, water baths, sonicators, lyophilizer, isoelectric focusing unit, scanning laser densitometer, PCR, and RT-PCR electroporation-electrofusion system. There is also a lab equipped with a scintillation counter for working with radioisotopes.


- **Computing Facility:** A separate computation lab with several PCs is also available. A Bioinformatics Centre sponsored by the Department of Biotechnology, Government of India, under the Biotechnology Information System Network (BTISnet) is also housed in the department.


- **Well Equipped Teaching Labs:**



MAJOR ACHIVEMENTS OF THE DEPARTMENT

Major Research Projects:

- DBT Unit of Excellence for cancer research
- DBT-AIST International Laboratory for Advanced Biomedicine (DAILAB) - expansion to DBT-AIST International Center for Translational and Environmental Research (DAICENTER)

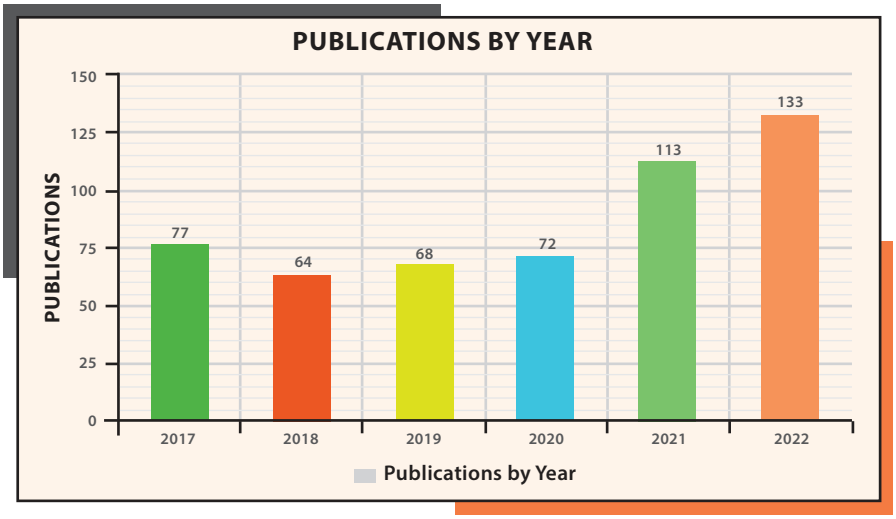
- GenomeIndia: Cataloguing the Genetic Variation in Indians
- DBT-Netherlands LOTUS project for cleaning Barapulla Drain
- Center of excellence for production of designer biopolymers
- Development of affordable system for rapid diagnosis of TB
- DOSA - Diagnostics for One Health and User Driven Solutions for AMR
- PAVITRA GANGA - Unlocking wastewater treatment, water re-use and resource recovery opportunities for urban and peri-urban areas in India
- Indian Nanoelectronics Users Program – Idea to Innovation
- Plastic biodegradation using microbial consortia and engineered microorganisms

R&D Achievements:

- Transfer of biofertilizer production technology to Nagarjuna Chemicals & Fertilizers
- Mass production of designer biopolymers
- Novel portable device for early-stage detection and categorisation of blood bacterial infection

~ 20 patents filed in past 5 years

Publications:



International

- National Institute of Advanced Industrial Science and Technology (AIST), Japan
- Clemson University, USA
- University of Ulm, Germany
- University of Otago, New Zeland
- University of Queensland, Australia
- University of Buffalo, USA
- Technological University Dublin
- HUJI, Israel
- INRAE, Rennes, France
- Indo-Dutch

- Indo-EU
- Indo-German

National

- GenomeIndia project (consortium of 20 Institutes) *https://www.cbr.iisc.ac.in/research/flagship-projects/genomeindia/*
- IIT Kanpur
- All India Institute of Medical Sciences, New Delhi
- National Institute of Immunology, New Delhi
- Jawaharlal Nehru University
- Aligarh Muslim University
- Jamia Hamdard University
- Regional Center of Biotechnology
- ICAR-CPRI
- Mizoram University

FUNDING

The Department boasts of funding from various National and International funding agencies

STUDENT'S ACHIEVEMENTS

- Recipient of Prime Minister Research Fellowships
- Best Poster awards in various National and International Conferences
- Start-Ups
- Placements in reputed core companies like Novartis, Novozymes, Merck, Pfizer and various non-core companies

Startups by our Alumni

Safe Analytics Pvt. Ltd. Imbed Biosciences, FinAccel, Strategy Connect, Brown Foods, Stealth Mode, Claim Therapist, Eumentis, Survey2connect, Gemini Solutions Pvt. Ltd. Itaas, Tekie, Valetude Primus Healthcare Pvt. Ltd., Agrowave, Kvayat Medical, Accio Jobs, Larn AI, Stealth Start Up, Bharat Pe, Ether, EffyRile, Myways.ai, Nirmalaya, Quirksmith Lifestyle.

DEPARTMENT OF
CHEMICAL ENGINEERING

Anil K. Saroha, *Ph.D. (IIT Delhi)*
Professor
Multiphase Reactors,
Environment Engineering.

Head of the Department

Suddhasatwa Basu, *FNAE, FNASc., Ph.D. (IISc., Bangalore)*
Professor
Hydrogen and Fuel Cell Technology,
Electrochemical Energy Storage & Engineering

Ashok N. Bhaskarwar, *Ph.D. (IISc., Bangalore)*
Professor
Interfacial Engineering, Chemical Reaction Engineering, Pollution-prevention Technologies, Chemical Product Design.

Divesh Bhatia, *Ph.D. (Univ. of Houston)*
Associate Professor
Automotive Catalysis, Transient Catalytic Systems, Gas Cleanup and Conditioning,
Hydrogen Engines and Emissions.

Vivek V. Buwa, *Ph.D. (IIT Bombay)*
Professor
Computational Fluid Dynamics, Multiphase Flows, Reactor Engineering.

Paresh P. Chokshi, *Ph.D. (IISc., Bangalore)*
Professor
Hydrodynamics Stability, Theoretical/Computational Polymer Physics, Dynamics of Complex Fluid, Polymer Processing.

Shalini Gupta, *Ph.D. (NC State Univ.)*
Professor
Colloidal Interactions and Nanoscale Engineering, Molecular Self-assembly, Microfluidics, Nanolithography.

Somnath Ghosh, *Ph.D. (Univ. of Twente, Netherlands)*
Assistant Professor
Microfluidics, Fluid Mechanics, Functional Colloids Synthesis and their Interaction, Interfacial Engineering.

Gaurav Goel, *Ph.D. (Univ. of Texas, Austin)*
Associate Professor
Transport at Nanoscale, Structure-property Solvophobic Interactions and Self-assembly.

Mohammad Ali Haider, *Ph.D. (Univ. of Virginia)*
Professor
Heterogeneous Catalysis,
Biorenewable Chemicals and Biofuels.

Rajesh Khanna, *Ph.D. (IIT Kanpur)*
Professor
Phase Separation, Thin Liquid Films, Mist Reactors, Collids and Interfacial Science.

Hariprasad Kodamana, *Ph.D. (IIT Bombay)*
Associatet Professor
Model Based Control, System Identification, Process Monitoring, Bayesian Inference, Process Data Analytics.

Manjesh Kumar, *Ph.D. (University of Houston)*
Assistant Professor
Novel Material Synthesis, Characterization and Design, Heterogeneous Catalyist, Mechanistic Study of Functional Material Failure Modes.

Jyoti Phirani, *Ph.D. (Univ. of Houston)*
Associate Professor
Flow Through Porous Media, Reservoir Simulation, Enhanced Oil Recovery, Unconventional Energy Resources.

Sudip K. Pattanayek, *Ph.D. (IIT Bombay)*
Professor
Polymer Physics, Biopolymers Under Flow, Polymer Nano-composites.

Abhijeet Raj, *Ph.D. (University of Cambridge, UK)*
Associate Professor
Fuel combustion and pollutant emission reduction; Acid gas process modeling and simulation; Hydrogen and syngas; Reaction kinetics and mechanism development.

Manoj C. Ramteke, *Ph.D. (IIT Kanpur)*
Professor
Modeling and Optimization of Chemical and Polymeric Systems, Meta-heuristic Algorithms, Process Planning and Scheduling.

Anurag Singh Rathore, *Ph.D. (Yale Univ.)*
Professor
Biosimilars, Bioprocessing, Quality by Design (QbD), Process Analytical Technology (PAT), Multi-variate Data Analysis (MVDA).

Shantanu Roy, *Ph.D. (Washington Univ.)*
Professor
Multiphase Reactor Engineering, Multiphase Flows, Radioactive Trace Particle Tracking.

Jayati Sarkar, *Ph.D. (IIT Kanpur)*
Professor
Instabilities, Adhesion, Debonding, Dewetting and Pattern Formation of Soft Thin Films, Computational Fluid Dynamics, Self-organization of Complex Fluids, Granular Materials.

Kamal K. Pant, *FNAE, FNASc., Ph.D. (IIT Kanpur)*
Professor
Heterogeneous Catalysis and Reaction Kinetics, Catalytic Hydrocarbon Conversion Processes, Water Treatment.

Anupam Shukla, *Ph.D. (IIT Kanpur)*
Professor
Membrane Synthesis & Seperations, Electrochemical Systems Engineering.

Vikram Singh, *Ph.D. (Cornell University, USA)*
Associate Professor
Low Reynolds Number Fluid Mechanics-Suspensions and Emulations, Colloids and Aerosols, Geothermal Energy.

Vikrant, *Ph.D. (Eindhoven University of Technology, The Netherlands)*
Assistant Professor
Fluidization, Fluid-Particle Mechanics, Multiscale Modelling of Multiphase Flows, Computational Fluid Dynamics (CFD), Discrete Element Model (DEM), Gasification and Combustion, Carbon Capture using Solid Sorbent.

Sreedevi U., *Ph.D. (IIT Kharagpur)*
Professor
Heterogenous Catalysis & Reaction Engineering, Thermochemical & Chemical Pathways to Renewable Liquid Fuels, Green Chemical Technologies.

Anil Verma, *Ph.D. (IIT Delhi)*
Professor
Sustainable Environergy Electrochemical Systems: Batteries, CO_2 Electrochemical Reduction to Hydrocarbons, Microbial Fuel Cell, Graphene Synthesis and Application in Energy Devices, C/C Composites.

M.K.S. Verma, *Ph.D. (IISc., Banglore)*
Assistant Professor
Fluid Mechanics, Flow Instability in Flexible Channel/ Tube, Microfluidics, Medical Devices, Bio-inspired Design, Lithium-ion Batteries, Electrochemical Modeling, Battery Management System (BMS).

Sharad K. Gupta, *Ph.D. (Brooklyn University)*
Emeritus Professor
Transport Phenomenon, Membrane Separation Process.

Ratan Mohan, *Ph.D. (IIT Kanpur)*
Adjunct Professor
Computational Fluid Dynamics, Process Engineering, Thermodynamics.

R.R. Sonde, *Ph.D. (IIT Bombay)*
Visiting Professor
Process Design & Engineering, Strategic Technology Development in Nuclear & Defence System, Clean Techniques in Energy & Environment, Conceptualizing Technology Roadmap, Business Development, Building High Performance Teams, Cross Cultural Management & Building Eco-system for Innovation.

INTRODUCTION

The Department of Chemical Engineering (ChE) at IIT Delhi, one of the finest in India, is dedicated to providing the best education, research practices and ecosystem to all its associated members. The undergraduate and postgraduate students can choose from a wide range of courses and research projects from the Department's meticulously designed academic programme. The courses span from fundamental sciences to complex mathematical relationships and engineering design aspects of chemical and biological process technology. The students are rigorously trained and evaluated on a continuous basis so that they are well prepared to be leaders in whichever field they choose to pursue may it be academia, industry, technology management, entrepreneurship or working for a social cause. The course curriculum is upgraded every ten years to keep up with the changing scenario, requirements and technological advancements around the world.

The Department maintains a vibrant research profile and currently boasts of having one of the best group of faculty members in the country who are not only experts in their respective fields of research but are also engaged in multidisciplinary projects that cater to the broader economic, societal and environmental development and growth of the country. The Department maintains a close liaison with a large number of chemical, biotech companies and design organizations because we believe it is essential to perform basic fundamental scientific research alongside the applied one. The faculty regularly undertakes consultancy assignments in which postgraduate students can make great contributions and students at the undergraduate level are constantly encouraged to identify industrial organizations for summer internships.

Every faculty member has a well-equipped lab in which advanced instruments are kept for use by all the students. Some of the facilities include liquid-liquid extraction columns, autoclaves, large capacity blowers, compressors, gasifiers, combustors, pyrolysis systems, bubble and packed columns, circulating fluidized beds, batch and continuous flow reactors, carbon-dioxide absorption systems, bench-top optical and electron microscopes, continuous chromatography, microbial and mammalian bioreactors, Raman spectroscopy, CD spectroscopy, NIR spectroscopy, FTIR, GCMS, TGA, DTA, TPD/TPR, submicron particle size analyzer, powdered particle shape analyzer, high speed photographic equipment, data loggers, high speed multipoint recorders, HPLC, ion chromatograph, CHN analyzer, viscometer, GC with mass spectrometer, atomic absorption spectrometer, automatic contact angle goniometer and tensiometer, radioactive particle tracking (RPT) system, spin coater and surface plasmon resonance (SPR) spectroscope, BET Surface Area Analyser, Malvern Mastersizer 3000, Integrated Confocal Raman Microscope & Atomic Force Microscope, Formulaction Turbiscan Tower. The Department also has two pilot plants and a newly furbished central characterization lab that currently houses an XRD, rheometer and a surface texture analyzer. More instruments are constantly added to this repertoire.

In addition to the analytical instrumentation facilities, there are also extensive computing facilities and softwares like Aspen Plus, SimSci, Fluent, CFX and Promax that are made available to the undergraduate and research students for carrying out their project work. The Department has also set up a state-of-the-art pollution control and testing laboratory and a process research laboratory provided with 40 intel core 2 duo computers and a state-of-the-art Tata-Honey Well Automation Laboratory.

Once a week, the department organizes a research seminar in which external speakers or our own Ph.D. students present their research work. This helps the students to stay abreast with the latest developments in the Chemical Engineering field and also gives them a perspective about their own research from a global view standpoint. Summer and winter schools under quality-improved programme (QIP) are also organized from time to time. With so much happening in the department, we strongly urge you to join us as a student, staff or faculty, or at least pay us a visit when you are in the neighborhood.

VISION

The Department's long-term vision is to become a world leader as a developer of technologies related to energy, environmental protection, novel materials, and healthcare. The Department has been prolific in

the areas of materials development for energy generation and storage, catalysis and multiphase reactor engineering, process intensification in non-renewable and renewable energy sectors, modeling and simulation from molecular to process scales, and manufacturing technology for production of biotech therapeutics. We would like to build on our strengths and strive for national and international presence in these areas by continuing our fundamental research and technology development initiatives, and further strengthening our bachelors, masters and doctoral programmes. We expect that these endeavors will not only attract superior faculty but will provide and create an enabling ecosystem for students to explore, innovate and smoothly transition into the professional arena. The Department would like to build focused research programmes networked with industry, institutions, universities and government agencies. We would like to develop/co-develop effective and affordable technologies scripting joint IPR in partnership with industry, or through consortia leading to spin-offs. The Department strives to promote a technology temperament in society at large, especially to young minds through extensional activities via technology enhanced video and web based distance learning courses, creation of virtual laboratory and resource centres and participating in policy making and public debates.

ACADEMIC PROGRAMMES

The Department offers two undergraduate degrees, one leading to a 4 year B.Tech. and the other to an integrated 5 year Dual Degree (B.Tech + M.Tech.). At the postgraduate level, the Department offers M.Tech., M.S. (Research) and Ph.D. degrees. The teaching at the undergraduate level aims at providing the students a broad-based education in theory and practice of Chemical Engineering keeping in view the current and future requirements of the country. At the postgraduate level, students are trained to assume independent responsibilities by laying emphasis on self study component in courses and assigning them TA duties to mentor UG students. Opportunities are provided to the students at all levels to get acquainted with the latest developments in the various areas of Chemical Engineering. Our institute also has an M.O.U. with Ethiopia and we regularly get students from there as part of our M.Tech. and Ph.D. foreign programmes.

UNDERGRADUATE

B.Tech. students need to do a compulsory foundation courses in the areas of basic sciences, humanities, social sciences and engineering sciences along with Departmental core and elective courses. Departmental courses constitute about half of the total curriculum. Some of the core chemical engineering subjects include fundamentals of mass/heat transfer, chemical reaction engineering, process control, thermodynamics, fluid mechanics, plant design and economics. Students also do open electives to broaden their repertoire of interdisciplinary knowledge-base. Further, there is provision to do a minor degree, for example in computer science and engineering, for which a student needs to do additional credits in the minor area to be eligible for the minor area specialization.

POSTGRADUATE

The 5 year dual degree programme (integrated B.Tech. + M.Tech.) in Chemical Engineering is viewed as a high-value added course fit for students who wish to enhance the scope of their B.Tech. degree with one additional year of research experience. The students can take additional elective courses which opens avenues for better placements both in academia and in the industry. The masters of technology (M.Tech.) is a standard two year programme after B.Tech. comprising of one year of rigorous coursework followed by an year of research training under the guidance of a ChE faculty supervisor. The Department also offers M.S. (Research) programme in Chemical Engineering which includes first semester of course work followed by three semesters of rigorous research work. There are also provisions for doing a part-time M.Tech./MS for persons already employed in the industry and are looking for value addition in their knowledge base and resumes.

The highly motivated individuals choose to obtain a Doctor of Philosophy (Ph.D.) degree in Chemical Engineering as this is an intensively research-driven programme. The students are also expected to qualify a set of the advanced chemical engineering courses in their first year while maintaining a minimum CGPA

requirement. The various broad topics of Ph.D. research include renewable and non-renewable energy, catalysis, multiphase reaction engineering and process intensification, complex fluids and rheology, advanced materials, process modeling simulation, optimization, process control, pharmaceutical biotechnology, environmental engineering and waste management.

RESEARCH AREAS

The ChE faculty is actively engaged in basic and applied research leading to the award of many Masters and PhD degrees. These projects are sponsored by industries, user organizations and government funding agencies (DST, DBT CSIR, DRDO, MNRE, etc.). The projects are directed towards development of innovative and indigenous technologies for processes relating to efficient heat and mass transfer, design of biosimilars, biomass thermo-chemical conversion processes, hydrodynamics and cold flow studies in trickle beds, packed beds and bubble columns, membrane transport studies, recovery of metals from spent catalysts, oil recovery from emulsion effluents, natural gas production from gas hydrates, solid oxide fuel cells, waste water treatment and design of novel diagnostic bioassays. The research activities of the department can be broadly classified in the following subareas.

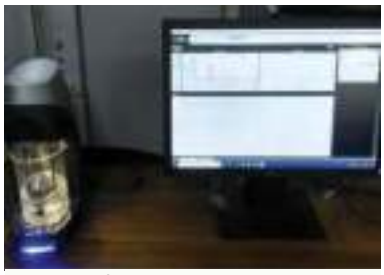
- Battery and Fuel Cells
- Bioseparations and Bioprocessing
- Colloids and Nano Scale Engineering
- Computational Fluid dynamics
- Density Functional Theory Simulations
- Fluid and Particle Mechanics
- Homogeneous and Heterogeneous Catalysis
- Interfacial Engineering
- Model based Optimization and Process Control
- Molecular Dynamic Simulations
- Petrochemical Technology
- Polymer Physics and Engineering
- Process Data Analytics
- Process Intensification
- Reservoir and Refinery Processes
- Renewable Energy Engineering
- Water Treatment


HPLC


Microreactor Unit


Optical Microscope


Radioactive Particle

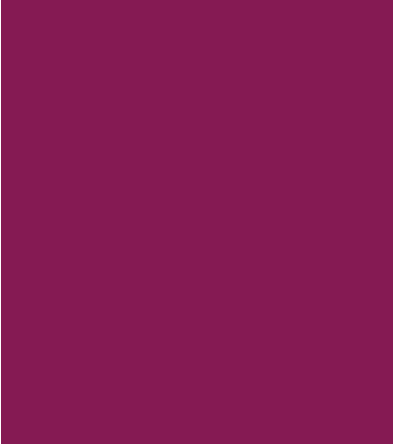

Malvern Mastersizer 3000

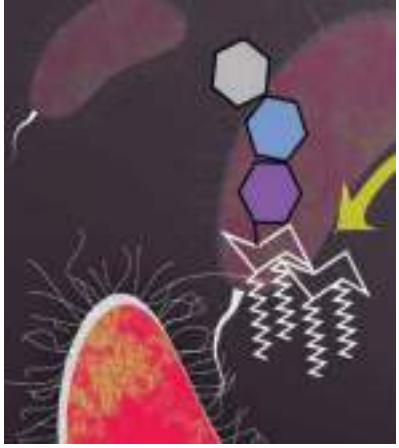
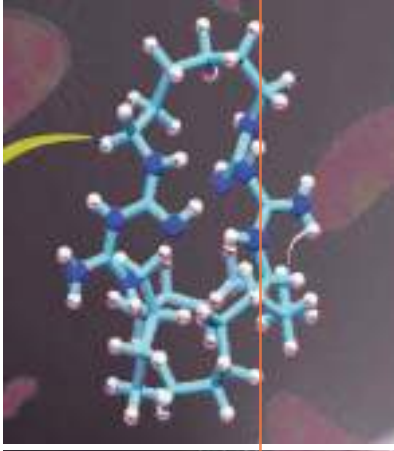

Bet Surface Area Analyzer

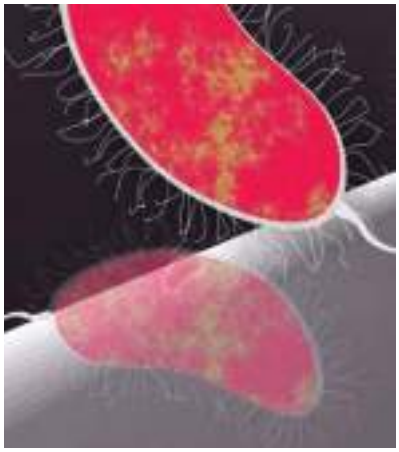

Turbiscan Tower


UV-VIG Spectrophotometer


3D-controlled Micro Imaging




DEPARTMENT OF
CHEMISTRY





Siddhart Pandey, *Ph.D. (University of North Texas, Denton)*
Institute Chair Professor (HAG)
Optical Spectroscopy, Advanced Fluorescence Techniques, Molecularly Organized Media, Environmentally Friendly Solvent Systems, Chemosensors, Photophysical Processes.

Head of the Department

Biswarup Chakraborty, *Ph.D. (I.A.C.S.)*
Assistant Professor
Polyoxometalate Based Hybrid Nanostructure, Bifunctional Materials for Photo- and/or Electro-catalysis, Small Molecule Activation; CO^2 Reduction and H^2O Oxidation, Kinetics Study and Reaction Mechanism.

Pramit K. Chowdhury, *Ph.D. (Iowa State Univ.)*
Professor
Physical and Biophysical Chemistry, Protein Folding using Single Molecule Confocal Microscopy.

Narayanan D. Kurur, *Ph.D. (California Institute of Technology)*
Professor
NMR Methodology.

Shashank Deep, *Ph.D. (IIT Delhi)*
Professor
Physicochemical Characterization of Macromolecule Interaction and Biophysical Studies of Protein Folding and Protein Aggregation Surface using Multinuclear NMR Spectroscopy, Fluorescence, Microscopy and different Calorimetric Techniques.

Tanmay Dutta, *Ph.D. (Calcutta University)*
Associate Professor
Biochemistry, Enzymology, Molecular RNA Biology, Genetics.

Anil J. Elias, *Ph.D. (IIT Madras)*
Professor
Synthetic Main Group and Organometallic Chemistry.

Ashok K. Ganguli, *Ph.D. (IISc., Bangalore)*
Professor
Nanomaterials, Superconductors, Dielectric Oxides and Intermetallics.

Shivajirao L. Gholap, *Ph.D. (IISc., Bangalore)*
Associate Professor
Natural Product Synthesis and Their Biological Studies, Development of New Synthetic Method and its Application in Organic Synthesis.

Dibyajyoti Ghosh, *Ph.D. (JNCASR, Bangalore)*
Assistant Professor (Jointly with DMSE, IIT Delhi)
Computational Materials Science, Non-adiabatic Charge Carrier Dynamics, Machine Learning for Accelerated Functional Materials Discovery, Optoelectronics in Emerging Materials, Defects in Semiconductors, Ion-dynamics in Functional Solids, Spintronics.

V. Haridas, *Ph.D. (NIIST, Trivandrum)*
Professor
Chemical Biology of Peptides and Proteins, Biophysics of Peptide/Protein Folding.

Chinmay K. Hazra, *Ph.D. (Westfälische Wilhelms-Universität Münster)*
Assistant Professor
Development of New Synthetic Methods, Activation of Small Molecules Such as CO_2 and CO, Catalysis, Remote Functionalizations, Physical Organic Chemistry, Reaction Mechanisms.

Pravin P. Ingole, *Ph.D. (University of Pune)*
Associate Professor
Electrochemical Techniques, Electroanalysis, Nanomaterials.

Nidhi Jain, *Ph.D. (Delhi Univ.)*
Professor
Nanocatalysis in Organic Synthesis, Ionic Liquids, Structural Studies of DNA-Carcinogen Adducts.

Tarak Karmakar, *Ph.D. (JNCASR, Bangalore)*
Assistant Professor
Molecular Dynamics Simulations, Enhanced Sampling, Machine Learning, Applications in Biophysics, Materials, and Nano-bio Systems.

Hemant Kumar Kashyap, *Ph.D. (Jadavpur Univ.)*
Professor
Statistical Mechanics of Soft-matter, Molecular Dynamics Simulations, Ionic Liquids, Lipid-membranes.

Sunil Kumar Khare, *Ph.D. (IIT Delhi)*
Professor
Biochemistry, Enzyme Technology, Applied Microbiology Synthesis.

Subrata Kundu, *Ph.D. (IIT Kanpur)*
Assistant Professor
Synthetic Organometallic and Main-group Chemistry, Phosphorus Chemistry, Main-group Radicals.

Kuntal Manna, *Ph.D. (Iowa State University, USA)*
Associate Professor
Homogeneous and Heterogeneous Catalysis, Metal-organic Frameworks.

Selvarajan Nagendran, *Ph.D. (IIT Kanpur)*
Professor
Chemistry of Group 13 and 14 Elements with Special Emphasis to the Low-valent Compounds of Silicon.

Nalin Pant, *Ph.D. (Princeton Univ.)*
Professor
Theoretical and Experimental Studies on Molecular Conformation, Molecular Recognition.

Sayantan Paria, *Ph.D. (Indian Asso. for the Cultivation of Sci.)*
Associate Professor
Bioinspired Inorganic Chemistry, Water Oxidation, Nitrene Transfer, Late-transition Metal-oxo Complexes, Spectroscopic Characterization of Metastable Reaction Intermediates.

N.G. Ramesh, *Ph.D. (IIT Madras)*
Professor
Synthetic Organic Chemistry, Carbohydrate Chemistry, Asymmetric Synthesis.

Sudipta Raha Roy, *Ph.D. (NIPER-Mohali)*
Associate Professor
Organic Synthesis, Catalysis, Organometallic Chemistry.

Soumik Siddhanta, *Ph.D. (JNCASR, Bangalore)*
Assistant Professor
Surface-enhanced Spectroscopic Techniques, Bioimaging, Bioanalytical Chemistry, Applications of Nanomaterials in Biology.

Sameer Sapra, *Ph.D. (IISc., Bangalore)*
Professor
Nanomaterials, Semiconductor Nanocrystals, Quantum Dots, Light Emitting Devices, Charge Transfer and Photovoltaics including DSSC and QDSC.

Sajesh P. Thomas, *Ph.D. (IISc., Bangalore)*
Assistant Professor
X-Ray Quantum Crystallography Studies of Weak Intermolecular Interactions, and Unusual Chemical Bonds; Crystal Engineering; Solid-State Formulation of Pharmaceutical Drugs; Design and Structure-Property Relations of Functional Molecular Materials; Computational Crystallography.

Jai Deo Singh, *Ph.D. (Lucknow Univ.)*
Professor
Chemistry of Chalcogens/Organo-chalcogens and their Applications in Organic Synthesis & Catalysis, Organic Metals and Superconductors.

Ravi P. Singh, *Ph.D. (IIT Kanpur)*
Professor
Asymmetric Catalysis, C-H and C-F Activation, Total Synthesis of Small Molecules.

Ravi Shankar, *Ph.D. (Panjab Univ.)*
Professor
Inorganic Polymers, Organometallic Chemistry/ Coordination Chemistry of Silicon, Germanium and Tin.

Janakiram Vaitla, *Ph.D. (National Chemical Laboratory)*
Assistant Professor
Sulfur Ylide Chemistry, Carbene Mediated Transformations, Synthesis of Natural Products, Conversion Carbon Dioxide to Valuable Chemicals, Activation and Functionalization of Relatively Inert Bonds, Photoredox Catalysis.

M. Ramu Yadav, *Ph.D. (University of Hyderabad)*
Assistant Professor
Co-operative Catalysis, Decarboxylative Reactions, New Fluorination Reactions, Asymmetric Catalysis, Artificial Metalloenzyme Catalysis.

Ajai Kumar Singh, *Ph.D. (Delhi Univ.)*
Emeritus Fellow
Organochalcogen Ligand Chemistry, Designing of Metal Complexes for Catalyzing Organic Reactions.

B. Jayaram, *Ph.D. (City Univ. New York)*
Emeritus Professor
Biomolecular Modeling and Simulation, Physicochemical Model for DNA Sequence Analysis, Ab Initio Protein Structure Prediction, Active Site Directed Drug Design.

Ramakrishna Ramaswamy, *Ph.D. (Princeton Univ.)*
Visiting Faculty
Chaos and Nonlinear Dynamics, Computational and Systems Biology, Nonequilibrium Statistical Mechanics.

INTRODUCTION

The Department offers M.Sc., M.Tech. and Ph.D. programmes in Chemistry and also caters chemistry courses for B.Tech. students in engineering disciplines. It provides good opportunities for research at doctoral and post-doctoral level on a variety of topics in conventional and interdisciplinary areas of Chemistry. As a part of its academic activities, the department organises seminars, symposia, summer schools as well as winter workshops. It also undertakes industrial consultancy projects and has ongoing collaborative research projects in frontier areas with institutions in India and abroad.

ACADEMIC PROGRAMMES

POSTGRADUATE

M.Sc.

The Four-Semester Master of Science in Chemistry is designed to provide a broad-based training in physical, inorganic and organic chemistry. Courses in biochemistry and analytical chemistry are also included in the core programme. Students are offered choice of electives in various specialized areas like solid state chemistry, organometallic chemistry, statistical mechanics, bioorganic chemistry and immunochemistry. Students are required to also take two electives from outside the department. The project in second year initiates the students into research work in various branches of Chemistry.

M.Tech.

The M.Tech. Programme in "CHEMICAL SYNTHESIS & ANALYSIS" is one-of-a-kind programme in the country which provides advanced training in the design, synthesis, separation, and characterization of molecules while preparing students for careers in industry or academia. In addition, students are offered choice of electives in various specialized areas of chemistry, chemical and polymer engineering and management. It culminates in a year-long project where the foundation for scientific research is laid.

RESEARCH AREAS

The Department is actively engaged in research including doctoral research, in all contemporary areas of chemistry. Major disciplines include Analytical, Inorganic, Organic, Physical Chemistry and Biochemistry.

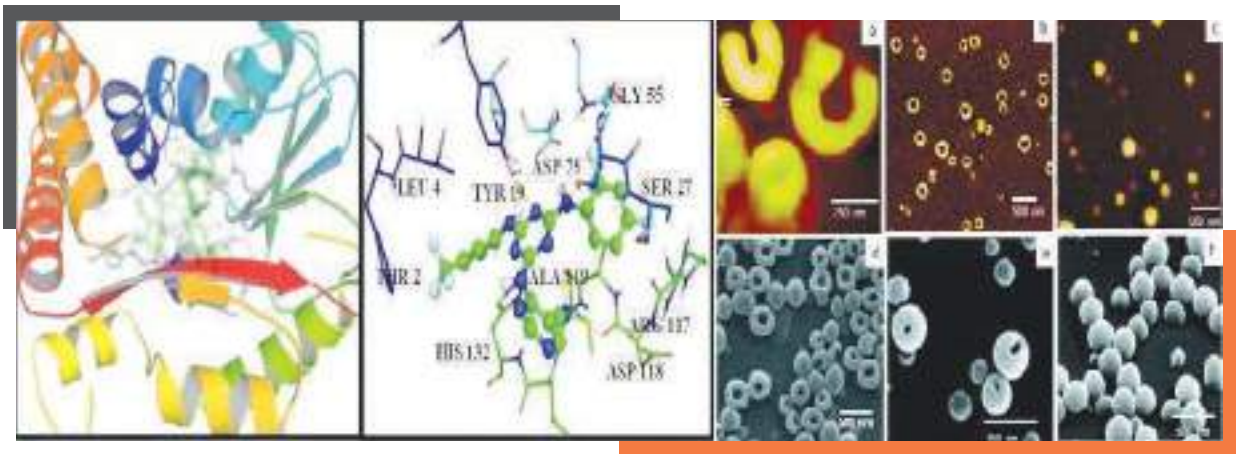
- **Analytical Chemistry:** Optical Spectroscopy, Environmental/Chemical Analysis, Electroanalytical Methods.
- **Biochemistry:** Peptide Synthesis for Molecular Device Construction, Computer Aided Molecular Design, Enzymology, e-Immobilization, Biocatalysis and Bioconversions, Microbial Biochemistry, Fermentation and Bio-remediation, Extremozymes and Extremopiles, Proteomics, Nucleic acid biochemistry, Nano-biocatalysis and nanotoxicity, structural biology, inhibition of amyloid formation, ligand receptor interaction.
- **Inorganic Chemistry:** Organometallic Chemistry of Main Group/Transition Elements, Polyoxometalate chemistry, Solid-state chemistry, Inorganic Polymers. Supramolecular Chemistry, Metallo porphyrins as Catalysts, Intermetallic Compounds, Coordination chemistry, Chemistry of Materials, Nanocrystalline Solids, Coordination Polymers, Crystal Engineering, Bio-inspired catalysis, Catalysis through Organometallic Compounds.
- **Organic Chemistry:** Total Synthesis of Bioactive Natural Products and New Synthetic Methods, Transition–Metal Compounds in Organic Synthesis, Synthetic Carbohydrate Chemistry, Asymmetric Synthesis and Catalysis, Peptides, Proteins and other Natural Products, Chemistry of Singlet Oxygen, Molecular Recognition and Organization, Supramolecular Chemistry, Bioorganic Chemistry, Kinetics and Mechanism of Organic Reactions, Ionic Liquids in Organic Synthesis.
- **Physical Chemistry:** Statistical Thermodynamic investigations of Chemical and Biochemical Systems via Computer simulations, Electrochemical techniques, Electrocatalysis/Photocatalysis, Nanomaterials, NMR methodology, Biophysical Chemistry, Fluorescence spectroscopy (Ensemble and Single molecule), Vibrational spectroscopy and imaging, Optical, Electronic and Biological Properties of

Nanomaterials. Carbon dioxide reduction, energy storage, water splitting, artificial photosynthesis, surface chemistry and heterogeneous catalysis, Quantum and classical computer simulations on chemical and biological systems, Theoretical Studies on Protein-DNA, Drug-DNA and Receptor-ligand Interactions. Simulation Methods for Quantum Systems, Clusters, Magnetic and Photophysical Properties of Intercalated Materials. Structural and Physico-Chemical Characterization of Protein-protein Interaction and Protein Stability, Understanding Complex Fluidic Systems, Computational materials science, Optoelectronic Materials, Ion Dynamics, Machine Learning, Spintronics, Low-Dimensional Materials.

LABORATORY FACILITIES

The following equipments are available as part of the department facilities:

- Single Crystal X-ray Diffractometer (Bruker)
- Powder X-ray Diffractometer (Bruker)
- DPX-300 NMR Machine (Bruker)
- 500 MHz NMR
- FTIR Spectrometer (Nicolet, Protege 460)
- Electrochemical (CH Instruments) and Spectro-electrochemical set-up (Metrohm Autolab, PGSTAT-302N)
- UV-Visible Spectrophotometer (Lambda Bio 20 Perkin Elmer / Model 330, Hitachi, Beckman)
- Thermal Gravimetric Analyzer (Perkin Elmer)
- Differential Scanning Calorimeter (Perkin Elmer)
- C,H,N Analyzer 2400 (Perkin Elmer)
- Steady-State Fluorescence Spectrometer
- Fluorescence Lifetime Spectrometer
- Fast Protein Liquid Chromatography
- Gas Chromatograph (Dionex)
- Gel Permeation Chromatography
- High Pressure Liquid Chromatograph (Waters 1525) GPC
- Vapour Pressure Osmometer (Knauer)
- Polarimeter (Rudolph)
- Ion Chromatograph (792 Basic IC, Metrohm)
- Supercomputing Facility for Bioinformatics and Computational Biology
- Glass Blowing
- Polymerase Chain Reaction System
- Gel Documentation System
- CD Spectrometer
- Dynamic Light Scattering System
- Glove Box
- ESI MS/MS Mass Spectrometer (Bruker)
- Confocal Microscope (Nanonics)



DEPARTMENT OF

CIVIL ENGINEERING

Head of the Department

A.K. Nema, *Ph.D. (IIT Bombay)*
Professor
Environmental Engineering, Modelling, Simulation and Optimization of Environmental Systems, Integrated Waste Management, Environmental Impact and Risk Assessment.

B.J. Alappat, *Ph.D. (IIT Bombay)*
Professor
Environmental Engineering, Solid Waste Management, Incineration and Waste-to-Energy, Fluidized Bed Operations.

R. Ayothiraman, *Ph.D. (IIT Madras)*
Professor
Soil Dynamics and Earthquake Geotechnical Engineering, Pile Foundations, Deep Excavation and Tunnelling in Soft Ground, Problematic Soils and Ground Improvement, Experimental Geotechnics.

Arnab Banerjee, *Ph.D. (University of Auckland)*
Assistant Professor
Metamaterial, Structures, Wave Propagation, Nonlinear Dynamics, Contact Modeling, Structural Dynamics, Earthquake Engineering, Bridges, Finite Element Analysis, Vibration, Structural Analysis & Optimization, Dams.

Sahil Bansal, *Ph.D. (NTU Singapore)*
Assistant Professor
Engineering Reliability Estimation, Risk and Loss Modelling, Uncertainty Quantification, Structural Health Monitoring, Optimal Design, Rare Event Simulation.

Suresh Bhalla, *Ph.D. (NTU, Singalore)*
Professor
Structural Mechanics, Structural Health Monitoring, Smart Materials & Structures, Tensegrity Structures, Underground Structures, Bio-mechanics, Green Structures.

Debayan Bhattacharya, *Ph.D. (IIT Gandhinagar)*
Assistant Professor
Constitutive Modelling of Frictional Materials, Experimental and Computational Geomechanics, Instability and Bifurcation in Soils, Image Processing and Instrumentation, Mechanics of Porous Media, Numerical Modelling of Geotechnical Structures.

Shashank Bishnoi, *Ph.D. (EPFL, Switzerland)*
Professor
Experimental and Numerical Studies into Hydration of Cements and Supplementary Cementitious Materials, Sustainability, Durability and Life Cycle Costs of Concrete Structures.

B.R. Chahar, *Ph.D. (IIT Roorkee)*
Professor
Canal Design, Groundwater Modelling and Artificial Recharge, Seepage and Drainage, Stream - Aquifer Interaction, Optimization, Numerical Techniques.

Sumedha Chakma, *Ph.D. (IIT Delhi)*
Associate Professor
Settlement in Landfills, Gas Generation from Landfills, GIS Based Landfill Management, Bioreactor Landfill, Infiltration Characteristics of Different Vegetation and Landuse, Watershed Management, Water Contamination and Remediation, Open Channel Hydraulics, Contaminant Hydrology.

T. Chakraborty, *Ph.D. (Purdue Univ.)*
Professor
Foundation Engineering, Soil Plasticity and Constitutive Modeling, Blast Loading in Soil, Soil-Structure Interaction and Underground Construction in Soil and Rock.

Das Sovik, *Ph.D. (IIT Kharagpur)*
Assistant Professor
Bioelectrochemistry, Resource Recovery from Waste, Wastewater Treatment, Emerging Contaminants.

N.K. Garg, *Ph.D. (Wales Univ.)*
Professor
Water Resources System, Finite Element, Watershed Modelling, Irrigation Management, CAD.

Ashok Gupta, *Ph.D. (IIT Delhi)*
Professor
Structural Engineering, Earthquake Engineering, Health Monitoring of Structures.

Supratic Gupta, *Ph.D. (Nagoya Univ.)*
Assistant Professor
Structural Engineering, Concrete Mechanics, Self Compacting Concrete, High Performance Concrete, Utilization of Fly Ash, Marble Powder and Granite Powder in Low Strength Concrete, Foam Concrete, High Strength Concrete and Fibre Reinforced Concrete.

Gazala Habib, *Ph.D. (IIT Bombay)*
Associate Professor
Source and Atmospheric Aerosol Characterization, Regional Air Quality, Health, Source Apportionment Modelling, Climate and Health Effect and Climate Modelling.

A.K. Jain, *Ph.D. (IIT Delhi)*
Professor
Design of RCC and Steel Structures, Earthquake Engineering, Wind Engineering, Offshore Structures, Dynamic Testing of Structures.

K.N. Jha, *Ph.D. (IIT Delhi)*
Professor
Construction Project Management, Project Success Factors, Schedule-Cost Estimation, Computer Applications in Project Management, Asset Management.

D.R. Kaushal, *Ph.D. (IIT Delhi)*
Professor
Hydraulic and Water Resources Engineering, Computational Fluid Dynamics, Sediment Transport, Hydraulic Structures, Slurry Pipeline, Flow Instrumentation.

A.K. Keshari, *Ph.D. (IIT Kanpur)*
Professor
Groundwater Flow and Pollution Modelling, Remote Sensing and GIS, Hydrology, Optimization and FEM, EIA and Hydrogeological Hazard.

Rakesh Khosa, *Ph.D. (IIT Delhi)*
Professor
Water Resources Systems, Stochastic Processes, Conflict Resolution and Hydrologic Modelling of Large River Basin.

Sri Harsha Kota, *Ph.D. (Texas A&M University, USA)*
Associate Professor
Formation, Transformation and Chemical Mechanisms of Air Pollutants Near Roadways, Development of Air Quality Models, Estimation of Emission Factors, Source Apportionment of Air Pollutants, Regional Air Quality.

Arun Kumar, *Ph.D. (Drexel Univ.)*
Professor
Human Health Risk Assessment, Nanoparticles, Water Treatment, Decision-making, Emerging Contaminants.

N.M. Anoop Krishnan, *Ph.D. (IISc., Bangalore)*
Associate Professor
Atomistic and Multiscale Simulations of Construction Materials, Mechanics and Physics of Glasses and Cementitious Materials, Radiation Damage and Nuclear-Waste Immobilization, Nanomaterials, Machine Learning and Artificial Intelligence.

Alok Madan, *Ph.D. (SUNY Buffalo, USA)*
Professor
Earthquake Engineering, Nonlinear Structural Dynamics, Concrete Structures, Computing in Structural Engineering, Structural Masonry.

J. Uma Maheswari, *Ph.D. (IIT Madras)*
Associate Professor
Design Management, Automation in Design and Construction, Digital Project Modeling including BIM.

Rajib Basu Mallick, *Ph.D. (Auburn University, USA)*
Professor
Pavement Engineering; Design, Construction and Maintenance; Sustainable and Resilient Pavements; Recycling, Energy Harvesting, Moisture Damage, Development of Test Methods and Specifications for Mix Design and Quality control.

B. Manna, *Ph.D. (IIT Kharagpur)*
Professor
Foundations for Industrial Machines, Dynamic Soil-Pile Interaction, Soil Dynamics, Foundation Engineering, Geotechnical Earthquake Engineering.

M. Manoj, *Ph.D. (IISc., Bangalore)*
Associate Professor
Transportation Planning, Activity/Travel Demand Modelling, Long-Term Mobility Decisions, Travel Behaviour Data Collection, Built Environment and Travel Behaviour, Econometric Modelling.

Vasant A. Matsagar, *Ph.D. (IIT Bombay)*
Professor
Structural Engineering, Earthquake and Wind Engineering, Offshore Structures, Fiber Reinforced Polymer Composites, Finite Element Analysis, Blast & Fire Engineering, Multi-hazard Protective Structures.

Nezamuddin, *Ph.D. (Univ. of Texas)*
Associate Professor
Transportation Network Analysis, Transportation Logistics and Optimization, Traffic Operations, Intelligent Transportation Systems, E-mobility.

G.V. Ramana, *Ph.D. (Rensselaer, USA)*
Professor
Geotechnical Earthquake Engineering, Dynamic Site Characterization, Machine Foundations, Environmental Geotechnology, Geosynthetics.

Kalaga R. Rao, *Ph.D. (IIT Kharagpur)*
Professor
Mass Transit Planning, Traffic Flow Modelling and Travel Demand Modelling, Road Safety.

Manabendra Saharia, *Ph.D. (University of Oklahoma, USA)*
Assistant Professor
Flood Forecasting, Land Surface Modeling, Radar and Satellite Precipitation, Statistics, and Machine Learning, Human Computation.

Dipti Ranjan Sahoo, *Ph.D. (IIT Kanpur)*
Professor
Supplemental Damping and Energy Dissipation, Earthquake Engineering, Performance Based Seismic Design, Strengthening, Retrofitting, Steel & Concrete Structure, Large-Scale Seismic Testing, Dampers.

J.T. Shahu, *Ph.D. (IIT Kanpur)*
Professor
Geotechnology for Tracks and Pavements, Ground Improvement, Reinforced Structure, Foundations, Tunnels.

Deepanshu Shirole, *Ph.D. (Colorado School of Mines, Golden, USA)*
Assistant Professor
Geotechnics, Rock Mechanics, Rock Physics, Civil Build Materials, Non-Destructive Evaluation, Ultrasonics and Acoustical Techniques, Imaging Procedures, Electrokinetic Material Mediation, Damage Analysis and Healing.

S.K. Sinha, *Ph.D. (UC Davis, USA)*
Assistant Professor
Geotechnical Earthquake Engineering, Soil-Anchor Systems, Sensing Technologies, Numerical Modeling, Energy Geotechnics, Soil and Granular Mechanics.

Aravind K. Swamy, *Ph.D. (New Hampshire Univ.)*
Professor
Pavement Engineering, Constitutive Modeling of Pavement Materials, Damage Mechanics.

Dhanya C.T. *Ph.D. (IISc., Bangalore)*
Professor
Hydroclimatological Modelling, Nonlinear Dynamics and Chaos Theory, Stochastic Hydrology, Optimization in Water Resource Systems, Data Mining in Hydrology, Water Resources Management.

V. Arya, *Ph.D. (IIT Madras)*
Assistant Professor
Biological Wastewater Treatment, Physico Chemical Treatment of Water and Wastewater, Removal of Emerging Contaminants, Advanced Oxidation Processes.

Prashanth Vangla. *Ph.D. (IISc., Bangalore)*
Assistant Professor
Interface Behavior of Particulate and Continuum Interfaces, Morphological Characterization of Soils Based on Digital Image Processing, 3D Printing in Geosynthetics and Granular Materials, Bio-inspired Geotechnics, Characterization and Quantification of the Pore Structures of Granular Materials, Site Characterization and Monitoring.

B. Bhattacharjee, *Ph.D. (IIT Delhi)*
Emeritus Professor
Durability of Concrete, Rebar Corrosion, Cement Based Composites, Construction Technology, Building Science, Green Building, Sustainability.

Manoj Datta, *Ph.D. (IIT Delhi.)*
Emeritus Professor
Geotechnical Engineering, Geoenvironment, Landfills, Ash Ponds, Tailings, Ground Improvement, Slope Stability, Dams, Offshore Geotechnology.

A.K. Gosain, *Ph.D. (IIT Delhi)*
Emeritus Professor
Integrated Watershed Modelling, GIS Hydrological Modelling, Irrigation Management, Enviornmental Impact Assessment.

Mukesh Khare, *Ph.D. (New Castle Univ.)*
Emeritus Professor
Air and Vehicular Pollution Modelling, Indoor Air Pollution, Urban Air Quality Management.

Shashi Mathur, *Ph.D. (Delaware Univ.)*
Emeritus Professor
Groundwater Contamination Bioremediation of Soils, Flow through Porous Media, Phyto-remediation, Biodegradation in Landfills.

K.S. Rao, *Ph.D. (IIT Delhi)*
Emeritus Professor
Rock Mechanics and Rock Engineering, Geotechnical Engineering, Engineering Geology, Seismic Microzonation.

INTRODUCTION

The Civil Engineering Department at IIT Delhi was established along with the inception of the Institute in 1961. It now offers a regular four year Bachelors of Technology degree in Civil Engineering, and eight different M.Tech. Programmes along with M.S. (Research) and Ph.D. Programmes in different frontier areas of research in Civil Engineering. The Department has faculty of international reputation and possesses laboratories/research/computational facilities comparable to any lead in university of the world. It promotes industry-academia interaction through consultancy services and undertakes cutting-edge research through sponsored research projects. The department also takes a lead role in ensuring that the advancements in Civil Engineering and Technology reach service professionals through training and continuing education programmes. The Department undertakes curriculum development activities by updating the existing course, developing new courses and preparing resource materials for teaching.

ACADEMIC PROGRAMMES

UNDERGRADUATE

The Undergraduate curriculum is broad-based and is designed to introduce the students to the wide range of problems encountered by civil engineers. The major components of the curriculum are Geotechnical Engineering, Structural Engineering, Water Resources Engineering, Environmental Engineering, and Transportation Engineering.

POSTGRADUATE

The Postgraduate courses of the Department cover a wide range and enable students to specialize in one of the programmes listed below and also to study courses in other fields of interest in the department. In addition, each M.Tech. student is required to do a major project which involves introduction to the methodology of research or design and development and submit a dissertation. The specialization in M.Tech. Programmes are:

- Construction Engineering and Management
- Environmental Engineering and Management
- Geotechnical and Geoenvironmental Engineering
- Rock Engineering and Underground Structures
- Structural Engineering
- Water Resources Engineering
- Transportation Engineering
- Construction Technology and Management (Industry Sponsored)

RESEARCH AREAS

The Department offers doctoral and post-doctoral research programmes in the following areas:

- **Building Science and Construction Management:** Quantification in Industrial Research, Quantitative Techniques and Monitoring in Management of Capital Projects, Network Techniques for Scheduling and Resources Allocation Problems, Contract Management, Value Engineering. Durability, Creep, Shrinkage and Temperature Effects of Concrete, Fiber Reinforced and Special Concrete, Corrosion of Reinforcing Steels, Energy Efficient Building, Building Sciences, Asset Management, Project Success Factors, Green Buildings.
- **Design, Planning and Management,** Lean Construction, Automation in Design & Construction.
- **Engineering Geology:** Weathering Processes and their Effects, Petrography of Aggregate, Rock Drill Ability, Geomorphology, Terrain Evaluation, Landslide Hazard Zonation, Seismic Microzonation and Waste Disposal in Rocks, Hill Slope Engineering.

- **Environmental Engineering:** Water Supply and Wastewater Engineering, Industrial Pollution Control, Physico-Chemical, Biological and Thermal Treatment Techniques for Wastes and Wastewaters, Emerging Molecules in the Environment, Solid Waste Management, Fluidized Bed Reactors, Carbon Sequestration, Environmental Impact and Risk Assessment, Microbiological Risk Assessment, Environmental Indices, E-Waste Management, Nanoparticles in the Environment, Human Health Risk Assessment, Air Pollution and Control, Urban and Regional Air Quality Management, Indoor Air Pollution, Aerosols, Chemical Constituents, Precursor Gases, Source Profile Development, Atmospheric Chemistry, Receptor Modeling, Climate Modeling, Benchmarking, Endocrine Disrupting Chemicals and Personal Care Products in Environment, Incineration, Waste-to-energy.
- **Geoenvironmental Engineering:** Hazardous Waste Landfills, Municipal Solid Waste Landfills, Ash Ponds, Ash Utilization, Mine Tailings Dams, Waste Mounds, Liners, Covers, Vertical Barriers, Geotechnical Reuse of Waste Materials.
- **Offshore Structure:** Fixed and Floating Offshore Oil Production Platforms-Steel Jackets, Concrete Gravity Platforms-Guyed Towers, Tension Leg Platforms, Articulated Towers, Modelling of the Sea Environment: Soil-Structure-Fluid Interaction, Model Analysis for Linear and Non-linear Systems, Submarine Pipeline, Dynamics of Floating Bodies.
- **Rock Engineering:** Strength and Deformation of Rocks and Rock Masses, Joint Systems, Application of Finite Element Method, Boundary Element Method and other Methods, Stresses and Deformation around Underground Openings, Stability of Rock Slopes, Subsurface Exploration by Geophysical Methods, Geomechanics Modelling, Underground Support Systems, Ground Improvement, Servo Controlled Stiff Testing Machine, Environmental Hazards.
- **Soil Engineering:** Shear Strength Behavior under Generalised Stress and Strain, under Partial Saturation, under High Stresses, under Cyclic Load, Shallow and Deep Foundations, Constitutive Relationships of Soils, Application of Finite Element, Boundary Element and Finite Difference Methods to Analysis of Problems of Flow, Stability, Substructures, Earth and Earth Retaining Structures and Soil-Structure Interaction, Reinforced Soil Structures, Geosynthetics, Marine Geotechnology, Environmental Geotechnology, Landfill Engineering, Ground Improvement, Geotechnical Earthquake Engineering, Seismic Microzonation, Geotechnology related to Roads and Railway Tracks, Geomechanics from micro to macro, Bio-Geotechnics, Geohazards, Mechanics of granular materials, Computational geomechanics, Particulate discrete element modelling.
- **Structural Engineering:** Nonlinear Dynamics and Stability, Elasto-plasticity, Wave Propagation, Performance-based Seismic Design, Strengthening, Large-scale Seismic Testing, Micro-structural Modeling, Hydration of Cements and Supplementary Cementitious Materials, Smart Materials & Structures, Metamaterials, Structural Health Monitoring, Bio-mechanics, Engineered Bamboo Structures, vibrational and Renewable Energy Harvesting, Sustainability, Durability and Repair of Concrete Structured, Blast, Fire and Wind Engineering, Multi-hazard Protective Structures, Green Building, Non-destructive Evaluation, Structural Dynamics and Control Systems, Mechatronics, Engineering Reliability Estimation, Uncertainty Quantification, Machine learning and artificial intelligence for structures and construction materials.
- **Surveying and Remote Sensing:** Land and Geographic Information Systems, Multipurpose Surveys using Aerospace Data, Remote Sensing Applications to Land and Water Resources, Environmental Problems, Analytical Photogrammetric Control Extension.
- **Transportation Engineering:** Travel demand modeling, Public transport planning and operations (BRT, Metro, LRT, Bus systems), Traffic engineering and management, Traffic flow modeling and simulation (heterogeneous traffic), Pedestrian dynamics and evacuation modeling, Transportation system analysis, E-mobility, Urban and regional transportation system planning, Planning and modeling

of non motorized transport system (pedestrian, bicycles), Traffic safety, Accident prediction modeling, Highway safety analysis, Evaluation of pavement materials, Modeling of pavement materials, Pavement Design and Modelling Economic Analysis to Transportation Systems, Airport engineering, Continuum damage mechanics, Recycling of pavement materials, Bitumen rheology, Sustainable and Resilient pavement Engineering, Application of Artificial Intelligence, Composite pavements.

- **Water Resources Engineering:** Surface and Groundwater Hydrology, Flood Forecasting, Hydraulic and Hydrological Modelling, Irrigation, Drainage, Erosion and Sedimentation Problems, Mathematical Modelling of Geophysical Systems, Planning and Management of Water Resources Systems, Environmental Impact Assessment, Groundwater Contamination, Bio-remediation, Watershed Managememt, Physically Based and Statistical Modelling of Hydrologic Systems, Rationalization of Floods through Pattern Analysis, GIS and Remote Sensing, Finite Element and Optimization Methods in Water Resources, Slurry Pipeline, CFD Modelling of Multiphase Flows.

Doctoral research is being carried out in the following areas:

Structural Dynamics and Control Systems, Elastodynamics and Stability, Smart materials & Structures, Structural Health Monitoring, Engineered Bamboo Structures, Micro-Structural Modelling of Cements and Supplementary Cementitious Materials, Durability of Concrete Structures, Multi-hazard Protective Structures, Green Building, Earthquake Engineering, Wind Engineering, Structural Control, Reinforced Concrete Structures, Bridge Engineering, Offshore Structures, Tall Buildings, Soil Structure Interaction, Fiber Reinforced Polymer Composites, Fire Engineering, Blast Resistant Structures, Waste Utilization in Building Materials, Corrosion of Concrete/Reinforced Concrete, Performance Life Prediction of Structure, Fatigue, and RC Mechanics, Neural Network, Brick Masonry, Constitutive Modelling: Creep, Elastoplasticity, Damage of Concrete, Rebar Band Modelling Self Compacting and High Performance Concrete, Smart Structures Non-Destructive Testing & Evaluation of Structures.

Geological Engineering, Rock Weathering, Aggregate Reaction, Rock Mechanics, Geophysical Methods, Stability of Rock Slopes, Underground Structures, Numerical, Physical and Geomechanical Modelling, Physical and Geomechanical Modelling, Geosynthetics in Infrastructure Projects, Soil Mechanics, Foundation Engineering, Earth Dams, Earth Retaining Structures, Geosynthetics, Reinforced Soils, Environmental Geotechnology, Marine Geotechnology, Earthquake Geotechnics, Soil Dynamics, Landfill Engineering, Geotechnology for Roads and Railway Tracks.

Biological Processes for Wastewater Management: Upflow Anaerobic Sludge Blanket Reactors, Constructed Wetlands, Compact Activated Sludge Process, Urban Water, Water Quality Modeling, Urban Air Quality Management including Monitoring and Modeling, Indoor Air Pollution Modeling, Vehicular Pollution Modeling, Source and Atmospheric Aerosol Characterization, Emission Inventory Development, Receptor Modeling, Climate Modeling, Human Health Risk Assessments, Nanoparticle Removal, Nanoparticle Toxicity to Bacteria, Multi-criteria Multi-objective Multi-stakeholder Decision making, Emerging Molecules in the Environment, Carbon Sequestration through Mineral Carbonation, Engineered Landfills, GHG emissions from reservoirs, Circulating Fluidized Bed Operations, Environmental Forensics. Thermal performance of buildings and Energy Efficient Building Design.

Contraction Management System Engineering and Design, Transport planning, Transport policy, transportation safety, construction work zone safety, Heterogeneous Traffic flow modeling, Traffic safety and capacity of hill roads, Mass transportation planning, Fuzzy systems, urban transport infrastructure planning and design, Expert systems in transportation engineering, Environmental impact assessment, Non-motorized transport planning, Modeling of pedestrian behavior, Geometric design of transportation infrastructure, Characterization of pavement materials, Pavement design (flexible and rigid), Damage modeling of bitumen and bituminous mixtures, Constitutive modeling of pavement materials, Recycling of civil infrastructure materials, Rheology of asphaltic materials, Condition assessment of highway infrastructure, Pavement management systems, Highway engineering, Airport infrastructure, Environmental

Impact Assessment of Transportation and Urban Environment, Multispectral Image Analysis and Pavement Characterization, Optimization of Recycling Techniques, Development of Laboratory test for Composite Pavements and Permeability of Surface Pavement layers.

Mathematical Modelling in Water Resources, Flood Forecasting, Statistical Modelling in Hydrology, Water Resources Systems, Surface and Ground Water Quality Modelling, River Hydraulics, Applications of Remote Sensing Techniques in Water Resources, Soil Characteristics, Watershed Modelling, Vegetation and Crop response to Moisture, Application of Neural Networks in Water Resources Modelling, Bio-remediation of Soils, Irrigation Water Management, Climate Change and its Impact on Water Resources, GIS Applications in Water Resources Modelling, Morphotectonic and Geological Studies, Natural Hazards such as Landslides, Coastal Erosion etc. and Environmental Monitoring, Pattern Recognition in Remote Sensed Data, Digital Terrain Modelling and Computer Applications and Photogrammetry.

LABORATORY FACILITIES

- **Structural Engineering Laboratories** is a cluster of 11 laboratories, namely Concrete Structures Laboratory, Heavy Structures Laboratory, Materials Research Laboratory, Smart Structures and Dynamics Laboratory, Structural Analysis Laboratory, Structural Simulation Laboratory, Advanced Dynamics Laboratory, Construction Technology Laboratory and Construction Simulation Laboratory and Multiphysics and Multiscale Mechanics Laboratory, Multi-Hazard Protective Structures Laboratory. This laboratory cluster has facilities to test material strength and prototype structures. Some of the key equipment includes strain controlled dynamic compression testing machine (4000 kN), MTS actuator, mercury intrusion porosimeter, atomic force microscope, high temperature furnaces, differential scanning calorimeters, corrosion testing facilities, portable dynamic shaber, high tech data logging systems and special interrogation systems for structural health monitoring based on smart piezoelectric sensors. It houses fire furnace (1300° C) with universal testing machines. In addition, it has state-of-the art shake table and large strong floor for conducting destructive tests on large specimens.
- **Computational Laboratory** is equipped with two Xenon Servers with Windows 2003 server Edition, for domain control and as license server, 50 core 2 Duo/Quad systems with 4GB of RAM and Windows 7 Enterprise Operating System. All the systems are connected to IITD LAN through Gigabit switches. The laboratory is equipped with some of the latest software viz. Microsoft Office 2010, Microsoft Office projects 2007, ArcGIS V10.0, Bentley Civil Engineering Software including STAAD pro V8i, Microstation,

MX Road, WaterGEMS, SewerGems, StormCAD, Matlab V2012a, Abaqus V11.0, Ansys V14.0, Plaxis 2D, RocScience, GeoStudio V2007, SAP2000 V15, Etabs V9.0, SAFE V14.0, SAFIR etc. The laboratory is also equipped with a 3000 ANSI Limens LED Projector mounted on the ceiling for conducting computer-aided tutorial classes and presentations. The laboratory has been equipped with PA system comprising of wired and wireless microphones and 6 speakers connected through a Digital Amplifier and a 12 Channel Mixer.

- **Soil Mechanics Laboratory** has facilities for testing soils under generalised stress-strain conditions (universal triaxial cell), under high confining pressures (up to 1400 kg/cm2), in large size specimens (100 mm diameter), and under partially saturated conditions. Computer controlled GDS triaxial test system is available. It has equipment for measurement of electric resistivity, thermal conductivity, testing soils under dynamic conditions, etc. and for model tests. Equipment to carry out field investigations by drilling boreholes, standard penetration tests, collection of undisturbed samples, plate load tests, dynamic cone and static cone penetration tests are available. A specially built tank 7x3x3 m. with a reaction frame of 40 ton. capacity to test prototype models of retaining walls (active and passive conditions), bridge abutments, geotextile reinforced walls, pile foundations, and footings, to study the thermal conductivity of soils, stability of model submarine pipelines, pullout behaviour of model anchors and skin friction behaviour of model piles. Facilities have been developed for the assessment of strength and friction behaviour, hydraulic behaviour, construction serviceability of geosynthetics (both natural and polymeric). Soil dynamics testing facilities include SASW for soil profiling, block vibration test, dynamic pile load test etc. MASW Shear wave velocity field testing apparatus, Geosynthetics test equipment for pullout, interface and sliding.
- **Rock Mechanics Laboratory** has facilities to test intact rocks and jointed rock masses, to model and test the modelled materials. The laboratory has the following equipment: a loading frame (500 ton vertical load, 100 ton lateral load) to test up to 70 x 70 x 70 cm. Specimens, with system for monitoring cell pressures and volume changes, loading and unloading sequences, biaxial and triaxial testing unit (up to 1400 kg/cm^2), triaxial (200 kg/cm^2), oblique shear and double shear equipment, strain indicators, sonic

wave velocity apparatus, borehole extensometer, core drill cutting and lapping machines. Laboratory extensions exist to study the foundations of dams, tunnels and strata control problems with 100 channel data logger.

- **Transportation Engineering Laboratory** has facilities to test aggregates, bituminous materials, bituminous mixes as well as soils. Digital Master Loader with the ability to test marshal and CBR specimens, connected with the data logger, Video Image processing system, Digital Video Camera, Software MX-ROADS, CUBE. The laboratory is also equipped with accelerated polishing equipment, skid resistance tester, automatic vehicle counting devices, etc. Pavement evaluation by Profilograph, Roughometer and Benkelmann beam apparatus. Traffic data collection system (miovision), Rut tester, Dynamic shear rheometer.
- **Environmental Engineering Laboratory** is equipped to examine water and wastewater chemically, physically, bacteriologically and biologically. Filtration columns, pilot scale rotating biological contactors, mini ion exchange plant, Simulated landfills, cold model re-circulating fluidized bed reactor, etc. are available for conducting research. It has the facilities of a constant temperature room and a dark room with a microbiological camera. An advanced instrumentation room houses modern equipments e.g. GCMS, AAS, HPLC, microprocessor based UV 2000 spectrophotometer, TOC Analyzer, digital gas liquid chromatograph, Dedicated microbial quality facility, digital electronic ion analyser, flame photometer, Digital Balance, Microbalance, digital microprocessor based DO and Ion meter, digital pH controller, indoor air quality monitor, air velocity meter, handy air samplers, respirable dust monitors, Bio-aerosol Sampler, Stack monitoring kit, Indoor air quality chamber, Bomb calorimeter and many other allied analytical equipments for the analysis of water / wastewater / air / organics / inorganics / metals. Besides, flue gas analyzer, RSPM Monitor for monitoring PM10 and Impactor based PM 2.5 monitor, multi-stream cyclon based monitor, Ozonator and Weather station are available.
- **Surveying and Remote Sensing Laboratory** is equipped with precise survey instruments for field surveying like Total, Station, GPS, Digital & Auto Level, etc. Precise angle measuring equipment measuring upto 1" and electronic distance measuring equipment of accuracy 1:50,000 are also available.
- **Engineering Geology Laboratory** is equipped for research work in the field of geochemistry, geophysics and industrial mineralogy, qualitative assessment of minerals for hydroelectric projects can be carried out. Data base is available for preparing landuse map of any area in India. PCs with large variety of softwares are available to process the geological data. There is a good geological museum with large collection of minerals, rocks, fossils and models.
- **Water Resources Simulation Laboratory** has two components. The laboratory is equipped with latest computational tools available in the area of Water Resources. The laboratory is equipped with 35 core2 Duo and i7 processors, LAN facilities for satellite image processing and application softwares dealing with ARCGIS and Expert System (LEVEL 5 OBJECT). Experimental facilities include Advanced Hydrologic System, Hydraulic Work Bench, Spectrophotometer, Ion Meter and other instruments for carrying out a detailed water quality analysis. River Hydraulics Facility in the form of two flumes enables model studies, sediment transport analysis, dam break and flood wave propagation studies. Bench scale test facility for slurry transportation pipeline systems is also available.

DEPARTMENT OF
COMPUTER SCIENCE AND ENGINEERING

Head of the Department

Prem Kumar Kalra, *Ph.D. (EPFL, Switzerland)*
Professor
Computer Graphics, 3D Animation.

Chetan Arora, *Ph.D. (IIT Delhi)*
Professor
Computer Vision and Machine Learning.

Amitabha Bagchi, *Ph.D. (Johns Hopkins Univ.)*
Professor
Data Algorithmics and Analytics,
Probability and Networks.

Nikhil Balaji, *Ph.D. (Chennai Mathematical Institute)*
Assistant Professor and TBO Group Faculty Fellow
Automata Theory, Quantitative Verification,
Computational Complexity.

Subhashis Banerjee, *Ph.D. (IISc., Bangalore)*
Professor (Ministry of Urban Development Chair)
Computer Vision, Real-time Systems, Robotics.

Sorav Bansal, *Ph.D. (Stanford Univ.)*
Professor (Microsoft Chair)
Compiler Design and Optimization.

Srikanta Bedathur, *Ph.D. (IISc., Bangalore)*
Professor (DS Chair of Artificial Intelligence)
Data Management, Knowledge Discovery
and Data Mining, Information Retrieval.

Kaustubh Beedkar, *Ph.D. (University of Mannheim)*
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Database and Information Systems.

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Social Computing, Information Retrieval,
Fairness in Machine Learning.

Ashish Chiplunkar, *Ph.D. (IIT Bombay)*
Assistant Professor
Algorithm Design, Stochastic Problems.

Keerti Choudhary, *Ph.D. (IIT Kanpur)*
Assistant Professor and TBO Group Faculty Fellow
Fault-Tolerant Algorithms, Extremal
Graph Structures, Dynamic Algorithms,
Graph Realizability.

Naveen Garg, *Ph.D. (IIT Delhi)*
Professor (Janaki and K.A.Iyer Chair)
Algorithms, Optimization.

Rahul Garg, *Ph.D. (IIT Delhi)*
Professor
Machine Learning, Big Data Analytics,
Neuroimaging, High Performance Computing.

Ragesh Jaiswal, *Ph.D. (Univ. of California, San Diego)*
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Abhilash Jindal, *Ph.D. (Purdue University)*
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Operating Systems, Mobile
Systems, Program Analysis.

S. Arun Kumar, *Ph.D. (TIFR, Bombay)*
Professor
Semantics and Verification.

Amit Kumar, *Ph.D. (Cornell Univ.)*
Professor (Jaswinder & Tarvinder Chadha of Operations Research Chair)
Algorithms, Combinatorial Optimization.

Subodh Kumar, *Ph.D. (Univ. of North Carolina)*
Professor (Uma-Puruskar-Liril Gupta Chair in Future Computing Technologies)
Computer Graphics, Virtual Reality, Parallel Programming, High Performance Computation.

Venkata Vivek Kumar Koppula, *Ph.D. (University of Texas, Austin)*
Assistant Professor and Pankaj Gupta Faculty Fellow
Quantum Cryptography, Lattice based Cryptography, Code Obfuscation.

Vireshwar Kumar, *Ph.D. (Virginia Polytechnic Institute and State University (Virginia Tech)*
Assistant Professor and Tbo Group Faculty Fellow
Security and Privacy in Cyber-Physical Systems, Applied Cryptography, Adversarial Machine Learning.

Kumar Madhukar, *Ph.D. (Chennai Mathematical Institute)*
Assistant Professor and Chandruka New Faculty Fellow
Program Verification, Model Checking, Syntax-Guided-Synthesis.

Mausam, *Ph.D. (Uni. of Washington, Seattle)*
Professor (Jai Gupta Chair)
Artificial Intelligence, Natural Language Processing, Machine Learning.

Rahul Narain, *Ph.D. (Univ. of North Carolina)*
Assistant Professor
Computer Graphics, Animation, Numerical Methods.

Preeti Ranjan Panda, *Ph.D. (Univ. of California, Irvine)*
Professor (Prof. Anshul Kumar Chair)
Embedded Systems - architectures and Compilers, Cache and Memory Technologies, Energy-efficient Computing, VLSI Design Automation.

Kolin Paul, *Ph.D. (Bengal Engineering College, Calcutta)*
Professor (Microsoft Chair)
Embedded Systems, Hardware Security, Reconfigurable Computing.

Rohan Paul, *Ph.D. (University of Oxford)*
Assistant Professor
Human Robot Interaction, Language Grounding, Symbolic Reasoning.

Sanjiva Prasad, *Ph.D. (Stony Brook Univ.)*
Professor
Semantics and Verification, Programming Languages, Concurrent Systems, Formal Foundations of Networks and Security.

Maya Ramanath, *Ph.D. (IISc., Bangalore)*
Associate Professor
Database Systems and Information Retrieval, Semantic Web Data Management Including Information Extraction, Query Processing, Result Ranking and Reasoning.

Sayan Ranu, *Ph.D. (Univ. of California, Santa Barbara)*
Associate Professor (Nick McKeown Chair)
Data Mining, Network Science, Spatiotemporal Data Analytics, and Bioinformatics.

Huzur Saran, *Ph.D. (Univ. of California, Berkeley)*
Professor
High Speed Networks, Graph Theory & Algorithms.

Smruti Ranjan Sarangi, *Ph.D. (Univ. of Illinois)*
Professor (Usha Hasteer Chair)
Computer Architecture, Operating Systems, Cyber Security, IoT.

Aaditeshwar Seth, *Ph.D. (Univ. of Waterloo)*
Professor
Information and Communication Technologies for Development, Media Analysis, Computer Networks.

Rijurekha Sen, *Ph.D. (IIT Bombay)*
Assistant Professor
Mobile and Embedded Systems (Hardware Architecture, OS, Sensing, Efficient Processing, Security), Computational Sustainability.

Parag Singla, *Ph.D. (Uni. of Washington, Seattle)*
Professor
Neuro Symbolic Resaoning, Probabilistic Graphical Models, Machine Learning, Artificial Intelligence.

Subodh Vishnu Sharma, *Ph.D. (University of Utah)*
Associate Professor (Pankaj Gupta Chair Professor of Privacy and Decentralisation)
Formal Verification, Program Analysis, Concurrent Systems, System Security.

Vaishnavi Sundrarajan, *Ph.D. ((Chennai Mathematical Institute)*
Assistant Professor
Formal Methods, Verification and Security.

Rohit Vaish, *Ph.D. (IISc., Bangalore)*
Assistant Professor (Pankaj Gupta Faculty Fellow)
Algorithms and Economics, Artificial Intelligence, Computational Social Choice, Game Theory.

Anshul Kumar, *Ph.D. (IIT Delhi)*
Honorary Professor
CAD for VLSI, Computer Architecture.

M. Balakrishnan, *Ph.D. (IIT Delhi)*
Honorary Professor
Embedded Systems, Assistive Technology, System Level Design.

B.N. Jain, *Ph.D. (Stony Brook University)*
Honorary Professor
Computer Networks, Network Security.

S.N. Maheshwari, *Ph.D. (Northwestern Univ.)*
Honorary Professor
Algorithms, Parallel Processing, Information Systems.

Deepak Kapur, *Ph.D. (MIT, USA)*
Honorary Professor
Formal Methods, Program Analysis, Distributed Computing and Social Aspects of Computing.

Anish Arora, *Ph.D. (UT Austin)*
Adjunct Faculty
Dependable Distributed and Networked Systems.

Karthikeyan Bhargavan, *Ph.D. (IUniversity of Pennsylvania)*
Adjunct Faculty
Security and Privacy, Formal Verification.

Yogish Sabharwal, *Ph.D. (IIT Delhi)*
Adjunct Faculty
High Performance Computing Group IBM India Research.

Rajeev Shorey, *Ph.D. (IISc., Bangalore)*
Adjunct Faculty
Communication Networks, Data Analytics, Machine Learning and Artificial Intelligence.

Gautam Shroff, *Ph.D. (Rensselaer Polytechnic Institute)*
Adjunct Faculty
Computing, Security Data Science, Artificial Intelligence

INTRODUCTION

IIT Delhi has been active in Computer Science education and research since the early 1970s. The Department of Computer Science and Engineering was established in 1982. It currently has 37 full-time faculty members, all with PhDs from leading institutions and recognised in their fields of expertise, with a plan to grow to around 42 in the coming two years. Apart from full time faculty members, the Department currently has several distinguished honorary and emeritus professors, adjunct faculty from leading research laboratories and international universities, and several visiting faculty members, all of whom participate in teaching and research activities.

ACADEMIC PROGRAMMES

The CSE department currently offers a 4 year B.Tech., a 5-year Integrated Dual Degree (B.Tech. + M.Tech.), M.Tech., M.S. (Research) and Ph.D. programmes in Computer Science and Engineering. It offers a minor area programme for non-majors, as well as 6 specialisations each for B.Tech. and M.Tech. students. Undergraduate students from other disciplines can join the M.Tech. programme with Advanced Standing. In addition, the department participates in interdisciplinary M.Tech. programmes in VLSI Design, Tools & Technology, the Ph.D. and M.S. (Research) programmes of the Khosla School of Information Technology, the Bharti School of Telecommunication M.Tech. programmes, and will participate in interdisciplinary programmes in Cyber-security and Machine Learning and Artificial Intelligence. The curricula are in line with current international trends, and are also used as model curricula by other Indian universities and colleges.

The current student strength in the department is about 772 (439 in Undergraduate, 194 in Dual Degree, 88 in Masters and 51 in Doctoral programmes). Admission to the programmes is highly competitive - for the undergraduate and dual-degree programmes, there is a nation-wide Joint Entrance Examination (JEE) Advanced. At the Masters/Ph.D. level, only students with a score of 99 percentile or better in the nation-wide GATE exam are offered admission. A significant number of employed computer professionals are also enrolled in our postgraduate programmes as sponsored candidates.

The curricula are comprehensive in their coverage of various aspects of computer science including algorithms and computational theory, architecture and systems software; networks; reliability and security; data analytics; graphics, vision and computing applications, especially those involving AI and machine learning. The emphasis is on design, methodology, analysis and good software practices. As part of the degree requirements, undergraduate, dual-degree and masters students are expected to complete a two-semester project which may involve developing a subsystem that typically contributes to fulfilling the objectives of a research project.

RESEARCH AREAS

- **Algorithms and Complexity Theory:** (*associated faculty:* Amitabha Bagchi, Ashish Chiplunkar, Naveen Garg, Ragesh Jaiswal, Amit Kumar, Keerti Choudhary, Nikhil Balaji and Venkata Koppula, S.N. Maheshwari, Rohit Vaish).

  Algorithmic graph theory, Computational geometry, Randomized algorithms, Approximation algorithms, Complexity theory, Online algorithms, and Cryptography.

- **Artificial Intelligence (AI) and Machine Learning (ML):** (*associated faculty:* Chetan Arora, Amitabha Bagchi, Subhashis Banerjee, Srikanta Bedathur, Rahul Garg, Mausam, Rohan Paul, Sayan Ranu, Aaditeshwar Seth, Parag Singla, Abhijnan Chakraborty and Vireshwar Kumar, Rohit Vaish).

  Reinforcement learning and AI planning, Neuro-symbolic ML, Probabilistic graphical models, Statistical relational learning, Extreme classification, Embodied artificial intelligence, Ethical AI, Fairness and reliability in ML, Privacy issues in ML, ML for social networks, ML applications to healthcare, AI for crowdsourcing, Knowledge-based AI, Computational advertising, AI for robotics.

- **Natural Language Processing (NLP):** (*associated faculty:* Srikanta Bedathur, Rahul Garg, Mausam and Maya Ramanath).

  Intelligent information systems, Information extraction, Question answering, Dialog systems, Knowledge-base completion, Neural architectures for NLP.

- **Databases and Data Analytics:** (*associated faculty:* Srikanta Bedathur, Amitabha Bagchi, Mausam, Maya Ramanath, Sayan Ranu, Aaditeshwar Seth, Parag Singla and Abhijnan Chakraborty, Kaustubh Beedkar).

  Intention mining, Policy driven databases, Information retrieval, Information dissemination in social networks, Semantic web data management, Opinion mining, Indexing and querying in graph databases, Spatio-temporal data analytics, Data wrangling.

- **Architecture and Embedded Systems:** (*associated faculty:* M. Balakrishnan, Preeti Ranjan Panda, Kolin Paul, Smruti Ranjan Sarangi, Rijurekha Sen and Anshul Kumar).

  Hardware-software co-design, Embedded systems design, Reconfigurable computing, Fault-tolerant computing, Hardware implementations, Temperature-aware architectures, Energy-efficient architectures, Design-for-debug, Cache memory, 3D and non-volatile memory, Architectural extensions for mobile security, Architectures for machine learning, Architectures for computer vision, Secure architectures.

- **Graphic, Vision and Human-Computer Interfaces:** (*associated faculty:* Chetan Arora, Subhashis Banerjee, Prem Kalra, Subodh Kumar and Rahul Narain, Rahul Garg and Rohan Paul).

  Computer graphics, Virtual reality, Computer vision, Digital image and video processing, Mobile multimedia, Embedded computer vision, Robotic vision, Medical image analysis.

- **Computer Networks and Distributed Systems:** (*associated faculty:* B.N. Jain, Huzur Saran, Rijurekha Sen, Aaditeshwar Seth and Vireshwar Kumar).

  Mesh networks, 4G LTE/ WiMAX, Cognitive radio, Cellular network measurements, Wireless networks, Network security, Operating systems security.

- **Programming Languages, Semantics and Verification:** (*associated faculty:* Sorav Bansal, S. Arun-Kumar, Sanjiva Prasad, Subodh Sharma, Kumar Madhukar, Vaishnavi Sundararajan).

  Programming language semantics, Theory and practice of concurrent systems, Process algebras, Distributed computing, Program analysis and verification, Logic in computer science, Applications of verification in network models, multiprocessors, and relaxed memory models and Language-based security.

- **Operating Systems, High Performance Computing and Systems Software:** (*associated faculty:* Sorav Bansal, Sobodh Kumar, Smruti Ranjan Sarangi, Subodh Sharma and Abhilash Jindal).

  Compiler design, mobile operating systems and device drivers, Virtualization, Operating systems for IoT systems.

- **Information and Communication Technologies for Development:** (*associated faculty:* M. Balakrishnan, Kolin Paul, Rohan Paul, Aaditeshwar Seth and Rijurekha Sen).

  Poverty mapping, Urbanization, Bias in mass media, Computer systems for less-literate populations, Content distribution in rural areas, Community radio, Community media, Mobile health, Assistive Technology, Governance and accountability.

- **Neuroinformatics and Medical informatics:** (*associated faculty:* Chetan Arora and Rahul Garg).

  Brain Imaging, Functional MRI (fMRI), Electroencephalography (EEG), Near-infrared spectroscopy (NIRS), Human Functional Connectome.

- **Cyber Security and Secure Information Systems:** (*associated faculty:* Ragesh Jaiswal, Sanjiva Prasad, Huzur Saran, Smruti Ranjan Sarangi, Subodh Sharma, Venkata Koppula and Vireshwar Kumar, Vaishnavi Sundararajan).

Formal notions of security, Formal verification for security, Language-based security, Secure architectures and Embedded systems, Network security, Blockchain-based systems, Privacy and data protection, Electronic voting, Digital identity.

Sponsored Research and Funding

The CSE Department faculty works on funded research projects in all areas of computer science research. Currently funded project budgets amount to around ₹390 million, of which around ₹170 million is from Indian government agencies, about ₹140 million from Indian and international industrial sources and ₹80 million from internal sources.

The department is thankful to its alumni for their generous support which has been a key enabling factor for its growth and achievements. Recently, Mr. Mohit Aron, B.Tech. CSE, 1995, gifted 1 Million USD to help the department establish itself as the world leading Computer Science Department.

LABORATORY FACILITIES

Computing resources in the department include several high-end servers, server clusters, and data storage systems. All of these are networked and connected to more than 150 PCs and workstations. Every faculty member, staff and Ph.D. student has a fully networked workstation with access to the Internet and adequate long term storage space in the central repository. Every undergraduate and postgraduate student is also given full access to the Internet and the Department servers. Besides. All laboratories in the Department also provide full access to the internet and to the central repository. Other major equipment include EDA software, multi-million gate FPGA based prototyping and validation system, robot platforms etc. The PCs and workstations are connected through 10/100 mbp/s links. The departmental network is connected to the Institute-wide network through two 10Gbps links switched fiber optic line with 10 Gbps link to the outside world.

The major laboratories are:

- **Algorithms Lab:** The Algorithms lab in the computer science department conducts research in a variety of areas including algorithms, combinatorics, stochastic processes, optimization, computational complexity, quantum computing, game theory and cryptography. The lab supports computing requirements for research scholars in the area of Algorithms.
- **General Computing Lab:** This laboratory supports the general purpose computing needs of most students. It houses more than 70 workstations and provides full email and internet access. The servers provide the software required for laboratories in most of the Department courses.
- **Digital Hardware Design Lab:** This laboratory supports the training and project needs of students in the area of digital hardware design. Facilities include microprocessor based system design and FPGA based design equipment.
- **Advanced Networking Lab:** Besides providing access to ERNET and internet services, the laboratory supports development of multimedia communications and applications, ATM protocol stack, wireless and mobile communications, network security and simulation studies in high-speed networks.
- **Vision & Graphics Lab:** This laboratory supports development efforts in two areas, namely real-time vision and graphics. The facilities include the latest graphics workstations, robot manipulators, computing clusters, virtual reality and other state of the art equipment.
- **VLSI Design & Tool Lab:** This laboratory, established in 1996 with support from Philips Semiconductors as part of the VLSI Design, Tools and Technology programme houses a state-of-the-art CAD facility consisting of several servers and workstations. P4 clients, X-terminals, plotter and VLSI design software. The CAD facility features in-house, commercial and public domain software (including Cadence and Synopsys) for VLSI synthesis and simulation.

- **Database and Analytics Lab:** This lab features multiple high-end servers and GPU clusters, along with a number of state of the art workstations. Work in this lab is primarily on addressing scalability challenges in managing and analyzing structured and unstructured data including relational, graph, textual and streaming data.
- **Verification Lab:** This laboratory hosts several workstations supporting various specialized model-checking and verification tools.
- **Architecture Lab:** This lab houses state of the art workstations, and a Dell storage server for supporting research activities in high performance computer architecture and modern embedded systems.
- **Cyber Security Research Lab:** The mandate of the cyber security lab is to carry out fundamental research in the areas of Cryptography, Computer Systems & Network Security and Advanced Information Systems Security. The main focus is on developing provably secure algorithms to meet the efficiency and security demands of emerging technology trends such as cloud computing.
- **Data Analytics Lab:** Data analytics as a field of computer science is comparatively new and is an amalgamation of other fields such as data management, information retrieval, machine learning, natural language processing, data mining and statistics. It is concerned with consuming and processing large amounts of diverse data, including, text (HTML web pages, online books, scientific publications, etc.), structured data (for example, data residing in database systems), video, audio, etc. to derive useful insights. The current focus of the lab is on processing large scale text-data and large scale graphs. Open Information Extraction, Coherent Large-Scale Multi-Document Summarization, AI Applications to Crowd-sourcing, Commonsense Knowledge Extraction and Natural Language Processing over Microblogs.
- **Cloud Computing Lab (HIPC Lab):** The lab contains infrastructure facilities for research in high-performance computing, operating system and compiler design, distributed and cloud computing.
- **SAPIEnt Lab:** Systems & Algorithms Protecting Indian Environment. The word SAPIEnt itself means humans, for whom we need to take good care of the environment. This Lab is works on road traffic measurement and management, Air Pollution measurement and Analysis.

DEPARTMENT OF
DESIGN

Aneesha Sharma, *Ph.D. (IIT Bombay)*
Associate Professor
Creativity, Culture & Design, Neuro-cognition of Creativity, User Experience Design, Information Design.

Head of the Department

Jay Dhariwal, *Ph.D. (IIT Bombay)*
Assistant Professor
Design for Health and Wellness in the Built Environment, Product Design, Data Driven Design, Mechatronics, Engineering Design, Design for Energy Efficiency.

Subir Dey, *Ph.D. (IIT Guwahati)*
Assistant Professor
Comics Studies, Illustration, Graphic Design, Designing for Children.

Aakash Johry, *Ph.D. (IDC School of Design, IIT Bombay)*
Assistant Professor
Playful and Experiential Learning, Serious Games (for Health, Citizen Science or Behaviour Change), Design for Marginalized Populations.

Gourab Kar, *Ph.D. (Cornell University)*
Assistant Professor
Human Factors and Ergonomics, Sedentary Behavior and Health, Universal/Inclusive Design, Environmental Design Research, Body-conscious Design, Social and Cultural Factors in Design.

Jyoti Kumar, *Ph.D. (IIT Guwahati)*
Associate Professor
Human-computer Interaction, Design for Emotion and Persuasion, Design for Usability, User Experience Design.

Pramod Khadilkar, *Ph.D. (IISc., Bangalore)*
Associate Professor
Behavioral Design, Design for Human Development, Design for Base of the (Economic) Pyramid, and Social Innovation.

Charu Monga, *Ph.D. (IIT Guwahati)*
Assistant Professor
Visual Communication, Filmmaking, Animation, Digital Media, Game Design, Cultural Construction, Design Research.

Sumer Singh, *Ph.D. (IIT Delhi)*
Associate Professor
Product Design, Transportation Design, Design for Sustainability, Design Sketching, Computer Aided Surfacing, Design Innovation.

Srinivasan Venkataraman, *Ph.D. (IISc., Bangalore)*
Assistant Professor
Design Creativity and Innovation, Design Theory and Methodology (incl.Design Thinking), Virtual Reality, AI in Design, Inclusive Design, New Product Development.

P.V. Madhusudhan Rao, *Ph.D. (IIT Kanpur)*
Professor
Product Design, Computer Aided Design, Design of Medical and Assistive Devices.

Sabyasachi Paldas
Professor of Practice
Industrial Design, Product Detailing.

Saurabh Tewari, *Ph.D. (IIT Kanpur)*
Assistant Professor
Design History, Design Studies, Communication Design and Culture, Typography, Design Education, Architecture.

INTRODUCTION

The Department of Design was established in the year 2017 and traces its roots to the Instrument Design and Development Centre (IDDC), which has been pioneering design education at IIT Delhi since 1994. Presently the Department has expert faculties in the three main Design domains of Industrial Design, Communication Design, and Interaction Design. The Department offers Doctoral (Ph.D.) and Masters in Design (M.Des.) programmes, and Bachelors in Design (B.Des.) programme. It also offers a Minor in Design for B.Tech. students. Being an integrated part of IIT Delhi, the Department of Design offers multi-dimensional learning opportunities to all the students.

ACADEMIC PROGRAMMES

Bachelor of Design (B.Des.) Programme

The Department of Design started its full-time B.Des. programme in June 2022. The programme is four years duration, and admission is through UCEED. The B. Des. Programme at IIT Delhi offers a diverse range of courses that cater to the current requirements of academia, industry, and society. The extensive 4 years of design education ensures that a B.Des. graduate becomes a responsible designer and is able to translate ideas into demonstrable solutions through the adoption of a human-centered design process. The programme offers courses from all the major domains of design like product design, interaction design, and communication design to name a few.

Master of Design (M.Des.) in Industrial Design Programme

The full-time M.Des. programme caters to the requirement of the society and industry for designers capable of creating human-centered solutions that respond to the needs of people, technology, and businesses. The programme is two years duration, and admission to the programme is through CEED. The core of the programme involves an immersive studio experience with hands-on practice that is complemented by user-centered, research-driven and industry-sponsored projects. The programme emphasizes the development of 21st-century designerly skills that are needed for nurturing the design leaders of the future.

Ph.D. in Design

The Department of Design offers robust full-time and part-time Ph.D. programmes which can be inter-disciplinary in nature. The Ph.D. programme encourages researching design from multiple perspectives such as Technology, Humanities, Management, Sociology, Psychology, etc. to name a few domains.

RESEARCH AREAS

The Department of Design offers opportunities in the following Research domains pertaining to Design: Industrial Design, Product Design, Interaction Design, Graphic Design, Communication Design, Applied Ergonomics and Human Factors in Design, Universal and Inclusive Design, Human-Computer Interaction, Design Automation, Materials & Design, Design for Product Life-Cycle, Art & Design, Product Aesthetics, Digital Media & Design, Design & Culture, Animation, Film making, Digital Heritage, Neuro-cognitive aspects of Creativity, Creativity and Innovation, Design Theory & Methodology, Design Policy, Design Strategy and Design Management, Design History, Design Studies, Playful and experiential learning, Serious games, Design for marginalized populations, Typography, Design Education, Architecture.

LABORATORY FACILITIES

The department of Design consists of fully functional and well-equipped spaces that act as labs as well as learning spaces for the design students and researchers. The following spaces act as the labs in the department:

- **User Experience Lab:** The UX lab is equipped with state-of-the-art facilities for Usability Testing and User Experience Testing using behavioural and physiological tools like Eye Tracking, Pupillometry, Electroencephalography (EEG), Galvanic Skin Response (GSR), Behavioural observation software (Morae) and Facial recognition and physiological data integration tool (iMotion). Studies on emotional and cognitive responses to designed products are undertaken in this lab.
- **Sustainability Lab:** The lab for sustainability grooms students in the area of environmental sustainability, which includes intervention in the longevity of products, afterlife, Serviceability, Circular Economy, Packaging Design, Framework for Sustainability, Aesthetics for Sustainability, Culture and Society for Sustainability, Intervention in Rural ecosystem. It houses a material research facility, leaf extraction machine, and Compression moulding machine. The lab also hosts sponsored research and consultancy projects in the domain of sustainability, Ayurveda, and other related fields.
- **Vehicle design lab:** The vehicle design lab grooms students for the design of transportation systems, automotive styling, Sketching and rendering of concepts in a virtual environment, clay modelling, and development of representation models of concept vehicles. It houses a marker rendering facility and a clay modelling facility.
- **Makerspace:** Makerspace is a DIY facility for people who like to make things, are curious about how stuff works, or would like to learn new skills in tinkering. Makerspace is equipped with machines such as laser cutters, waterjet cutters, CNC routers, 3D printers, PCB prototyping stations, soldering stations, welding kits, and various hand and power tools.
- **Human Factors and Ergonomics Lab:** The ErgoLab is designed as a flexible facility for research work on usability, human performance, comfort, health, environmental simulation and user preferences. The ErgoLab is in process of acquiring measurement systems for surface electromyography, energy expenditure, motion analysis, force and pressure mapping, environmental assessment, and performance and productivity assessment software.
- **QuEST Lab:** This lab works in designing products and solutions for Quality of Life Enhancement using Science and Technology. Among other things, the lab houses Weather Station, Reference equipment for Air Quality Monitoring, Thermal Imaging Camera, Background Oriented Schlieren Imaging setup, Sensors for Indoor Environmental Quality.
- **DIVINE Lab:** DIVINE (Design and Innovation in Villagepreneurs Ecosystem) lab is a sponsored lab that facilitates research in the Indian rural ecosystem and facilitates students to visit villages and take up design projects relevant to rural ecosystems.

DEPARTMENT OF
ELECTRICAL ENGINEERING

I.N. Kar, *Ph.D. (IIT Kanpur)*
Professor
Nonlinear Control and Stability Analysis, Cyber-physical System, Time-delay System, Robotics.

Head of the Department

Abhijit R. Abhyankar, *Ph.D. (IIT Bombay)*
Professor
Power System Analysis and Optimization, Power System Security, Power Markets, Smart Grids, Distribution System Analysis and Optimization, Power System Flexibility, Electricity Regulatory and Policy Matters.

Sumeet Agarwal, *D.Phil. (Oxford Univ., U.K.)*
Associate Professor
Machine Learning, Complex Networks, Systems Biology, Evolution and Evolvability, Computational Linguistics, Cognitive Science, Public Health Informatics.

Soutik Betal, *Ph.D. (University of Texas)*
Assistant Professor
Nanorobotics, Electromagnetic Medical Devices and Implants, Nanofabrication, MEMS, Terahertz Devices, Electronic Devices and Sensors.

Shubhendu Bhasin, *Ph.D. (Univ. of Florida)*
Professor
Nonlinear Control, Adaptive Control of Uncertain Nonlinear Systems, Robotics, Autonomous Systems, Reinforcement Learning Control, Approximate Dynamic Programming, Differential Games.

Manav Bhatnagar, *Ph.D. (Oslo Univ.)*
Professor
Signal Processing for MIMO Communication Systems, Cooperative Communications, Ultra Wideband (UWB) Communications, Non-Coherent Decoders, Cognitive Networks, Coding Theory of MIMO Communication Systems, Power Line Communication, Satellite Communications.

Ranjan Bose, *Ph.D. (Pennsylvania Univ.)*
Professor (Microsoft Chair)
Wireless Communications, Broadband Wireless Access, Ultra Wideband Communications (UWB), Information Theory and Coding.

Tanmoy Chakraborty, *Ph.D. (IIT Kharagpur)*
Associate Professor
Machine Learning, Natural Language Processing, Social Network Analysis, Graph Mining.

Shouribrata Chatterjee, *Ph.D. (Columbia Univ.)*
Professor (NXP/Philips Chair)
Analog and RF Circuit Design and VLSI, Analog and Digital Filter Design, Low Power and Low Voltage Circuit Techniques, Measurement and Instrumentation Techniques.

Arpan Chattopadhyay, *Ph.D. (IISc., Bangalore)*
Assistant Professor
Communication and IoT Networks; Cyber Physical Systems: Design, Analysis, Control, Learning and Cyber-security, Blockchain; Signal Processing and Resource Allocation for Radar; Statistical Signal Processing; Networked Estimation; Applications of Reinforcement Learning.

S. Chaudhury, *Ph.D. (IIT Kharagpur)*
Professor (Dhananjoy Chair)
Computer Vision, Multimedia Systems, Computational Intelligence.

Amol Choudhary, *Ph.D. (University of Southampton, UK)*
Assistant Professor
Photonics, Integrated Optics, Microwave Photonics, Optical Communications, Nonlinear Optics, On-chip Lasers, Frequency Combs, Ultrafast Lasers, Photon-phonon Interactions.

Anandarup Das, *Ph.D. (IISc., Bangalore)*
Associate Professor
Power Electronics, High Power Multilevel Converters, Electric Drives, Modular Converters, Power Quality.

Subashish Datta, *Ph.D. (IIT Bombay)*
Assistant Professor
Linear Control Theory, Robust Control and LMIs, Graph Theoretic Control and Multi-agent Systems.

Swades K. De, *Ph.D. (State Univ. of New York)*
Professor
Performance Modeling and Analysis, Wireless Communication Networks and Systems, Energy Harvesting Wireless Networks, Broadband Wireless Access and Routing, Network Coexistence, Smart Grid Networks, IoT Communications.

Anuj Dhawan, *Ph.D. (North Carolina State University, USA)*
Professor
Nanomaterials, Plasmonics, Photonic devices, Biosensors, Biomedical Devices, Nanofabrication, Growth and Self-Assembly of Novel Optical and Electronic Materials, Integrated Nano-scale Systems, Computational Electromagnetic, Sensors: Fiber-optic and Chip-based, Biophotonics and Bioimaging.

Abhisek Dixit, *Ph.D. (K U Leuven Belgium)*
Professor (NXP/Philips Chair)
Silicon based Gubits and Cryogenic CMOS for Quantum Computing, Hot-carrier and TDDB Reliability of RF CMOS Devices and Circuits for WiFi/5G/6G Applications, Radiation Effects in CMOS, SPICE based Compact Models for Analog Mixed-signal and RF Technology PDKs.

Abhishek Dixit, *Ph.D. (Ghent University)*
Associate Professor
Optical Networks, Fibre-Wireless Converged Networks.

Saurabh Gandhi, *Ph.D. (MIT)*
Assistant Professor
Computational neuroscience Biosignal processing Dynamics of complex biological systems.

Tapan Kumar Gandhi, *Ph.D. (IIT Delhi)*
Associate Professor
Computational Neuroscience, Neuro-Inspired Engineering, Biomedical Signal and Image Processing, Machine Learning, Assistive Technology.

Gourab Ghatak, *Ph.D. (Telecom ParisTech, France)*
Assistant Professor
Wireless Communications, Stochastic Geometry IoT Networks, ML for Wireless Communications Reinforcement Learning.

Ankesh Jain, *Ph.D. (IIT Madras)*
Assistant Professor
Analog and Mixed Signal Circuit Design, Data Converters (ADC and DAC), Phase Locked Loop (PLL) and Clock Synthesizers, High Speed Circuit Design, Low Voltage Circuit Design.

S. Janardhanan, *Ph.D. (IIT Bombay)*
Associate Professor
Model Free Control, Robotics, Time-delayed Systems, Sliding Mode Control, Model Order Reduction, Controller Co-design.

Jayadeva, *Ph.D. (IIT Delhi)*
GSV Chair Professor
Machine Learning, Neuromorphic Engineering, VLSI Design, Swarm Intelligence Optimization.

S.D. Joshi, *Ph.D. (IIT Delhi)*
Professor
Statistical Signal Processing, Image Processing, Theoretical Approach to Signal/Image Analysis.

Subrat Kar, *Ph.D. (IISc., Bangalore)*
Professor (Ram and Sita Sabnani Chair)
Photonic Switching, Optical Networks, Computer Communication Networks.

M. Jagadesh Kumar, *Ph.D. (IIT, Madras)*
Professor
Nanoelectronics, VLSI Device Modeling and Simulation, IC Technology and Power Semiconductor Devices.

Lalan Kumar, *Ph.D. (IIT Kanpur)*
Associate Professor
Array Signal Processing, Brain Source Localization, BCI for Soft Exosuit/Exoskeleton.

Harshan Jagadeesh, *Ph.D. (IISc., Bangalore)*
Associate Professor
Coding Theory, Wireless Security, Cyber-physical Systems, Wireless Networks, Distributed Storage.

Amit Kumar Jain, *Ph.D. (IISc., Bangalore)*
Professor
High Power Converters, Electric Motor Drives for Electric Vehicle and Traction Locomotives, Electric Machine, Design, Energy Storage, Renewable Energy Etc.

Sandeep Kumar, *Ph.D. (IIT Kanpur)*
Assistant Professor
Optimization, Signal Processing, Machine Learning, Graphical Models.

Brejesh Lall, *Ph.D. (IIT Delhi)*
Professor
Multiscale Modeling of Stochastic Processing, Widescale Cyclostationary Process Representation, Physical Layer in Wireless Communication.

Dhiman Mallick, *Ph.D. (Tyndall National Institute, University College Cork)*
Assistant Professor
MEMS, Energy Harvesting, Magnetic/ Piezoelectric/Magnetoelectric Devices, Micro-power Management.

R.K. Mallik, *Ph.D. (Univ. of Southern California)*
Professor (JC Bose Fellow)
Communication Theory and Systems, Difference Equations, Linear Algebra.

Santanu Manna, *Ph.D. (IIT Kharagpur)*
Assistant Professor
Design/Simulation of Semiconductor Devices (Laser, Quantum Emitter, etc.; Molecular Beam Epitaxy Growth 3. Cleanroom Fabrication; Optoelectronic Measurements of Gr. IV & III-V (GaAs, InP) Based Devices: (i) Solid-state QD-based Single/ Entangled Photon Emitter and (ii) Mid-infrared Quantum Cascade Laser-based THz Emitter/Frequency Comb; Nonlinear Optical Properties of SiGe QDs.

S. Mishra, *Ph.D. (R.E.C. Rourkela)*
Professor (Power Grid Chair)
Power System Engineering, Intelligent Techniques for Control of Power System and Power Quality Studies, Renewable Energy.

Bhaskar Mitra, *Ph.D. (University of Michigan)*
Assistant Professor
MEMS and Microfabrication, Microfluidics, Plastic MEMS, Microplasmas, Gas Phase Nanofluidics.

Saif Khan Mohammed, *Ph.D. (IISc., Bangalore)*
Professor
Communication Theory, Information Theory, Wireless Communication in High Mobility Scenarios, Delay-Doppler signal Processing, Massive MIMO Systems.

Soumya Shubhra Nag, *Ph.D. (IIT Kanpur)*
Assistant Professor
Power Electronics, DC-DC Converters, High Gain Inverters, Electric Vehicle, Renewable Energy System, DC Distribution System, Marine Ship and Aircraft Power Supply, Power Electronics Converters, Mainly DC-DC Converters, High Gain Inverters, Impedance Source Converters.

Rakesh Kumar Palani, *Ph.D. (Univ. of Minnesota, Minneapolis)*
Assistant Professor
Analog/RF Mixed Signal Design, Data Converters, Low Power Circuits, Frequency Reference Circuits.

B.K. Panigrahi, *Ph.D. (Sambalpur Univ.)*
Professor
Power Quality, FACTS Device, Power System Protection, AI Application to Power System.

Deepak U. Patil, *Ph.D. (IIT Bombay)*
Assistant Professor
Optimal Control, Multi-Agent Systems, Switched and Hybrid Systems.

Shankar Prakriya, *Ph.D. (Univ. of Toronto)*
Professor
5G, Beyond 5G and 6G Communications.

Sumit K. Pramanick, *Ph.D. (IISc., Bangalore)*
Assistant Professor
High Frequency Link Converters, Multilevel Converters for Machine Drives, Grid Connected Converters, HVDC Circuit Breakers.

V. Ramgopal Rao, *Ph.D. (Universitaet der Bundeswehr Munich, Germany)*
Professor
Nanoelectronics, Technology Aware Design Challenges with Emerging Technologies (Process-Device-Circuit Interactions with Multigate MOSFETs, Polymer Transistors, Molecular Electronics etc.), CMOS Reliability, Bio-MEMS

Mustafijur Rahman, *Ph.D. (University of Minnesota, Twin Citites, USA)*
Assistant Professor
CMOS Analog/RF/m-Wave Integrated Circuits & Systems, CMOS Cryogenic Integrated Circuits & Systems For Quantum Computers.

Sumantra Dutta Roy, *Ph.D. (IIT Delhi)*
Professor
Computer Vision and Image Analysis, Pattern Recognition and Machine Learning, Medical nformatics, Biometrics, Bioinformatics, Music Information Retrieval and Analysis.

Mukul Sarkar, *Ph.D. (Technical University of Delft)*
Professor
Solid State Imaging, CMOS Image Sensors, Bio-Inspired Vision Systems, Neuromorphic Imaging, Analog/Digital Circuit Design, Optoelectronics and Photonics.

Nilanjan Senroy, *Ph.D. (Arizona State Univ.)*
Professor
Power System Stability and Control, Wide Area Measurement and Control, Statistical Techniques in Power Systems, Power Quality.

Shaunak Sen, *Ph.D. (California Instt. of Tech.)*
Associate Professor
Control Systems, Dynamical Systems.

Madhusudan Singh, *Ph.D. (Univ. of Michigan)*
Associate Professor
Flexible Electronics, Maskless Lithography And Printing Methods, Organic And Inorganic Photovoltaics, Organic Light-emitting Diodes, Nanoscale Transport, Sustainability, Wide-Bandgap Semiconductors, Device Design and Characterization.

Ankit Singhal, *Ph.D. (Iowa State University)*
Assistant Professor
Distributed Energy Resources (EVs, Solar PVs, Storage) Integration into Power Systems; Distribution Systems and Microgrids; Transmission-Distribution Co-simulation; TSO-DSO Coordination; Power Systems Simulation, Optimization, and Controls.

Sreyam Sinha, *Ph.D. (Cornell University)*
Assistant Professor
Power Electronics, Resonant Converters, Electric Vehicles, Wireless Power Transfer.

Seshan Srirangarajan, *Ph.D. (University of Minnesota, USA)*
Associate Professor
Signal Processing, Wireless Communications, Wireless Sensor Networks, Optimisation, Machine Learning.

Manan Suri, *Ph.D. (INPG, France)*
Associate Professor
Non-volitile Memory, Neromorphic & AI Hardware, Semiconductor Cyber Security.

M. Veerachary, *Ph.D. (University of the Ryukyus Japan)*
Professor
Power Electronics, High Frequency Switch-Mode Power Conversion, Fuzzy-neuro Controllers for PE systems, DSP based Controllers, Object Oriented Modeling of PE Systems, Development of MPPT Controllers for Space/Photovoltaic Sources, Photovoltaic Power Conversion, Intelligent Controllers for VRMs, Digital Control Theory and Applications.

Vivek Venkataraman, *Ph.D. (Cornell Univ.)*
Assistant Professor (Joint Faculty Phy/EE)
Nonlinear & Quantum Optics, Fiber & Integrated Photonics, Light-Matter Interaction & Atomic Physics, All-Optical Devices & Novel Light Sources, Optical Signal Processing and Communication.

Kaushik Saha, *Ph.D. (IIT Delhi)*
Professor of Practice
Semiconductor memory deign, Digital ASIC design, Digital audio / video systems, Multimedia coding and compression, Real time embedded system architecture and design, Wireline communication systems, Swarm intelligence.

Bhim Singh, *Ph.D. (IIT Delhi)*
Emeritus Professor (SERB National Science Chair Professor)
Power Electronics, Electrical Machines and Drives, HVDC, FACTS, Power Quality, Renewable Energy, DSP Based Control of Power Converter and Drive.

INTRODUCTION

The Department of Electrical Engineering, IIT Delhi, was established in the year 1961. The department runs 2 undergraduate programmes and 9 postgraduate programmes to cater to teaching and research needs in all areas of electrical engineering such as Integrated electronics and circuits, Tele-communications, Computer technology, Control & Automation, Power systems & Power electronics.

The department offers instruction at the undergraduate and postgraduate levels with the aim of providing a sound background in the areas of electrical, electronics and computer engineering to the brightest students of the country. The courses are tailored to the needs of technical manpower in the country and the world over, being aligned to the needs of a technologically self-reliant India, in the ever expanding fields of communications, computers, control, electronic circuits and power engineering.

The department has been rich in world class postgraduates, research scholars and faculty. There are two Fellows, IEEE, in the department and many other faculty members are Fellows of several national and international scientific bodies. The faculty members of the department are constantly engaged in research on technologies of national and global importance and regularly publish in IEEE and other top international journals. The departmental faculty actively engaged in research, development, technology transfer, industrial consultancy, continuing education programmes, curriculum and laboratory development, software development and organization of seminars, workshops, and conferences in related areas. The department has active interaction with industries, alumni, governmental agencies and utilities to stay abreast of the research and development needs of the technology ecosystem of the country and the world.

With an aim to enhance the cross-fertilisation of ideas, the departmental faculty participate enthusiastically in a number of interdisciplinary centres and programmes in the Institute, through research, instructional activities, and human resource development projects. In particular, the department has a close interaction with Centre for Applied Research in Electronics, Bharti School of Telecom Technology and Management, the Industrial Design and Development Centre, the Centre for Energy Studies, the Centre for Biomedical Engineering, the Computer Science and Engineering Department, and the Department of Physics.

ACADEMIC PROGRAMMES

UNDERGRADUATE

The Department offers B.Tech. in Electrical Engineering and B.Tech. in Electrical Engineering (Power and Automation). These two programmes with different foci provide the desired breadth and inter-disciplinary exposure to the students so that they can pursue any of the diverse areas of Electrical Engineering (e.g. Computer and embedded systems, design and fabrication of VLSI, intelligent robotic systems, cognitive and bio-inspired technologies, control systems, telecommunications and computer networking, wireless communication systems, signal and information processing, micro and nano-electronics, electromagnetic and electrochemical systems, power engineering, renewable energy, electrical transportation systems, green technologies etc.) either in an industry-based or research-based career.

The B.Tech. programme in Electrical Engineering (Power and Automation) concentrates on automation technologies and power engineering catering to the current needs of intelligent and effective energy management. Students of this B.Tech. Programme also have an option of specializing in specific areas by doing additional courses.

POSTGRADUATE

The Department offers M.Tech., M.S. (Research) and Ph.D. programmes in Electrical Engineering.

M.Tech. Programme

The Department offers six specialized postgraduate programmes leading to an M.Tech. degree:

- Communication Engineering
- Computer Technology

- Control and Automation
- Integrated Electronics and Circuits
- Power Systems
- Power Electronics, Machines and Drives

In addition, the Department jointly conducts industry sponsored interdisciplinary M.Tech. programmes specializing in:

- Opto-electronics and Optical Communications (jointly with Physics Department).
- VLSI Design, Tools and Technology (VDTT) (jointly with the Centre for Applied Research in Electronics and the Department of Computer Science and Engineering).
- Construction Technology and Management (jointly with the Civil Engineering Department and Mechanical Engineering Department).
- Telecom Technology and Management through the Bharti School of Telecommunication Technology and Management (jointly with the Department of Management).

The full-time M.Tech. programmes are normally of four semesters duration. The department has recently introduced a six semester (three year) M.Tech. programme, with enhanced scholarship. The students enrolled in this three year programme help in the development and maintenance of existing and upcoming laboratories. This gives them an opportunity to develop hands-on experience with state-of-the-art facilities.

M.S. (Research) Programme

The M.S. (Research) programme is appropriate for students aspiring to a career in research and development in the industry or in teaching. In contrast to students in the M.Tech. programme, the M.S. (Research) students are required credit fewer courses and carry out a high quality research project.

RESEARCH AREAS

The Department offers a doctoral programme with a view to push the frontiers of knowledge and to explore new and emerging areas. The brightest undergraduate and Masters students and teachers in engineering colleges are particularly encouraged to enroll for the Ph.D. programme. The various research activities are coordinated by different research groups within the department, reflecting the diverse research interests of the faculty. The different research areas covered by these groups are given below:

- **Communication Engineering Group:** Performance Analysis of Communication Systems, Cooperative Communications, Cognitive Radio, Information Theory and Coding, Communication Networks, Secrecy and High speed wireless and Wireline Communications, MIMO, Image / Video coding, Multirate Signal Processing, Array Signal Processing, Source Localization and Tracking, Optical Communication and Networks, FSO, Micro and Nano Photonics, Photonics and Switching, Electromagnetics, Plasmonics and Plasma Science, Molecular Communications, 5G, Beyond 5G and 6G Communications, IoT; Cyber-physical Systems: Design, Analysis, Control, Learning and Cyber-security, Blockchain; Radar; Statistical Signal Processing; Networked Estimation; Reinforcement Learning.
- **Computer Technology Group:** Computer Vision, Multimedia Systems, Image Processing, Computer Networks, Computer Architecture, Embedded Systems, Parallel Computation, Neural Computation, Pattern Recognition, Artificial Intelligence, Music Information Retrieval, Bioinformatics, Machine Learning, Biometrics.
- **Control Engineering Group:** Robust Control, Robotics, Optimal Control, System Identification, Reinforcement Learning Control, Nonlinear Dynamical Systems and Control, Adaptive Control, Cooperative Control and Path Planning, Sensor Fusion, Guidance and Navigation, Sliding Mode Control, Interval Analysis in Control Design, Computational Methods for Simulation and Control, Modeling and model order reduction, Attitude Control

and Structural Control, Numerical Modeling and Simulation, Embedded Control Systems, Applications to Biomolecular Circuits, Time-delayed Systems, Control of Cyber-physical Systems, Model-free Control.

- **Integrated Electronics and Circuits Group:** Electronic and Optoelectronic Materials, Flexible electronics, Sensors, Optoelectronic and Photonic devices, Field-Effect and Bipolar devices, MEMS devices, Memory, Spintronics, Thin Film and Solution-Processed Devices, Energy Harvesting and Scavenging devices, Analog, Analog and Mixed Signal Circuit, RF Circuits, Power Management Integrated Circuits, Data Converters, Low Power and Low Voltage Circuits, Compact Device Modeling, Machine Learning, MEMS and Microfabrication, CMOS Image Sensors, Emerging Non-Volatic Memories.
- **Power Engineering Group:** Electrical Machines, Energy Conversion, Power Electronics, Power Quality, Drives, Power and Energy Systems, Protection, Stability, Optimization, Energy Conservation, HVDC and FACTS, Applications of Microprocessors and Computers in Power and Drives, Renewable Energy Systems (Small Hydro, PV, Wind), and Energy Audit and Efficiency, Solar Inverters and Power Supplies.

LABORATORY FACILITIES

The Department maintains an extensive library, a departmental workshop and an ergonomically designed committee room equipped with video conferencing facility. The department has well equipped laboratories with extensive hardware and software facilities for teaching and research in the following areas:

- Basic Electrical Engineering
- Measurement
- Communications
- Microwaves
- Integrated Optics
- Signal and Information Processing
- Optical Communications and Optical Signal Processing
- Computer Technology, Computation
- Multimedia and Distributed Computing
- Robotics and Distributed Control
- Microprocessor Development Systems
- Electronic and Optoelectronic Materials, and Device Fabrication.
- Microprocessor Applications
- Control and System Engineering
- Process Control
- Electronic Circuits and Networks
- Electrical Machines and Drives
- Power Systems
- Power Electronics
- VLSI Design
- Electrical Energy Audit and Energy Conservation
- Electrical Machines
- Energy Instrumentation
- IoT, CPS and Networks Lab.

Most electronic experiments within a frequency limit of 40GHz, can easily be conducted in the laboratory facilities of the department.

DEPARTMENT OF
ENERGY SCIENCE AND ENGINEERING

Vamsi K. Komarala, *Ph.D. (IIT Delhi)*
Professor
Silicon Hetero Iunction Solar Cells,
Nano-science and Nano-photonics Concepts for
Enhancing Solar Cell Performance.

Head of the Department

Sumit K. Chattopadhyay, *Ph.D. (IIT Kharagpur)*
Assistant Professor
Power Electronic Converters, Multilevel Converters, Renewable Energy, Smart Grid, Micro-grid.

Subhendu Dutta, *Ph.D. (IIT Bombay)*
Assistant Professor
Application of Power Electronics in Solar Photovoltaic Systems, AC-DC Hybrid Nanogrid Systems, EV Charging.

Rahul Goyal, *Ph.D. (IIT Roorkee)*
Assistant Professor
Hydropower, Hydraulic Turbines, Experimental and Computational Fluid Dynamics, Cavitation, Sand Erosion.

K. Ravi Kumar, *Ph.D. (IIT Madras)*
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Concentrated Solar Thermal Energy Systems, Solar Industrial Process Heating, Thermal Energy Storage, Hydrogen Storage, Forecasting of Solar Radiation and Energy Audit.

Satyananda Kar, *Ph.D. (IPR)*
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Atmospheric Pressure Plasma Applications (Biomedical, Waste Water Treatment, Waste to Energy), Plasma Sources (DC, RF, Microwave).

Supravat Karak, *Ph.D. (IIT Kharagpur)*
Associate Professor
Organic Electronics, Polymer & Hybrid Solar Cells, Photodetecters, Sensors.

Vipin Kumar, *Ph.D. (NTU, Singapore)*
Assistant Professor
Electrochemical Energy Storage
Using Metal-Sulfur Batteries, and
Li-Ion/Na-Ion Supercapacitors.

Ramesh Narayanan, *Ph.D. (Jadavpur Univ.)*
Professor
Fusion Energy, Plasma Sources in Different Geometries, with Emphasis on ECR and RF sources, Plasma Thrusters, Waste-to-Wealth, Plasma Sources for National/Societal Application.

Snehasish Panigrahy, *Ph.D. (IIT Guwahati)*
Assistant Professor
Chemical Kinetic Modeling, Clean Fuel Technology Combustion, CFD, Heat and Mass Transfer.

Dibakar Rakshit, *Ph.D. (The Univ. of Western Australia)*
Associate Professor
Thermal Energy Storage, Building Energy Efficiency, Passive Air Conditioning, Battery Thermal Management (BTMS).

Kaushik Saha, *Ph.D. (University of Waterloo, Canada)*
Assistant Professor
Two-phase Flows in the Automotive and Power Generation Sectors, Internal Combustion Engine Processes, Waste Management in Thermal Plasmas and Syngas Combustion, NOx after-treatment with Urea-SCR, Coupling of Internal Nozzle Flow with Spray Atomization.

Bibhuti Bhusan Sahu, *Ph.D. (IIT Delhi)*
Associate Professor
Plasma Science and Diagnostics, Technological Plasmas at Low and Atmospheric Pressures, Plasma Nanotechnology.

Debaprasad Sahu, *Ph.D. (IIT Kanpur)*
Assistant Professor
EECR, Plasma Thruster, Plasma based ion Implantation, Magnetized Plasma Dynamics.

K.A. Subramanian, *Ph.D. (IIT Madras)*
Professor
Hydrogen Energy, Alternative Fueled Internal Combustion Engines/Vehicles, Hydrogen Backfire and Combustion, Hydrogen Fuel Cells, Zero-Emission Vehicles, Hybrid System, Integrated Energy System.

R. Uma, *Ph.D. (IIT Delhi)*
Associate Professor
Plasma Physics, Laser-plasma, E.M. Wave Interactions with Plasmas, Optics of Plasmas, Turbulence & Reconnection in Space & Laboratory Plasmas, Plasmonics.

S.K. Tyagi, *Ph.D. (CSS, Meerut)*
Associate Professor
Solar-Biomass, Energy Conservation, Energy and Exergy Analyses.

Ashu Verma, *Ph.D. (IIT Delhi)*
Associate Professor
Power System Analysis Optimization and Planning, Building Energy Management Systems, Microgrids.

Viresh Dutta, *Ph.D. (IIT Delhi)*
Emeritus Professor
Solar Photovoltaics, Semiconductor Nanoparticles, Hybrid Systems and Embedded Systems.

Tara C. Kandpal, *Ph.D. (IIT Delhi)*
Emeritus Professor
Solar Thermal Utilization, Techno-economics of Renewable Energy, Renewable Energy Education and Training.

R.K. Malhotra, *Ph.D. (IIT Delhi)*
Adjunct Professor of Practice
Energy Transition, Oil & Gas, Bio- Fuels, Hydrogen, I C Engines, Fuel Cells, Gasification Technologies, Environment protection, Carbon Capture Utilisation & Sequestration.

INTRODUCTION

Energy forms an integral part of all the scientific and engineering disciplines. Since the demand for energy world-over has been leading to rise of known as well as future sources of energy. Study of energy resources and technologies for their efficient utilization has great impact on economic and social life of a country. Energy experts are needed for developing sustainable solutions for meeting energy demand without adversely affecting the environment. The Department has mandated itself in training and research in Energy Engineering for serving the energy needs of the country with special emphasis on energy efficiency, renewable and alternative energy technologies and energy-environment interaction.

ACADEMIC PROGRAMMES

UNDERGRADUATE

The Department offers a four year B.Tech. Programme in Energy Engineering. It is also offering several electives in the emerging areas of Energy and Environment for UG students as open category courses.

POSTGRADUATE

The Department offers the following post-graduate programmes, as full-time/part-time programme for Engineering graduates and Science post-graduates, leading to the award of M.Tech. Degree:

- M.Tech. in Energy Studies (Interdisciplinary Programme)
- M.Tech. in Energy & Environment Technologies and Management
- M.Tech. in Renewable Energy Technologies and Management (sponsored students only)
- M.S.(R) in Energy Science & Engineering
- Ph.D.

RESEARCH AREAS

The major research groups of the centre are:

- Electrical Power and Renewable Energy Systems
- Plasma Science and Technology
- Solar-Thermal
- Energy Storage
- Internal Combustion Engines and Alternative Fuels
- Solar-Photovoltaics
- Wind and Hydro
- Energy Systems Simulation

The focused topics of doctoral and post-doctoral studies as well as sponsored research at the centre are:

- **Renewable Energy Technologies (Solar Photovoltaics, Solar Thermal, Biomass, Hydro and Wind):** Solar, wind, biomass, water and other energy sources are cleaner and perennial energy sources which the nature has provided for the use of mankind. The Department has done extensive work on solar thermal technologies and solar photovoltaic systems. Design of solar hot water systems, dryers, space heating/ cooling systems, thermal power generation and industrial process heating systems is performed by using state-of-art software. Studies on developing clean and efficient biomass cookstoves have also been initiated.

  The focus of the photovoltaics group has been on thin film based (2nd generation) and Dye-sensitized, Organic and Perovskite (3rd generation) solar cells fabrication and device analysis. The nanocrystalline materials for photo-electrochemical and organic solar cells are being developed. The studies also include implementation of nanophotonics concepts for enhancing solar cell performance, and silicon heterojunction solar cells based on amorphous silicon/crystalline silicon and carrier-selective contacts; perovskite-based photovoltaic devices and their long-term stability; understanding the correlation between photo-physical properties and microstructural properties of semiconducting thin films. Development of novel materials for low-cost and high-performance photovoltaic devices is also under progress.

  Under organic solar cells, use of organic polymers and other related hybrid semiconducting materials to maximize efficiency in the collection and harvesting of solar energy is being studied. The research group mainly focuses on the physics, material science and device engineering with the aim to develop innovations that will lead to the better device performance and higher device energy efficiencies.

The solar-biomass-hybrid laboratory has the mandate for solar and biomass-hybrid applications including but not limited to heating, cooling, cooking and desalination. Some of the experimental setups such as, vapor compression heat pump, thermoelectric-cooler-generator (TEC/TEG) and biomass combustion device testing facilities are available for both M.Tech. and Ph.D. students. The required instruments like the portable gas analyzer, particulate matter analyzer (PM2.5 and PM1.0) bomb calorimeter and microbalance were procured during the last three years. The R&D works in the area of solar-biomass-hybrid refrigeration, biomass-solar-desalination, vapor adsorption, clean biomass combustion for cooling, heating, cooking, desalination, and other industrial applications is on-going.

The focus of the research in hydropower is to investigate the off-design and transient operations of the hydraulic turbines. The main objective of the study is to understand the flow dynamics inside the turbine using both experimental and numerical techniques during steady-state and transient operating conditions. The study also includes the investigations of cavitation and sand erosion in hydraulic turbines.

The wind energy is considered as one of the first kind of renewable energy sources after the evolution of the solar energy. Exergies in the wind power generation gains greater interests to the researchers in past few decades. Both HAWT and VAWT exhibited a remarkable and comparable performance. The research on the wind turbine focuses on performance enhancement and understanding of the mechanism of flow using experimental and numerical techniques.

- **Internal Combustion Engines and Alternative Fuels:** Globally, conscious efforts are being made to undertake research and development activities to facilitate transition towards low carbon options in all sectors of the economy. Promoting the use of alternative fuels as clean fuel in internal combustion engines/ vehicles for transportation as well as for power generation is an important initiative in this context. The cutting-edge technologies for utilization of alternative fuels including methanol, ethanol, biogas, hydrogen, biodiesel and dimethyl ether in internal combustion engines are being developed. Life-cycle analysis and Greenhouse gases of alternative fuels are being studied for screening of sustainable fuels for internal combustion engines. The hybrid technologies including IC Engines with Electric System, IC Engines with Fuel cells and IC Engines with renewable energy system are being studied. A strong research linkage with oil & gas industries and automotive engine manufacturers is fostered to develop the required technologies. The further research work is focused towards achieving sustainable energy and environment.
- **Energy Conservation and Management:** One of the main aims of buildings is to provide internal environment where one can have visual as well as thermal comfort. This is partly provided by an energy efficient building design and/or by providing energy efficient end use devices. By using sophisticated computer modelling, the building group in the Centre assists the architects to arrive at an optimum design to achieve better day lighting and minimize the air conditioning load. Additionally, the group can also undertake the design and fabrication of building automation systems to reduce energy related operating costs.

  Thermal Energy Storage Studies pertaining to adequate façade to contrive a comfortable indoor environment with reduced active HVAC power requirements are carried out at Department of Energy Science & Engineering. This basically aims at designing thermally conducive environment for hot climatic conditions through deployment of phase change materials (PCMs) in building envelopes that can store the excess incoming heat through the envelope as latent heat (at constant temperature) and later release the stored heat to the colder ambient at night. In cold regions, PCMs packed under building floor can maintain a comfortable floor temperature for a long time by gradually releasing latent heat while undergoing phase change.

  Besides this medium temperature range thermal energy storage system designs for perennial supply of thermal energy, required for non-conventional refrigeration and cooling system are also studied. Recently the Department started exploring ultra-high temperature thermal energy storage systems to store electrical spillage as ordained by the concept of thermal batteries.

  The research activities, related to battery storage, that will be undertaken at Department will specifically focus on enhancing the energy storage capabilities of the electrochemical energy storage devices, such as lithium ion batteries, sodium-sulfur or lithium-sulfur batteries, and advanced batteries by employing nanoscale materials. These energy storage technologies would be used in combination with renewable energy sources (e.g., solar PV), and also to power electric vehicles, thus cutting down overall greenhouse gas emission and, thereby reducing global warming. The energy storage technologies that the Department

is presently focusing on will be one of the vital components for the future of a "clean energy landscape". Besides electrochemical energy storage devices, flexible and stretchable chemically and electrochemically active devices will also be developed to sense and monitor environmental degradation.

- **Fuel Cell Systems:** Development of PEM fuel cell systems for high efficiency and power density, Development of electrodes and bipolar plates with different materials for better performance of the fuel cells, Development of Direct Methanol Fuel Cell (DMFC).
- **Chemical Kinetic Modeling:** CFEL, the Clean Fuel and Energy Laboratory, is committed to conducting both basic and applied research in the realm of combustion chemistry as well as innovative, clean fuel technologies. At CFEL, fundamental experimental inquiries in combustion science are combined with diverse modeling tools and ab-initio quantum chemistry techniques to create crucial chemical kinetic mechanisms and computational fluid dynamics solvers, which can be utilized to simulate an extensive array of engineering scenarios, ranging from molecular to industrial scales.
- **Electrical Power and Renewable Energy Systems (EPRES):** The growing capacity of renewable energy based installations makes it necessary to develop efficient operation and control techniques to analyse and optimize the unbalanced distribution/transmission network. The intermittent nature and forecast uncertainties in renewable energy sources and loads must be considered in any analysis and design. The holistic grid/micro developments utilizing the energy management systems incorporating resource, demand side management, cloud/shared storage, effective use of battery/PV inverters, mobile loads in terms of electric vehicles etc. will lead to more certain and robust electrical systems. Many of the villages in India are electrified but have limited availability of the electricity. To address the technical challenges with respect to present and near-future scenario of the Nation, following research areas are the key focus of EPRES group:
  - » Development of energy management systems (EMS) for microgrid operations, buildings.
  - » Design and development of tools and techniques for distribution system operators (DSO) operation for LV/MV unbalanced distribution networks, power electronics based interconnects, Renewable based Multiple Distributed Generations, Electric Vehicles, etc.
  - » Development of Power Converters for small, medium and high-power applications in Renewable energy.
  - » Development of controls strategies for load frequency, voltage control and controller test facility for various types of micro-grids.
- **Plasma Science and Technology:** The lab was established in 1980 as "Plasma Physics Laboratory (PPL)" of the Department of Energy Science and Engineering [formerly Centre for Energy Studies] and the Department of Physics at IIT Delhi. The lab evolved to become one of first experimental plasma laboratories to be setup in an educational institution.

  The initial focus of the lab was on high power microwave plasma interaction in conducting waveguides for an understanding of the physics of plasma loaded waveguides (for use in plasma applications). Subsequently similar studies were conducted on helicon waves as well. Over time, the focus of the lab shifted to the development of ECR-based novel plasma sources for a wide range of applications for industry and scientific use. With the induction of several young faculties to the lab over the past decade, the lab has expanded its scope of research, and today it includes areas like development of ECR-based plasma thruster, large area ECR-based hydrogen beam source, high pressure ECR plasma source, rf plasma diagnostics, atmospheric plasma jets, and their applications. The Lab has also received funds under IoE as well as from PSA to initiate activities on Plasma-based Waste Management & Waste-to-Wealth.

  With the expansion of the lab's activities, the laboratory is now spread over three separate labs: "Plasma Physics Laboratory", "ELNIBS Laboratory" and "Plasma Applications Laboratory" (cold plasma application for biomedical and waste water treatment, plasma pyrolysis) under the common banner "Plasma Lab".

  Extensive theoretical work has been undertaken on waves, instabilities in the ionosphere magnetosphere and laboratory (fusion) plasmas. Significant work on nonlinear dynamics of plasmas including self organization and chaos to study plasma behaviour at high power particularly in fusion phenomenon has also been carried out. To foster societal applications based on material processing and nanoscience, Multifunctional Plasma Laboratory (MFPL) has been recently developed.

LABORATORY FACILITIES

Facilities are available in the Department for education and training as well as for facilitating industry-academia interaction.

- **Renewable Energy:** Thin Film Deposition Facility, temperature Dependant I-V Characterization of Solar Cells using Solar Simulator, Quantum efficiency measurement system, Impedance and capacitance-voltage measurement System, Excitonic Solar Cell Fabrication Facility, Carrier Mobility Measurement Set-up, Time Resolved Photoluminescence Set-up, 25 kWp Roof Top Photovoltaic Generator, Thermal Conductivity Analyzer, U Value Measurements, Alphatometer and Emissometer, Solar Transmittance Measurements, Fuel Technology, Gas Chromatograph: Gas Analyzer, Proximate Analysis of Fuels, UV-Visible Spectrophotometer, Bomb Calorimeter, Pyrolyzer, Pyrheliometer with Sun-Tracker.
- **Electrical Power and Renewable Energy Systems:** Software tools for power system analysis and optimization with renewable power generation and dynamic loads, real time digital simulator for hardware in loop simulations, laboratory scale Micro-Hydro Power Generation, doubly fed induction generator, Long Transmission Line Models, Wind/Solar emulator, power converters etc.
- **Internal Combustion Engines and Alternative Fuels:** Facility to measure flame kernel growth, backfire, injection, ignition, combustion, performance and emissions characteristics of internal combustion engines for alternative fuels; Instruments include Non-dispersive Infrared (NDIR) analyzer, FTIR analyzer, smoke meter, piezo-electric transducer, optical encoder and sensor and combustion analyser; Advanced facilities include Research Engine, Backfire measurement in hydrogen fuelled engine, CRDI Engine test rig, hydrogen engine test rig, DME fuelled engine test rig, Ammonia fuelled SI engine, RCCI/HCCI combustion engine, methanol fuelled test rig with oxygen-combustion; Computational facility such as simulation/computational Fluid Dynamics software to study the important engine processes including backfire, injection, spray, ignition, combustion and emissions. 'Constant volume chamber for spray and combustion diagnostics has been developed in the laboratory of Engines and Unconventional Fuels.'
- Internal Combustion Engines and Alternative Fuels: Facility to measure flame kernel growth, backfire, injection, ignition, combustion, performance and emissions characteristics of internal combustion engines for alternative fuels; Instruments include Non-dispersive Infrared (NDIR) analyzer, FTIR analyzer, smoke meter, piezo-electric transducer, optical encoder, combustion analyser; Advanced facilities include Research Engine, Backfire measurement in hydrogen fuelled engine, CRDI Engine test rig, hydrogen engine test rig, DME fuelled engine test rig, Ammonia fuelled SI engine, RCCI/HCCI combustion engine, methanol fuelled test rig with O_2 combustion, CO_2 capture from combustion engines using oxy-combustion; Computational

facility such as simulation/computational Fluid Dynamics software to study the important engine processes including backfire, injection, spray, ignition, combustion and emissions. 'Constant volume chamber for spray and combustion diagnostics has been developed in the laboratory of Engines and Unconventional Fuels.'

- **Plasma Science and Technology:** Plasma sources of different kind, viz. ECR (electron cyclotron resonance), RF (radio frequency), DC (direct current) etc. A Compact ECR Plasma Source (CEPS) for producing high density plasma; Large Volume Plasma System (LVPS) using multiple CEPS, for plasma processing application; Automated Langmuir probe system for plasma characterization; High resolution spectrometer for study of plasma emission spectroscopy; Plasma Simulation Facilities; Scalable plasma sources and advanced diagnostics for societal applications.
- **Energy Efficiency and Conservation and Energy Simulation:** Portable energy audit instruments like temperature, humidity, velocity meters, surface temperature reading instruments, clamp type voltmeter, ammeter and power factor meter. A collection of excellent software backed by a comprehensive data base. The software packages can be used for Energy Efficient Building Design, Solar Photovoltaic and Solar Thermal System Design, Hybrid System Design and Calculation of AC loads. Optimal Power System Expansion Model including the Environmental Impacts and Design and Analysis of Electrostatic Monitoring Precipitator.
- **Energy Systems Simulations:** Simulations play a vital role in the research of energy studies at Department. Computer simulations are used by the faculty members from Electrical and Power Systems, Plasma Science and Technology, Solar Thermal, Internal Combustion Engines and Automotive Sprays research groups. High-end workstations and desktops are available at the computational laboratory of the Department. Energy Science & Engineering faculty members have also initiated integrating Artificial Intelligence with their simulation framework for further advancement in the predictions and analysis of performance of energy systems.

DEPARTMENT OF
HUMANITIES AND SOCIAL SCIENCES

Head of the Department

Farhana Ibrahim, *Ph.D. (Cornell University)*
Professor
Ethnographies of the State and Violence; Anthropology of Security, Policing Civil-military relations; Ethnography of War Migration and Displacement; Ethnography of Disasters Borders and Nation; History and Anthropology; Ethnography of the Neighbourhood; Religion; Citizenship.

Ankush Agrawal, *Ph.D. (IGIDR, Mumbai)*
Associate Professor
India's Official Statistics, Applied Econometrics, Development Economics.

Ishan Anand, *Ph.D. (Jawaharlal Nehru University)*
Assistant Professor
Inequality, Agriculture, Political Economy; Development.

Arjun, *Ph.D. (Jawaharlal Nehru University)*
Professor
Performance Studies, Authorship, Intellectual Property, Digital Humanities.

Vibha Arora, *Ph.D. (Oxford University)*
Professor
Political Sociology, Environmental Sociology, Sociology of Development, Globalization and Transnationalism, Visual Anthropology, Medical Anthropology, Gender and Development, Social Research Methods, Sociological Theory, Sociology of South Asia, The Himalayan Region and their Diaspora.

Mahuya Bandyopadhyay, *Ph.D. (University of Delhi)*
Professor
Sociology of Organisations and Work, Prison Studies, Ethnography of the State, Gender and Masculinities, Urban Neighbourhoods, Violence and the Carceral Complex, Ethnographic Methods.

Abhijit Banerji, *Ph.D. (Yale University)*
Professor
Microeconomics, Industrial Organisation, Agricultural Markets.

Arudra Burra, *Ph.D. (Princeton University, USA)*
Assistant Professor
Moral and political philosophy, philosophy of law, legal history.

Pritha Chandra, *Ph.D. (University of Maryland)*
Professor
Syntactic Theory (Minimalism), Linguistic Variation and Change, Biolinguistics & Language and Politics.

Don Dcruz, *Ph.D. (University of Hyderabad)*
Assistant Professor
Epistemology, Philosophy of Science, Cognition and Artificial Intelligence, Metaphysics, Ethics.

Sisir Debnath, *Ph.D. (University of Virginia)*
Assistant Professor
Development Economics, Applied Microeconomics, Health Economics.

Divya Dwivedi, *Ph.D. (IIT Delhi)*
Associate Professor
Philosophy of Literature (Classical Poetics, German Romanticism, Russian Formalism), Aesthetics (Kant, Foucault, Ranciere), Philosophy of Psychoanalysis (Freud, Heidegger, Lacan, Deleuze, Derrida), Narratology, Literary Theory and Criticism, Formal inquiry into fictionality (Theory of Language, Modal Logic,Temporal Logic, Quine), Critical Philosophy of Caste and Race, Political thought of Gandhi, Political Cartoons and Novels of O V Vijayan.

Samar Husain, *Ph.D. (IIIT Hyderabad)*
Associate Professor
Human Sentence Processing, Natural Language Modeling, Natural Language Parsing, and Dependency Grammars.

Sumitash Jana, *Ph.D. (IISc., Bangalore)*
Assistant Professor
Understanding the Brain Mechanism that Mediate Self-control. Understanding the Impact of Mind-wandering and Mediation on Self-control in both Healthy and Clinical Populations, and Studying Self-control in More-realistic Scenarios using Virtual Reality.

Yashpal Jogdand, *Ph.D. (University of St. Andrews)*
Assistant Professor
Social Psychology, Critical Caste Studies, Dalit Studies.

Ravinder Kaur, *Ph.D. (University of Delhi)*
Professor
Sociology of Kinship, Marriage and Family, Urban Social Anthropology, Migration Studies, Gender Studies, Demographic Anthropology, Sociology of India, Social Change.

Stuti Khanna, *Ph.D. (Oxford University)*
Associate Professor
Cities, Modernism, Post-colonialism, South Asia, the Novel, Gender, Translation, Cinema.

Reetika Khera, *Ph.D. (University of Delhi)*
Professor
Social Policy in India, including Health and Nutrition, Education, Social Protection, Employment, Poverty, Inequality, Impact of Digital Technologies in Welfare.

Richa Kumar, *Ph.D. (MIT, USA)*
Associate Professor
Sociology of Agriculture, Sociology of Food and Nutrition, Science and Technology Studies, Rural and Agrarian Policy.

Rohit Kumar, *Ph.D. (Toulouse School of Economics)*
Assistant Professor
Econometrics, Empirical IO, Machine learning.
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Dickens Leonard, *Ph.D. (University of Hyderabad)*
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Anti-caste Thought and Community; Cinema and Print Cultures; Literature and Modernity; Translation and Dalit Studies.

Debasis Mondal, *Ph.D. (ISI, Kolkata)*
Associate Professor
Macroeconomics, International Economics and Public Economics.

Saptarshi Mukherjee, *Ph.D. (ISI, Delhi)*
Associate Professor
Microeconomic Theory, Mechanism Design, Game Theory, Bounded Rationality Theory.

Sumitava Mukherjee, *Ph.D. (IIT Gandhinagar)*
Assistant Professor
Judgement, Decision Making.

Angelie Multani, *Ph.D. (Jawaharlal Nehru University)*
Professor
Politics of Production of English Language Theatre in India, Extensive Work on Mahesh Dattani, One of India's Foremost Contemporary Playwrights, Published on Indian English Theatre and Fiction.

Sourabh B. Paul, *Ph.D. (Uni. of British Columbia)*
Associate Professor
Trade and Development, Applied Econometrics, Labour Economics, Health and Nutrition.

Bharati Puri, *Ph.D. (Jawaharlal Nehru University)*
Associate Professor
Philosophy of Culture and History, Moral and Political Philosophy, Contemporary Thought and Intellectual History, Deep Ecology, Buddhism/and Politics, Exile and Travel, Religion/and Politics, Religion in East Asia, Peace Studies, Tibet/Tibetan Literature and Politics, Ethnicities and Margins, Culture Religion and Politics in Ladakh, Children and Literature.

Sarbeswar Sahoo, *Ph.D. (National Univ. Singapore)*
Professor
Post-colonial State, Civil Society and Democratisation, Sociology of Religion (Christianity), and Neo-liberalism.

Paroma Sanyal, *Ph.D. (EFLU, Hyderabad)*
Associate Professor
Phonology Morpho-Syntax.

Simona Sawhney, *Ph.D. (Univ. of California)*
Associate Professor
South Asian Language and literature, Postcolonial Literature and Theory, Sanskrit Literature, Literary Theory.

Kamlesh Singh, *Ph.D. (Univ. of Rajasthan)*
Professor
Positive Psychology & its Applications, Psychometrics, Community Psychology, Mental Health of Rural Women and Adolescents, Psychoeducational Programmes.

Purnima Singh, *Ph.D. (Allahabad University)*
Institute Chair Professor
Group Processes, Justice, Identity, and Intergroup Relations in Organizational and Social contexts.

Varsha Singh, *Ph.D. (IIT Bombay)*
Asssociate Professor
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Assistant Professor
Sociology of Education, Gender Studies, Urban Anthropology, Ethnographic Methods, Sociology of News.

Naveen Thayyil, *Ph.D. (Tilburg University, Netherlands)*
Associate Professor
(1) Law, Techno-science and Democratisation: Regulatory Issues in New and Radical Technologies, Democratisation of Regulation of Technology, Risk Regulation, Use of Ethics in Technology Regulation, Development of Technologies and Public Contestations, and Public Participation in Regulation. (2) Environmental Law and Policy: International and Comparative Law.

Jayan Jose Thomas, *Ph.D. (IGIDR, Mumbai)*
Professor
Labour, Capital and Technology in Indian Industrialization.

Milind Wakankar, *Ph.D. (Columbia University)*
Associate Professor
Indian Mystical Traditions and the Modern Critique of Caste.

Ashwini Vaidya, *Ph.D. (Univ. of Colorado, Boulder)*
Assistant Professor
Computational Linguistic.

Sanil V., *Ph.D. (IIT, Kanpur)*
Professor
Philosophical Investigations into Art, Science, Technology, Literature and Social Sciences, Reason and Revolt, Violence, Hate and Revenge, Contemporary Indian Thought, Intellectual Traditions of Kerala, Philosophy of Biology.

Rukmini Bhaya Nair, *Ph.D. (Cambridge Univ.)*
Honorary Professor
Cognition, Signs and Language.

INTRODUCTION

The Department of Humanities & Social Sciences is an integral part of the Indian Institute of Technology Delhi. The Department houses most of the major disciplines of Social Sciences and Humanities with disciplinary and multi-disciplinary Ph.D. programmes, as well as a diverse range of Undergraduate elective courses at different levels. In addition to these, the Department also runs a Language Learning Centre for strengthening English Language skills. We also run short-term courses in French, German, Spanish and Japanese for students who wish to learn a foreign language.

ACADEMIC PROGRAMMES

UNDERGRADUATE

IITs are mandated to pursue teaching and research in science, technology and arts. IIT Delhi regards knowledge of Humanities and Social Sciences as a core value. All UG students must complete a minimum of 15 credits in HUSS courses. The courses offered for UG students are drawn from all the disciplines of the Department: Economics, Linguistics, Literature, Philosophy, Psychology, and Sociology and some are also inter or multi-disciplinary. Courses are divided between 200 level and 300 level, and some advanced UG students may also choose to opt for 700 or 800 level courses, apart from doing an independent research paper in any of the HUSS disciplines.

Minor Area Programme: B.Tech. Minor Area Programme in Economics was initiated in 2017, which is very popular among the UG students.

POSTGRADUATE

Ph.D.

The Department has a robust Ph.D. programme which is both disciplinary as well as inter-disciplinary, We have both a full-time as well as part-time Ph.D. programme to enable those who may be working to continue their academics. HUSS is one of the few departments that offer a genuine interdisciplinary approach to academics that is both based on a strong disciplinary foundation and yet open to non-traditional ideas and approaches. we promote and support multidisciplinary work of the kind that is possible only when creative researchers from various disciplines are in close locational and intellectual proximity through pre-Ph.D, courses that provide a specialized disciplinary perspective as well as collaboratively taught courses which have a broader inter-disciplinary orientation, We also have Post-Doctoral positions where young doctorates are encouraged to continue their research in a supportive and intellectually exciting atmosphere.

M.Sc.

The Department started two full-time M.Sc. programmes in Cognitive Science and Economics in the 2020-21 academic year.

M.Sc. in Cognitive Science: The programme familiarizes students with diverse theories, methods, and tools to understand the architecture and functioning of the human mind. It also envisages developing new state-of-the-art labs involved in finding better solutions to cognitive challenges and questions faced in the Indian scenario. It integrates teaching and learning through a multidisciplinary and diverse pedagogical curriculum. The M.Sc. programme trains students to pursue academic careers and to work at the crossroads of academic-industry linkages for advancing and leading intellectual creation in the cognitive science space. The graduates from this programme could work in diverse sectors from basic research, brain sciences, management, engineering/design (robotics, smart software, and technology, human-machine interaction), social organizations; or decide to pursue higher education in cognitive science or any of its allied disciplines.

M.Sc. in Economics: The programme draws on the strengths of mathematics, computer science, and other science and engineering disciplines. It is designed for students with bachelors degree in any discipline with substantial knowledge in mathematics. The programme has a strong research component and consist of semesters long project that would prepare students for research. It aims to impart advanced training in

economics with a focus on quantitative skills. The curriculum is designed so as to give exposure to broader issues related to developmental challenges in India and beyond. Students choose fields of specialisation in core economics and emerging areas at the intersection of economics with other social sciences as well as computer science and mathematics.

RESEARCH AREAS

Doctoral research is being carried out in: Organisational Behaviour, Human Resource Management, Social Psychology, Positive Psychology, Environmental Psychology, Cognitive Psychology; Sociology of Culture and Knowledge, Sociology of Development, Sociology of Religion, Gender Studies, Visual Sociology, Environmental Sociology, Ethnicity and Nationalism, Agrarian Studies; Economic Theory, Development Economics, International Economics, Quantitative Economics, Transport Economics, Environmental Economics, Industrial Economics, Indian Economy, Game Theory, Decision Theory, Mechanism Design; British Literatures, Theory of Criticism, Indian and Postcolonial Literatures, Performance Studies, Indian Political Thought, English Language, Linguistics, Philosophy of Language, Cognitive Studies. English Language, Linguistics, Philosophy of Language, Cognitive Studies; Epistemology, Metaphysics, Ethics, Aesthetics, Continental Philosophy, Phenomenology, Hermeneutics, Deconstruction, Law, Techno-Science and Democratization, Philosophy of Science, Technology and Social Sciences, History of Science, Sociology of Science Technology and Society, Interface of Science and Technology with Humanities, Social Identity, Intergroup Relations, Intergroup Contact and Social Change, Leadership and Collective Mobilisation.

LABORATORY FACILITIES

Cognitive and Behavioural Science (CBS) Laboratory: The CBS lab caters to the research needs of the Ph.D. scholars and faculty members. The lab is equipped with basic and state-of-the-art equipments in Cognitive Psychology and Psycholinguistics. This includes SR research 1000 Plus eye-tracker. The lab has several PCs for conducting behavioural experiments. It also has a high-performance computing server to handle computationally intensive research tasks.

Economics Laboratory: The Department has an Economics Laboratory, located in MS 627B. The laboratory provides access to computing facilities for research and training in economics and is very popular among our Ph.D. students for research and collaborative work. The computers in the labs are equipped with popular open source and proprietary packages like R, STATA, Matlab, and Python. The Department has subscriptions to database such as ASI, EPWRF, NSSO. Students have access to high performance computing facilities. We have a special workstation equipped with GPU for ML.

Another computing laboratory, jointly for the M.Sc. students Economics programmes, is coming up shortly.

Language Learning Centre

The Department has a Language Learning Centre offering support to all first-year students to enhance their language and communication skills. Besides, we have several other tools useful for research including cloud computing, Grammarly, and access to a centralised supercomputing facility. The central library of the Institute subscribes to several journals from different publishers including Elsevier and collections such as JSTOR and is also a part of DELNET.

LIBRARY

Located on the fifth floor of the Main Building, the Department of Humanities and Social Sciences Library houses a specialist collection reflecting the main teaching and research interests of the Department. These include Economics, Linguistics, Literature, Philosophy, Psychology and Sociology. The HUSS library is the first automated Department Library of IIT Delhi. Book lending services using computerised issue-return were started from January 27th 2014 for the faculty, staff and research scholars of the Department. The library uses LibSys, an integrated multiuser library management software. The library offers a quiet study space for students in the department and provides services like printing and internet access through a dedicated computer.





DEPARTMENT OF
MANAGEMENT STUDIES






Seema Sharma, *Ph.D. (IIT Delhi)*
Professor
Economics & Finance.

Head of the Department

Kanika T. Bhal, *Ph.D. (IIT Kanpur)*
Professor
OB,HR, Business Ethics & Corporate Governance, Leadership and Culture.

M.P. Gupta, *Ph.D. (IIT Delhi)*
Professor, Dhananjaya Chair
Information System Policy & Strategy.

Harish Chaudhary, *Ph.D. (IIT Delhi)*
Associate Professor
Marketing, HR and OB.

P. Vigneswara Ilavarasan, *Ph.D. (IIT Kanpur)*
Abdulaziz Alsagar Chair Professor
Information and Communication Technologies & Development (ICTD, ICTs & Government, Social Media & Business Practices).

Neeru Chaudhry, *Ph.D. (Monash Univ., Australia)*
Assistant Professor
Finance and Accounting.

Eri Ikeda, *Ph.D. (Erasmus Univ., Rotterdam, Netherlands)*
Assistant Professor
Economics.

Sanjay Dhir, *Ph.D. (Fellow, IIM Lucknow)*
Associate Professor
Strategic Thinking, Strategic Innovations, Ambidexterity, Corporate Strategy, Alliances and Joint Ventures.

Sonali Jain, *Ph.D. (IIM Ahmedabad)*
Assistant Professor
Finance & Accounting.

Amlendu Kumar Dubey, *Ph.D. (IGIDR, Mumbai)*
Associate Professor
Macro Economics, Development & Environmental Economics, Applied Econometrics.

Arpan Kumar Kar, *Ph.D. (Fellow, XLRI)*
Associate Professor
Digital Economy, Digital Business, Data Science, ML/AI Application.

Gourav Dwivedi, *Ph.D. (Fellow, IIM Lucknow)*
Assistant Professor
Operations Management, Game Theory, Operation Strategy, Project Management.

Smita Kashiramka, *Ph.D. (BITS, Pilani)*
Associate Professor
Banking, Mergers and Acquisitions, Financial Markets & Institutions and Corporate Finance.

Agam Gupta, *Ph.D. (Fellow, IIM Calcutta)*
Assistant Professor
Sharing Economy, Platform Ecosystems, Organizational Ecology, Computational Social Science, and Networks.

Jitendra Madaan, *Ph.D. (IIT Delhi)*
Associate Professor
Supply Chain Management, Reverse Logistics, Sustainable Operations, Disaster Management.

Vivek G. Nair, *Ph.D. (IIM Calcutta)*
Assistant Professor
Subjective Career Success, Careers of Diverse Groups, Flexible Work Arrangements, Meritocracy, and Management Education.

Biswajita Parida, *Ph.D. (Fellow, IIM-Ahmedabad)*
Assistant Professor
Marketing, Consumer Beharviour, Advertising, Branding, Product Management.

Prasanna Ramamoorthy, *Ph.D. (Fellow, IIM Ahmedabad)*
Assistant Professor
Production and Quantitative Methods, Operations.

Mahim Sagar, *Ph.D. (IIITM, Gwalior)*
Professor
Professor Marketing, Public Policy Marketing, Product Management, Telecom Policy Research, Community Drive Marketing/Branding of Public & Private Goods/Service.

Ravi Shankar, *Ph.D. (IIT Delhi)*
Amar S. Gupta Chair Professor of Decision Science
Operations & Supply Chain Management, Decision Science, Technology Management, Business Analytics.

Surya Prakash Singh, *Ph.D. (IIT, Kanpur PDF, NUS Singapore-MIT USA Alliance)*
Professor
Operations Management, Manufacturing Systems, Optimization Techniques, Operation Research, Strategy.

Shveta Singh, *Ph.D. (Univ. of Allahabad)*
Professor
Financial Management, Security Analysis & Portfolio Management, Corporate Governance & CSR.

Shuchi Sinha, *Ph.D. (Univ. of London)*
Associate Professor
Leadership, Managing Change Workplace Spirituality, Workplace Deviance, HR & OB.

Sushil, *Ph.D. (IIT Delhi)*
Abdulaziz Alsagar Chair Professor
Strategic Management, Strategic Alliances and M & A, Flexible Systems Management, Strategic Change & Flexibility, Technology Management, Creative Problem Solving, Waste Management.

Surendra S. Yadav, *Ph.D. (Univ. of Paris, Sorbonne, Paris)*
Emeritus Professor
Corporate Finance, International Finance, International Business, Security Analysis & Portfolio Management, General Management.

P.K. Jain, *Ph.D. (Delhi Univ.)*
Honorary Professor
Finance & Accountancy.

Mayur Chikhale, *Ph.D. (Stevens Institute of Technology, USA)*
Full-Time Visiting Faculty

Juhi Raghuvanshi, *Ph.D. (IIT Roorkee)*
Visiting Faculty

Neeraj Sanan, *Ph.D. (University of Manchester)*
Adjunct Faculty

Sudhir K. Jain, *Ph.D. (IIT Kanpur)*
Ex. Professor, DMS, IIT Delhi & Former Vice Chancellor, Shri Mata Vaishno Devi University, Katra (J&K)
Adjunct Faculty
Managerial Economics, Entrepreneurship and IPRs.

Arup Roy Choudhury, *Ph.D. (IIT Delhi)*
Professor of Practice

Rajeev Sharma, *Ph.D. (Univ of Waikato)*
Adjunct Faculty
Information System Area.

GUEST FACULTY

Prof. Prem Vrat, *Ex-Professor, IIT Delhi & Ex-Director, IIT Roorkee*

Prof. D.K. Banwet, *Ex. Professor, DMS, IIT Delhi*

Prof. Anuradha Balram, *Chief Cord, Awakened Citizen Programme NGO of R.K. Mission*

Prof. Parul Gupta, *MDI Gurugram*

Prof. Michael Hopkins, *Chair and Partner of MHC International Ltd. (MHCi), U.K.*

Prof. Sabri Boubaker, *Champagne School of Management, (Group ESC Troyes) Finance & Accounting Department Troyes, France*

Prof. Nakul Gupta, *MDI Gurugram*

Prof. Thomas Jospeh, *IIM Udaipur*

Prof. Prabhat Kumar, *Advocate and Consultant (Corporate Affairs)*

Prof. Marcos Severo, *Federal University of Goias, Brazil*

Prof. Sandeep Goyal, *CEO Shared Value (Institute of Competitiveness)*

Prof. A.K. Nigam, *Director HR & CSR- Whiteswan Consulting Group (WCG India)*

Prof. Manmohan Chaturvedi, *CISO Academy, Gurugram*

Mr. Piyush Sharma, *CEO Zee Entertainment*

Prof. Shibashis Mukharjee, *Assistant Professor, IIM Bangalore*

Prof. V. Upadhyay, *Adjunct Faculty HUSS IIT Delhi*

Prof. Anita Lal Tripathi, *Head- Centre for Entrepreneurship Fore School of Management, New Delhi*

Prof. Priyanka Vallabh, *MDI Gurugram*

Prof. Alka Gupta, *New Multan Nagar, New Delhi*

Prof. Manpreet Kaur, *Bharti Vidyapeeth Institute of Management, Paschim Vihar*

Prof. Himanshu Manglik, *President – WALNUTCAP Consulting LLP, Delhi*

Prof. Peter Trkman, *University of Ljubljana, Faculty of Economics Kardeljeva ploscad 17, 1000 Ljubljana*

Prof. Adrian, *Associate Professor in Cultural Studies at the University of Queensland, Australia*

Mr. Tarun Gupta - CTO, *Chief Architecture, Technology Partner and Advisor*

Dr. S.N. Gosh, *ACISI (UK), Chartered Institute for Security & Investment, U.K.*

Dr. Nikhil Kumar Varma, *Advisor QBRICS INC*

Ms. Sapna Popli, *Professor of marketing - IMT Ghaziabad*

Prof. Anshul Jain, *Assistant Professor, Finance MDI Gurugram*

Prof. Ashish Mohan, *DGM JCB India*

Mr. Vimal Kishore, *Professional CA*

Prof. Sunil Gupta, *Consultant- Higher Education*

INTRODUCTION

The Department currently runs three variants of the MBA program: a two-year full-time MBA programme, a two-year full-time MBA programme with focus electives on 'Telecommunication Systems Management' and a three-year Executive MBA programme with focus electives on 'Technology Management'. Department offers functional electives in Economics, Finance, Marketing, Information Systems, Strategy, Operations Management, Human Resource etc. The students in a two-year full-time MBA programme are admitted through a rigorous screening process of CAT (Common Admissions Test)*, Written Aptitude Test (WAT) and Personal interview.

Department of Management Studies (DMS) has heavy research orientation as its forte, which is further used extensively for designing courses to respond to the current industry issues. The course content is contemporary and has involved various stakeholders, including industry experts, CEOs and our alumni. DMS faculty who have served on various UN-related bodies and international professional associations are widely acclaimed internationally for their contributions in knowledge generation and research publications. Stanford has ranked DMS 2nd for its research output among IIMs and IITs. The faculty members work nationally and internationally for consulting activities and research projects and have been widely acclaimed for their contributions. To date, in more than three decades of existence, over 200 PhDs have been groomed by Department. The faculty has contributed at the highest policy level committees of the Government of India (GoI), served on various boards of corporate entities, as Chairman 'All India Board of Management Education' of AICTE and contributed to the establishment of the 5th Indian Institute of Management (IIM) at Kozhikode, and 7th Indian Institute of Management at Shillong. The Department faculty has published over 80 books and over 1200 papers in various 'A' category journals and conference volumes. DMS has a world-class IT infrastructure with a high faculty-to-student ratio. DMS has a rich software repository that facilitates computer-aided instructions and enables hands-on experience in leading business enterprises. The Global Field Study is a unique initiative that provides the students of DMS international exposure through their visits to various other countries like Germany, Singapore, China (Beijing & Shanghai), Malaysia, Brussels, Netherland, Belgium, France, Australia and Japan.

ACADEMIC PROGRAMMES

UNDERGRADUATE

The Department offers several courses to undergraduate students as electives and also offers a Minor Area in Business Management and Entrepreneurship.

PEDAGOGY

The Department places heavy emphasis on experiential and process-oriented learning. The pedagogical toolsinclude extensive use of Harvard case studies (HBS), simulation exercises, industry-oriented project work, eight weeks of summer projects, 3 weeks of Social Sector attachment and the like, to facilitate the same. The process – oriented learning is further enhanced by Global Field Study (GFS), which students undertake for their projects. Besides honing up individual decision-making skills, enough emphasis is laid on developing team skills and value-focused decision making. Extensive research and consultancy have gained wide peer-level recognition back the teaching.

Masters of Business Administration

With the unique features of systems orientation and a blend of creativity and analytical problem-solving skills, MBA Full Time is aimed to develop holistic managers who internalize a synthesis of conventional and modern management – thinking and who can comfortably adapt to changing business requirements. The program provides the students with various routes to the industry, matching its requirements with their skills and predispositions. Every student gets the opportunity to take courses in major streams: Information Systems, Finance, Marketing, Strategic Management, Human Resource Management and Operations Management. Along with the functional electives, the students also get a cross-functional perspective.

Masters of Business Administration *(Telecommunication Systems Management)*

The MBA Full-Time Program with a focus in Telecommunication Systems Management is a hallmark of techno-managerial excellence imparted to the scholars at DMS. This programme is comprehensive in nature, involving all the business functions – Information Systems, Finance, Marketing, Strategic Management, Human Resource Management, with an emphasis on Telecommunications Systems Management, which provides a strong foundation in Telecom Technology, Business and Regulation. This programme draws Telecom technology inputs from Bharti School of Telecom Technology and Management of IIT Delhi. The inclusive nature of the program fosters the creation of effective managers across different domains, equipping them with holistic skills and a strategic advantage when it comes to leading business in the Telecom sector.

Masters in Business Administration *(for Working Executives)*

For the Indian industry to gain global competitiveness, effective management of technology is crucial. This would mean using technology as a strategic variable to gain competitive advantage and would require an organization to critically understand technology planning and strategy processes, management of technology transfer and absorption, management of innovation and R&D and more. The Executive MBA programme with focus electives on 'Technology Management' aims to fulfil these requirements so as to enable the managers to effectively contribute to evolving core competencies in the Indian industry. This programme is designed to impart management education to working executives.

RESEARCH AREAS

The Department of Management Studies has a full-fledged Ph.D. programme in Management. With its liberal multidisciplinary approach, the department provides excellent ambience for research amidst the world class infrastructure at IIT Delhi. Department of Management Studies, IITD ranked 4th in India QS World University Ranking for Business and Management Studies in 2022 and ranked 4th in National Institutional Ranking Framework (NIRF) ranking 2022.

The research areas are broadly classified into the following areas:

- Economics
- Finance and Accounting
- Operations and Supply Chain Magement
- Information Technology and Systems
- Strategy and Technology Management
- Marketing
- HR-OB

The full-time doctoral students will receive financial aid as below. The students are required to do academic duty for 8 hours per week (excluding their research work) as a Teaching Assistant (TA). TAs will be assisting the faculties in developing the course content, taking tutorials and grading. Fellowship is extended for the fifth year, only on the basis and review of the work. Students will be provided financial support for attending national and international conferences as per the institute norms.

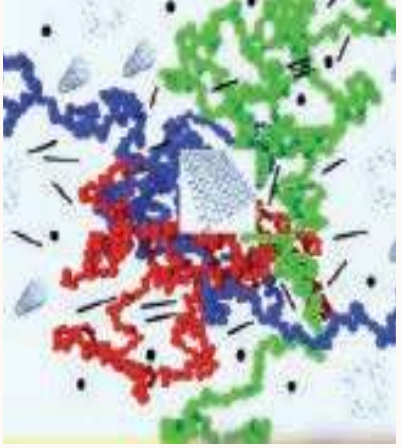
Period of Assistantship (With B.E./B.Tech./M.Sc./M.Tech. *or* Equivalent Qualification)	**Assistantship Amount**
First 2 year of registration	₹ 31,000/- Month
Next 3 year of registration	₹ 35,000/- Month

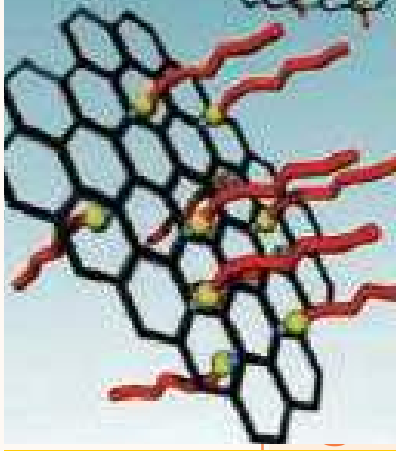
LABORATORY FACILITIES

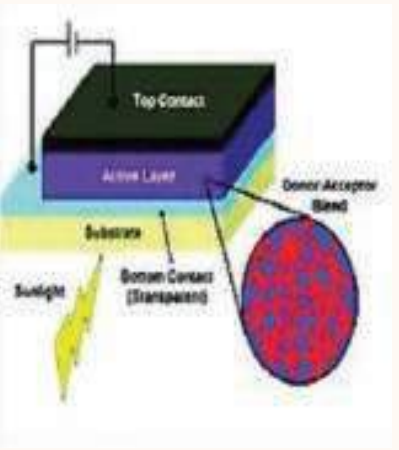
The Department of Management Studies has seven fully air-conditioned Wi-Fi enabled lecture theatres equipped with LCD projectors to ensure the best possible environment for learning. The auditorium has a seating capacity of over 120 and hosts numerous guest lectures, seminars and other programs. There is also an exclusive library in addition to the central library of the institute. The following laboratories facilitate learning and research:

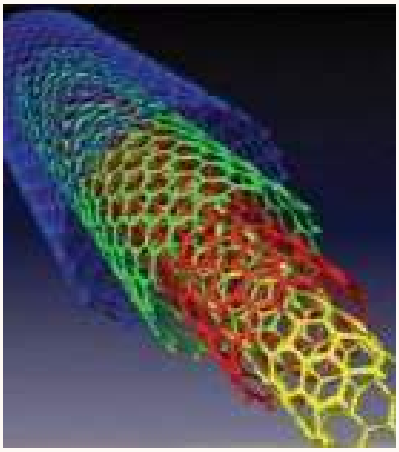
- Research Lab
- Operations Lab
- Behavioral Lab
- Strategy and Competitiveness Lab
- Centre of Excellence in Entrepreneurship
- Centre of Excellence "National Centre of Business Ethics, Corporate Governance and Corporate Social Responsibility"
- Information System and Data Science Lab

An extensive collection of software packages and databases such as SPSS, e-Views, Ace Equity, Bloomberg, AMOS, Vensim, I-Think, LISRD, NVivo, STATA, Hummingbird Knowledge Management Suite, Prowess, LINGO, ARENA etc. are available in the laboratories. Further, the Behavioral Laboratory has in-house camera, TV and specialized software to help the students hone their behavioural skills.



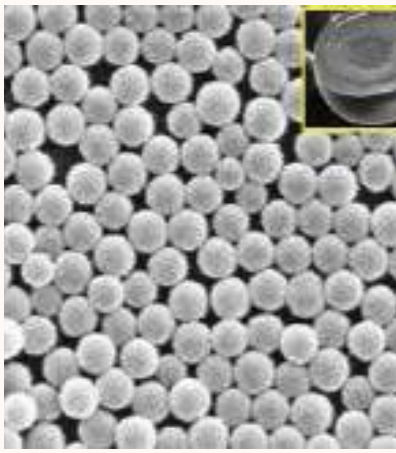


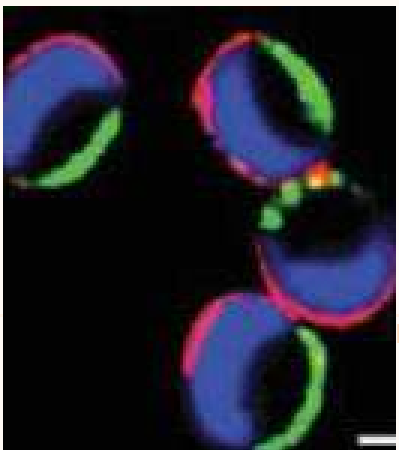




DEPARTMENT OF

MATERIALS SCIENCE AND ENGINEERING





Head of the Department

Rajesh Prasad, *Ph.D. (University of Cambridge)*
Professor
Physical Metallurgy, Heat Treatment, Phase Transformation, Metal Foams, Granular Materials.

Krishna Balasubramanian, *Ph.D. (IISc., Bangalore)*
Assistant Professor
Layered 2D Materials like Graphene TMD, bP and such for High Speed Electronic Transport, RF Devices, Molecular Separation. Ultra-fast and Quantum Optics Wart Excitons in 2D Materials and Quantum Wells. Superconductors for Qubits, Entangled Photons and THz Defection.

Shib Shankar Banerjee, *Ph.D. (IIT Patna)*
Assistant Professor
Functional and Smart Elastomeric Materials, Compounding and Processing of Polymers (Conventional and Reactive), Mechano-adaptive Composite Materials, Advanced Manufacturing of Polymers, 3D Printing of Functional Elastomeric/Polymeric Materials and Soft Material.

Ayan Bhowmik, *Ph.D. (Univ. of Cambridge, U.K.)*
Assistant Professor
Alloy Design, Superalloys, High-temperature Refractory Metal Alloys, Advanced Manufacturing (Selective Laser Melting, Direct Laser Deposition) and Repair Technology (Metal Cold Spray, Electropulsing, Localized Induction Heating), Phase Transformation and Crystallography of High-temperature Alloys, Structural Characterization Using Microscopy and Diffraction Techniques, Bulk and Micro-Mechanical Testing of Materials.

Ankur Goswami, *Ph.D. (IISc., Bangalore)*
Assistant Professor
Fabrication of MEMS Device for Detection, Sensing and Energy Harvesting Application. Structure Property Correlation in Oxide, 2D Semiconductors. Understanding Electronic, Magnetic and Piezo Properties of Materials Using Various Scanning Probe Technique.

Nitya Nand Gosvami, *Ph.D. (NUS, Singapore)*
Associate Professor
Fundamental Mechanisms of Friction and Wear of Materials, Nanotribology of Engineering Materials and Industrial Lubricant Additives, Nanoscale in Situ Methods in Tribology, Surface Science & Engineering, Failure Analysis of Materials, Nanoscale Aspects of Corrosion of Materials, Development of Novel Scanning Probe Microscopy Techniques, Nanoscience and Nanotechnology.

Dibyajyoti Ghosh, *Ph.D. (JNCASR, Bangalore)*
Assistant Professor
Computational Materials Science, Non-adiabatic Charge Carrier Dynamics, Machine Learning for Accelerated Functional Materials Discovery, Optoelectronics in Emerging Materials, Defects in Semiconductors, Ion-Dynamics in Functional Solids, Spintronics.

Jayant Jain, *Ph.D. (British Columbia)*
Associate Professor
Mechanical Behaviour Of Materials, Alloy Design, Microstructure-Property Relationship, Microstructure Manipulation, Characterization of Materials, Phase Transformations, Texture and Anisotropy of Materials, Thermo-Mechanical Processing, Crystal Plasticity Simulations. Fatigue in Materials, Nanoscale Creep and Fatigue, Nanoindentation, Nanomechanics, Fracture and Failure Analysis.

Josemon Jacob, *Ph.D. (Iowa State Univ.)*
Professor
Polymer Synthesis, Semiconducting Polymers, Polymer Based LEDs and Photovoltaics, Block Copolymers Biodegradable Polymers, Polymerization Catalysis.

Suryanarayana Vikrant Karra, *Ph.D. (Purdue University)*
Assistant Professor
Computational Materials Science, Energy Storage & Conversion Materials, Lithium-ion Batteries and Solid Oxide Fuel Cell Materials, Microstructural Evolution of Metals and ceramics, High Temperature Power Plant Component Materials, Phase Field Modeling.

Divya Nayar, *Ph.D. (IIT Delhi)*
Assistant Professor
Computational Materials Chemistry, Molecular Simulations of Soft Matter (Polymers, Biomolecules), Macromolecular Solvation Thermodynamics, Self-assembly in Nanomaterials.

Suresh Neelakantan, *Ph.D. (TU Delft)*
Associate Professor
Mechanical Behaviour of Advanced Materials in Bulk and Porous Forms, Materials Characterization. Current Interest in β Titanium Alloys, TRIP Steels & Ti-, Ni- and Fe- Based: Shape Memory Alloys, Stochastic Fibre Networks and Auxetic (i.e. Negative Poisson's Ratio) Materials/Composites. Main Focus on in-Situ Transformation Effect on Deformation Behaviour and Structure-property Correlations in Metallic Materials.

Leena Nebhani, *Ph.D. (Karlsruhe Institute of Technology)*
Associate Professor
New Synthetic Routes for Polymer and Surface Functionalization based on Raft Polymerization and Click Chemistry, Antimicrobial Hydrogels and Cryogels for Water Disinfection, Synthesis and Polymer Functionalization of Organically Modified Silica.

Nirat Ray, *Ph.D. (MIT)*
Assistant Professor
Synthesis and Characterization of Nanomaterial Based Designer Solids and Nanocomposites; Electron Beam Lithography; Electronic Charge Transport and Optical Properties; Semiconductor Nanostructures; Organic and Molecular Organic Semiconductors and Device Applications; Materials for Non-volatile Memory; Magnetic Nanowires and Magnetic Tunnel Junctions for Spintronics; Multiferroics; Computational Material Science.

Lakshmi Narayan Ramasubramanian,
Ph.D. (IISc., Bangalore)
Assistant Professor
Mechanical Behaviour of Metals and Alloys, Metallic Glasses Fracture, Fatigue , Indentation and Structural Integrity of Materials, Additive Manufacture Materials.

Sampa Saha, *Ph.D. (Michigan State Univ.)*
Associate Professor
Biodegradable Polymeric Materials, Polymer Brushes, Electro Hydrodynamic Co-Jetting, Micro and Nano Structured Materials, Multi-Layered and Multi-Compartmental Polymeric Particles.

Sangeeta Santra, *Ph.D. (IISc., Bangalore)*
Assistant Professor
Solid State Diffusion, Thermodynamic-Kinetics Microstructure, Superconducting Materials, Interfacial Reactions of Multimaterial Systems and Advanced Functional Materials.

Bhabani K. Satapathy, *Ph.D. (IIT Delhi)*
Professor
Morphology And Phase Behaviour of Block Copolymers, Polymer Blends and Composites, Micromechanics, Fracture and Fatigue of Polymer Nano-Composites, Tribology of Polymer Based Materials, Biotribology, Thermo-Mechanical Behaviour of Biomaterials.

Bijay P. Tripathi, *Ph.D. (CSMCRI, Bhavnagar)*
Associate Professor
Functional Materials and Membranes with Tailored Properties, Next-generation Membranes for Water, Energy, and Separation, Clean Water Generation (Micro, Ultra, and Nanofiltration), Antifouling and Antibacterial Surfaces and Membranes, Nanostructured Membranes for Molecular Separation, Membranes, Separators, and Electrodes for Energy Generation and Storage, Flow Catalysis for Synthesis and Environmental Remediation, Platform for Enzyme Immobilization and Biocatalyis.

Ashok K. Ganguli, *Ph.D. (IISc., Bangalore)*
Professor, Joint Faculty
Nanomaterials, Superconductors, Dielectric Oxides and Intermetallics.

A.K. Ghosh, *Ph.D. (Suny Buffalo)*
Emeritus Professor
Rheology and Processing, Polymer Reaction Engineering, Polymer Blends and Alloys, Mixing and Compounding, Computer Aided Modelling, Polymeric Nano-composites, Polymer Film Processing, Cellular and Biopolymers.

INTRODUCTION

The Department of Materials Science and Engineering (DMSE) has been established on 1st January 2018 for developing and undertaking research on materials for specific end uses. It holds the privilege of being the only materials research and engineering department in Delhi-NCR region. The principal thrust of the department is manpower development and research for enhancing the fundamental knowledge as well as developing new materials. The department emphasizes interaction with the related industry. The changing needs of the industry are kept in view while designing and upgrading teaching and research programmes.

Mission

To provide frontier education in Materials Science and Engineering at the undergraduate and postgraduate levels to:

- Achieve excellence in education and research to meet the growing needs of the society.
- Expose the students to interesting and challenging curriculum for skill enhancement to suit the global market.
- Provide an environment conducive to innovation, creativity, implementation of new ideas and team spirit to foster young and fresh talents.
- Promote high standards of professional ethics.

ACADEMIC PROGRAMMES

The Department currently has two M.Tech. programmes, one in Polymer Science and Technology and the second one in Materials Engineering with a combined intake of about 35 students. We also offer a research-oriented Master of Science programme known as M.S.(R). Admission to these programs is through the Graduate Aptitude Test in Engineering (GATE) exam held every year. The annual intake for undergraduate students is around 40 selected through Joint Entrance examination (JEE). Our Ph.D. programme has about 100 research scholars working on various aspects of Material Science and Engineering.

RESEARCH AREAS

High Performance Materials:

- **Metals, Glass and Ceramics:** Structure-property correlation in advanced materials, Fracture and Fatigue, Indentation, nano-scale friction and wear, Material characterization using advanced microscopy, phase transformations, solid-state diffusion-controlled reactions, Synthesis and characterization of metal matrix composites, Light metals and alloys, 3D printed metals and alloys, Auxetic materials, Bulk metallic glasses and composites, functionally graded materials, nanomaterials, high entropy alloys, materials for extreme environments, thermal barrier coatings, alloy processing and properties, refractory metals and compounds, aluminide bond coats. Advanced ceramics, optical glass, toughened and tempered glass, structural and functional ceramics, and glass-ceramics.
- **Polymers:** Synthesis of polymers, structure-property correlation in polymers, rheology and processing of polymers, functional and smart elastomeric materials, polymer matrix composites, tribology and mechanical behaviour of polymers, 3D printing of functional elastomeric/polymeric materials, membranes for various applications, antifouling, and antibiofouling materials and membranes, redox polymers, materials for energy storage, separation and purification, organic-inorganic hybrid materials, catalytic materials and nanomaterials for catalysis and environmental applications, 2D materials, graphene, Covalent organic frameworks, biodegradable materials and biomaterials, organically modified mesoporous silica nanoparticles, surface engineering using controlled radical polymerization techniques, recycling of materials, 3D printing.
- **Computational Materials Science:** First-principles-based materials design, micromagnetic simulations, computational materials chemistry, molecular modelling, and simulations of soft

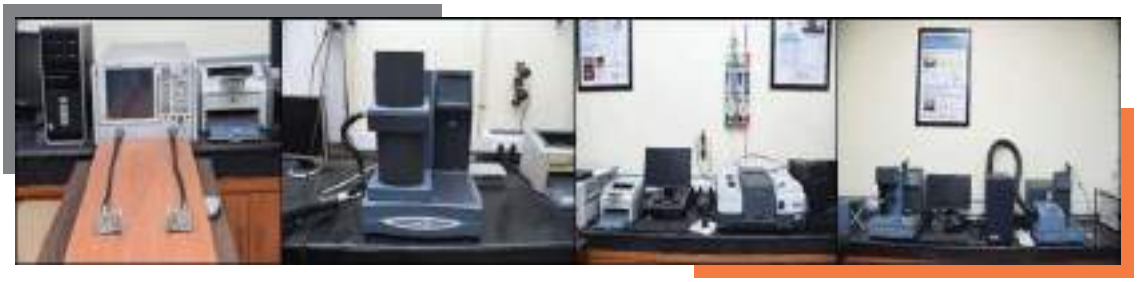
materials (self-assemblies, (bio)polymers, nanomaterials), machine learning for materials informatics. Computational materials science, Optoelectronic Materials, Ion Dynamics, Machine Learning, Spintronics, Low-Dimensional Materials.

- **Functional Materials:** Semiconductor nanostructures and device applications, magnetic nanowires, and magnetic tunnel junctions for spintronics device applications, MEMS/NEMS devices, solar cell, organic.

LABORATORY FACILITIES

- **Material Chemistry Lab:** Freeze Dryer, Specialised Polymerization set-ups, Distillation apparatus including Vacuum Distillation, Rotary Vacuum Evaporator, Constant Temperature Baths., Deionized & Distilled Water Apparatus, Hot Air Ovens, Vacuum Ovens, High Precision Balances, High Speed Stirrer, Glove Box, Spin Coater.

- **Material Characterization Laboratory:** Differential Scanning Calorimeter (DSC), Thermo-gravimetric / Analyser (TGA), Gel Permeation Chromatography (GPC), FTIR Spectrometer, Nanoparticle Analyzer, Dynamic Mechanical Analyzer, UV-Visible Spectrometer, Fluorescence Spectrometer, Zeta Sizer, High-performance liquid chromatography, Atomic Force Microscopes, Scanning Electron Microscope with EDS, Optical microscopes with heating and cooling stage, Optical emission spectroscopy, Dynamic Contact angle measurement system, Four Probe Electrical Conductivity Apparatus, Vector Network Analyzer, WVTR, OTR, Fluorescence Microscopes, FE-SEM.

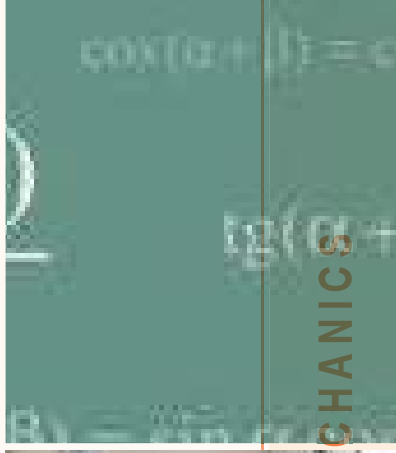


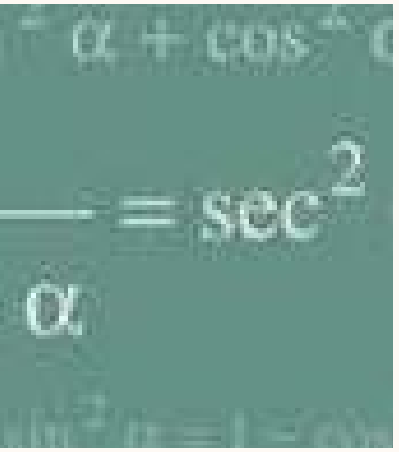
- **Material Processing Lab:** Single-screw Extruder, Twin-screw extruder, Injection Moulding Machine., Compression Moulding Machine, 3D-Printing, Two-roll Mill, Chase Friction Dynamometer, Batch Foaming unit, Tool Grinding Machine, Scrap Grinding Machine, Pulveriser, Plasma Coater, Autoclave for Microcellular Foaming, Micro-compounder, Micro-injection Molding Machine, HAAKE Film Blowing Unit, Melt Flow Index Tester, Single screw extrusion foaming, Electro spinner.

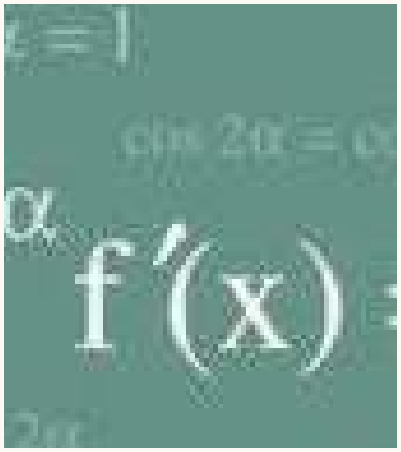
- **Material Testing Laboratory:** Bohlin Capillary Rheometer, Malvern parallel plate Rheometer, Anton Paar M702 Rotational Rheometer, Zwick-Z250-UTM with video extensometer, Zwick Z-10-UTM, MTS, Polarized Light Optical Microscopy, Aramis-GOM strain field analyser, Impact Tester, Nanoindentation, Micro and Nano-Hardness Testers.

- **Transmission Electron Microscope (TEM) Maximum point resolution - 0.4 nm:** Maximum magnification - 12 lacs, Facilitated with EDX.

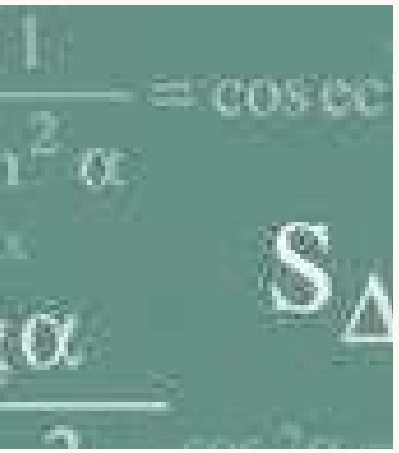
- **Central Facilities for Materials Testing**: Scanning Electron Microscope, Nuclear Magnetic Resonance Facility, Transmission Electron Microscope, Atomic Force Microscope, Raman Spectrometer, Liquid Nitrogen Plant, Confocal Laser Scanning Microscope, Wide Angle X-ray Diffractometer.

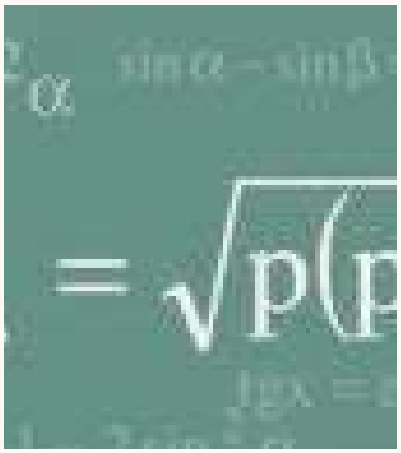


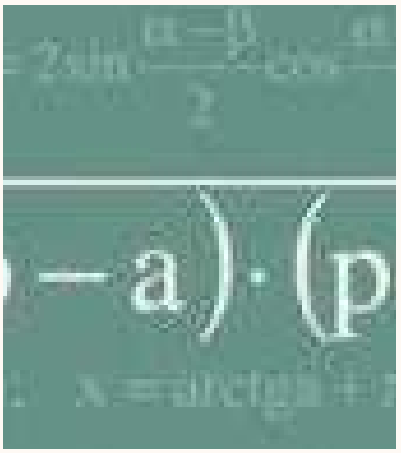


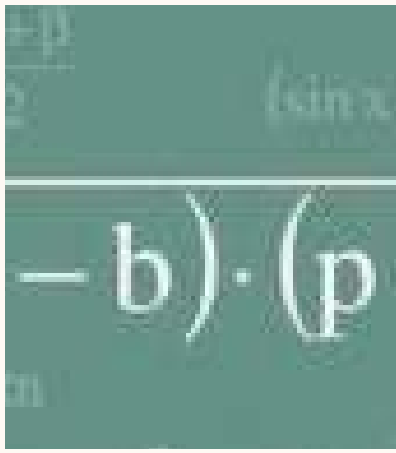


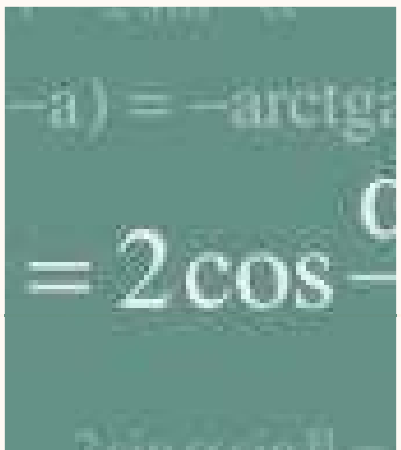
DEPARTMENT OF **MATHEMATICS**











Aparna Mehra, *Ph.D. (Delhi Univ.)*
Professor
Mathematical Programming, Fuzzy Optimization, Financial Mathematics.

Head of the Department

Biplab Basak, *Ph.D. (IISc., Bangalore)*
Assistant Professor
Algebraic Topology, Combinatorial Topology and Discrete Mathematics.

N. Chatterjee, *Ph.D. (Univ. of London)*
Professor
Natural Language Processing, Statistical Modeling, Semantic Web.

Aparajita Dasgupta, *Ph.D. (York University, Toronto, Canada)*
Assistant Professor
Harmonic Analysis, Pseudo-differential Operators.

S. Dharmaraja, *Ph.D. (IIT Madras)*
Professor (Institute Chair Professor)
Applied Probability, Queuing Theory, Performance Modeling, Financial Mathematics.

Minati De, *Ph.D. (ISI Kolkata)*
Assistant Professor
Data Structures & Algorithm, Approximation Algorithms, Combinatorial and Computational Geometry.

Debdip Ganguly, *Ph.D. (TIFR-CAM)*
Associate Professor
Partial Differential Equations, Geometric Analysis.

Surjeet Kour, *Ph.D. (IIT Kanpur)*
Assistant Professor
Commutative Algebra, Group Theory.

Harish Kumar, *Ph.D. (ETH Zurich)*
Associate Professor
Computational Methods for Partial Differential Equations.

N. Shravan Kumar, *Ph.D. (Madras Univ.)*
Associate Professor
Abstract Harmonic Analysis.

V.V.K. Srinivas Kumar, *Ph.D. (IIT Kanpur)*
Assistant Professor
Computational Partial Differential Equations.

Anant Kumar Majee, *Ph.D. (TIFR-CAM)*
Assistant Professor
Stochastic Conservation Laws, Stochastic Optimal Control in Ferromagnetism.

Mani Mehra, *Ph.D. (IIT Kanpur)*
Professor
Numerical Method, Wavelets Method for PDEs.

Vivek Mukundan, *Ph.D. (Purdue University)*
Assistant Professor
Commutative Algebra, Algebraic Geometry.

Anima Nagar, *Ph.D. (Gujrat University)*
Associate Professor
Topological Dynamics.

B.S. Panda, *Ph.D. (IIT Kanpur)*
Professor
Algorithmic Graph Theory, Graph Theory, Algorithms, Parallel and Distributed Computing.

Shiv Prakash Patel, *Ph.D. (TIFR Mumbai)*
Assistant Professor
Representation Theory, Automorphic forms, Number Theory.

Kamana Porwal, *Ph.D. (IISc. Bangalore)*
Assistant Professor
Finite Element Methods for PDEs and Optimal Control Problems.

Amit Priyadarshi, *Ph.D. (Rutgers University)*
Assistant Professor
Fractal Dimensions, Positive Operators.

Ashutosh Rai, *Ph.D. (The Institute of Mathematical Sciences, Chennai)*
Assistant Professor
Theoretical Computer Science, Parameterized Complexity, Graph Algorithms.

S.C. Sekhara Rao, *Ph.D. (IIT, Kanpur)*
Professor
Parallel Computing, Numerical Analysis.

Biswajyoti Saha, *Ph.D. (The Institute of Mathematical Sciences, Chennai)*
Assistant Professor
Number Theory.

Ekata Saha, *Ph.D. (The Institute of Mathematical Sciences, Chennai)*
Assistant Professor
Number Theory.

Sivananthan Sampath, *Ph.D. (IIT Madars)*
Associate Professor
Applied Harmonic Analysis, Inverse Problems, Learning Theory.

Ritumoni Sarma, *Ph.D. (TIFR, Bombay)*
Associate Professor
Algebraic Groups.

Punit Sharma, *Ph.D. (IIT Guwahati)*
Assistant Professor
Numerial Linear Algebra, Nearness Problems in Control Theory.

R.K. Sharma, *Ph.D. (IIT Delhi)*
Professor
Algebra, Cryptography.

Vikas Vikram Singh, *Ph.D. (IIT Bombay)*
Assistant Professor
Stochastic Games, Chance Constraints, Stochastic Optimization.

K. Sreenadh, *Ph.D. (IIT Kanpur)*
Professor
Differential Equations and Analysis.

A. Tripathi, *Ph.D. (Univ. at SUNY, Buffalo)*
Professor
Number Theory, Combinatorics and Graph Theory.

Viswanathan Puthan Veedu, *Ph.D. (IIT Madras)*
Associate Professor
Approximation Theory, Fractal Functions.

INTRODUCTION

The Department offers courses at both undergraduate and postgraduate levels. It runs a five year dual degree programme (B.Tech. + M.Tech.) in Mathematics and Computing, a four year B.Tech. programme in Mathematics and Computing, and a two year M.Sc. programme in Mathematics. The Department also has an active Ph.D. programme.

ACADEMIC PROGRAMMES

UNDERGRADUATE

The Department offers a five year dual degree programme (B.Tech. + M.Tech.) in Mathematics and Computing and a four year B.Tech. programme in Mathematics and Computing at undergraduate level. The dual degree programmes have replaced former five year integrating M.Tech. in Mathematics and Computing programme from 2013 onward. The aim of these programmes is to build a broad based theoretical background of Mathematical Sciences and practical training in Computing, Numerical Methods, and Mathematical and Statistical Modeling. Graduate of these programmes will be ready for a career in research and development in software industries, financial institutes and for a research-based career.

POSTGRADUATE

The Department offers a two-year post B.Sc. course leading to the degree of Master of Science in Mathematics. The main feature of this programme is that during the first year it makes the student familiar with basic theory in all the streams of Mathematics-Pure Mathematics, Applied Mathematics, Statistics, Operations Research, Computer Science. And in the second year, the student has an option of choosing modern advanced courses in some specialized area(s).

RESEARCH AREAS

Doctoral research is being carried out in all major areas of Mathematics, Applied Mathematics, Statistics and Operation Research and Theoretical Computer Science and its application.

The major research area of the department are: Algebra, Graph Theory, Computations PDEs, Cryptography, Partial Differential Equations, Financial Mathematics, Natural Language Processing, Number Theory, Numerical Analysis, Optimization, Parallel Computing, Topological Dynamics, Topology, Wavelets and its Applications, Harmonic Analysis, Fractals, Inverse Problems, Learning Theory, Stochastic Game Theory.

LABORATORY FACILITIES

The Department has three well-equipped Computing Laboratories with PCs and supporting software. These Laboratories are available to students for training and implementation of their computer programmes on assignments during courses or project work.

DEPARTMENT OF

MECHANICAL ENGINEERING

Head of the Department

M.R. Ravi, *Ph.D. (IISc., Bangalore)*
Professor
Heat Transfer, Computational Fluid Dynamics, Combustion, Biomass Energy, Rural Energy Systems.

Krishnakant Agrawal, *Ph.D. (IISc., Bangalore)*
Assistant Professor
Turbulent Reacting Flows, Gas Turbines and IC Engines, Aero-acoustics, Combustion Dynamics and Emissions.

S. Aravindan, *Ph.D. (IIT Madras)*
Professor
Ceramics, Composites, Welding, Nano-Manufacturing.

Supreet Singh Bahga, *Ph.D. (Standord Univ.)*
Associate Professor
Microfluidics and Nanofluidics, Electrohydrodynamics, Heat Transfer.

Naresh Bhatnagar, *Ph.D. (IIT Bombay)*
Professor
FRP Composite Materials, Processing and Manufacturing, Injection Molding, Biomaterails.

Nomesh B. Bolia, *Ph.D. (Univ. of North Carolina)*
Professor
Operations Research, Stochastic Modeling, Application of MDP to Various Control Problems, Application of OR to Logistics and Economics.

Anoop Chawla, *Ph.D. (IIT Kanpur)*
Professor, (Henry Ford Chair)
CAD, CAE, Dynamics, Bio-mechanics, Road Safety, Impact and Blast Mechanism.

Ashish K. Darpe, *Ph.D. (IIT Delhi)*
Professor
Machinery Health Monitoring, Rotor Dynamics, Vibration and Noise Engineering.

Abhishek Das, *Ph.D. (WMG, The University of Warwick, U.K.)*
Assistant Professor
Electric Vehicle Battery Joining, Joining of Lightweight Materials and Structures, Modelling and Simulations of Various Joining Processes, Non-Traditional Machining, Process Control, Metrology and Measurement.

Debabrata Dasgupta, *Ph.D. (IIT Kharagpur)*
Assistant Professor
Microfluidics and Microscale Transport Processes, Computational Fluid Dynamics, Multiphase Transport.

Naresh V. Datla, *Ph.D. (University of Toronto)*
Associate Professor
Fracture and Fatigue, Composites, Biomechanics.

Subhra Datta, *Ph.D. (Northwestern Univ.)*
Associate Professor
Micro-scale Fluid Mechanics, Lectrokinetics, Microfluidics.

S.G. Deshmukh, *Ph.D. (IIT Bombay)*
Professor
Supply Chain Management, Quality Management, Information Systems.

J.K. Dutt, *Ph.D. (IIT Delhi)*
Professor
Rotor Dynamics, Vibration and Control.

Devendra K. Dubey, *Ph.D. (Purdue University)*
Associate Professor
Computational Materials Science, Molecular Modeling, Nanomechanics, Biomaterials and Biomechanics, Finite Element Modeling.

Sudarsan Ghosh, *Ph.D. (IIT Kharagpur)*
Professor
Grinding of Ceramics and Superalloys, Machining of Titanium Alloys, Surface Engineering.

Anurag Goyal, *Ph.D. (Georgia Tech)*
Assistant Professor
Thermo-fluid Systems, Heat Transfer, Refrigeration and Air-conditioning, Waste-heat Recovery, Thermal Energy Storage, Building Energy Efficiency, Water Purification and Desalination.

Amit Gupta, *Ph.D. (Univ. of Central Florida)*
Professor
Energy Storage, Flapping Wing Aerodynamics, Microfluidics.

Harish Hirani, *Ph.D. (IIT Delhi)*
Professor
Bearings (Hydrodynamic, Rolling Element, and Magnetic), Synthesis and Application of Smart (Magnetorheological Fluids).

Sunil Jha, *Ph.D. (IIT Kanpur)*
Professor
Advanced Machining and Finshing Processses, Micro and Nanofinshing, Mechatronics, Robotics.

Jitendra P. Khatait, *Ph.D. (University of Twente)*
Associate Professor
Precision Machine Design, Flexures, Medical Devices, Robotics.

Sangeeta Kohli, *Ph.D. (IISc., Bangalore)*
Professor
Heat Transfer, Fluid Mechanics, Renewable Energy Technology.

Rama Krishna K., *Ph.D. (IISc., Bangalore)*
Assistant Professor
Kinematics and Mechanisms, Geometric Modeling for CAD and Manufacturing, Mechanics and Machine Design.

D. Ravi Kumar, *Ph.D. (IIT Madras)*
Professor
Metal Forming, Mechanical Metallurgy.

Mayank Kumar, *Ph.D. (Massachusetts Institute of Technology USA)*
Associate Professor
Multiphysics Simulations of Energy Conversion Systems, Turbulent Multiphase Reacting Flows, Coal Gasification & Clean Coal Technology.

Kusum Meena, *Ph.D. (Auckland University of Technology New Zealand)*
Assistant Professor
Additive Manufacturing, Auxetic Metamaterials, Laser Material Processing.

Kaushik Mukherjee, *Ph.D. (IIT Kharagpur)*
Assistant Professor
Orthopaedic Biomechanics & Implant Design, Developmental Biomechanics, Bone and Joint Mechanobiology, Mechanics of Human Movement, Finite Element Analysis.

S.V. Modak, *Ph.D. (IIT Delhi)*
Professor
Vibration Engineering, Experimental Modal Analysis, Finite Element Model Updating in Structural Dynamics, Vibro-acoustics.

Sudipto Mukherjee, *Ph.D. (Ohio State Univ.)*
Professor (Volvo Chair)
Mechanism, Robotics, Mechanical System Design, Impact Biomechanics.

Prithviraj Mukhopadhyay, *Ph.D. (IIT Madras)*
Assistant Professor
Machining of Ceramics, Cutting Tool Development, Joining, Surface Coating and, Vacuum Tech.

Prashant Palkar, *Ph.D. (IIT Bombay)*
Assistant Professor
Mixed-Integer Nonlinear (and Linear) Optimization, Parallel Computing, Derivative-Free Optimization, Applications of Operations Research, Algorithmic Game Theory.

Pulak Mohan Pandey, *Ph.D. (IIT Kanpur)*
Professor
Rapid Prototyping, Unconventional Machining, Finite Elements, CAD/CAM.

R.K. Pandey, *Ph.D. (Banaras Hindu Univ.)*
Professor
Bearing Lubrication, Tribological Elements Design, Engine Tribology, Lubrication in Metal Forming.

Rajan Prasad, *Ph.D. (IIT Madras)*
Assistant Professor
Acoustics and Dynamics, Mechanics of Materials.

B. Premachandran, *Ph.D. (IIT Madras)*
Professor
Heat Transfer, Computational Fluid Dynamics.

Varun Ramamohan, *Ph.D. (Purdue University)*
Assistant Professor
Probabilistic Modeling, Simulation and Optimization, with Applications in Healthcare Systems Engineering.

P. Venkateswara Rao, *Ph.D. (IIT Madras)*
Professor
Machining of difficult to machine materials, Grinding of Ceramics, Micro/Nano Manufacturing, Sustainable Machining.

Anjan Ray, *Ph.D. (Michigan State Univ.)*
Professor
Combustion, Heat Transfer.

Bahni Ray, *Ph.D. (IIT Kanpur)*
Assistant Professor
Multiphase Flow, Physics of Fluids, Micro Fluidics, Computational Fluid Dynamics, Stability Analysis, Traffic Flow.

Subir K. Saha, *Ph.D. (McGill Univ.)*
Professor
Multibody Dynamics, Robotics, Design, Mechatronics.

Sagar Sarkar, *Ph.D. (IIT Kharagpur)*
Assistant Professor
Laser Material Processing, Laser Additive Manufacturing, Online Process Monitoring and Control, AI and ML in Additive Manufacturing, Fatigue and Fracture in Additive Manufacturing.

Shaurya Shriyam, *Ph.D. (Univ. of Southern California)*
Assistant Professor
Data-Driven Optimization for Problems in Automation, Logistics and Healthcare; Complex Resource Distribution Networks; Multi-agent Planning and Reinforcement Learning.

Satinder Paul Singh, *Ph.D. (IIT Delhi)*
Professor
Dynamics of Rotary Machinery, Composite Materials, Machine Design, Active Vibration Control, Nano-Mechanics.

Sujeet Kumar Sinha, *Ph.D. (Imperial College London)*
Professor
Nano-tribology, Bio-tribology, Polymer Tribology, Materials in Mechanical Design.

P.M.V. Subbarao, *Ph.D. (IIT Kanpur)*
Professor
Experimental Turbulence, Tomography, Power Generation Systems and I.C. Engines.

Prabal Talukdar, *Ph.D. (IIT Guwahati)*
Professor
Radiative Heat Transfer, Porous Media, Convective Drying, Reheating Furnace, Inverse Problems, Thermal Protective Fabric.

Bhupinder Godara, *M.Tech. (IIT Delhi)*
Professor of Practice
Refrigeration and Air-conditioning Product Design With a Focus on Sustainable, Environment Friendly and Affordable Technologies for India.

P. V. Madhusudhan Rao, *Ph.D. (IIT Kanpur)*
Joint Faculty
Product Design & Realization, Computer Aided Design & Manufacturing.

INTRODUCTION

The faculty members of the Department of Mechanical Engineering are engaged in research and teaching in a wide variety of areas. The Department has four broad specializations: mechanical design, industrial, production, and thermal engineering. The faculty, staff, and students are involved in cutting-edge research at the forefront of several topics, including acoustics and dynamics, artificial intelligence (AI) and machine learning (ML) applications in mechanical engineering, applied mathematics, automation and robotics, bioengineering, control systems engineering, fluid mechanics, heat transfer, combustion and energy systems, industrial engineering and operations research, manufacturing technologies, mechanics of materials, micro- and nano-engineering, public systems, system design, and tribology. These research area form a significant portion of the topics of doctoral dissertations and master's Thesis. The Department offers various undergraduate- and graduate-level courses in the above areas. Several research projects of interdisciplinary nature are ongoing in collaboration with faculty of other departments, centres, and schools of IIT Delhi and with other institutions in India and abroad.

The research and teaching activities are supported by 16 skilled staff who manage 28 state-of-the-art laboratories. The department is also host to also hosts faculty on sabbatical from Indian and foreign institutions, DST INSPIRE Faculty Fellows, and postgraduate and undergraduate students from several institutions/universities in India and abroad. Several faculty members serve as experts on national and international technical committees.

ACADEMIC PROGRAMMES

The Department faculty offer courses at various levels catering to different degree programmes.

The Department offers two undergraduate programmes leading to the Bachelor of Technology (B.Tech.) degree with specializations in (i) Mechanical Engineering, and (ii) Production and Industrial Engineering.

The Department offers four postgraduate programmes leading to Master of Technology (M.Tech.) degrees with a specialization in Mechanical Design, Industrial Engineering, Production Engineering, and Thermal Engineering. Also, a Master of Science (Research) (M.S.(R)) programme is offered in these specializations. There are more than 300 Ph.D., 170 M.Tech., and 30 M.S.(R) students in the department. The Department also offers a joint Diploma Program in Visionary Leaders in Manufacturing with NITIE, Mumbai, for professionals with several years of industrial experience.

The faculty also participate in interdisciplinary Master of Technology programs in Construction Technology and Management, Computer Applications, Polymer Science and Technology, Industrial Tribology and Maintenance Engineering, Energy Science and Engineering, and Transportation Engineering. The faculty also participate in the Master of Design programme, and activities of the Khosla School of Information Technology and School of AI at IIT Delhi. Several faculty members have also been engaged in improving rural technologies for enhanced livelihood.

Various topics under the main areas of the department are listed below:

Mechanical Design: Mechanical vibrations, Rotor dynamics, Damped structures, Composite structures, Smart structures, Active vibration control, Experimental modal analysis and identification, Structural dynamic modification, Finite element model updating, Dynamic design, Noise engineering, Condition monitoring, Bearing dynamics, Lubrication, Bio-tribology, Tribological Coatings, Mechanical system design, Computer-aided mechanical design, Computer-controlled mechanisms, Vehicle dynamics, Modeling the impact of vehicles, Impact biomechanics, Concurrent engineering design, Mechanisms, Robotics, Multi-body dynamics, Application of multi-body dynamics in design, Analysis of rural engineering systems, Mechatronics, Sensors and actuator design, MEMS, Design of micro-systems, Nano-mechanics, Artificial intelligence applications in mechanical engineering, Expert systems for design and manufacturing, Mechanical engineering applications to medical science.

Industrial Engineering: Applied probability, Stochastic modeling and simulation, Project management, Supply chain management, Computer integrated manufacturing systems, Facilities planning, Value engineering, Flexible systems, ERP, Intelligent manufacturing systems, e-business, Quality and reliability engineering, Maintenance management, Manufacturing system design and analysis, Service system design, Production planning and control, Operations Research (OR) applications in healthcare, manufacturing, telecommunications, transportation, policy, governance and finance.

Production Engineering: Metal cutting, Metal forming, Welding, Metal casting, Material characterization, Nontraditional manufacturing processes, Measurements and metrology, Grinding of ceramics and metal matrix composites, Processing of polymers and composites, Injection moulding, Finite element applications in manufacturing, CAD/CAM, Rapid prototyping, Intelligent manufacturing, Micro and nano-manufacturing, Biomaterials and medical implants, Nano-composites, Modeling of material behavior, Lean concepts in machine tool design. Magnetorheological Finishing, CNC finishing systems, Smart manufacturing – IIoT, Augmented reality, Digital twin.

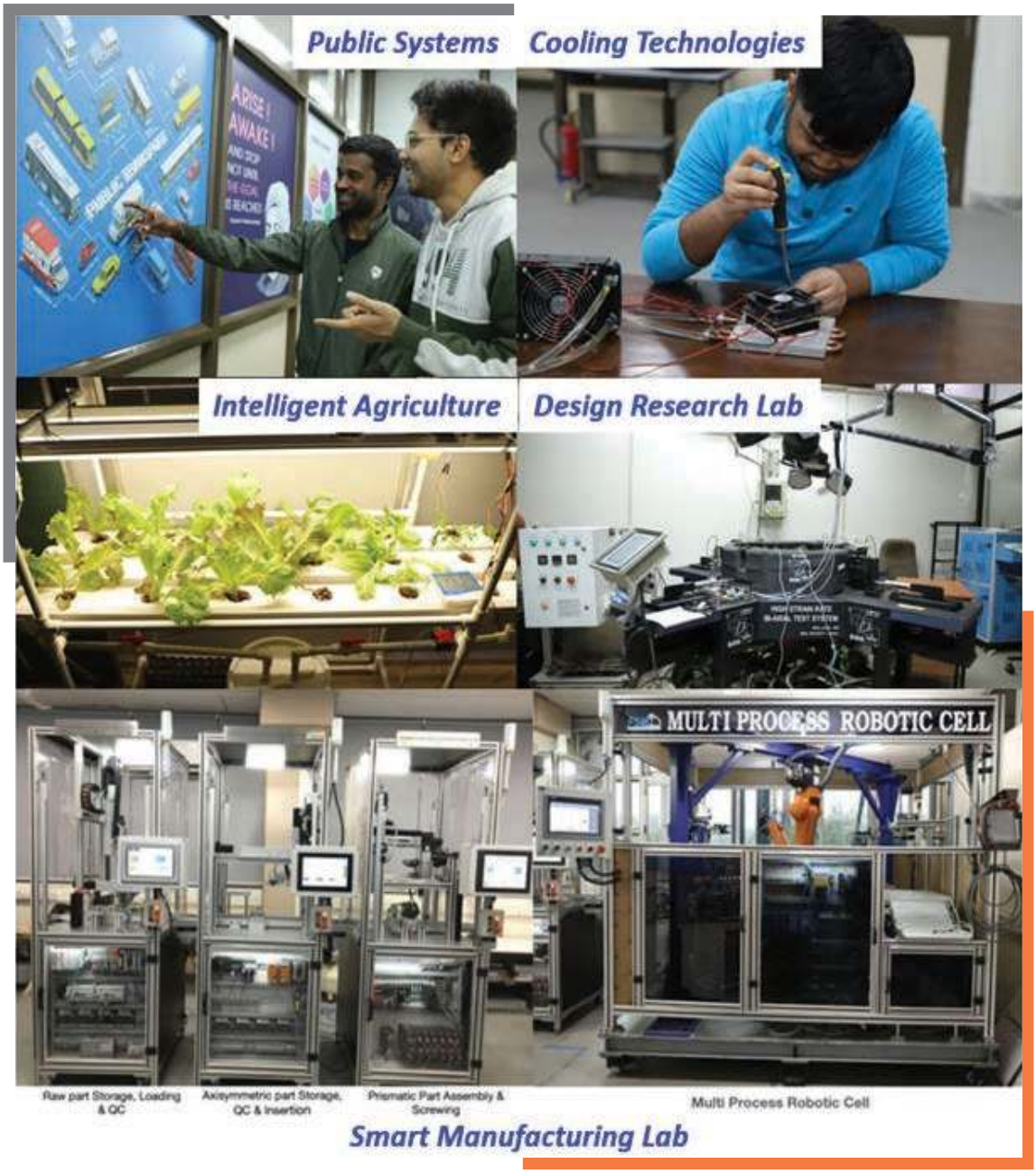
Thermal Engineering: Combustion, Fire dynamics and fire safety, Internal combustion engines: alternative fuels, engine modelling and simulation, Biomass utilization, Experimental and modelling studies of gasifiers, Biomass stoves, Sustainable energy systems, Waste heat utilization, Renewable energy systems, Fundamentals of heat and mass transfer, Micro- and nano-scale heat transfer, Transport phenomena in micro- and nano-fluidic devices, Refrigeration and air-conditioning, Cooling of electronic components, Fundamentals of fluid dynamics, Flapping wing aerodynamics, Energy Storage, electrochemical and thermal, Solar Cooling Thermal, technologies, water purification and desalinatin, Heat and mass transfer in biological systems, Air pollutuion and its mitigation.

Interdisciplinary Research: Transportation research and injury prevention program, Quality and productivity audit of rural industries, Medical implants, Autonomous robotics, Development of composite materials, Atmospheric convection, Rural Technology Action Group (RuTAG).

Mechanics and Material Characterization (MMC) Lab

LABORATORY FACILITIES

The Department has 28 well-equipped laboratories or research and teaching activities. The Production Engineering, Welding, Metrology, Machine Tools & CNC laboratories house the machinery required for manufacturing and inspection. A state-of-the-art Micro-manufacturing laboratory houses sophisticated machines for micro- and nano-manufacturing. Laboratories that cater to the activities in the area of mechanical design include Mechatronics, Vibration and Instrumentation, Vibration Research, Mechanism and Simulation, Bio-tribology, Tribological coatings and Design Research laboratories. Computer-Aided Graphics instruction Laboratory (CAGI Lab), equipped with computers, and drawing and design software packages, is used to impart mechanical design training. Microfluidics, Combustion, Refrigeration and Air-conditioning, Internal Combustion Engines, Turbo-machinery and Heat Transfer Laboratories serve the needs of research and teaching in thermal engineering. Industrial Engineering Lab helps in teaching and research activities in the areas of operations research, Health care, public policy and governance, transportation, clean air and manufacturing analytics.



Condensed Matter Experiment

Condensed Matter Theory

Computational and Statistical Physics

DEPARTMENT OF **PHYSICS**

High Energy Physics

Physics of Quantum Matter and Information Systems

Optics and Photonics

Plasma Physics

Head of the Department

Pankaj Srivastava, *Ph.D. (Rajasthan Univ.)*
Professor
Experimental Solid State Physics,
Electronic Structure of Materials,
Surface-interface Physics.

Aditya Narain Agnihotri, *Ph.D. (TIFR, Mumbai)*
Assistant Professor
Ion-atom Collision Physics, Ion-irradiation of Biologically Relevant Molecules.

Sujin B. Babu, *Ph.D. (Univ. du Maine, France)*
Associate Professor
Aggregation of Colloids, Porous Media,
Low Reynolds Number Swimmers.

Varsha Banerjee, *Ph.D. (IISc., Bangalore)*
Professor
Statistical Mechanics of Complex Spin System, Surface Growth Phenomena, Fractal Architectures and their Characterization.

Saswata Bhattacharya, *Ph.D. (IACS, Kolkata)*
Associate Professor
Computational Materials Science, Energy Conservation, Catalysis, Graphene, Genetic Algorithm, Machine learning.

R. Chatterjee, *Ph.D. (IIT Kanpur)*
Professor
Experimental Condensed Matter Physics - novel Magnetic Multi-functional Materials: Bulk and Nano/Thin Film forms.

Sujeet Chaudhary, *Ph.D. (IIT Delhi)*
Professor
Experimental Condensed Matter Physics:
Thin Films, Magnetism, Spintronics.

Amita Das, *Ph.D. (IIT, Kanpur)*
Professor
Plasma Physics, Laser Plasma Interaction, Particle and Fluid Simulation in Plasma.

Pintu Das, *Ph.D. (Uni. of Saarland, Germany)*
Associate Professor
Experimental Condensed Matter Physics: Magnetism at Nanometer Scale, Charge Carrier-dynamics (Low-frequency) as well as Atomic/Nanometer Scale Electronic Phenomena in Correlated Electron Systems, Instrumentation.

Rajendra S. Dhaka, *Ph.D. (UGC-DAE CSR, Indore)*
Associate Professor
Experimental Condensed Matter Physics: Electronic Structure, Thin Films, Strongly correlated Systems, Surface-Interface Physics, High-Tc Superconductors, Angle-resolved Photoemission Spectroscopy.

Joyee Ghosh, *Ph.D. (Jawaharlal Nehru Univ.)*
Associate Professor
Quantum and Nonlinear Optics,
Quantum Information Technologies,
Atomic, Molecular and Optical Physics.

Pradipta Ghosh, *Ph.D. (IACS Kolkata)*
Assistant Professor
Phenomenological Analyses of Physics Beyond the Standard Model in the Areas of Neutrino Physics, Higgs Physics, Leptonic Flavor Violation, Dark Matter and Collider Studies.

Santanu Ghosh, *Ph.D. (Jawaharlal Nehru Univ.)*
Professor
Experimental Condensed Matter Physics,
Thin Film, Ion Materials Interaction.

Sankalpa Ghosh, *Ph.D. (Jawaharlal Nehru Univ.)*
Professor
Bose Einstein Condensate of Cold Atoms,
Quantum Hall Effect, Graphene,
Topological Insulator.

Abhishek Muralidhar Iyer, *Ph.D. (IISc., Banglore)*
Assistant Professor
Different Aspects of Particle Physics Phenomenology: Investigation of Strong Dynamics in the Context of Both QCD and QCD like Theories. Flavour Physics of B and K Mesons and Investigating their Reach in the Current and Future Experiments (eg. LHCb, BELLE-2, NA62 etc). New Data-Driven Techniques for Current (eg. LHC) and Future Colliders (eg. FCC-hh, FCCee etc).

Bhaskar Kanseri, *Ph.D. (University of Delhi)*
Associate Professor
Quantum Optics, Ultrafast and Non-linear Optics, Optical Coherence and Interferometry, Polarization and Spectral Switching.

Neeraj Khare, *Ph.D. (BHU)*
Professor
Nano-Structure Functional Oxides, Novel Magnetic Materials, Superconductors, SQUID, Solar Cells.

Sunil Kumar, *Ph.D. (IISc., Banglore)*
Associate Professor
Ultrafast Optics and Spectroscopy, Plasmonics, Electron Correlated Solids.

Deepak Kumar, *Ph.D. (TIFR, Mumbai)*
Assistant Professor
Experimental Soft Matter Physics, Current Research Interest Includes Interfacial Phenomena in Soft and Highly Deformable Systems as well as the Complex Dynamics of Driven Granular Matter.

Brajesh Kumar Mani, *Ph.D. (PRL, Ahmedabad)*
Assistant Professor
Computational Condensed Matter Physics, Computational Many-body Physics, Molecular Dynamics and Monte Carlo Simulations.

Kaustuv Manna, *Ph.D. (IISc., Banglore)*
Assistant Professor
Experimental Investigation of Various Topological Phase of Matter, Specialization on Single Crystal Growth, Magnetization, High Magnetic Field Electrical and Thermal Transport Measurements.

Hitendra K. Malik, *Ph.D. (IIT Delhi)*
Professor
Plasma Physics: Particle Acceleration, Instabilities, Fusion, Microwaves-plasma Interaction, Solitons, Space Plasmas, THz Radiation Generation, Hall Thrusters, Plasma-material Interaction.

Rahul Suresh Marathe, *Ph.D. (RRI Banglore)*
Associate Professor
Non-euilibrium Statistical Mechanics, Biophysics Theory, Modelling, Simulations.

Sujit Manna, *Ph.D. (IACS, Kolkatta)*
Assistant Professor
Experimental Condensed Matter Physics, Quantum Materials, Unconventional Super-conductivity, MBE, Spectroscopic Imaging (STM/STS).

Marshal, *Ph.D. (UMIST, Manchester, UK)*
Associate Professor
Designing Different Types of Plasmas & using them for making new Materials, Thin Film Coatings and Bio-sensors.

Amruta Mishra, *Ph.D. (Utkal Univ.)*
Professor
Superconductivity in Quark Matter and Ultra-cold Atoms, In-medium Hadron Properties and Observable in High Energy Accelerator Experiments.

Pranaba Kishor Muduli, *Ph.D. (Humboldt Univ. & PDI, Berlin)*
Professor
Spin Torque Induced Magnetization Dynamics, Spintronics and Nanomagnetism.

Rohit Narula, *Ph.D. (MIT, USA)*
Assistant Professor
Condensed Matter Theory, Raman Spectroscopy.

G. Vijay Prakash, *Ph.D. (Andhra Univ.)*
Professor
Nano-photonics, Quantum Functional Materials, Inorganic-organic Nano-hybrids, Non-linear Optics.

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Theoretical High Energy Physics and Mathematical Physics (Gauge/Gravity Duality, Conformal Field Theory, P-adic Field Theories, Quantum Information Theory).

V. Ravishankar, *Ph.D. (Lehigh Univ.)*
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Quantum Information, Yang Mills Plasma, Quantum Chromodynamics.

Bodhaditya Santra, *Ph.D. (Univ. of Groningen, Netherland)*
Assistant Professor
Cold Atom Quantum Technology.

Vikrant Saxena, *Ph.D. (IPR Gandhinagar)*
Assistant Professor
Computational Plasma Physics, Laser-plasma Interactions, Nonlinear Waves and Solitons in Plasmas, XFEL Irradiation of Rare Gas Clusters, Plasma based Particle Acceleration etc.

Kaushik Sen, *Ph.D. (University of Fribourg, Switzerland)*
Assistant Professor
Determination of Fundamental Interactions and Dynamics in Quantum Materials using Polarized Raman Scattering and Synchrotron X-rays.

Amartya Sengupta, *Ph.D. (Rutgers Univ. & NJIT)*
Assistant Professor
Experimental Ultrafast Optics, THz Spectroscopy, Optical Spectroscopy at High P-T, Mineral Physics.

Tarun Sharma, *Ph.D. (Tata Institute of Fundamental Research, Mumbai)*
Assistant Professor
String theory, Quantum Field Theories, Supersymmetry, Higher Spin Symmetry, AdS-CFT, Fluid-Gravity Correspondence.

A.K. Shukla, *Ph.D. (IIT Delhi)*
Professor
Laser, Semiconductor, Raman Spectroscopy, Ion Implantation, Laser Annealing Superconductors and Nanoscience.

J.P. Singh, *Ph.D. (JNU Delhi)*
Professor
Nano-Structure Growth, Nano-science, Experimental Condensed Matter Physics.

Suprit Singh, *Ph.D. (IUCAA Pune)*
Assistant Professor
Matter-gravity Interaction in Cosmology, Black Holes, Analogue Spacetimes and Quantum Gravity, and the Emergence of Classicality. Once Classical, we are involved in Observational Cosmology Including Astrophysical Magnetic Fields on Galactic and Extragalactic Scales.

Aloka Sinha, *Ph.D. (IIT Madras)*
Professor
Nonlinear Optics, Liquid Crystals, Optical Information Processing, Biometrics.

Rajendra Singh, *Ph.D. (Jawaharlal Nehru Univ.)*
Professor
Semiconductor Materials and Processing, Wide Band Gap Semiconductor, Semiconductor Nano-wires, Semiconductor Wafer Bonding.

Manisha Thakurathi, *Ph.D. (IISc., Banglore)*
Assistant Professor
Dynamics and Topological Aspects of Quantum Systems, Interaction, Disorder Effects, and Transport in Equilibrium and Non-equilibrium Systems.

Folke Tobias Florus Toll, *Ph.D. (Hamburg Univ., Germany)*
Assistant Professor
High Energy Physics.

R.K. Varshney, *Ph.D. (IIT Delhi)*
Professor
Fibre and Integrated Optics, Nonlinear Optics, Fiber Optic Sensors, Fiber Lasers.

M.R. Shenoy, *Ph.D. (IIT Delhi)*
Emeritus Professor
Optoelectronics, Fibre and Integrated Optics, Optical Fiber Components, Nonlinear Guided Wave Optics.

B.R. Mehta, *Ph.D. (IITD)(Schlumberger Chair)*
Adjunct Professor
Thin Film and Nanostructured Materials, Inorganic-organic Hybrid Interfaces, Resistive Memory, Thermoelectric, Photo Electro Chemical and Solar Cell Devices.

Yoshiro Azuma, *Ph.D. (Univ. of Oregon, USA)*
Visiting Professor (Japan)
Atomic and Molecular Physics, Particularly Many-electron Effects Probed by Synchrotron Radiation.

INTRODUCTION

The Department is engaged in advanced research in several areas of physics and offers a variety of courses for undergraduate and postgraduate students. The Department offers a B.Tech. programme in Engineering Physics, M.Sc. programme in Physics, and M.Tech. programmes in (i) Solid State Materials, (ii) Applied Optics, and (iii) Opto-electronics and Optical Communications (an interdisciplinary programme, jointly with the Electrical Engineering Department).

The Department has well-equipped teaching laboratories and an excellent research infrastructure. The research is broadly focused on topical areas like Condensed Matter Physics, Optics and Photonics, Plasma Physics, and Theoretical & Computational Physics. State-of-the-art research on contemporary topics like Nanoscience and Nano-technology, Energy Materials and Devices, Magnetism, Spintronics, Optical Fibers Sensors & Devices, Photonic Crystals, Optical Memory, Microwave and Laser-plasma Interaction, Quantum Optics Optical Imaging etc. is being carried out.

ACADEMIC PROGRAMMES

UNDERGRADUATE

The Department offers a variety of courses to all undergraduate students at IIT Delhi under the catagories of Basic 'Science course' and 'Elective Course' requirements. The Department also offers a set of specific 'Core Courses' for the undergraduate programme 'Engineering Physics'. These courses are also available to undergraduate students of other engineering disciplines as Open Electives. Department offers programme linked courses to UG students of some other branches. Department also offers two minor area to UG Programmes.

B.Tech. in Engineering Physics

The programme in Engineering Physics stresses the basic physics that underlies most developments in engineering, and the mathematical tools that are important to all engineers and scientists. This emphasis, combined with hands-on-experience of working with modern computers, electronics, lasers and other equipments, culminates in an excellent preparation for a broad range of careers. There is also provision for students to opt for one of the four departmental specializations : 1) Nano-Science & Technology 2) Photonics Technology 3) Quantum Technologies. 4) Theoretical and Computational Techniques in Physics.

POSTGRADUATE

M.Sc. in Physics

The M.Sc. (Physics) programme is designed to impart masters-level education in Physics through various lecture courses and laboratory classes. The department also offers three specializations in the broad areas of Optics & Photonics, Material Science and Theoretical Physics.

M.Tech. in Solid State Materials

The Solid State Materials programme encompasses science and technology of materials, their synthesis, characterization and applications in devices. The programme prepares graduates to take-up challenges in research and development in Solid State Technology, Nanoscience and Technology, Materials Science and Engineering, and Semiconductor Technology and Processing.

M.Tech. in Applied Optics

The Applied Optics programme is primarily designed to emphasise the “Applied” nature of modern and classical optics. The programme is suited to the requirements of various Optical and Opto-electronic industries and R&D organisations.

Interdisciplinary M.Tech. in Optoelectronics and Optical Communication

This Interdisciplinary programme is offered Jointly by Physics and Electrical Engineering Department. This programme trains students in the areas of Fiber & Integrated Optics, and Optical Communication and Networks, which are useful to various industries.

RESEARCH AREAS

Doctoral and Post-doctoral research is being carried out in:

- **Condensed Matter Experiments:** The research activity of condensed matter experimental (CME) group at the Physics Department covers a wide range of topics such as (i) nanostructured materials, thin films and devices, (ii) novel magnetic multifunctional and topological materials, (iii) spintronics and magnetism, and (iv) wide band gap semiconductors such as GaN and Ga2O3, AlGaN/GaN heterostructures, 2D quantum materials like grapheme, transition metal dichalchogenides and thin-films of half Heusler alloys Growth and nanoscale devices based on semiconductor nanowires, and (v) optical properties of condensed matter e.g., ultrafast dynamics of condensed matter with femtosecond laser. CME group houses several specialized laboratories as well as several departmental facilities. The CME group has close links with Central Research facilities (CRF) and Nanoscale Research Facility (NRF) of the Institute. NRF houses Class 100 and 1000 clean rooms as well as several characterization facilities. At present, the department has an X-Ray Diffractometer (XRD), an X-ray Photoelectron Spectroscopy (XPS), a SQUID magnetometer, a Physical Property Measurement System (PPMS), a Magnetic Property Measuring System (MPMS) ultrafast-optics laboratory (also housing a Raman spectrometer and a photoluminescence set-up), a Pulsed Laser Deposition (PLD) system and an Atomic Force Microscope (AFM) as departmental facilities. Individual research labs also have several state-of-the-art facilities, the details of which can be found by visiting the corresponding laboratory web pages.
- **Condensed Matter Theory:** The CMT group has an interdisciplinary focus with broad research interest spanning from first principles based simulation of designing new materials and understanding their properties using "state-of-the-art density functional theory (DFT) and beyond methods" to the theoretical modelling of transport and other properties of various condensed matter systems. We also theoretically model transport in quantum Hall systems, graphene, and topological insulators. Quantum simulation of exotic condensed matter phases with Ultra-cold atoms is another area of expertise. Our research also aims to theoretically discover and characterize different topological phases consisting of fractional fermions and Majorana fermions with features uniquely advantageous for topological quantum computing. Using DFT we probe the fundamental physics and related technological applications for atomic and many-atomic complex systems. Some properties of our interest include electronic and band structure, electric and magnetic properties, phonons, magnons and electromagnons in complex (anti)ferroic oxides bulk and nanostructures. We also use ab initio calculation to explore the viability and rational design of real-world functionalized CNT metastable photoswitches and Single-Photon Emitters (SPEs). We also theoretically model transport in quantum Hall systems, graphene, and topological insulators. Quantum simulation of exotic condensed matter phases with ultra-cold atoms is another area of expertise. Our research also aims to theoretically discover and characterize different topological phases consisting of fractional fermions and Majorana fermions with features uniquely advantageous for topological quantum computing.
- **Statistical and Computational Physics:** Statistical Physics is devoted to understanding macroscopic assemblies of identical particles. Such systems appear over a wide range of length scales in many different fields. We study diverse systems of contemporary interest, ranging from classical solids, exotic liquids, soft materials, mesoscopic systems and active matter to name a few. Broadly, our research encompasses the following themes: (i) emergent phenomena in complex spin systems with

disorder and long-ranged interactions; (ii) Non-equilibrium properties of complex fluids such as liquid crystals, ferronematics and patchy colloids; (iii) miniature heat engines, and particle and heat transport in mesoscopic systems; (iv) motility of micro-organisms on surfaces and Micro-swimmers in Newtonian and Non-Newtonian fluids; (v) pattern formation in granular materials; and (vi) mechanics of extremely flexible structures such as thin films. We use a variety of analytical techniques from equilibrium and Non-equilibrium statistical physics, computational techniques such as Monte Carlo, parallel tempering, molecular dynamics and graph cuts along with experiments involving State-of-art imaging techniques and sensitive mechanical characterization.

- **High Energy Physics:** High energy physics encompasses both the very small and the very large distance scales — of elementary particles (femtometer scale) and of the observed universe (cosmology)! It is well described by the standard model, which brings together three fundamental Interactions — electromagnetic, weak and strong.

  Collider physics is a tool which combines both perturbative and non perturbative aspects of these interactions. We study particle production in collider interactions in an attempt to understand both. In particular, strong interaction, described by quantum chromodynamics, is per se notoriously difficult. We employ effective field theoretical techniques to understand its non perturbative aspects — to study low energy properties of hadrons and quark gluon plasma. We also use them to study particle production in gravitational fields, and also some aspects of quantum gravity.

  Standard model, though stupendously successful, is still incomplete which makes HEP even more exciting. There are several theoretical problems; even more, there are experimental hints for rich physics beyond the standard model. We study this in the context of topics such as neutrino physics and dark matter.

- **Optics and Photonics:** Historically the Physics Department at IIT Delhi has a strong background in broad areas of Optics and Photonics. IIT Delhi started the first Optics Master's programme in the country in 1960's. At present the Physics Department has approximately 15 faculty members engaged in Optics and Photonics related research. Current research activities span a wide ranging topics that include areas of fundamental importance (e.g. Physical Optics, Statistical Optics, Singular optics and inhomogeneous polarization states, quantum photonics, non-linear optics, nano-photonics/ metamaterials, light propagation in random media) as well as cutting edge applied research areas (e.g. integrated optics and optical communication, holography, microscopy/nanoscopy, optical metrology, computational imaging, green photonics, illumination engineering, Bio-photonics including applications to medical diagnostics, THz optics, ultrafast optics, spectroscopy, optical tweezers, beam engineering, atmospheric optics and development of optical sensors). Optics and Photonics faculty have number of collaborations across different disciplines within IIT Delhi (electrical engineering, biosciences/biomedical engineering, material science, chemistry), as well as outside IIT Delhi with DRDO, ISRO and other national research facilities like CSIR labs, as well as medical schools/ hospitals (e.g. AIIMS), and industry. The department hosts a DST-FIST facility on ultrafast optics that has State-of-the-art instrumentation enabling collaborative work with various disciplines.

- **Physics of Quantum Materials & Information Systems:** The three focussed attempts in Quantum Computation (QC) are- (i) Majorana-based Topological Quantum Computation (TQC) (ii) Superconducting qubits based QC and (iii) Trapped ion based QC. Importance of the field is evident from the fact that Google and IBM have invested heavily in superconducting qubits while Microsoft has invested in Majorana qubits.

  The focus of our Department are towards (i) Cold Atom-based quantum technologies, (ii) Quantum Photonics and (iii) General Quantum Materials like Topological Insulators, quantum well based semiconductor technologies, spintronics related research etc.

In cold atom based technologies, the atoms are cooled to million times colder than room temperature using precisely frequency tuned lasers. The inherent quantum nature of atoms and photons allows one to design versatile quantum systems and fully control their properties by simple and clever approaches. These technological and conceptual developments will lead us to build large scale quantum information processing network, quantum computation protocols for solving industry and society relevant problems.

A group of researchers, in the department are studying Topological Semi-metals, a quantum phase of matter that host Dirac and Weyl fermions. They study the transport properties of these exotic materials under very low temperature, high magnetic field and high pressures and realise the exotic quantum features in the laboratory scale.

- **Plasma Physics:** Plasmas are known to be the fourth state of matter. These contain large number of positive ions and electrons in almost equal number along with some neutral particles. Negative ions can also occur in plasmas and also there can be dust particles, referring to them as Multi-component / dusty plasmas where the charge neutrality holds good. However, the dynamics of plasma greatly alters due to the presence of such additional charges. Each plasma species can contribute to different application of plasma. For example, electrons are responsible for high frequency phenomena including EM radiation generation, whereas the ions contribute to the synthesis of materials, surface hardening, sputtering, deice fabrication etc.

  Plasma group primarily working in the broad research areas of intense laser-plasma interaction, Plasma-material interaction, plasma propulsion, plasma based radiation sources, and dusty plasmas. We employ theoretical approach including nonlinear physics as well as numerical methods, namely, hydrodynamics, molecular dynamics and Particle-in-cell (PIC) techniques to investigate some of the above areas and also perform experiments.

- **Atomic and Molecular Physics:** Our area of interest is ion-atom/molecule/cluster/ices collisions. Heavy ion impact Ionization and fragmentation of the molecules of biological and astrophysical interest are studied. Our area of expertise include secondary electron spectroscopy, Recoil-ion-momentum spectroscopy and Infrared spectroscopy. We are also interested in development of equipments which are useful in atomic physics experiments and our aim is to collaborate with the industry to make them commercially available.

- **Astrophysics:** Research in the Astrophysics group at the Physics Department, IIT Delhi revolves around open questions such as:

  a) What is the small scale structure of space time?

  b) How do the matter and gravity interact in the quantum picture?

  c) What leads to the emergence of "classical" reality?

  d) What are the quantum effects in gravity and how to test them?

  In tandem with this, we also make contact with observations in Astronomy and Astrophysics, especially employing Optical and Radio data. In an ongoing effort in this direction, we are involved in mapping the magnetic field of our galaxy, the Milky way, through pulsar observations.

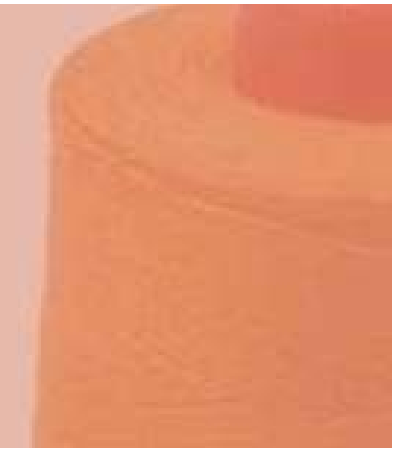
LABORATORY FACILITIES

The Department has well-equipped laboratories for both teaching and research programmes. Some of the major research laboratories are: Solid State Physics Laboratory, Thin Film Laboratory, Magnetics & Advance Ceramics Laboratory, Nano-stech. Laboratory, Plasma Physics Laboratory, Plasma Beam

Laboratory, Fibre and Integrated Optics Laboratory, Laser Spectroscopy Laboratory, Optical Image Processing Laboratory, Quantum Electronics Laboratory. A large number of facilities are available in these and other laboratories and these include: Electron Microscopes (HRTEM, FESEM, TEM, SEM), Atomic Force Microscope (AFM), Scanning Tunneling Microscope (STM), MOKE Microscope, Scanning Auger Microprobe (SAM), Electron Spectroscopy for Chemical Analysis (ESCA), Photovolatic, Thermoelectric and Photo electro chemical Characterization facility, Powder and Thin Film X-ray Diffractometers, XRR, FTIR Spectrophotometer, Laser Raman Spectroscopy System, SQUID Magnetometer, Dielectric and Ferroelectric Set-up, Arc-melting, Auto Lab General Purpose Eletrochemical System, Optical Multichannel Analyser, Closed-cycle Helium Cryotip System, High Power Argon-ion/Neodymium/YAG/Excimer/Dye/Ti: Sapphire Lasers, Optical Photon-correlator, Plasma Diagnostics System, PPMS Facility, Microwave Processing of Materials in a single (E- or H- field) or multiple mode, Ultrahigh Vacuum Units, Vacuum Coating Units, DC and RF Sputtering Units, Concave Reflection Grating, Spatial Light Modulators, Optical Transfer Function Bench, Holographic Recording Set-up, Coherent Filtering Set-up, Facility for Optical Phase Conjugation with Photorefractives, Facility for Fabrication of Tunnel Diodes, Solar Cells, Thin Film Devices and Integrated Circuits, Optical Fibre Splicing and Characterisation Set-up, In-line Optical Fibre Components Fabrication and Testing, Fabrication and Characterization of Planar Optical Waveguides, Erbium doped fibre amplifiers, Optical Spectrum Analyser, Wavelength Meters, High resolution Microscope, DWDM wave length tuned Laser Diode light sources, Long Period Fiber Grating fabrication, variety of optical fibre sensors, Facility for making High Temperature Superconductors, Plasma and Photo CVD Units, DLTS, PL Facility, Optical CD Fabrication Facility, Indigenously developed HV compatible field emission measurement setup.

An Ultra Fast Optics (UFO) facility has been developed in the Department via a DST-FIST Project. This UFO facility is a unique facility that caters to diverse fields of Inter-disciplinary research, wherever the research activity demands high power and ultrafast light. This facility, serves a wide variety of research activities aiming at the studies of spatial and temporal dynamics of light-matter interaction or Stand-alone experiments. Potential beneficiary disciplines of the faculty are expected in the field of Optics, Nano-photonics, Material Science & Nano-science and Technology, Plasma Physics, Optoelectronics, Biology, Biotechnology, Medicine, Chemistry and Private Industries. The facility is expected to be useful to the research of other departments/Centers/Schools of IIT Delhi namely, Chemistry, Biochemical and Biotechnology, Biomedical, Electrical, Textile, CARE, IDDC, Materials Science and Engineering, and School of Biological Sciences.






DEPARTMENT OF

TEXTILE AND FIBRE ENGINEERING






R. Alagirusamy, *Ph.D. (Georgia Tech.)*
Professor
Textile Performs for Composite Applications, Natural Fibre Composites, Short Staple Spinning, Structure Property Relationship of Yarns, Textile Reinforced Concrete.

Head of the Department

Ashwini K. Agrawal, *Ph.D. (Univ of Rochester)*
Professor
Fibre Science & Technology, Polymers, Smart Textile Materials, Nano materials, Plasma Processing, Composite Fibres.

S. Wazed Ali, *Ph.D. (IIT Delhi)*
Associate Professor
Functional Finishing of Textiles (Broadly, Textile Chemistry - Dyeing & Finishing), Nanotechnology in Functional Materials (Polymers & Textiles), Eco-friendly / Green Chemical Processing of Textiles, Electro-active/ Piezoelectric Polymers and Textiles.

B.K. Behera, *Ph.D. (IIT Delhi)*
Professor
Fabric Manufacturing, 3D Weaving and Textile Structural Composites, Textile Reinforced Concrete, Mechanics of Textile structure, Project Management.

Vijaykumar Narayandas Baheti, *Ph.D. (TU Liberec, Czech Republic)*
Assistant Professor
Advanced Materials Utilizing Fibrous Industrial Wastes; Ball Milling of Fibrous Materials in Dry and Wet Condition; Activated Carbon Fabric Structures; EMI Shielding and Joule Heating Fabrics; Textile Reinforced Composites and Concrete Structures; Recycling of Textile Wastes.

B.S. Butola, *Ph.D. (IIT Delhi)*
Professor
Shear Thickening Fluids and Ballistic Textiles, Textile Finishing With Metal Oxides and Bio Materials, Polymeric Nano Composites.

Apurba Das, *Ph.D. (IIT Delhi)*
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Clothing Comfort, Nonwoven & Technical Textiles, Compression Bandage, Protective Clothing, Yarn Manufacturing, Instrumentation.

Dipayan Das, *Ph.D. (Tech. Univ. of Liberec)*
Professor
Nonwoven Products & Processes: Fibrous Air Filters, Fiber-reinforced Composites, Theory of Textile Structures, Fiber-to Yarn Engineering, Statistical Analysis and Optimization.

Sourabh Ghosh, *Ph.D. (Basel Univ., Switzerland)*
Professor
Tissue Engineering, Medical Textile, 3D Bioprinting.

Deepti Gupta, *Ph.D. (IIT Delhi)*
Professor
Natural Fibres, Natural Dyes, Eco Friendly Finishing of Textiles, Protective Clothing, Garment Sizing.

Manjeet Jassal, *Ph.D. (IIT Delhi)*
Professor
Speciality & Innovative Polymeric Materials for Textile Applications, Smart Textiles, Nanomaterials and Nanomaterials reinforced composites, Electrospinning.

Mangala Joshi, *Ph.D. (IIT Delhi)*
Professor
Nanotechnology Applications in Textiles, Polymer Nanocomposite Fibres, Nanofibres and Nanocoatings, Bioactive and Functional Textiles, Material Development for Aerostats/Airships.

Abhijit Majumdar, *Ph.D. (Jadavpur Univ.)*
Professor
Soft Body Armour, Ultra-violate Radiation Protection, Soft Computing, Multi-criteria Decision Making, Sustainable Supply Chain Management.

Bipin Kumar, *Ph.D. (IIT Delhi)*
Assistant Professor
Fabric Engineering, Knitting, E-textiles, Personal Protective Equipments, Medical Textiles.

Samrat Mukhopadhyay, *Ph.D. (IIT Delhi)*
Professor
Fiber Reinforced Composites, Green Technologies using 2D Materials like Grapheme and Mxene, Single Polymer Composites, Green and Sustainable Technologies, Technology Intervention in Handlooms, Color Science.

Bhanu Nandan, *Ph.D. (Kanpur Univ.)*
Professor
Fibrous Materials for Energy Storage and Catalysis, Electro-spinning, Polymer Physics, Nanomaterials via self-assembly.

Amit Rawal, *Ph.D. (Univ. Bolton)*
Professor
Nonwovens, Modelling of Fibrous Assemblies, Technical Textiles.

Sumit Sinha Ray, *Ph.D. (Univ. of Illinois, Chicago)*
Assistant Professor
Air/Water Filtration,Porous Materials for Energy Applications, Experimental and Theoretical Thermal-Fluid Sciences at the Micro/Nanoscale, Characteristics and New Methodologies of Nonwoven Micro/Nanofiber, Biomaterials, Drug Delivery.

R.S. Rengasamy, *Ph.D. (IIT Delhi)*
Professor
Garment Technology, Mechanics of Yarns and Machines, Clothing and Comfort, Oil Spill Removal using Fibrous Materials, Nonwovens, Extreme Cold Climate Clothing.

Archana Samanta, *Ph.D. (IIT Delhi)*
Assistant Professor
Fibre Designing, Functional Bio-composites, Energy Harvesting Applications, Sustainable Textile Finishes.

Javed Nabibaksha Sheikh,
Ph.D. (I.C.T. Mumbai), FSDC
Associate Professor
Sustainable Textile Chemical Processing, Functional Modification of Fibrous Polymers, Recycling of Polymeric Waste, Natural Dyeing.

Rajiv K. Srivastava, *Ph.D. (KTH, Sweden)*
Professor
Porous and Fibrous Matrices, Reactive Electro-spinning and Prototyping, Green Polymerization Methods, Biodegradable Polymers.

Harun Venkatesan, *Ph.D. (The Hong Kong Polytechnic University, Hong Kong S.A.R)*
Assistant Professor
Textiles for Sustainability, Ultralight and Porous Materials for Thermal Regulation, Silk Science, Biomimetics.

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Emeritus Professor
Biomaterials, Biotextiles, Tissue Engineering, Wound Care Systems, Intelligent Polymers & Fibres, Plasma Processing, Nano-biotechnology and Nanomaterials.

R. Chattopadhyay, *Ph.D. (IIT Delhi)*
Emeritus Professor
Yarn Manufacturing Processes, Quality Assurance, Ropes and Cordages, Product Development.

S.M. Ishtiaque, *Ph.D. (Tech. Univ. of Liberec)*
Emeritus Professor
New Spinning Technologies, Yarn Structure, Machine Design, Textile Management.

INTRODUCTION

The Department offers a B.Tech. Programme in Textile Technology and three M.Tech. programmes in Textile Engineering, Fibre Science and Technology and Textile Chemical Processing, besides offering the Doctoral programme.

The departmental activities are focused on niche and futuristic area, such as technical & smart textiles, nanotechnology applications, biotextiles, engineering of functional apparel, etc. The department has tie-ups with several universities in India and abroad.

ACADEMIC PROGRAMMES

UNDERGRADUATE

The B.Tech. programme in Textile Technology covers development and characterization of the polymeric raw materials and methods of conversion of the same into textile materials followed by further value addition and appropriate engineering into niche products. Issues related to the management of the production facilities and marketing the products are also covered adequately.

POSTGRADUATE

The M.Tech. programme, in Textile Engineering focuses on training for mechanical processing of textile fibres into various textile products. The M.Tech. programme in Fibre Science and Technology trains students for the manmade fibre industry as well as in the chemical processing of textile materials. M.Tech. programme on Textile Chemical Processing focuses on advanced science and technology used in wet processing and trains students for the Textile Chemical Processing industry.

All M.Tech. programmes train students for both research and academic careers.

RESEARCH AREAS

Current areas of doctoral and post-doctoral research include study of structure and properties of fibres and fibrous materials, analysis and design of yarn and fabric formation systems, mechanics of production processes, comfort properties of textiles, optimization and mechanism of dyeing and preparatory processes, eco friendly processing, micro encapsulation, antimicrobial finishes, nanotechnology applications, plasma treatment, design of technical textiles, smart and innovative textiles, electroconductive textiles, medical textiles and tissue engineering, polymer composites and apparel engineering. The activities are supported by several funded projects.

LABORATORY FACILITIES

The Department has several state of art laboratories which are briefly described below:

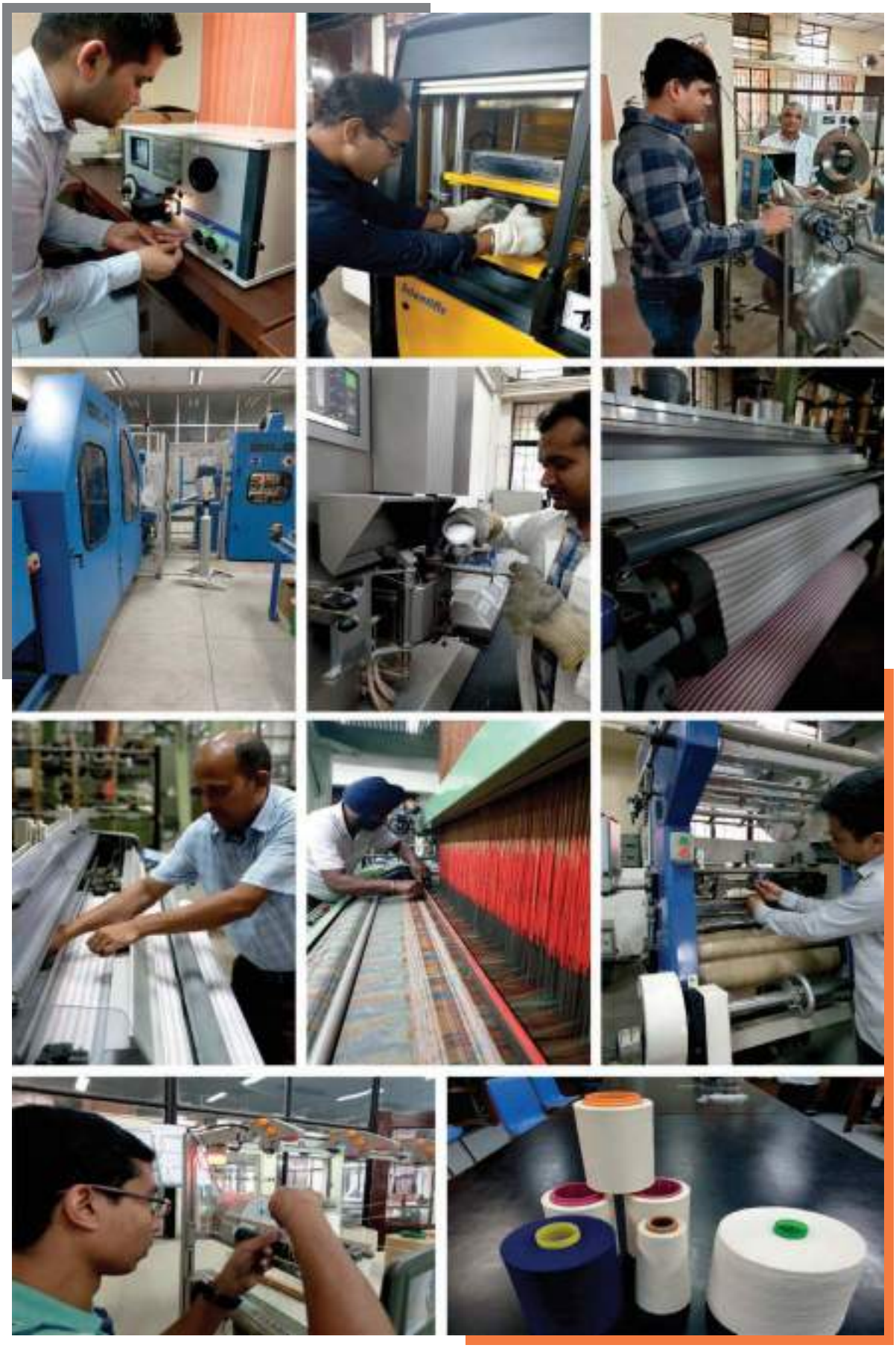
- **ECWC Lab (Extreme Cold Weather Clothing Lab):** A fully body Asian male medium-size Newton sweating thermal manikin having 34-zones with motorized walking motion stand placed in a climatic chamber is installed at Building 99°C. The sweating rate and heat flux can be set independently. The Oprational range of climatic chamber are: -60 to +70°C and RH 10 to 95%.

- **Fibre Science and Fibre Production Laboratory:** This Laboratory houses facilities starting from fibre Production to fibre Characterization. It hosts a complete range of characterization equipment such as DSC, TGA and TMA, Brookfield Rheometer, FTIR, Wide angle X-ray diffractometer, sonic modulus analyzer, etc. It also houses facilities for polymerization from small to pilot scale. Recently bicomponent fibre production facility has also been installed.
- **Yarn Manufacturing Laboratory:** This Laboratory houses a wide range of machines for producing yarns with different technologies at research as well as production scale. Staple fiber yarns can be produced by using ring, and friction spinning technologies. Miniaturized spinning machines are also available for Small-scale preparation of yarn samples.
- **Fabric Manufacturing Laboratory:** The Weaving section is equipped with modern preparatory machines and looms. Preparatory section includes latest Schlafhorst 332 model winding machine, Savio lab model Orion winding machine and sectional warping machine with all controls. In weaving Section- projectile, rapier, water jet and airjet looms as also a sample loom along with single end sizing and warping machine are installed. Apart from these, the lab is equipped with needle loom for tape and label, Staubly electronic dobby and Bonas electronic jacquard. Weaving section is also equipped with a CAD station system for both woven and printed design. Knitting section includes flat knitting and circular machines. Nonwovens Research laboratory is part of this lab. Industrial sewing machines constitute the garment technology facility.
- **Textile Chemical Processing Laboratory:** Housed in this laboratory are lab scale versatile equipment for chemical processing of textile fabrics, yarns and fibres. In addition, the laboratory contains relevant analytical/testing equipment for assessing performance of treatment imparted to textiles including computer colour matching system, spectrophotometers, fastness tester, Flame retardancy tester and a full-fledged antimicrobial testing facility. Textile chemistry laboratories are equipped with a wide range of dyeing, printing and finishing machines including IR dyeing machines, HT-HP dyeing machine, lab scale jigger and padding mangles. New additions include magnetic levitation based yarn dyeing system, Plasma machine for surface functionalization, Weather-o-meter, Cone calorimeter, Limiting oxygen index tester, Vertical flammability tester, Electro-chemical work station, Freeze dryer and Rota evaporator, BOD, Padding mangle, Drying & curing chamber, High temperature steamer, etc.
- **Textile Testing Laboratory:** Physical Testing Laboratory of the department is a state of the art lab for testing textile fibers, yarns and fabric.
  - » **Fiber Testing:** Physical properties of fibers like length, strength, fineness and maturity etc. can be accessed with various basic instruments such as bear sorter, fiber fineness tester, HVI for measuring basic properties like fiber length, maturity, fineness and strength.
  - » **Yarn Testing:** Physical Properties of yarns are important for its further use in fabric production. Various physical properties of yarns affect the fabric quality. Several instruments are available for yarns testing including Yarn Evenness Tester, Auto Twist Tester, Instron Tensile tester, CSP measuring machine, Yarn Hairiness Tester, Yarn to yarn and yarn to metal Friction meter etc.
  - » **Fabric Testing:** Physical and thermal properties of fabric are of practical importance in many advanced engineering applications. Most common physical and thermal properties are thickness, areal density, tensile strength, tear strength, flexural rigidity, drapability, crease recovery, Pilling and abrasion, bursting strength, air permeability, water vapor permeability, moisture management behavior, fabric hand value, thermal conductivity, thermal resistance, thermal insulation behavior and Hydrostatic head testing . Several instruments are available for the above fabric testing such as Instron tensile strength Tester, Kawabata tester (tensile, compression, shear and bending module), water wicking tester, WVTR, Bursting strength tester, Moisture management Tester.

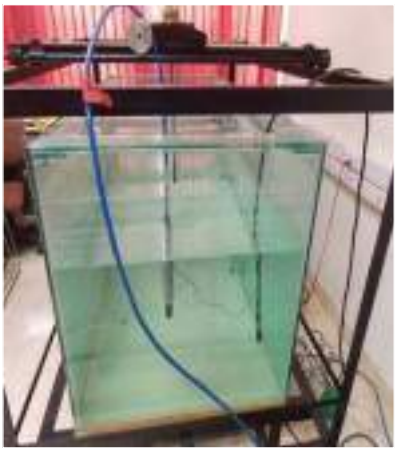
- **SMITA Research Laboratory:** SMITA Research Lab has emerged as a prime centre of research in the field of Smart Materials and Innovative Textile Applications. Centre has been instrumental in developing novel technologies with key focus on areas like nanomaterial based specialty finishes and coatings, advanced composite fibres and films, nanofibres, responsive materials, atmospheric pressure plasma processing and wearable electronics. SMITA Research Lab owns the world class and most modern state of the art facilities under one roof for ultra-precision analysis and development of the next generation technologies. Some of the important facilities are High Resolution TEM 200 KV with EDS and EELS, FESEM with Oxford EDS system, FESEM with peltier stage, 400 MHz Solid and liquid state ready NMR, Confocal dispersive Raman microscope with automated stage, Micro Tensile Tester, Capillary flow porometer, Rotational Rheometer, Melt Capillary Rheometer, Pressure Drop Analyser with Particle Counter, Electrical property measurement system, GCMS, FTIR-ATR, Differential viscometer and RI detector, DSC, TGA, AFM etc. Centre has a fully equipped chemical lab and houses top notch sample preparation and pilot facilities like Padding, drying and curing units, Plasma processing unit, Bicomponent fiber melt spinning unit, Pilot Reactors, Microbial testing lab, Continuous melt coating unit, Electrospinning systems, Twin Screw Extruder, high temperature muffle furnace, IR dyeing and laundrometer machine, hydrothermal reactors, spin coater, environmental chamber, etc.
- **Aerostat and Airship Material - Processing and Characterization Lab:** A state of the art laboratory has been set up under Smart and Intelligent Textiles (SITEX) vertical of Joint Advanced Technology Centre (JATC) sponsored by 'Defence Research and Development Organisation', Govt. of India for developments related to Aerostat and Airship Hull. The focus of this lab is to develop advanced coated and laminated textiles using specialty fabrics, polymeric resin and films and adhesives to get light weight, strong, weather resistant material with excellent gas barrier properties. Major processing facilities are– Single Screw Extruder with Extrusion cast Line, Twin Screw Extruder with Mini Injection Moulding machine, Hot Melt Coating and Laminating Machine and Solution coating machine. The testing and characterisation include– Thermal system (DSC/TGA/DMA), FTIR, Weatherometer, UTM, Gas Permeability Tester and Flex Durability Tester.
- **JATC Soft Body Armour Materials Laboratory:** The objective of this research lab is to develop soft body armour materials using high performance fibres like Kevlar, Dyneema, Spectra, Zylon etc. 2D and 3D fabric structures are woven by varying various structural parameters on single rigid rapier loom. Often these fabrics are treated with silica based Shear Thickening Fluid (STF) and nano additives. Finally, fabrics and soft armour panels are evaluated for impact resistance using drop tower and ballistic resistance using 9 mm lead core bullet.

  The facility houses Sample loom for 3D weaving, Compression moulding machine, Super mass collider, Padding mangle, High energy drop tower, Rheometer and UV transmittance analyser.
- **Focus Incubation Centre for 3D Weaving and Structural Composites:** This centre was established with the financial support from Ministry of Textiles, Govt. of India. The objective of this centre is to develop variety of innovative 3D woven structures such as 3D solid structures, spacer fabrics, honeycombs, profiled fabrics, tubular structures, aerodynamic structures, stiffeners and 3D auxetic structures primarily suitable for structural composite preforms. The centre also converts these complex 3D fabrics into their respective composite materials. Apart from development of various 3D fabrics and structural composites, the center is equipped with the facilities to characterize these materials. The characterization includes mechanical performance, structural analysis, damage analysis and surface morphology investigation of preforms as well as composites. As of now, the department has already acquired some major facilities such as 3D weaving machine using multi beam looms as well as creel fed loom, 4-axis Filament winding machine, Compression moulding machine, VRTM system, UTM with flexural, compression, shear test modules, Impact testing both by drop weight and Izod system, Scanning Electron Microscopy, Fabric thermal tester, and many other ancillary equipment relevant to 3D weaving and composite processing.

- **Regenerative Engineering Laboratory:** This laboratory houses experimental facilities to conduct research at the interface between fundamental and applied research, by combining the principles of Textile Technology (Medical Textiles) and Tissue Engineering to (a) develop novel engineering solutions for complex clinical diseases; (b) gain better qualitative and quantitative understanding of the tissue micro-environmental conditions fundamental for tissue development and pathogenesis; (c) develop patient-specific constructs by 3D Bioprinting.
- **Computer and Microprocessor Laboratory:** Facilities in these labs are used by students for course work, internet search, preparing reports, analyzing test data and preparing presentations. The microprocessor section of this lab is used to teach control and monitoring systems.
- **Resource Centre and Library:** The resource centre is a repository of resources essential for investigators to further their research, for a student to continuously upgrade his knowledge database and for a teacher to keep abreast with the state of art in today's world of textiles. The resource centre has a wide compilation of books, reports, theses (Ph.D., M.Tech. and B.Tech.) and journals. It also has a rich collection of samples of technical textiles for various applications.








CENTRE FOR

APPLIED RESEARCH IN ELECTRONICS



Head of the Centre

Ananjan Basu, *Ph.D. (Univ. of California)*
Professor
Microwave and Millimeter-wave Engineering, Antennas, Microwave Imaging.

Mahesh P. Abegaonkar, *Ph.D. (Pune Univ.)*
Associate Professor
Microwave Engineering, Antennas, Metasurfaces, Periodic Structures.

Monika Aggarwal, *Ph.D. (IIT Delhi)*
Professor
Signal Processing, Communication, Sensor Array Processing and Underwater Acoustics.

Prabhu Babu, *Ph.D. (UU, Sweden)*
Associate Professor
Signal Processing and Communications, Machine Learning and Optimization.

Samaresh Das, *Ph.D. (IIT Kharagpur)*
Associate Professor
Quantum Electronics, Optoelectronics, THz and Nano Electonics.

Kirti Dhwaj, *Ph.D. (University of California, Los Angeles, USA)*
Assistant Professor
Filter/Antenna Systems.

Ankur Gupta, *Ph.D. (IIT Bombay)*
Associate Professor
MOS and III-V Device Design, RF CMOS Circuit Design, Wireless Power Transfer.

Arun Kumar, *Ph.D. (IIT Kanpur)*
Professor
Digital Signal Processing, Speech, Audio and Underwater Acoustics, Multi-sensor Data Fusion.

Rahul Mishra, *Ph.D. (NUS, Singapore)*
Assistant Professor
Nanoelectronics, Spintronics, Neuromorphic Devices.

Pushparaj Singh, *Ph.D. (NTU, Singapore)*
Associate Professor
Microelectromechanical Systems (MEMS) Sensors and Micro-systems, Nano Devices, Through-silicon via Interconnects and Packaging, MEMS/NEMS for Biomedical Applications.

R. Bahl, *Ph.D. (IIT Delhi)*
Emeritus Professor
Sensor Signal Processing, DSP System Design, Underwater Acoustics, Bio-Acoustics.

S.K. Koul, *Ph.D. (IIT Delhi)*
Emeritus Professor
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Vikram Kumar, *Ph.D. (Lehigh Univ. USA)*
Honorary Professor
Semiconductor Physics & Technology.

Ulrich L. Rohde, *Ph.D. (Clayton Univ., USA)*
Honorary Professor
Microwave circuits, (Amplifiers, Oscillators and Mixers) as well as Frequency Synthesizers.

INTRODUCTION

The Centre for Applied Research in Electronics focuses on research and training in specialized areas of Electronics. These areas are Signal Processing, Microwaves and Microelectronics. The Centre has several excellent laboratory facilities for intensive Hands-on Post-graduate training and conducting advanced research work.

ACADEMIC PROGRAMMES

POSTGRADUATE

M.Tech. in Radio Frequency Design and Technology (RFDT) [Duration: 2 years/4 Semester]

A multidisciplinary Masters programme in Radio Frequency Design & Technology (RFDT) is offered by the Centre. The programme provides specialization in Signal Processing / Microwaves / Microelectronics. This course is unique in India imparting hands-on training that focuses on hardware and experimental work in a wide range of topics like real-time digital signal processing and applications, speech and audio signal processing, wireless and underwater communications, antenna design, active and passive circuit design at microwave and millimeter wave frequencies, fabrication of solid-state devices, MEMS based sensors and actuators, RF MEMS etc. The projects done by the students provide an opportunity to do applied research work that is often of great relevance to industry.

RESEARCH AREAS

The Centre offers doctoral programme that is highly rated in the country.

- **Microwaves and RF:** RFIC and RFMEMS, Imaging and Surveillance, RF Digital Co-design, Active and Reconfigurable Antennas and Arrays, High Power Solid-state Systems, Nonlinear Modeling and Measurements, Components & Systems up to THz.
- **Signal Processing:** Acoustic Signal Processing for Underwater and Air applications, Speech and Audio Signal Processing, Signal Processing for Communications, Sensor Array Signal Processing, Multi-Sensor Data Fusion, Signal Processing for IoT.
- **Microelectronics:** MEMS and Microsystems, Nanoelectronics, Microsensors development for defense, space, health and environmental monitoring, mm-wave and THz devices and technologies.

LABORATORY FACILITIES

The Centre has several State-of-the art facilities, this includes:

- Water-tank facility for underwater acoustics experiments
- Acoustic Anechoic Room for air acoustics/audio experiments
- Transducers, sensors, amplifiers and other electronics equipment for underwater and air acoustic research experiments
- Multi-channel data acquisition systems
- Computational platforms for high-speed DSP
- ABM Mask Aligners
- Laser writer (direct lithography)
- Multi-target DC and RF sputtering system
- E-test for microdevices (under variable temperature and pressure)
- E-beam evaporator
- Reactive Ion Etching
- Diffusion and oxidation furnace
- HF vapour etching systems
- RF Anechoic Room for antenna testing and characterization
- Vector network analyzers (up to 1THz) and Spectrum Analyzer (up to 40 GHz)
- Probe stations, Free space material property measurement
- RF MEMS and EM simulation tools
- Microwave Signal Sources
- THz detector testing bench

Microelectronics Lab (Fabrication & Device Testing)







CENTRE FOR
ATMOSPHERIC SCIENCES




Head of the Centre

Somnath Baidya Roy, *Ph.D. (Rutgers, USA)*
Professor
Land-atmospheric Interaction, Deforestation, Agriculture, Carbon Cycle; Mesoscale and Boundary Layer Modeling, Regional Climate Change; Renewable Energy Meterology.

Krishna Mirle AchutaRao, *Ph.D. (Tulane Univ. USA)*
Professor
Climate, Climate Modelling, Climate Model Validation, Climate Variability, Climate Change Detection and Attribution, Ocean Heat Content, Sea-level Rise, Air-sea Heat Transfer and Climate Data Analysis Tools.

Sagnik Dey, *Ph.D. (IIT Kanpur)*
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Air Quality, Climate Change and Human Health, Aerosol-Cloud-Climate Interaction, Remote Sensing of the Earth's Climates System.

Yama Dixit, *Ph.D. (University of Cambridge, UK)*
Assistant Professor
Proxy Reconstructions and Paleoclimate Dynamics, Changes in Hydrology, Abrupt Climate Change and Impacts on Ancient Societies.

Sarvesh Kumar Dubey, *Ph.D. (IIT Delhi)*
Assistant Professor
Atmospheric Modelling, Atmospheric Dynamics, Numerical Weather Prediction, Climate Modeling, Observational Analysis and Tropical Meteorology.

Dilip Ganguly, *Ph.D. (Physical Res. Lab., Ahmedabad)*
Associate Professor
Aerosol-cloud-precipitation Interaction, Cloud Parameterization, Radiative Forcing and Climate Change, Climate Sensitivity and Feedback Processes, Climate Diagnostics, Monsoon Dynamics.

Shahzad Gani, *Ph.D. (University of Texas at Austin)*
Assistant Professor
Designing and Executing Long-term Atmospheric Measurements, Setting up and Operating Range of Air Quality Instrumentation - low-cost to State-of-the-art, Complementing Field Measurements with Satellite and Modeling Datasets, Interpreting Air Quality Observations in the Context of Physics, Chemistry, and Meteorology, Studying Aerosol Dynamics in Extremely Polluted Environments.

Ravi Kumar Kunchala, *Ph.D. (University of Pune)*
Assistant Professor
Atmospheric Chemistry, Transport Modeling, Remote Sensing of Greenhouse Gases, Monitoring and Modeling of Greenhouse Gases.

Saroj K. Mishra, *Ph.D. (IISc., Bangalore)*
Associate Professor
Climate Modelling, Indian Monsoon, Climate Projection, Climate Change, Climate Mitigation and Adaptation, Tropical weather and Climate.

Manju Mohan, *Ph.D. (IIT Delhi)*
Professor
Numerical Modeling of the Atmospheric Boundary Bayer, Chemical Transport Modeling and Atmospheric Pollution Studies, Heat Island Measurements and Modeling, Urban Climate, Science of Extreme Weather.

Samiran Mandal, *Ph.D. (IIT Bhubaneswar)*
Assistant Professor
Physical Oceanography, New Generation Ocean Observing Platforms, Mesoscale and Sub-mesoscale Ocean Processess.

Vimlesh Pant, *Ph.D. (Univ. of Pune)*
Associate Professor
Physical Oceanography, Ocean Modelling, Air-sea Interaction, Atmospheric Aerosols, Meteorological and Oceanographic Observations.

Sajeev Philip, *Ph.D. (Dalhousie University, Canada)*
Assistant Professor
Earth's Climate and Global Surface Air Quality, Carbon Cycle and Greenhouse Gases Science, Public Health Impacts due to Aerosols and Trace Gas Exposure.

Sandeep Sukumaran, *Ph.D. (IIT Kharagpur)*
Associate Professor
Climate Modeling, Indian Summer Monsoon, Climate Change.

A.D. Rao, *Ph.D. (IIT Delhi)*
Emeritus Professor
Ocean State Forecasting, Storm Surge Modeling, Coastal Circulation, Internal Waves.

INTRODUCTION

The Centre for Atmospheric Sciences (CAS) was set up in the year 1979 with the objective of undertaking modelling studies of atmospheric and oceanic processes for a better prediction of monsoon and its variability. Subsequently, the Ministry of Education, Government of India funded the Centre under the Sixth Five Year Plan. The Centre was also Co-sponsored by the India Meteorological Department with a view to initiate research and mathematical modelling in meteorology in an academic institute. In 1981, the Planning Commission upgraded CAS to an advanced Centre for research. In order to complement its research activities, the Centre started the Ph.D. programme in atmospheric sciences which was the first of its kind in the country. In 2008, CAS started the M.Tech. programme in "Atmospheric and Oceanic Sciences & Technology" with the support of Ministry of Earth Sciences and Indian Space Research Organization. In the year 2011, the UG Minor Area Programme "Atmospheric and Oceanic Sciences" was initiated, which is the only one of its kind in the country. Currently, the Centre has faculty strength of 15. In the last five years, 30 Ph.D. and 50 M.Tech. degrees have been awarded by the Centre. Based on the number of research publications, degrees awarded, courses offered and student/faculty strength criteria, we estimate that CAS is ranked nationally among the top two Centres/Departments in the field. According to the 2011 US National Academy of Sciences benchmarking criteria, we also compare favorably with all US Centres/Departments in our discipline.

ACADEMIC PROGRAMMES

Currently CAS has three vibrant teaching programmes, namely:

- B.Tech. Minor Area in Atmospheric Sciences
- M.Tech. in Atmospheric-Oceanic Science & Technology
- Ph.D.

UNDERGRADUATE

The Centre has initiated Minor Area Programme in Atmospheric Sciences since 2011-12. In this minor area programme, there are six courses exclusively designed for UG students, which deal with fundamentals of weather, climate, climate change, oceanography, monsoon, earths physical processes climate modeling. UG Students need to take at least 2 courses from this pool for minor area.

The students also have options for 26 electives where they have a wide range of choice from various applied courses covering all important topics in atmospheric and oceanic sciences. In order to complete the Minor Area Programme in Atmospheric Sciences, students need to earn 20 credits from among these courses. A minor area project of 5 credits is also introduced as part of the minor area programme to facilitate completion of 20 credits.

POSTGRADUATE

i) The M.Tech. Programme in Atmospheric-Oceanic Science & Technology is designed to train students from diverse backgrounds in the exciting field of Weather and Climate. The courses are also oriented to help the graduate students get employed in government organizations, public and private sectors or continue in a doctoral programme within the country and abroad. There are 11 core courses including three bridge courses and a Major Project. Major projects provides an opportunities to students to work on state-of-art- research topics in diverse areas of Weather, Climate and Atmospheric transport of pollutants. In addition to these core courses, there are a number of electives which include all state-of-the-art topics in atmospheric and oceanic sciences. Some special modules for one credit are also floated every semester which are usually timed with the visits of distinguished scientists from inside the country and abroad.

   In order to complete the M.Tech. programmes in Atmospheric Sciences, students need to earn 54 credits from among these courses.

ii) The Ph.D. programme is for highly motivated students Interested in an academic career. In addition to a thesis on a State-of-the art topic, students are required to complete 12-18 credits of coursework depending on their background.

RESEARCH AREAS

The goal of CAS is to carry out cutting-edge Interdisciplinary research and create highly skilled manpower through M.Tech. and Ph.D. Programmes in 4 core areas: atmospheric modeling, oceanic modeling, air pollution and climate science. In the last five years, CAS faculty has published about 200 publications in Peer-reviewed SCOPUS Journals. Regular seminars by distinguished speakers of International repute from India and abroad are arranged in the Centre so that our faculty and students can keep abreast of the latest scientific developments in the field.

Key Research Areas:

- **Atmosphere:** Numerical Modeling of the Atmosphere, General Circulation, Tropical Meteorology and Indian Monsoon, Land-Surface Process Modeling, Land-Atmosphere Interaction, Chemical Transport Modeling.
- **Ocean:** Ocean Modeling, Coastal Processes, Ocean State Simulations and Forecasting, Storm Surges and Inundation.
- **Climate:** Climate Dynamics, Climate Variability and Changes, Climate Change Detection & Attribution, Global and Regional Climate Modeling, Climate Projections, Climate Change Impacts on Extreme Weather, Health, Agriculture, Water Resources and Energy, Aerosol-Cloud-Climate Interactions, Paleoclimate.
- **Air Pollution Modeling:** Urban Meteorology, Air pollution dispersion and chemical transport modeling, Air Quality and Health Impact Studies, Heat Island Measurements and Modelling, Fog Prediction.
- **Applied Mathematics:** Numerical Methods, Data Assimilation and Adjoint Modeling, Inverse Modeling, GPU Computing.
- **Renewable Energy:** Renewable Energy Meteorology, Renewable Energy Resource Assessment and Forecasting.

LABORATORY FACILITIES

The Centre for Atmospheric Sciences maintains the following state-of-the-art laboratories:

- Computing Server Lab
- Climate Modelling Lab
- Air Quality Modelling Lab I & II
- Atmospheric Measurement Lab
- Mesoscale Modelling Lab
- Remote Sensing Lab
- Ocean State Forecasting Lab
- Atmospheric Observatory at Sonipat Campus

a) IIT Delhi PADUM HPC System:

Partial funding is provided by CAS in the form of DST-FIST grant (500TB & 60 Tera-Flop) for the procurement of the Hybrid High Performance Computing Facility named PADUM (1 Peta-flop, 1500TB) at IIT Delhi. CAS receives more computing time compared to users from other department of IIT Delhi on the PADUM HPC system.

IIT Delhi HPC PADUM system has following configurations:

- High Power Hybrid Computational Facility of 1 PFlops
- Total 606 compute nodes (382 CPU + 201 GPU + 23 Xeon Phi nodes)
- In addition, there are 4 general login nodes, 2 GPU login nodes and 2 Xeon Phi Login nodes.
- Storage capacity of 1500 TB

b) Sikka: A 320 TB Storage-cum-data analysis server located in the Center's Computing Server Lab.

c) Storage: A 115TB data storage server located in the Center's High Computing Server Lab.

d) Krish: A 256 TB storage cum data analysis server located in Centre's Computing Server Lab.

The computing laboratories at the Centre are equipped with state-of-the-art desktop workstations for data analysis and visualization with software's such as ERDAS imagine, ArcGIS etc.

The following equipment are available in CAS laboratories for weather, climate and air quality monitoring:

Main Campus:

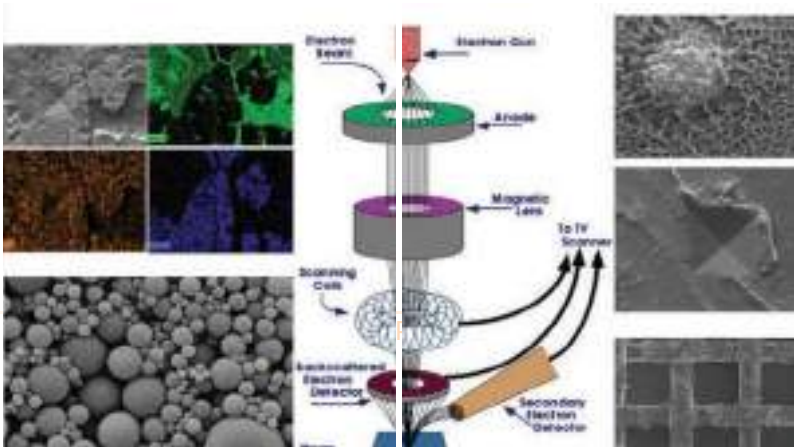
- Aethalometer
- 10 m tall tower with AWS
- AQMS IMD-IITD SAFAR station
- PM Sampler
- AMOD sampler for NASA AERONET
- SPARTAN
- Low-cost sensor testbed
- Heat-stress monitor
- Upright metallurgical microscope
- Stereo Zoom microscope
- Muffle furnace
- Water quality sensors

Sonipat Campus:

- LiDAR Ceilometer
- AWS with Pyranometer and Pyrheliometer
- Neutral cluster and Air Ion Spectrometer
- Optical Particle Sizer
- AMOD Sampler
- Real time Environmental Monitor
- CRD Spectroscopy Gas analyzers
- Aerosol Chemical Speciation Monitor
- Scanning Mobility Particle Sizer

CENTRE FOR

AUTOMOTIVE RESEARCH AND TRIBOLOGY



Head of the Centre

B.K. Panigrahi, *Ph.D. (Sambalpur Univ.)*
Professor
EV, Charging Infrastructure, IoT & Cyber Security.

Saptarshi Basak, *Ph.D. (IIT Kharagpur)*
Assistant Professor
Design of Special Machines for Automotive Applications, On-board Generation Systems, Control and Estimation in Variable Speed AC Drives.

Husain Kanchwala, *Ph.D. (IIT Kanpur)*
Assistant Professor
Applied Dynamics and Vibrations, Rotordynamics of Vehicular Transmissions, Vehicle Propulsion, Vehicle System Dynamics and Control, Systems Engineering and Functional Safety.

Deepak Kumar, *Ph.D. (IISc., Bangalore)*
Professor
Metal Working, Nanotribology, Contract Mechanics, Atomic Force Microscopy, Surface/ Interface Analysis.

Shahab Fatima, *Ph.D. (IIT Kharagpur)*
Associate Professor
Machinery Health Monitoring, NVH, Acoustical Natural Materials, Reliability and Maintenance.

Krishna Raj R., *Ph.D. (IISc., Bangalore)*
Assistant Professor
Powertrain-drives and Control for Electric Vehicles, more Electric Aircraft Power System, Multilevel Converter Topologies for Drives.

Naresh Tandon, *Ph.D. (IIT Delhi)*
Emeritus Professor
Machine Health Monitoring, Noise Engineering, Vibration, Noise and Acoustic Emission.

INTRODUCTION

The Centre for Automotive Research and Tribology (CART) was established in May 2019 with a vision to promote interdisciplinary research in the area of Electric Vehicle (EV), energy storage and other relevant areas. The centre envisages strong networking and collaboration among various academia, industries, research labs in India and abroad to carry out cutting edge research.

ACADEMIC PROGRAMMES

POSTGRADUATE

The new M.Tech. Programme in "Electric Mobility" is multidisciplinary in nature and will cover key aspects related to electric vehicles, drivetrain, chargers and charging infrastructure, battery energy storage systems, battery management system, reusability of energy storage elements, reliability, automotive health monitoring, Automotive NVH (Noise, Vibration, and Harshness), vehicle dynamics, autonomous and connected vehicles, vehicular telematics, and materials for electric vehicle, along with hands on practice and design in laboratories.

LABORATORY FACILITIES

- Electric Vehicle Laboratory
- Powertrain Laboratory
- Charging Infrastructure laboratory
- Automotive Health Monitoring Laboratory
- Design and Data Analytics Laboratory
- Dyno Laboratory
- Battery Laboratory
- Project Laboratories
- Scanning Electron Microscopy Laboratory
- Tribology laboratory

KEY FACILITIES AVAILABLE

- Grid Simulator
- Battery Management System
- Rapid control Prototyping Platform
- Battery Tester
- Battery Emulator
- Battery Electrochemical Impedance Measuring System
- Battery Pack Spot Welding Machine
- Battery Cell Simulator
- AC and DC Simulator
- Chargers and Charge Discovery System
- Machine Fault Simulator
- Acoustic Camera
- Data Acquisition Systems
- 4 microphone Transmission loss setup
- Modal Exciter
- Scanning Electron Microscopy (SEM)
- Sound Quality Analyzer
- Thermal Imaging Camera
- Battery Simulation software
- Electric Vehicle modelling software
- Power Quality Analyzer

Ongoing Research Areas:

Power Electronics and Drives for Electric Mobility: The focus is on the design and development of high-power density power electronics converters, onboard chargers, machines for electric vehicles, power train technology and various controllers for drives and converters. Development of various novel control algorithms for converters and motor drives is one of the key focus at present. The future plan is for the development of fuel Cell-based electric buses in association with various industry partners.

Charging Infrastructure: A great emphasis is given for the design and development of Level1, Level2 chargers, Fast DC chargers, battery swapping stations etc. Researchers are also involved in the development of various intelligent algorithms for the placement of fast charging stations and battery swapping stations in a distribution network. We are also looking into the Grid issues pertaining to the higher penetration of EVs.

Battery and Battery Management System: In context of batteries, the key areas of research at CART are (a) Battery materials; (b) Novel thermal management system for maintaining temperature uniformity among the cells and restrict the rise of maximum temperature above normal conditions; (c) Digital twin based on IoT; sensors; cloud computing; Multi-physics modelling and machine learning for Real-time monitoring of SoC and SoH of batteries under dynamic discharge conditions; (d) Aging controlled fast charging of batteries by evaluation of optimal charging current, and simultaneously optimizing charging time and capacity.

Automotive Health Monitoring and NVH: The thrust of the research is on the development of an intelligent fault diagnosis and prognosis system for electric vehicles and remaining useful life estimation of components of electric vehicles. The research is also focused on the improvement of NVH (Noise, Vibration, and Harshness) characteristics of the electric vehicle by developing strategies for noise characterization, control, and detection of electric vehicles.

Autonomous Vehicles: The modern vehicles come with a myriad of sensors and hence it makes design sense to integrate additional sensors to enable autonomy, starting from systems for lane departure to parking assists to complete driverless platoons. The research focus is mainly to enable sensor fusion to enable perception, developing embedded system with safety properties running millions of codes in an autonomous EV system. Close collaboration with faculty in CSE, ME and EE working in the area of Robotics, embedded systems and AI/ML will lay the foundation for a strong research programme in autonomous vehicles.

CART Inauguration

EV Battery Charging Setup facility from Grid

Battery Spot Welding System

BATTERY TESTING SYSTEM

Battery Regenerative Testing

- Regenerative battery energy discharge/charge
- Module/Pack surface temperature monitoring
- Cell and Pack level testing at OCV and HPPC
- DCIR Testing
- Testing of different Charging Protocol
- Bi-directional Battery Emulator

Cell Tester & Simulator

- Bidirectional Power Supply Design
- Battery Pack Voltage Simulation Ability
- High Precision V-I Measurements
- Parallel Operation for current sharing design
- Short-circuit Simulation Test via BMS

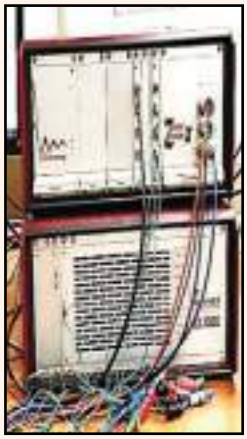
Environmental Chamber

- Cell, Module and Pack Testing at specific temperature and humidity
- Temperature Range: -20 °C to 100 °C
- Humidity: 10% RH to 98% RH

BMS Emulator

- NTC/PTC Simulation; Emulation of temperature sensors
- Extended Fault Simulations
- R-ISO Check
- Emulate Isolation Resistor
- High Precision Cell Emulation

Electrochemical Workstation



- Polarization curve plotting
- Multi-cell Multi-Tasking Voltammetry
- Arbitrary Current Potential & Time Measurements
- Automatic Series Measurements

Multi-channel Potentiostat

- Voltammetry
- Internal Impedance
- Pulsed Test
- Ohmic drop Determination
- Urban Cycle Simulation
- Corrosimetry
- IV Characterization

AUTOMOTIVE HEALTH MONITORING

Automotive Condition Monitoring

Machinery Fault Simulator

Simulation of rotating machine faults and diagnosis using AI-based condition monitoring techniques.

Faults

- Motor Fault
- Bearing Defect
- Gear Box Fault
- Unbalance
- Misalignment
- Crack Shaft

Diagnostic Techniques

- Vibration Monitoring
- Motor Current Signature Analysis
- Noise Monitoring
- Acoustic Emission
- Thermography

Development of intelligent fault diagnosis and prognosis system for automotive and allied components.

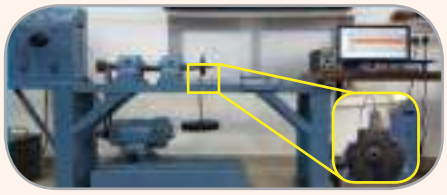
Components

- EV Motors
- Bearings
- Gear Box

Analysis Methods

- Artificial Intelligence
- IoT
- Sensor Fusion
- Signal/Image Processing

Motor Test Rig



Automotive Noise, Vibration and Harshness (NVH) Measurement

Acoustic Holography and Beamforming

Estimation of acoustic parameters using an array of microphones and particle velocity transducers.

Noise Source characterization and Control

- Sound Intensity Measurement
- Noise Source Identification and Ranking
- Transfer Path Analysis
- Airborne Noise Measurement

Modal Analysis

- Resonant Frequency
- Structure-borne Noise
- Mode Shapes

Sound quality and overall characteristics measurement to enhance drive comfort and experience.

Head and Torso Simulator (HATS)

- Loudness
- Sharpness
- Roughness
- Tonality
- Prominence Ratio

Sonoscout (8 Channel DAQ with CAN BUS)

- Battery Temperature
- Tire Pressure
- Air Quality
- EV Motor Parameter
- ECU Data Analysis
- NV characteristics

Sound Quality Measurement

Pass-by Noise Test

Estimation of vehicle sound to limit its contribution towards traffic noise.

Noise Source Identification

- Pedestrian Alertness System
- Sound Pressure Measurement
- Sound Power Determination
- Sound Intensity Identification
- Exhaust Noise of ICE
- Aerodynamic Noise
- Tyre Screeching Noise

Acoustical Material Test Setup

Material Performance Metrics

- Sound Absorption Coefficient
- Noise Reduction Coefficient
- Flow Resistivity Measurement
- Sound Transmission Loss
- Sound Transmission Class

CENTRE FOR

BIOMEDICAL ENGINEERING

Head of the Centre

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FRP Composite Materials, Processing and Manufacturing, Injection Molding, Biomaterails.

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Computational Medicine, Physiological Modeling, Synthetic Biology, and DNA Nanotechnology.

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Biomaterials, Drug Delivery, Cancer Diagnosis & Therapy.

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Biomaterials, Application of Raman Microscopy and Spectroscopy for Tissue Engineering, Graphene-Polymer Composite, Cancer Metabolism, Liquid-liquid Phase Separation in Biology, Fibrin-platelet Interaction.

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Biosensors; Nanoparticle Sensing; Microfluidic Lab-on-a-chip; Capillary Electrophoresis Microchip; Immobilization and Stabilization of Biomolecules.

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Quantitative Medical Image Analysis for CT and MRI, Perfusion and Diffusion Imaging, Neuro-rehabilitation, Mobile Healthcare.

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Biomaterials, Tissue Engineering, Exosome Engineering, Immunomodulation, Oxygen Therapy.

Anup Singh, *Ph.D. (IIT Kanpur)*
Associate Professor
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Naveen Kumar Singh, *Ph.D. (IIT Guwahati)*
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Biosensor Development at the Interface of Bioengineering, Electronics, Chemistry, Biophysics, and Chemical Biology; Programmable Biomaterials using Nucleic Acid (Aptamer) and Hydrogels that can Undergo Dynamic and Controllable Changes on Demand.

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Design of Nano-structured Materials for Biomedical Implants, Cancer Diagnostics & Therapy, Tissue Engineering, Drug Delivery, Study of the Bioactivity of Nanostructures and Finding Structure-bioactivity Relationships.

Harpal Singh, *Ph.D. (IIT Delhi)*
Emeritus Professor
Medical diagnostics, Drug Delivery Systems, Antimicrobial Polymers, Polymeric Hydrogels, Nanobiotechnology, Polymer based Implants & Medical Devices.

INTRODUCTION

Centre for Biomedical Engineering was established in 1971 as a Joint programme of Indian Institute of Technology, Delhi and All India Institute of Medical Sciences, Delhi. The Centre has applied engineering principles to address medical and biological problems. It has faculty from diverse backgrounds who are actively engaged in various interdisciplinary research activities. In addition, the centre has collaborative projects with major institutes and hospitals in India and abroad. Over the years, it has become a premier centre for biomedical research in the country and has provided interdisciplinary base to develop health care technologies. In the last two decades the focus has expanded to include medical imaging, tissue engineering, nanomedicine, implants, biomedical devices, and informatics approaches for the prevention, diagnosis and treatment of diseases.

ACADEMIC PROGRAMMES

The Center has a Ph.D. programme and M. Tech. programme in Biomedical Engineering. Various courses relevant to Biomedical Engineering, which are open to undergraduate and graduate students at IIT Delhi are offered by the Centre.

Some of the courses being offered include Introduction to Basic Medical Sciences for Engineers, Industrial Biomaterial Technology, Research Techniques in Biomedical Engineering, Tissue Engineering, Biomaterials, Biosensor Technology, Medical Imaging and Processing, Emerging Biomedical Technology & Health Care, Biomechanical Design of Medical Devices, Cancer: Diagnosis and Therapy, Point-of Care-Medical Diagnostic Devices, Orthopaedic Device Design, Biofabrication, Nanomedicine, and Computational Biomechanics.

M.Tech. students from CBME are pursuing higher studies from reputed universities around the world. Several students are currently employed in leading biomedical and healthcare related companies.

RESEARCH AREAS

The Centre's research focus spans in four thrust areas:

- **Bio-Instrumentation:** Biosensor, Molecular markers in diseases, Lab-on-a-chip, Microfluidics, Biomedical transducers and sensors, Neuro endoscopy, Integrated healthcare, Assistive devices & rehabilitation, DNA based diagnostics.
- **Biomaterials:** Nanomedicine, Controlled drug delivery systems, Soft skin regeneration, Targeting of bioactive molecules to brain and cancer, Wound care healing, Tissue engineering, Medical diagnostics and therapy.
- **Biomechanics:** Orthopaedics, Orthodontics, Computational analysis and software packaging, Neuromechanics, Neural prosthetics, Soft tissue mechanics, Artificial tissue.
- **Medical Imaging:** Development of protocols, techniques, methodology and software tools along with evaluation of their clinical potential; Medical image processing, Quantitative image analysis; Applications of Machine-learning/Deep-learning.

The average number of Ph.D. students graduated over the last 5 years per faculty has been 4.4 and the average SCOPUS cited publication per faculty is 8. The Center has received extramural research funding of ~10 Crores from government funding agencies and ~20 Lakhs as industrial consultancy for the year 2019-2021.

Recently major facilities such as Confocal laser scanning microscope, Raman Spectroscopy with imaging and Flow cytometer has been installed. New labs based on drug delivery, laser micromachining, Lab-on-a-chip and image processing have been established.

Technology Developed by the Centre Include:

MRI Compatible Knee Joint Axial-Load Exerting Device, Wearable gait analysis system, Novel kit for assay of iron in biological fluids, Modulated DC iontophoretic Device, Diblock copolymer in a Nanosytem and

Implementations thereof, Contra Lateral Limb Controlled Prosthetic Knee Joint, Wireless ECG patch and system for obtaining High Definition mobile ECG, A Surgical Stapler, Bilayer dressing for wound healing; Biocompatible graphene quantum dots for drug delivery and bioimaging applications, Green Florescent Carbon Dots for pH Sensing.

The Centre has in Past Transferred Following Technologies to Industries:

Heat sealable coatings onto paper for adhesion with PVC polyester and polystyrene films for packing application, Immobilization of aminoacylase on functionalized acrylics for production of 6- aminopencillinic acid from pencillin, Antimicrobial acrylic bone cement for fixation of hip and knee joints, Polymeric nanoparticles and process of preparation thereof for delivery of peptide based anticancer agents, Contra Lateral Limb Controlled Prosthetic Knee Joint, Iontophoretic Transdermal Device for delivery of Declofenac, Opto- electronic Hemoglobinometer and Intelligent Artificial Leg.

LABORATORY FACILITIES

The Centre has the following laboratory facilities:

- Biomechatronics
- Bioelectronics, Biomechanics & Fabrication
- Biomaterials, Biosensor
- Pre-Clinical and Animal Experimentation (AIIMS)
- Bio-signal Processing
- Soft Tissue Engineering
- Drug delivery Laboratory
- Nanoparticles Characterization
- Biomaterials Instrumentation
- Nanomaterial Synthesis Lab
- Laser Micromachining Lab
- Lab-on-a-chip
- Biomedical Instrumentation
- Medical Imaging Processing
- Molecular Biology
- Bio-therapeutics
- Aritficial Tissue Lab

Injection Molding BOY XXS


3D-Printer –Stratasys Objet30 OrthoDesk


400 W CW Fibre Laser


Device Testing Laboratory


Dual Laser (CO_2 + Fibre Laser)


High resolution Spectrometer HR2000 ES




EDUCATIONAL TECHNOLOGY SERVICES
CENTRE




Head of the Centre

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Department of Electrical Engineering

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Department of Humanities and Social Sciences

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Computer Science & Engineering

Paroma Sanyal, *Ph.D. (University, Hyderabad)*
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Department of Humanities and Social Sciences

Varsha Singh, *Ph.D. (IIT Bombay)*
Associate Professor
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Department of Humanities and Social Sciences

INTRODUCTION

In pursuance of the national objectives of maintaining excellence in education and training of engineers, the Indian Institute of Technology, Delhi Established an Educational Technology Services Centre in 1987.

Major activities of the Centre include providing support for enhancement of teaching-learning process; developing media-based instructional resources; conducting academic and applied research and undertaking consultancy and sponsored research projects.

The Centre has a well established programme for faculty development which is recognized and widely utilized by national and international sponsoring agencies.

Over the years, the Centre has produced a large number of complete video courses, single concept video programmes and CAI packages with the help of the faculty members of the Institute covering a vast range of subjects.

The Centre has a modern video studio and recording and editing facilities. Multiple studio-classrooms are available for on-line recording of courses. Non-linear editing set up and streaming servers are available for post-production and video streaming respectively. ETSC uses the Sony ANYCAST system and the New Tek Tricaster system in the Video Studio for non-linear editing and recording. Video conferencing facility has been installed in the Conference Room of ETSC. The facility is being used for faculty interviews, meetings and distance education.

Some of the new initiatives of the ETSC include projects sponsored by MHRD, Swayam, Swayam-Prabha and IIT-PAL. Under Swayam, ETSC actively encourages faculty members of the institute to develop MOOCs (Massive Open Online Courses) to be disseminated country-wide. ETSC is responsible for recording, post-production and uploading content into the Swayam platform, as well as, hand-holding faculty members towards developing content. Under Swayam-Prabha, ETSC manages 2 TV-channels (Textile Engineering and IIT PAL). In IIT-PAL ETSC engages in working with faculty members of the institute towards content creation, recording, post-production and managing of TV channels (Physics, Chemistry, Maths and Biology).

In addition, courses for Annual Refresher Programme in Teaching (ARPIT) have been recorded, edited and uploaded on SWAYAM. These courses will be treated as Faculty refresher course forcareer advancement scheme (CAS) for promotion.

During the lockdown period due to COVID-19 pandemic, ETSC played a major role in reaching out to students by managing on line classes, conducting VCs and meetings.

ETSC also manages all audio and video facilities of the Institute that are used during classes, as well as for events in the Institute. Meetings, conferences, seminars as well as cultural events are all handled by ETSC.

ACTIVITIES

The Educational Technology Services Centre (ETSC) is actively engaged in promoting the use of Educational Technology at the Institute and also at the national level. Some of its major activities are:

1. Design & Development of Instructional Resources: In the form of videos and web based.
2. Provision and maintenance of AV equipment for classroom teaching.
3. Video and computer based instructional packages.
4. Organizing training programmes for faculty and professionals across the country.
5. Video conferencing for faculty selection interviews and meetings.
6. E-learning and MOOCs (Massive open online courses).
7. Undertaking sponsored and research projects.
8. Dissemination of Instructional Resources: Through development of information brochures and databases.







COMPUTER SERVICES
CENTRE







Head of the Centre

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Senior System Manager (SG)
D.B.M.S., System Analysis and Design, System Administration, Web Design & ERP.

Manish Agarwal, *Ph.D. (IIT Delhi)*
System Architect
HPC & Administration, Large Scale Molecular Simulations, Parallelization of Analysis Codes.

P.K. Baboo, *Ph.D. (Berhampur)*
Senior System Manager (SG)
Database Management Systems, System Analysis and Design, System Administration.

Sudip Narayan Banerjee, *M.Tech. (CSI)*
System Architect
Data Centre/HPC Clusters, Server Admin., Virtualization, NFV, DPU & Network security.

Rajesh Bhat, *Ph.D. (IIT Delhi)*
System Manager
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Jaya, *M.Tech. (IIT Delhi)*
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Sunil Kak, *M.Tech. (IETE)*
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Gopal Krishen, *M.Sc. (Kurukshetra Univ.)*
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Ram Lal, *Ph.D. (Jamia Milia Islamia University)*
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System Administration, Information Technology, E-governance, MATLAB programming, Image Processing & Object-oriented Programming.

Gaurav Munjal, *B.Tech. (DCRUST)*
System Architect
Application Programming, System Administration, DBMS, Web Development, OSS|BSS Systems.

M. Mallikharjuna Rao, *Ph.D. (IIT Delhi)*
System Manager
ERP Implementation, ANN applications in Control of Building Frames and Software Development.

INTRODUCTION

The main objectives of the Computer Centre are to:

- Provide round the clock computing and networking facilities to serve a user population of 12000+ users consisting of UG students, PG students, Research Scholars, Faculty & Staff of the Institute and also to visiting faculty and students.
- Implement and maintain system & application software.
- Implement and manage the Institute Network.
- Provide Computer lab facility to students for the conduct of UG/PG lab courses & exam.
- Work on cutting edge technology & provide Services to users based on new technology.
- Provide support both in development & administration of ERP related module implementation.
- Provide support to online teaching and training to Institute employees.

COMPUTING FACILITIES

The Centre is equipped with 112 CISCO UCS blade servers out of which 80 Blade Servers are used for Cloud computing with 200 TB of virtualized storage and 32 blade servers with 130 TB of storage for user homes and infrastructure use like email, proxy, web services etc. CSC also has around 450 Desktop computers under Windows and Linux environment connected over a switched fast Ethernet. Uninterrupted Power Supply is provided through 2x 80 KVA MGE UPS system and DG set.

HIGH PERFORMANCE COMPUTING (HPC)

The HPC facility in the Data Centre consists of the following:

Compute Nodes: 606 (CPU nodes: 405, GPU nodes: 201)

Haswell nodes (422 nodes):

- GPU (161 nodes): NVIDIA K40 (12GB)
- CPU (261 nodes): 2x E5-2680 v3 2.5GHz/12-Core
- RAM: 64 GB
- 12 CPU and 8 GPU nodes have 512 GB RAM each

Skylake nodes (184 nodes):

- GPU (40 nodes): NVIDIA V100 (32GB)
- CPU (144 nodes):
- RAM: 96GB
- 40 GPU and 8 CPU nodes have 192 GB RAM each

In addition, we have 6 login nodes for job submission, monitoring etc.

Storage: Home space: 678 TB and Scratch space: 3430 TB.

PC SERVICES

There are five PC Labs in the CSC premises having 220+ Desktop computers under Windows and Linux environment. Besides this there are four Computing labs in the Lecture Hall Complex (LHC) having about 230+ desktop computers running Ubuntu and Windows 10. Every user has been provided a Kerberos user-account and password for logging into the system and also for using Internet facility. The PC Labs in the main building of the Centre are open Round-the-Clock for authorized users. These labs are extensively used by the departments for conducting UG/PG Lab courses and by general students.

NETWORK SERVICES

The Institute LAN is a state-of-the-art switched network with dual redundant connectivity with a 10 Gbps backbone. The core and distribution network are deployed using single-mode fiber. The passive design consists of three rings of 12 tubes of 12 core fibers, one each for the east campus, the central academic campus, and the west campus. Each ring passes through both the primary data center site (DC) and the secondary disaster recovery site (DR). The infrastructure for internet access, firewall, and core switches are deployed in a redundant active-active cluster configuration. IIT Delhi is connected to the National Knowledge Network (NKN) with 10 Gbps dual connectivity from Power Grid and RailTel. The connectivity includes virtual routing service, Internet Connectivity, and connectivity with other Institutes connected on the NKN backbone.

The access network, consisting of approximately 475 plus edge switches for end-user connectivity through UTP cabling in the departments, hostels, and blocks. Network access is provided to every student, faculty, staff, and guest. The facility has been extended to each lab, classroom, seminar hall, office, room in guesthouses.

Internet and Intranet access is available in faculty/officer homes via GPON over fiber (750+ houses) and ADSL connectivity over internal telephone lines. The centralized Wi-Fi access through 1400+ wireless access points is available in the whole academic, hostel area, guesthouses, RCA, and Hospital, etc. The IITD wired and wireless network is also extended to IITD's Sonipat campus through a point-to-point link.

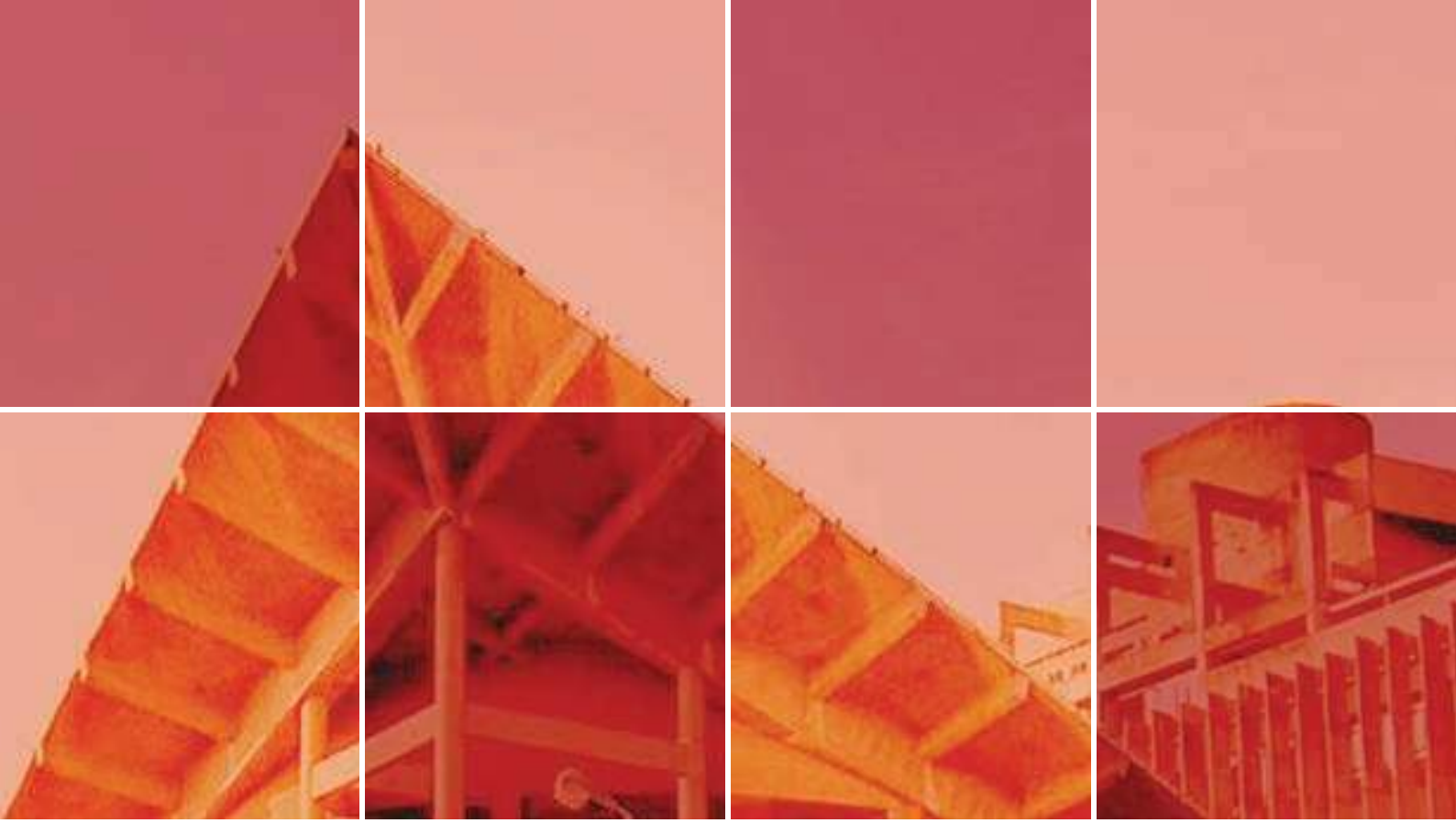
Many network services, including mail, web, VPN, NTP, HPC, domain name, etc. is being provided over this network.

FACILITIES/SERVICES

- All Services are authenticated and authorized using a central Kerberos system.
- The **email facility** is also provided to all the users with webmail interface "Round cube".
- **Baadal** is a Cloud computing environment that provides virtualized computing resources for for academic and scientific environments. Some of the main features of Baadal are: Dynamic Resource scheduling and power management; Facilities for suspend, resume, shutdown, power on/off, specifying resource requirement of VM; and Dynamic resource utilization monitoring.
- **The Data Center (DC) consists of Cisco UCS B200 :** Six chassis with 48blade servers – 16 blades each with 2x18 Cores Intel(R) Xeon(R) CPU Gold 6240 @ 2.60GHz with 256 GB RAM, eight chassis with 8 blades each with 2x24 cores CPU Intel Xeon Gold 53184 2.16 GHz with 256 GB RAM.

- *The Disaster Recovery Data Centre* **(DRDC)** is situated in the SIT building. The DRDC has been built by IBM and can support a total IT load of 60 KW. The DRDC has the same hardware configuration as Data Centre (DC).
- The CSC provides **Infrastructure Services** through Virtualization technology.
- The CSC has **Microsoft Volume Licensing** EES agreement for the Campus under which Microsoft software such as Windows Server, Windows OS, MS Office, Office365, Visual Studio etc. are available for use. We also have access to one Drive academic account as well as all services including MS Teams.
- The center also has the following **third-party software packages:** MATLAB, Mathematica, Ansys, COMSOL, LabVIEW, Materials Studio, Intel Parallel Studio, PGI compilers, Origin lab Pro, etc. available on the CSC webpage.
- The centre maintains **local repositories** of several popular open-source software.
- The CSC has configured **moodle** a public domain course management software, for use by faculty and students for the courses running during the semester.

- IIT Delhi is also a part of **Eduroam**, a global WIFI roaming programme across academic campuses through ERNET India.
- **Own Cloud/Next Cloud**, a file and document sharing utility similar to the popular drop box is also provided for user community. The utility supports storing and sharing of files, images, music and documents, contacts, calendars, tasks etc.
- To facilitate downloads of data files through non-standard ports, **download Server: download.iitd.ac.in** can be used. and to facilitate download of huge data for Research, proxy server **xen03.iitd.ac.in** (Research proxy) can be used. The faculty has been authorized to provide download permissions to their students from the webpage.
- **Virtual web** hosting facility can be used for securely hosting all websites of the form **http://xyz.iitd.ac.in** which are not maintained by CSC. In addition, CSC maintains large number of websites including IITD main websites and some departmental websites.
- **User web pages** is available for the use of faculty and PhD. students for hosting their webpages on the server web.iitd.ac.in
- To provide **Internet access** to visitors, faculty and officers have been authorized to create user account for their visiting faculty & students.
- To facilitate limited access within IITD, CSC has a separate **web server** *privateweb.iitd.ac.in* where users can have their personal web pages.
- **VPN** facility is provided to the users for accessing IITD internal network from outside IIT Delhi. The faculty have been authorized to create cert-keys for their own use and their advisees from the VPN webpage on the CSC website. Users can also send a mail to sysadm@cc.iitd.ac.in for availing VPN facility.
- Network Time Protocol **(NTP)** servers are synchronized with standard internet time servers with time drift less than a few milliseconds and can be used by all users.
- MRTG and RRD **Health Graphs** have been provided to see the Status Reports of the Various System activities/Services.
- **SLA** ticketing systems- SLA for Networking & SLA for Software have been provided for resolving User problems pertaining to Network and Software issues.
- **ERP modules are provided for:** Academics, Convocation systems, Hostel Accounts, Personnel Management System, CDN, Central Accounts, Audit System, Security Unit, IIT Hospital, Guest House, IRD and Store & Purchase modules are under implementation.



NATIONAL RESOURCE
CENTRE FOR
VALUE EDUCATION IN ENGINEERNG

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Heat Transfer, Fluid Mechanics,
Renewable Energy Technology.
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Head of the Centre

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Biomedical Engineering

Shubhendu Bhasin, *Ph.D. (Univ. of Florida)*
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G. Bhuvaneswari, *Ph.D. (IIT Madras)*
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P.R. Bijwe, *Ph.D. (IIT Delhi)*
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Nomesh Bolia, *Ph.D. (Univ. of North Carolina)*
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Harish Chaudhary, *Ph.D. (IIT Delhi)*
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V.M. Chariar, *Ph.D. (IIT Delhi)*
CRDT - Rural Development Technology

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Rahul Garg, *Ph.D. (IIT Delhi)*
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Amit Gupta, *Ph.D. (Univ. of Central Florida)*
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S.K. Gupta, *Ph.D. (IIT Delhi)*
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Amit Kumar Jain, *Ph.D. (IIT Guwahati)*
Electrical Engineering

Manjeet Jassal, *Ph.D. (IIT Delhi)*
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Saroj Kaushik, *Ph.D. (IIT Delhi)*
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Jyoti Kumar, *Ph.D. (IIT Delhi)*
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Anushree Malik, *Ph.D. (IIT Delhi)*
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Bhanu Nandan, *Ph.D. (Kanpur Univ.)*
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Rajesh Prasad, *Ph.D. (Cambridge Univ.)*
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Rajendra Prasad, *Ph.D. (IIT Delhi)*
Emeritus Professor, CRDT

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Anjan Ray, *Ph.D. (Michigan State Univ.)*
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Kamlesh Singh, *Ph.D. (Univ. of Rajasthan)*
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Parag Singla, *Ph.D. (Washington Seattle Univ.)*
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D. Sundar, *Ph.D. (Pondicherry Univ.)*
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Rajiv K. Srivastava, *Ph.D. (KTH, Sweden)*
Textile and Fibre Engineering

Santosh Satya, *Ph.D. (IIT Delhi)*
CRDT - Rural Development Technology

V.K. Vijay, *Ph.D. (IIT Delhi)*
CRDT - Rural Development Technology

INTRODUCTION

National Resource Centre for Value Education in Engineering (NRCVEE) was setup in 2001. The role of the Centre is to create awareness in the technical community about human values. Accordingly, the mandate of NRCVEE is to identify, develop and disseminate techniques by which engineering students and practicing engineers can be motivated to imbibe human values and appreciate their impact on technology development, professional ethics and human welfare.

ACADEMIC PROGRAMMES

The Centre offers elective courses for UG and PG students. The Centre runs a Ph.D. programme to support interdisciplinary research on topics that pertain to the impact of science and technology on human values and professional ethics and vice-versa. The Centre also provides a platform for faculty from across the institute to engage with students through projects, courses and other activities so as to develop better understanding of issues related to human values and technology. The Centre acts as a catalyst in the activity of sensitizing the campus community at large to these issues through lectures by eminent personalities. It also organizes several workshops on meditation, self-enquiry and the like for students and other campus residents.

RESEARCH AREAS

The Centre supports research primarily through its Ph.D. programme in the following areas:

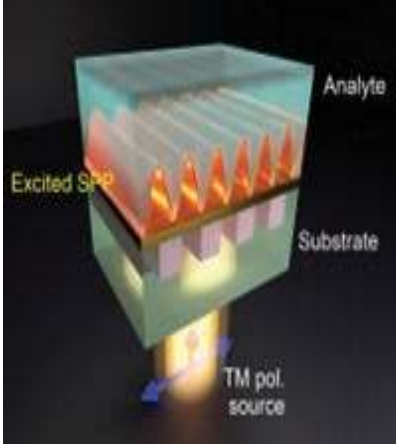
- **Holistic Health and Wellness:** All issues pertaining to holistic view of individual's health and wellness. These include modern scientific research on proven mind-body techniques for physical and mental health, such as Mindfulness, Yoga, Tai-Chi, Qi-Gong, Ayurveda, Holistic nutrition and others. Yogic Neuroscience, Indian Psychology, Cognitive Sciences, Clinical trials on Yoga and Ayurveda, fMRI-based Neuroimaging (fMRI), EEG, MEG, PET, fNIRS.
- **Leadership for Sustainable Development:** Various aspects of holistic and sustainable development. Notions of development which go beyond purely material well-being, and consider other aspects of human/societal well-being such as intellectual, emotional and overall happiness. Notions of development which encompass sustained co-existence among human-beings as well as with nature. How to create leadership (in various walks of life - especially in engineering/technology) for taking forward these alternate views on development.
- **Inner Development:** Understanding first person mental phenomena, especially those pertaining to Meditation, Mindfulness and Contemplation in a rigorous academic framework. Theoretical frameworks for alternative worldview based on deep contemplative insights. Teaching and research on first person mental phenomena through accurate and reproducible observations.

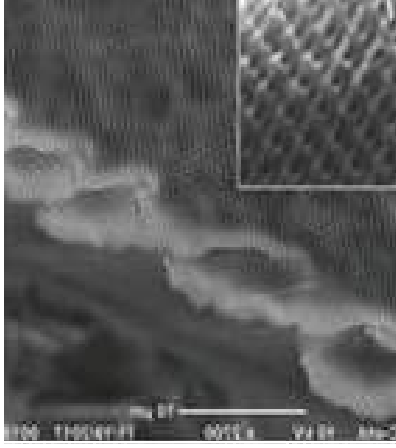
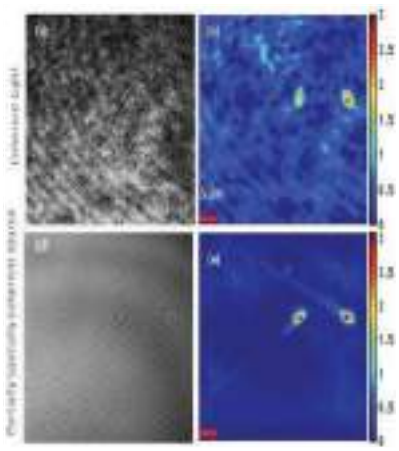
  Inner and Outer Harmony through Music and Arts. Classical music, dance and art forms that promote introspection, concentration, various aspects of self-awareness and devotion. Evolution of parallel streams of classical music in India. Development of classical art forms through folk art forms. Societal awareness through classical music. Streams of thought in classical music. Connections between carnatic music and sufism. Technology-based analysis and dissemination of music.
- **Value Education and Technology:** Teaching the teachers, tools and techniques for inculcating value education to students, especially at tertiary level of science and engineering. Research on effectiveness of various techniques for value education. Newer models of education. Use of technology for large scale dissemination of knowledge.

FACILITIES

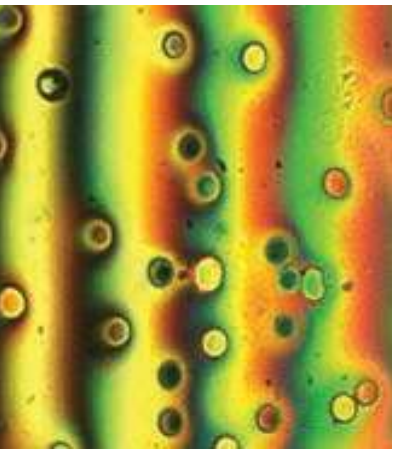
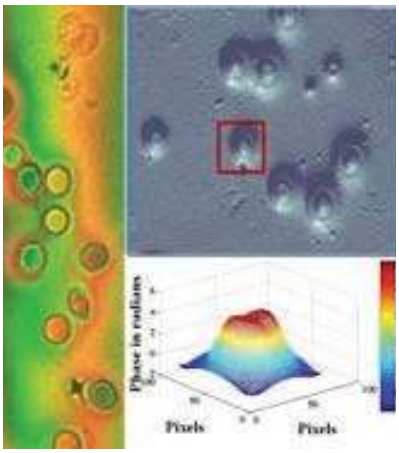
The Centre has a unique collection of books and audio-visual material on topics pertaining to science, spirituality, human values and ethics. It also has a meditation room that can accommodate 30 people and is open to students and all campus residents.

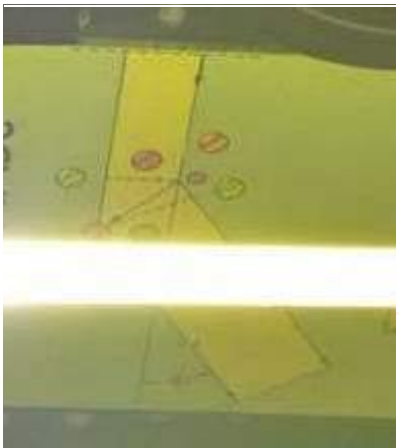





OPTICS AND PHOTONICS
CENTRE



Head of the Centre

Joby Joseph, *Ph.D. (IIT Delhi)*
Professor
Photonics, Applied Optics, Holographic Data Storage, Digital Holography, Optical Data Security, Photonic Crystals, Photonics Metamaterials, Super-resolution imaging, Photonic biosensing.

Gayathri Bharathan, *Ph.D. (Macquarie University, Australia)*
Assistant Professor
Near and Mid-infrared Fibre Lasers, Ultrafast Lasers, Femtosecond Laser Micro-machining.

Ritwick Das, *Ph.D. (IIT Delhi)*
Associate Professor
Nonlinear optics and Lasers, Sub-wavelength and surface optics, Topological Photonics.

Deepak Jain, *Ph.D. (ORC, Southampton, UK)*
Assistant Professor
Fiber Optics, Semiconductor Devices, Integrated Photonics and Artificial Intelligence for Photonics.

Kedar B. Khare, *Ph.D. (Univ. Rochester)*
Associate Professor
Optics/Photonics, Computational Imaging, Inverse Problems, Compressive Sensing.

Parvendra Kumar, *Ph.D. (IIT Guwahati)*
Assistant Professor
Quantum Optics, Open Quantum Systems, Cavity Optomechanics.

Dheeraj Pratap, *Ph.D. (IIT Kanpur)*
Assistant Professor
Metamaterials, Metasurfaces, Transformation Optics, Plasmonics, Nanophotonics.

P. Senthilkumaran, *Ph.D. (IIT Madras)*
Professor
Applied Optics, Singular Optics, Physical Optics.

Saurabh Mani Tripathi, *Ph.D. (IIT Delhi)*
Associate Professor
Fiber Optics, Integrated Optics, Guided-Wave Optics, Photonic Sensors.

Vishal K. Vaibhav, *Ph.D. (Max Plank Institute, Germany)*
Assistant Professor
Nonlinear Optics, Computational Physics, Numerical Analysis of PDEs.

Anurag Sharma, *Ph.D. (IIT Delhi)*
Emeritus Professor
Fiber Optics, Integrated Optics, Gradient Index Optics, Applied Optics, Numerical Modelling of Guided Wave Optical Devices.

INTRODUCTION

Optics and Photonics Centre has been created recently at IIT Delhi, with a vision to establish an academic unit of eminence, dedicated to innovations in teaching, research and technology development in the area of Optics and Photonics. Its mission is to develop into a globally-competitive 'look-up-to' Centre in India for all areas in Optics and Photonics, from fundamentals to cutting-edge research & innovation with a strong emphasis on pedagogy, training, certification, product development and entrepreneurship.

The Centre aims to undertake research, development and innovation along with quality human resource training in all areas of Optics and Photonics through maintaining a judicious balance between classical fields and modern as well as upcoming areas. The Centre will bring in symbiotic collaborations with government establishments and industry frontrunners to undertake R&D activities in critical areas, benchmark the product development and provide strategic input for their growth. The Centre envisages to synergize and symbiotically harness the potential of the field of Optics and Photonics for other areas of research at the institute, namely nanotechnology, quantum computation and information, machine-learning. This is particularly appealing in view of the strong interdisciplinary nature of the topics and elements of the subject of photonics. The Centre will pursue innovations in technologically crucial standard areas which includes optical engineering, instrumentation, and laser technology development. The Center is presently carrying out cutting-edge research in the areas of structured light manipulation, computational photonics, quantum optics, nanophotonic device fabrication including metamaterials and photonic crystals, optical frequency conversion with emphasis on mid-infrared and terahertz spectral band. In future, the Center will be adding experts from the field of ultrafast optics and terahertz photonics, silicon photonics and photonic circuit integration, biophotonics and quantum optical device fabrication. The Centre enjoys strong academic collaboration with a number of faculty members from other academic units such as Physics, Electrical Engineering, and SeNSE.

The field of optics and photonics is ever growing which is essentially due to the applicability of optical phenomena in a variety of natural processes and events in day-to-day life. Therefore, the Center has a major focus on the outreach activities for educating citizens, young learners and inquisitive minds from the perspective of optics and photonics. The Center will carry out regular outreach programs at Schools, Colleges and Universities (within the country and outside) and provide hands-on training programs as a part of its scientific-social responsibility initiative for wider dissemination of knowledge in the field of optics and photonics.

ACADEMIC PROGRAMMES

The Centre will have primarily Ph.D. Research, M.Tech. and M.S. (Research) Programmes.

i. **Ph.D. Programme:** Ph.D. programme that includes research at the fundamental level as well as applied research. The applied research will have a strong component of interdisciplinary ideas. Students with a varied background which includes physics, engineering and biological sciences will be trained and exploring in their specific areas of research.

ii. **M.Tech. Programme in Photonic Systems:** This programme will be offered for two academic years (spread across four semesters) and will include a variety of foundational-level and advanced-level courses along with electives, comprehensive laboratory courses, and technologically significant and challenging optics and photonics research-level projects.

iii. **M.S.(R) Programme in Photonics:** The programme will be offered for one year and expected to produce engineers and scientists possessing a fundamental ideas and concepts in photonics and specific research skills to apply the acquired knowledge for the design, implementation and development of photonic systems having practical applications for Indian industry, Indian defense force related R&D projects etc.

RESEARCH AREAS

The research activities of the Centre could be thematically categorized as:

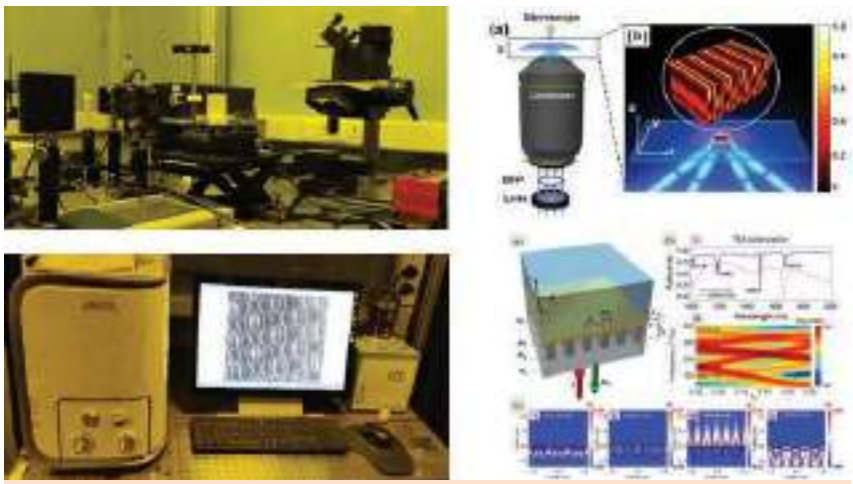
- **Lasers & Guided Wave Optics:** Lasers, High Power Lasers and laser optics, Laser Systems and Applications in Medicine, Defence, Communications (including VLC), and Manufacturing, Guided wave optics, Fiber optics and Optical communication, Integrated optics, Fiber lasers and amplifiers, specialty fibers and sources.
- **Optical Engineering:** Geometric optics, Optical design, testing and fabrication, Micro-optics, Large-size Optics, Optical Instrumentation, measurement, and metrology, Optical devices and sensors. Illumination Engineering, Lighting and optical sources and radiation measurement (photometry, colorimetry and radiometry), Adaptive Optics, Free-space optics, Physical and Statistical optics, Wave propagation, Singular optics, Polarization optics, Diffractive and micro-optics, freeform optics, Atmospheric, oceanic and space optics, Scattering, Remote sensing (LIDAR) and sensors.
- **Imaging, Sensing and Biophotonics:** Fourier optics and optical signal processing, Holography, Image processing, Machine vision, Optical data storage, Computational Imaging and Sensing, Imaging systems, Microscopy, Augmented Reality (AR)/Virtual Reality (VR) & Mixed Reality (MR)- 3D display, vision and communication technology, Bio-medical optics and biophotonics, Vision, color, and visual optics, Nanoscopy for biological samples, Biosensors.
- **Nanophotonics:** Nano-photonics, Plasmonics, Photonic Metamaterials, Photonic crystals, Optics at surfaces, Micro-/Nano-Optics, OE-MEMS, Optical Materials, Detectors, Optoelectronics, Liquid crystal photonics, Spectroscopy, Polymer Photonics, Green Photonics, Silicon photonics, solar cell optics, sunlight harvesting.
- **Ultrafast and Quantum Optics:** Nonlinear optics and applications, Terahertz optics and photonics, IR & Mid-IR Optics, Ultrafast optics, Extreme Optics, Atomic and molecular physics, Quantum Integrated Photonics, Quantum Information, Quantum Technologies, Topological Photonics.

LABORATORY FACILITIES AND RESEARCH GROUP

The Centre will establish well-equipped state-of-the art laboratory facilities for teaching and research in Optics and Photonics. At present, the following research laboratories are fully functional and a few are being prepared:

Photonics Research Laboratory:

The Photonics Research Laboratory led by Professor Joby Joseph is currently involved in research and developmental activities in areas such as: phase controlled 3-D interference lithography for fabrication of large area photonic structures, studies on photonic resonant structures for biosensing and other applications, Design and fabrication of photonic metamaterials and metasurfaces, Super resolution optical imaging using structured illumination, Shock-wave analysis using Schlieren and shadowgraphy techniques etc. Experimental facilities available include: 1D, 2D, 3D Interference Lithography setup,



Photonics Research Laboratory

JEOL Tabletop SEM, Femtofiber laser, He-Cd Laser 325 nm and 442 nm, Coherent Genesis laser 355 nm, Toptica blue mode laser 405 nm, He-Ne laser 632.8nm, Cobolt samba lasers 532 nm, Holoeye Spatial Light Modulators, UV-VIS spectrometer, Spin Coater, Hot plates, Digital Balance, Centrifuge systems, Box furnace, 3D Printers etc.

Computational Imaging Laboratory:

The computational imaging laboratory headed by Prof. Kedar Khare works on novel imaging concepts that use optical design and advanced reconstruction algorithms to realize unprecedented imaging performance beating traditional limits in terms of resolution, accuracy, imaging speed, field-of-view, etc. A number of successes over the last several years include system concepts based on our optical phase reconstruction and phase engineering algorithms that allow imaging with "incomplete" data. Collaborative work with other departments at IIT Delhi including CBME and KSBS has also yielded a number of novel results with important system implications. A high resolution phase microscope product has recently been introduced commercially through our efforts – the first full-fledged unit is now installed in IIT Delhi's Central Research Facility (CRF) for generic use. The microscope provides full-resolution holographic 3D images of live cells and has a number of applications in basic bio-sciences as well as diagnostics.

Computational Imaging Laboratory

Singular Optics Laboratory:

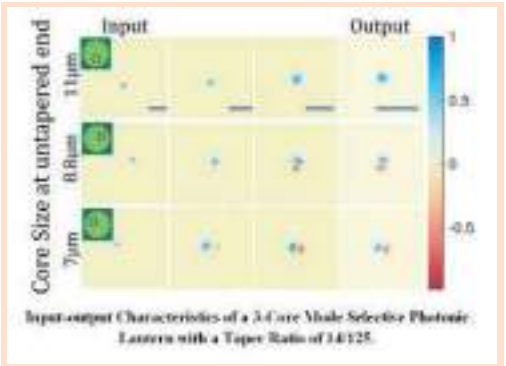
The Singular optics Laboratory led by Professor P. Senthilkumaran is active in physical optics research. Current research activities are in the areas of phase and polarization singularities, correlation optics, interferometry, diffractive optics, polarization optics and topological aspects of light fields. The group is also actively engaged in the design and fabrication of elements for laser beam shaping, spectral beam combining and structured beam generation. It is also involved in non-destructive optical testing and metrology. In collaboration with various other labs this group also carries out research in statistical optics, beam propagation, imaging, photonic crystals and in biomedical optics. Some of the experimental facilities available in this laboratory are: all type of interferometers, Stokes camera, He-Ne lasers, various diode lasers in the 1030-1100nm wavelength range, spatial light modulators, spiral phase plates and q-plates, laser beam profilers and Arcoptic tunable phase retarders.


Singular Optics Laboratory

Computational Photonics Group:

Computational Photonics Group is led by Prof. Anurag Sharma and focuses on developing computational methods for waveguide modeling and wave propagation. These methods are used for device modeling. In the past, variational methods for modes of optical fibers and integrated optical waveguides have been

developed. Also developed were the method for ray tracing in gradient-index (GRIN) optical systems. Recent focus has been modeling of microstructured fibers (MoF) and fiber Bragg gratings (FBG). Another device that has been a subject of study is the photonic lantern for which a new and simple propagation method has been developed. Using this method a protocol for optimization of photonic lanterns has been developed. Currently, methods are being developed for propagation of higher order modes in few mode optical fibers and for modes carrying optical angular momentum (OAM). Another area that is of current focus is the development of methods for non-paraxial and bidirectional vector wave propagation which will be useful for modeling silicon photonic devices.



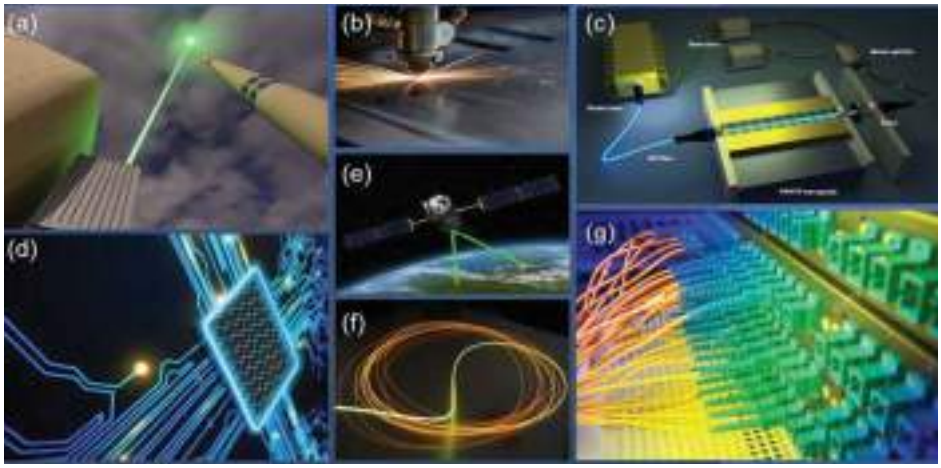
Input-output Characteristics of a 3-Core Mode Selective Photonic Lantern with a Taper Ratio of 3.6/125.

Computational Photonics Group

Efforts are also underway in generalizing the conventional Fourier transform to integrable nonlinear systems. The resulting transform is known as the nonlinear Fourier transforms (NFT) which has found application in optical communication. It is also an important tool for design and characterization of fiber Bragg gratings and grating assisted co-directional couplers for various communication and sensing applications. The group has demonstrated a family of Cooley-Tukey type Fast NFT algorithms for encoding and decoding information carried by optical signals in single mode fibers in the nonlinear regime of operation.

Semiconductor and Fiber Photonics Devices (SFPD) Group:

This SFPD group is led by Prof. Deepak Jain and focuses on semiconductor and fiber-based photonics devices. SFPD aims to develop next-generation semiconductor and fiber devices for material processing in the manufacturing industry, tame lightning, and clearing debris in space, broadband supercontinuum light sources for spectroscopy and imaging, photonic integrated circuits fibers and amplifiers for optical communication, photonics hardware to meet artificial intelligence demand, and single-photon sources for quantum computing with an interdisciplinary approach along with the training of the students and researchers.



At SFPD: we guide, produce, amplify, control, tailor, filter, split, shape, broaden, and compress light for mankind's benefits!

For more details, please *visit: https://sites.google.com/view/fopd/home*

Potential Ph.D. Projects:

a) Development of Photonic Processor for Artificial Intelligence

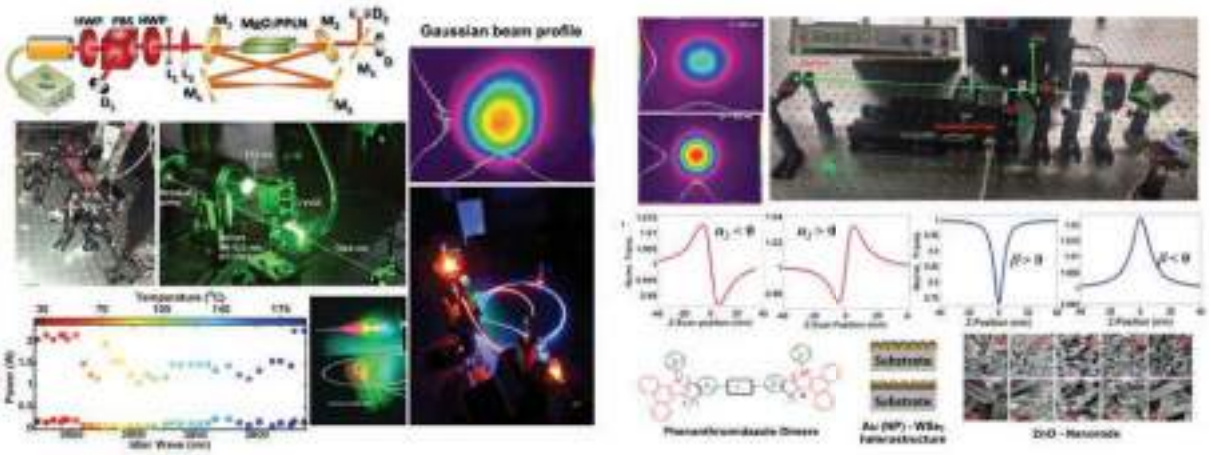
b) Artificial Intelligence for Photonics

Laser Optics and Nonlinear Photonics (LONP) Group:

This group is led by Prof. Ritwick Das and focuses on three broad areas in the field of optics/photonics.

Nonlinear Optics: In this area, the group focuses on devising high-power second harmonic generators, optical parametric generators (OPGs) and optical parametric oscillators (OPOs) which provide plausible routes to reach those spectral regions that are inaccessible to conventional laser technology via exploiting second-order nonlinear optical properties of non-centro-symmetric crystals. The group develops high-power, frequency (or wavelength) tunable sources in the mid-infrared and far-infrared spectral bands at continuous-wave (cw) or quasi-cw and ultrashort (femtosecond) time scales. Such sources are employed for trace-gas sensing and absorption spectroscopy of trace-gas molecules such as methane, formaldehyde, nitrogen, carbon-dioxide along with probing the atomic Rydberg states. In addition, the group collaboratively investigates the absorption and emission properties of a broad class of sub-wavelength organic and inorganic aggregates (or nanoparticles/nanoclusters) using the nonlinear optical spectroscopy through estimating the third-order nonlinear optical coefficients. The group employs a variety of techniques such as Z-scan, I-scan, four-wave mixing (FWM) and interferometry for such investigations.

Nanophotonics and Surface Optics: In this area, the group focuses on electromagnetic wave propagation through periodically and quasi-periodically stratified media containing plasmon-active metals and other hybrid configurations. The investigations are aimed at discovering possibilities of coupling between different degrees of freedom of propagating modes as well as surface (stationary) modes such Tamm-plasmon modes, surface-plasmon modes and a few more. The major goal of this research activity is to provide robust and efficient methods for signal processing in the miniaturized photonic integrated circuits and realization of efficient optical sensors.

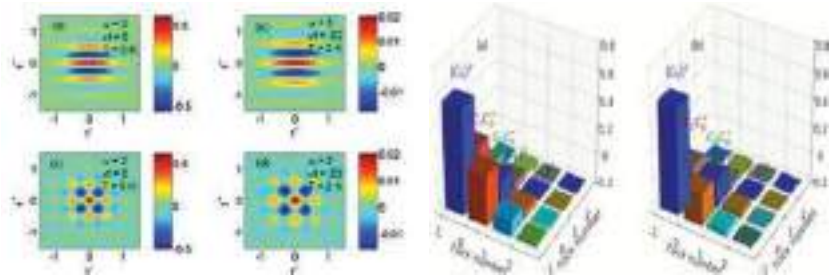


Photonic Topological Insulators and Optical Edge-modes: The primary bottleneck in most of the optical processing/communication configurations is 'unwanted scattering' which includes 'backscattering'. 'Topologically-protected' modes in optics/photonics provide a potentially viable route to circumvent the undesirable impact of 'backscattering' of light. In this area of research, the group investigates a broad range of linear (photonic crystal based) and nonlinear optical systems for which the topological constants could be ascertained. Subsequently, the impact of perturbations and tolerance with regard to backscattering is investigated. This area of research also provides a plausible route to devise 'open quantum systems' as well as substantially reduce the issues associated with 'decoherence' in closed 'quantum-optical' systems.

Quantum Optics Group:

Quantum optics is a highly active, ever-expanding, and productive area of research. It deals with the study and applications of light-matter interaction in the quantum regime. Over the past few decades, a good understanding of quantum light-matter interaction has enabled the development of various technologies

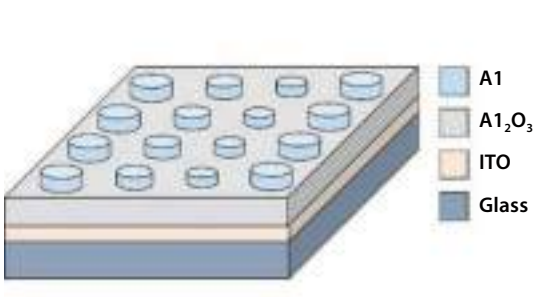
such as MRI, atomic clocks, transistors, and lasers. These technologies now benefit society in nearly every domain, including healthcare, security, communication, and computing. However, there has been a recent global focus on further harnessing the unique features of quantum physics, such as quantum superposition and quantum entanglement, for developing futuristic quantum technologies such as quantum internet, quantum communication, quantum imaging and sensing, quantum radar, and quantum computing.



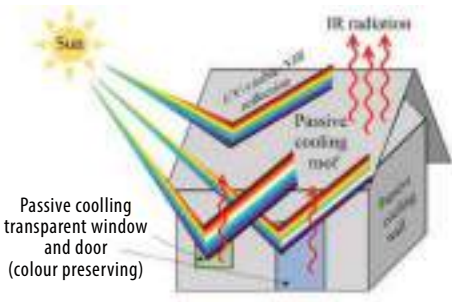
This group is led by Prof. Parvendra Kumar and the group's current expertise includes cavity quantum electrodynamics, open quantum systems, coherent control, and recently quantum optomechanics. Our work focuses on exploring the quantum world of light-matter interaction for applications in quantum science and technology. To demonstrate various key ideas, such as solitons, optical force, coherent population trapping, fast initialization of spin qubit and ultrafast control, sub-Planck structures, single- and entangled photons, and squeezed light, we have studied and investigated a variety of quantum systems, including quantum dots, Schrodinger cat states, nonlinear medium, and atomic systems. Next, we intend to investigate entanglement and quantum teleportation, chiral flow, and non-reciprocal transport in a network of optomechanical resonators; super- and sub-radiance with the arrays of quantum dots coupled to the waveguide modes. We also intend to establish a cutting-edge lab within a few years to put our theoretical ideas into practice and demonstrate the quantum advantage.

Metaphotonics Research Group:

The Metaphotonics Research Group, under the direction of Prof. Dheeraj Pratap, is currently engaged in research and development activities in fields like metamaterials and metasurfaces to manipulate the light-matter interaction over a broad range of electromagnetic spectrum from near UV to LWIR and their applications in passive radiative cooling, perfect absorption, waveguides, exceptional point sensing, and quantum photonics; the transformation optics to design and study the complex photonic structures and devices; phononics to manipulate the phonon-photon interaction with optical anisotropy, quantum phononics; plasmonics for biomedical applications such as multi-modal thermal therapeutics, theranostics, photothermal and photoacoustic imaging, energy harvesting, nanoscale radiative heat transfer and thermal management in the integrated electronic and photonics devices; scanning thermal microscopy to study the photothermal behavior at the micro and nanoscale.



Metasurface



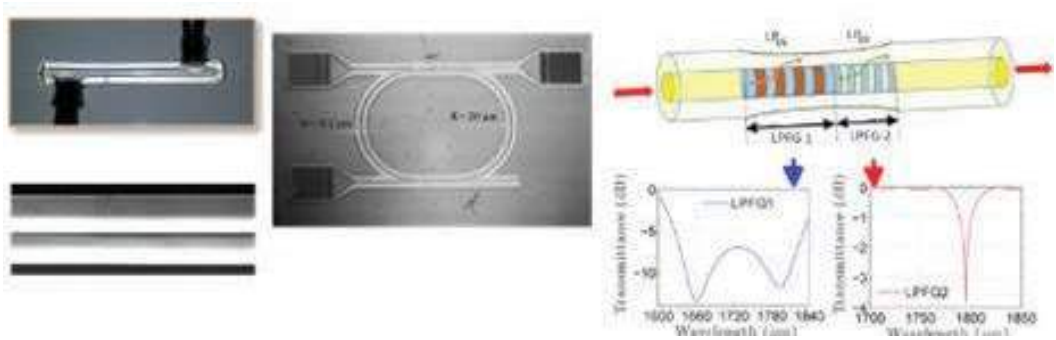
Passive Radiative Cooling

Near and Mid-infrared Photonics Group

This group is led by Prof. Gayathri Bharathan and aims to make significant progress in the development of near and mid-infrared fiber lasers, fiber amplifiers, and fiberized integrated components. The future of near and mid-infrared fiber lasers and fiberized integrated components is promising, as they provide several benefits over conventional lasers. These lasers have the potential to revolutionize various applications such as spectroscopy, sensing, and medical diagnostics due to their ability to generate high-power beams in a wide range of wavelengths from 2 to 12 µm. The development of mid-infrared fiber lasers is now an active topic of research, nevertheless, the development of mid-infrared fiber lasers is still in its infancy due to the unavailability of fiber-coupled components in comparison to the near-infrared region. As a result, fiberized integrated components such as waveguides, couplers, WDM, and so on are becoming increasingly important in the development of all-fiber mid-infrared lasers because they facilitate the transfer from the laboratory to practical applications. This group will concentrate on the design and development of mid-infrared compatible integrated components and hence on the development of all-fiber mid-infrared laser cavities. Furthermore, this group aims to produce novel and innovative results such as supercontinuum broadband sources that could potentially be employed in a variety of applications such as environmental and health monitoring. In addition, we expect to develop near-infrared fiber lasers for material processing.

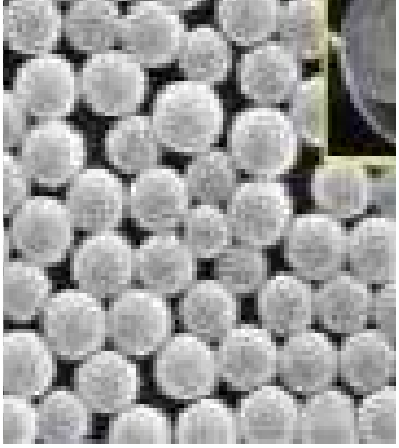
Fibre Laser and its Medical Application

Photonic Sensors Laboratory:

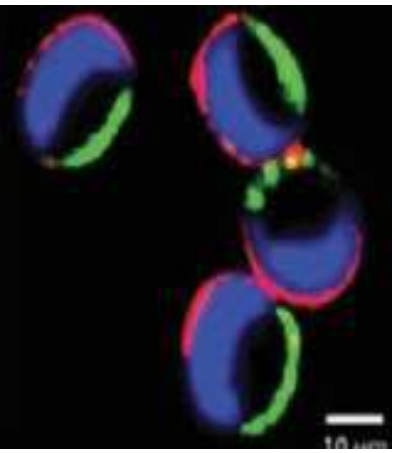


The Photonics Sensors Laboratory led by Professor Saurabh Mani Tripathi, focuses on study and development of novel photonic sensors for the accurate detection of bio-chemical agents, structural health monitoring, and mitigation with respect to unwanted perturbations. Some sensors developed by us include: fiber-optic sensor for trace detection of E. coli bacteria in water, hepatotoxic microcystin-LR in drinking water, simultaneous detection of multiple analytes, multi-parameter insensitive sensor, etc. We have also made discoveries related to wavelengths at which the transmission spectra are insensitive to perturbations, as well as the wavelengths at which the sensor shows potentially infinite sensitivity. Our current research interest involves developing sensors for nano-fluctuations and sensing characteristics of open quantum systems. The laboratory is in development phase with equal focus on rigorous optimization of the design of the sensor as well as their fabrication and experimentation.





CENTRE FOR
RURAL DEVELOPMENT AND TECHNOLOGY





Head of the Centre

P. M. V. Subbarao, *Ph.D. (IIT Delhi)*
Professor
Thermal Engineering, Energy Resources and Technologies.
Department of Mechanical Engineering

Ram Chandra, *Ph.D. (IIT Delhi)*
Assistant Professor
Anaerobic Digestion of Biomass; Agricultural Machines and Power.

Vijayaraghavan M. Chariar, *Ph.D. (IIT Delhi)*
Professor
Ecological Sanitation, Design for Sustainability, Traditional Knowledge Systems.

Kavya Dashora, *Ph.D. (CAZRI, Jodhpur)*
Associate Professor
Biosensors, Non-chemical Pest Management, Agricultural Technologies, Panchgavya.

Pooja Ghosh
Assistant Professor
Solid Waste Management, Bioenergy, Bioremediation, Environmental Toxicology.

Priyanka Kaushal, *Ph.D. (TU Wien Vienna)*
Associate Professor
Biomass-to-energy, Energy Systems; Technology Assessment and Carbon Neutrality.

Vivek Kumar, *Ph.D. (IIT Delhi)*
Professor
Paper Technology, Waste Water & Ecofriendly Technology.

Anushree Malik, *Ph.D. (IIT Delhi)*
Professor
Bioremediation, Waste Water, Management, Algal Technologies.

Hariprasad P., *Ph.D. (Univ. of Mysore)*
Associate Professor
Environmental Biology and Biotechnology, Applied Secondary Metabolites.

Jatindra K. Sahu, *Ph.D. (IIT Kharagpur)*
Associate Professor
Food Engineering, Green Extraction & Encapsulation, Food Tribology, Food Safety & Quality.

Ajay Saini, *Ph.D. (TISS, Mumbai)*
Assistant Professor
Governmentality Studies, Rural Development, Isolated Indigenous Communities, Northeast India, Andaman and Nicobar Islands.

Satyawati Sharma, *Ph.D. (IIT Delhi)*
Professor
Biomass Production, Conversion and Utilization; Mushroom Technologies.

V.K. Vijay, *Ph.D. (IIT Delhi)*
Professor
Biogas, Renewable Energy, Rural Industrialization, Rural Energy Systems & Entrepreneurship.

Sunil K. Khare, *Ph.D. (IIT Delhi)*
Joint Faculty
Microbial Screening & Molecular Biology.
Department of Chemistry

Kamal K. Pant, *Ph.D. (IIT Kanpur)*
Joint Faculty
Green Technologies for Sustainable Energy & Environment.
Department of Chemical Engineering

S.N. Naik, *Ph.D. (IIT Delhi)*
Emeritus Professors
Biofuels, Oils, Fats and Waxes Technology, Extraction of Natural Products & Value Addition of NTFPs.

Vijay P. Bhatkar, *Ph.D. (IIT Delhi)*
Honorary Professor
Computer Science and ICT, Rural Development.

Santosh Satya, *Ph.D. (IIT Delhi)*
Honorary Professor
Holistic Health, Food Safety and Quality.

Ramesh Raliya, *(Smart Aerosol Technologies, USA)*
Adjunct Faculty
Design & Development of Nanoscale Materials; Translational Research (Lab to Land); Regulatory; Policy Support & Predictive Analyses; Execution of Pilot to Industry Scale Projects; Exploring Inter-disciplinary Applications of Nano-forms.

Nitya Sharma, *Ph.D. (BHU)*
IITD - PDF

Megha Mathur, *Ph.D. (IIS University)*
IITD - PDF

INTRODUCTION

The Centre for Rural Development and Technology (CRDT) was established to coordinate and provide inputs for scientific and technological advancements in the rural sector by giving technical back-up for the sustainable rural development.

The guiding mission of CRDT is to sensitize the students towards the pressing societal needs and developing solutions forthe same.Special emphasis is on sustainable utilization of resources and close loop recycling technologies. The centre aims to generate a sustainable technology base through synergy of modern S&T interventions and Traditional Knowledge.The centre undertakes appropriate teaching, research, technology dissemination and outreach related activities, and network with other technical institutions, grass root organizations, government agencies, and rural industries, for improving living conditions and generating livelihood.

ACADEMIC PROGRAMMES

UNDERGRADUATE

The Centre offers many elective courses to undergraduate students.

POSTGRADUATE

The Centre offers twenty-nine courses with strong lab or field component to postgraduate students as electives. Our basket of academic courses is designed to provide wide range of courses spanning over Rural Resources, Governance, Traditional and Emerging Technologies and Natural Product Development.

Ph.D.

CRDT has a pool of over 135 research scholars working on diverse aspects of rural development and technology. Scholars are rigorously trained in subject/research and evaluated on a continuous basis to carve future leaders in variety of professions such as academia, industry, developmental organizations, entrepreneurship or think tanks.

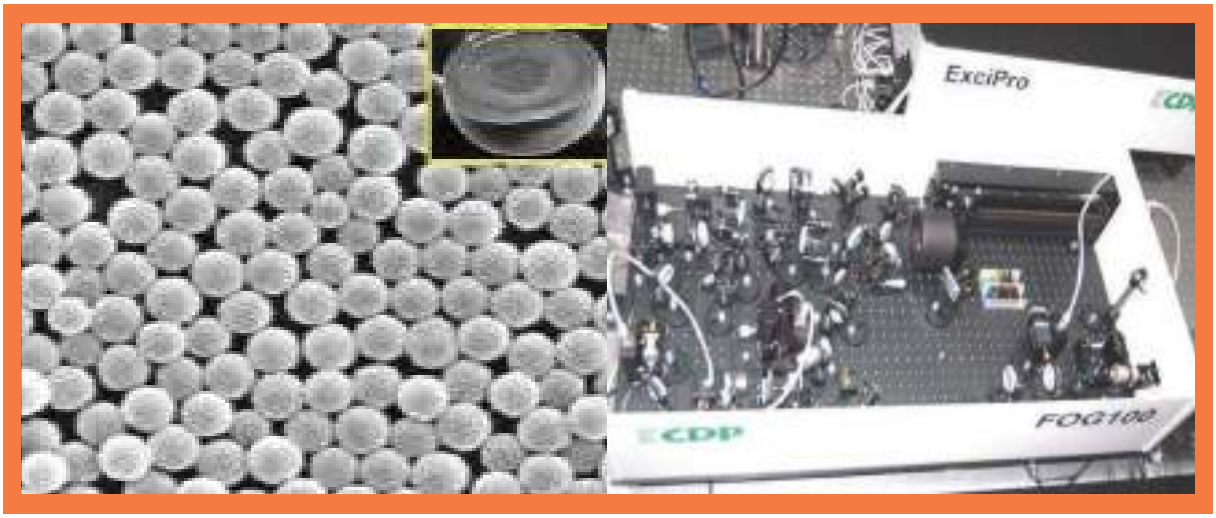
RESEARCH AREAS

The main research areas of the centre are:

- **Rural Resources, Energy & Environment:** Rural energy systems, biogas production, enrichment and bottling, algal biofuels/biorefinery, biodiesel, biomass gasifiers, biomass cookstoves, engine conversion kits, picohydel systems, environment and climate change, monitoring, bioremediation and detoxification of environmental contaminants, Solid-liquid waste treatment & valorization, life cycle assessment, etc.
- **Local Governance, Social Systems & Grassroot Innovations:** Rural Infrastructure, Design for sustainability, green product development,Traditional Knowledge & Values, Ecological sanitation and nutrients recovery, Rural Development and Governance, culture and indigenous people, Agri/artisanal tools and livelihoods, Rural Planning and Entrepreneurship Development, etc.
- **Microbio, Nano & Biomass Technologies in Rural Settings:** Sustainable biomass production, conversion and utilization, rapid composting & bio-manures, bio-inoculants and bio-pesticides, applied secondary metabolites, environmental biotechnology, bio-economy and panchgavya, nanotechnology, block chain technology in agriculture, etc.
- **Food, Health and Nutrition:** Green extraction, encapsulation and value addition of bioactive, 3-D food printing, food tribology, sustainable food production systems, food quality and safety, bio-formulations for stored food products, value addition of non-timber forest, Medicinal and nutraceutical mushrooms, medicinal and aromatic plants and herbs, post-harvest technology, agro-waste management.

CRDT has successfully completed and demonstrated several extramural sponsored R&D projects and industrial consultancies funded by various national and international agencies. Currently, large number of research projects and extension activities are undertaken by our faculty, funded by various Government and Private funding agencies. Besides CRDT has a strong presence on International platforms through sustained bilateral/multilateral international collaborations. In the last five years, CRDT has to its credit over 306 high impact journal publications, 13 books, 28 patents, and 3 start-ups.

CRDT also uses the social entrepreneurship route as a mechanism for creating impact in several areas. The Centre regularly offers Short-term Courses as well as Training Programmes for both national and international participants with background in community development, research, policy making, entrepreneurship and governance. CRDT plays a lead role in coordinating pan-India initiatives such as the *Unnat Bharat Abhiyan (UBA)*. UBA, a flagship programme of Ministry of the Human Resource Development, aims to bring a transformational change in rural development by active participation of higher academic institutions with local communities, and reorientation of academic curricula and R&D design of knowledge institutions in the country. The wide network originating from such efforts provides CRDT a unique platform for consultation and dissemination.



LABORATORY FACILITIES

The Centre has established need based academic and core research labsequipped with some state-of-the-art research equipment. The Centre has a privilege of 7 acres of open land space inside IIT Delhi campus (Mahatma Gandhi Gramodaya Parisar) to enable the pilot testing of technologies before making tangible contributions on land.

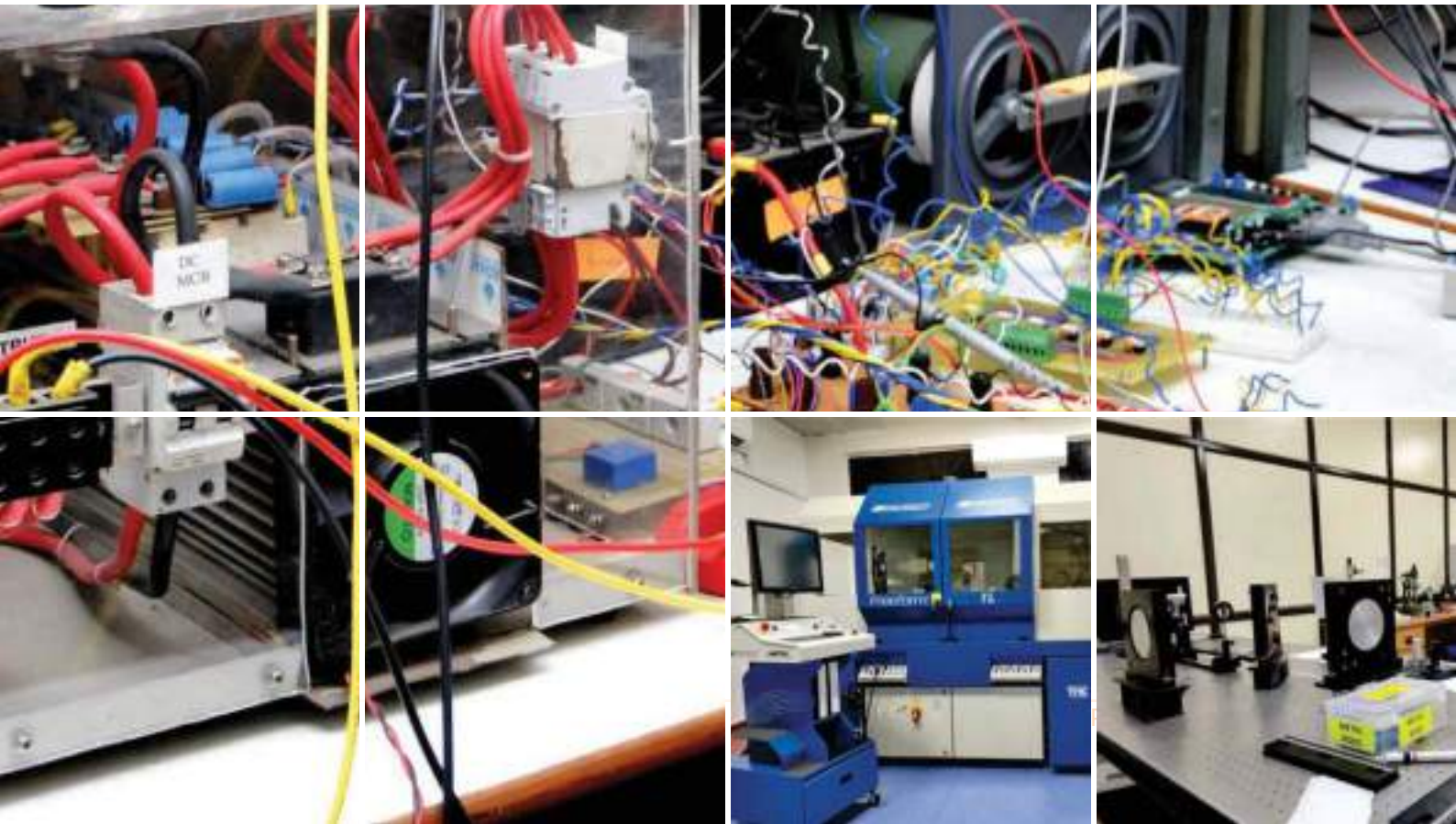
The major research laboratories are:

- Applied Microbiology Lab
- Agro Ecology Lab
- Food & Bioprocess Engineering Lab
- Agro-Forest Products Processing Lab
- Applied Biomass Lab
- Biogas Research Lab & Test Centre
- Biomass Lab

- Biochemical Lab Biogas Enrichment and Bottling Lab
- Cook-stove Lab
- Environmental Biotechnology Lab
- Food and Bioprocess Engineering Lab
- Frugal Innovation Lab
- Regional Testing and Knowledge Centre for Clean Cook-stoves
- Supercritical Fluid Extraction Lab
- Agricultural Nano-biotechnology Lab
- Air Quality Lab

SeNSE

Centre for Sensors, Instrumentation and Cyber-physical Systems Engineering



Head of the Centre

Anuj Dhawan, *Ph.D. (North Carolina State University, USA)*
Professor
Plasmonic Devices, Optoelectronic Devices, Chemical and Biological Sensors, SPR and SERS based Sensors, Nanofabrication, Flexible Electronics, Integrated nano-scale systems, Integrated Photonic Devices, and Computational Electromagnetics.

Satish Kumar Dubey, *Ph.D. (IIT Delhi)*
Associate Professor
Digital Holography, Laser Based Instrumentation for Measurement and Monitoring Systems, Opto-Electronic Sensing for PoC Diagnostics.

Gufran Sayeed Khan, *Ph.D. (University of Erlangen-Nuremberg, Germany)*
Professor
Optical Instrumentation, Applied Optics, Aspheric Optics, Interferometry, X-Ray Optics, Diffractive Optical Elements, Computer Generated Holography, Computer Controlled Polishing, Diamond Turning.

Manish Kumar, *Ph.D. (IIT Delhi)*
Assistant Professor
Optical Microscopy, Optical Imaging, Optical Systems, Bio-Imaging, Fluorescence Microscopy, Light-sheet Microscopy, Confocal Microscopy, Optical Instrumentation.

Jasleen Lugani, *Ph.D. (IIT Delhi)*
Assistant Professor
Quantum Optical Technologies, Integrated Quantum Photonics, Quantum Information Processing, Non-Linear Optics, Optical Memories, Photon Pair Generation, Photonic Processors, Integrated Optics Platforms, Photonic Circuits.

Shahid Malik, *Ph.D. (IIT Bombay)*
Assistant Professor
Analog integrated Circuits, Signal Conditioning Circuits, Biomedical Instrumentation, Embedded Sensing Microsystems, Implantable/Injectable Sensors, Sensing Prosthetic, and Remote Sensing Instrumentation.

Jolly Xavier, *Ph.D. (IIT Delhi)*
Associate Professor
Optoplasmonic Cavity-hybridized Ultra Sensitive Single Molecule Biosensors, Integrated Nanophotonic and Nanoplasmonic Devices, Tunable Quantum Optical Sources and Frequency Combs, Quantum Photonic Sensors and Integrated Devices, Nanostructured Energy Harvesting Devices, Integrated Reconfigurable Optical Micromachines and Singular Optics, Opto-electro-mechanical Micro/Nano Devices and Applications.

Ravibabu Mulaveesala, *Ph.D. (IIT Delhi)*
Associate Professor
InfraRed Vision and Industrial Imaging. Signal, Image and Video Processing Techniques for Non-invasive Imaging/ Non-destructive Testing Methods. Non-destructive Testing & Evaluation. Structural Health Monitoring. Bio-medical Imaging. Thermal Non-destructive Testing/ Thermal wave imaging. InfraRed Imaging.

Chandra Shakher, *Ph.D. (IIT Madras)*
Honorary Professor
Holography, Holographic Optical Elements, Fibre-optic Sensors, Optical Instrumentation.

D.T. Shahani, *Ph.D. (IIT Delhi)*
Honorary Professor
Electronic Instrumentation, Electro-magnetics, Antennas.

I.P. Singh, *Ph.D.*
Visiting Faculty
Mechanical Instrumentation, Microprocessor Application.

A.L. Vyas, *Ph.D. (IIT Delhi)*
Visiting Faculty
Electronic and Ultrasonic Instrumentation, Signal Processing, Sonar Systems, Transducer Design.

JOINT FACULTY

Joby Joseph, *Ph.D. (IIT Delhi)*

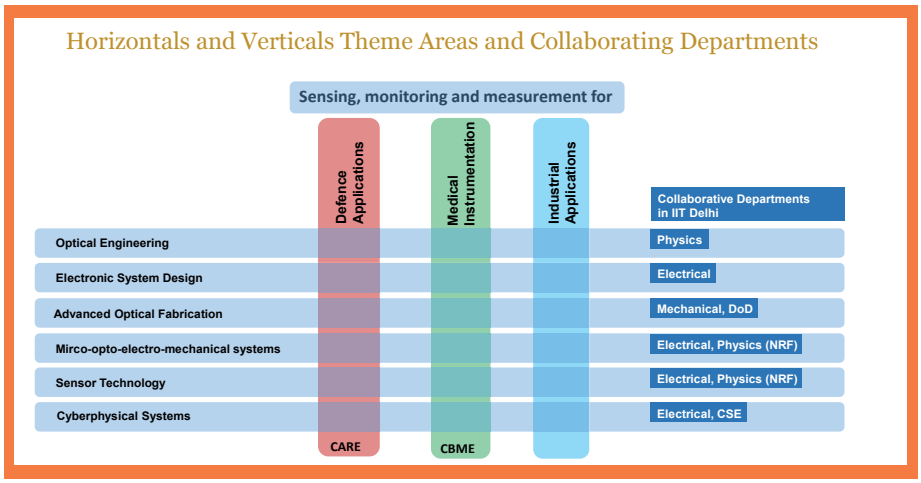
Dalip Singh Mehta, *Ph.D. (NPL Delhi/CCS Univ. Meerut)*

GUEST FACULTY

Rana Pratap Sircar, *(Head of Innovation & Technology, DIG, SVCS Ericsson Global India)*

INTRODUCTION

The Centre for Sensors, Instrumentation and Cyber-physical System Engineering (SeNSE) - formerly known as Instrument Design Development Centre (IDDC), is an interdisciplinary unit. It offers a M.Tech. course in Instrument Technology and Ph.D. in specialized research areas combining multiple disciplines– microelectronics, optics, electronic and photonic circuits, mechanical engineering and quantum optics to design and develop complete systems. In keeping with modern trends, industrial/societal expectations vis-a-vis the national goals, two more research areas - Sensors Technology and Cyber Physical Systems - have been included in its theme and the centre has been renamed as SeNSE. The Centre has made significant contribution through various sponsored R&D projects in developing Sensors/Systems for defense, medical and industry. It aims to achieve the national goals and foster excellence in state-of-the-art technologies. After it's restructuring, SeNSE has six core areas of focus - optical engineering, electronic system design, advanced optical fabrication, micro-opto-electro-mechanical systems, sensor technology and cyber-physical systems- across three application domains - defense, medical and industrial applications.



Research topics undertaken at SeNSE include: Sensors and Transducers; Electronic and optical sensors; Electronic Components and Circuits; Electronic circuit design (analog and digital); Electronic Techniques for Signal Conditioning and Interfacing; Signal processing; Image processing and computer vision; CMOS analog and mixed signal circuits & systems for sensors; Optical Metrology; Micro-optics; Aspheric and freeform optics; Optical instrumentation; Holographic microscopy; Digital speckle pattern interferometry; Optical coherence tomography; Display Devices and Technology; Quantum optical devices; Integrated quantum technologies; Nanophotonic and Nanoplasmonic devices; Linear and nonlinear micro-resonator integrated devices; Optical image processing; Machine Vision and Automation; Signal, Image and Video Processing Techniques for Non-destructive Testing; Infrared Vision and Automation, Sub-surface Sensing and Imaging, Industrial Imaging, Tera Hz, InfraRed, X-ray, and Ultrasound Imaging Modalities; Precision Measurement Systems; Precision mechanics; Instrumentation and Control; Instrument Design and Simulations; Mechatronics; Embedded systems; Sensors Systems; Smart Systems.

ACADEMIC PROGRAMMES

Interdisciplinary M.Tech. in Instrument Technology

This is an interdisciplinary M.Tech. program, aimed to develop and train the manpower for the industrial needs requiring the knowledge and skills in different disciplines of science and engineering. The Center admits the students from various streams i.e. Electronics/Electrical/Electronics & Communication/Instrumentation, Mechanical engineering and Physics. Apart from theory courses, students also undergo rigorous laboratory courses as part of the hands on training programme. This helps them contribute towards sponsored R&D activities via their Masters projects.

RESEARCH AREAS

- **Sensors and Transducers:** Electronic and optical sensors; Electronic Components and Circuits; Electronic circuit design (analog and digital); Electronic Techniques for Signal Conditioning and Interfacing; Sensor Signal processing, Image processing; CMOS analog and mixed signal circuits & systems for sensors.
- **Imaging Technologies:** Optical image processing; Machine Vision and Automation; Signal, Image and Video Processing; Techniques for Non-destructive Testing; Tera Hz, InfraRed, X-ray, and Ultrasound Imaging Modalities, Infrared Vision and Automation, Sub-surface Sensing and Imaging, Industrial Imaging.
- **Optical Engineering and optical instrumentation systems:** Optical 3D imaging with emphasis on biomedical application, optical metrology, design and development of opto-electronic/electro-optic sensors, NDT technology.
- **Precision Mechanics:** Precision optical and mechanical fabrication, Mechatronics, Microfluidics, Composite and nanomaterials.
- **Biomedical Instrumentation:** NIR and IR imaging for biomedical application, wearable sensors for health monitoring, design of point of care diagnostic devices. Fluorescence microscopy, Light-sheet microscopy, Optical coherence tomography.
- **Electronic systems, Instrumentation and Sensors (Integration):** Design of electronic systems, Industrial quality control, signal and image processing, non-destructive testing, Instrumentation and Control, Display Devices and Technology.
- **Microelectronics/MOEMS/Sensors Fab:** MEMS/MOEMS based devices and their integration for sensing, design of microelectronic devices. Nanophotonic and Nanoplasmonic devices; Linear and nonlinear micro-resonator integrated devices.
- **Cyber-physical systems:** Machine Learning and Artificial Intelligence applied to health applications/ public health, Embedded systems; Sensors Systems; Smart Systems, genetics and biological networks, energy autonomous IoTs, resilient IoT and security of the Internet of Things.
- **Quantum Technologies:** Integrated quantum photonics, quantum device engineering, quantum non-linear optics, Tunable quantum optical sources and Quantum photonic sensors.

LABORATORY FACILITIES

- **CAD and Simulation Lab:** Equipped with state of the art machines with CAD and Simulation software to design and simulate various prototypes.
- **Manpower Development in Instrument Technology (MDIT) Lab:** Equipped with best facilities in electronics design and instrumentation.
- **Advanced Instrumentation Lab:** Equipped with complete range of instruments to carry out DSP based system design.
- **InfraRed Imaging Laboratory (IRIL):** Equipped with state-of-the-art research facilities in the field of Infrared Imaging for sub-surface sensing and imaging applications.
- **Laser Application and Holography Lab:** Equipped with state of the art facility to develop the sensors and Laser based instruments for industrial and medical applications.
- **Optical Metrology Lab:** Works in opto-electronic and opto-mechanical area for precision measurement and monitoring systems.
- **Optical Workshop:** Equipped with fabrication machines and metrology tools for the production of optical elements such as mirrors, retroreflectors, lenses, parabolic optics, prisms and many other components.





TRANSPORTATION RESEARCH AND INJURY PREVENTION CENTRE






Kalaga Ramachandra Rao, *Ph.D. (IIT Kharagpur)*
Professor
Department of Civil Engineering
Transportation Engineering: Expertise in Mass Transit Planning, Traffic Flow Modeling and Road Accidents Analysis.

Head of the Centre

CORE FACULTY

M.N. Sai Chand Chakka, *Ph.D. (Univ. of New South Wales, Sydney, Australia)*
Assistant Professor
Transportation Network and Safety Modelling: Expertise in Traffic Simulation Modelling, Pervasive Traffic Data, Surrogate Safety Measures, Highway Safety, Simulation of Connected and Automated Vehicles, and Large-scale Network Planning.

Rahul Goel, *Ph.D. (IIT Delhi)*
Assistant Professor
Transport and Health: Traffic Injury Epidemiology, Traffic Emissions and Air Pollution, Active Travel and Physical Activity, Health Impact Assessment, Gender and Transport.

Deepty Jain, *Ph.D. (IIT Delhi)*
Assistant Professor
Transportation Planning, Low Carbon Mobility, Built Environment Studies, Sustainable Urban Transport, Risk Mitigation and Adaptation.

Deepty Jain, *Ph.D. (IIT Delhi)*
Assistant Professor
Transportation Planning, Low Carbon Mobility, Built Environment Studies, Sustainable Urban Transport, Risk Mitigation and Adaptation.

Geetam Tiwari, *Ph.D. (Uni. of Illinois, Chicago)*
Professor
Transportation Planning: Expertise in transportation planning and travel analysis, traffic safety and safety of vulnerable road users, public transport planning, pedestrian and bicycle infrastructure planning, highway safety and road safety audits.

JOINT FACULTY

Anoop Chawla, *Ph.D. (IIT Kanpur)*
Professor
Department of Mechanical Engineering
Mechanical Engineering: Expertise In Cad/Cam and Mathematical Modeling, Biomechanics. Presently Involved in Computer Modeling of Pedestrian Crashes with Truck Fronts, and Motorcycles with Cars, Fe Modeling of Human Body, Impact Characterization of Human Tissues.

N. Chatterjee, *Ph.D. (London University)*
Professor
Department of Mathematics
Statistical Modelling, Big Data Analysis.

K.N. Jha, *Ph.D. (IIT Delhi)*
Professor
Department of Civil Engineering
Construction Technology and Management.

Puneet Mahajan, *Ph.D. (Montana)*
Professor
Department of Applied Mechanics
Expertise in Dynamics and Vibrations. Currently Involved in Modelling Vibrations of Tractors and their Effect on Drivers, Helmet Impact Modelling.

Sudipto Mukherjee, *Ph.D. (OHIO State)*
Professor
Department of Mechanical Engineering
Dynamics, Vehicle Crash Modeling, Biomechanics. Currently Involved in Motorcycle and three Wheeler Crash Modeling, Fe Modeling of Human Body, Impact Characterization of Human Tissues.

Sanjeev Sanghi, *Ph.D. (CUNY, New York)*
Professor
Department of Applied Mechanics
Expertise in Turbulence, Fluid Mechanics, Non-Linear Mechanics and Chaos, Pollution Studies and Development of Educational Software.

ASSOCIATE FACULTY

Ankush Agrawal, *Ph.D. (IGIDR, Mumbai)*
Department of Humanities and Social Sciences

S. Banerjee, *Ph.D. (IISc., Bangalore)*
Department of Computer Science & Engineering

Sagnik Dey, *Ph.D. (IIT Kanpur)*
Centre for Atmospheric Sciences

Gazala Habib, *Ph.D. (IIT Bombay)*
Civil Engineering Department

Husain Kanchwala, *Ph.D. (IIT Kanpur)*
Centre for Automotive Research and Tribology (formerly ITMMEC)

Ravinder Kaur, *Ph.D. (Delhi University)*
Department of Humanities and Social Sciences

Reetika Khera, *Ph.D. (Delhi School of Economics)*
Department of Humanities & Social Science

Kaushik Mukherjee, *Ph.D. (IIT Kharagpur)*
Department of Mechanical Engineering

Manoj M., *Ph.D. (IISc., Bangalore)*
Department of Civil Engineering

Nezamuddin, *Ph.D. (Univ. of Texas)*
Department of Civil Engineering

Sourabh B. Paul, *Ph.D. (Uni. of British Columbia)*
Department of Humanities & Social Science

Ravi Shankar, *Ph.D. (IIT Delhi)*
Department of Management Studies

Rijurekha Sen, *Ph.D. (IIT Bombay)*
Department of Computer Science & Engineering

Vikram Singh, *Ph.D. (Cornell)*
Department of Chemical Engineering

Aravind K. Swamy, *Ph.D. (New Hampshire Univ.)*
Department of Civil Engineering

ADJUNCT FACULTY

Girish Agrawal, *Ph.D. (Purdue University)*
Professor in the School of Art & Architecture, O.P. Jindal Global University (JGU)
Transportation Safety: Applications of Computations Neural Networks; Geotechnical Data Analysis, Road Safety Law and Policy, Earthwork Optimization, Public Infrastructure, Informal Transport Networks, Public Health, Urban Heat Island Effect, and Urban Development Policy.

Shrikant I. Bangdiwala, *Ph.D. (UNC-Chapel Hill)*
Director, Division of Statistics, Population Health Research Institute, McMaster University, Canada
Expertise in Nonparametric Methods, Observer Agreement, Multilevel Analysis, Global Health, Methodology for Clinical Trials, Injury Statistics, Statistical Graphics, Methodology for Clinical Epidemiology, Meta Regression.

Sarath K. Guttikunda, *Ph.D. (IUniversity of Lowa)*
Founder and Director, Urban Emissions, India
Air Pollution Models, Emissions Inventories, Pollution Source Apportionment, Air Pollution Control Strategies, Environmental Policy, Capacity Building, and Public Awareness.

Mathew Varghese, *MS(Ortho), MBBS*
Head, Orthopaedics Department and Ex-Director, St. Stephen's Hospital, Delhi
Orthopaedic Surgery and Injury Analysis and Effects of Vibrations on Spines.

HONORARY PROFESSOR

Hermann Knoflacher, *Ph.D. (Vienna Univ. of Technology, Austria)*

V. Sumantran, *Ph.D. (Virginia Tech)*
Chairman, Celeris Technologies

PROFESSOR OF PRACTICE

Vijay Gopal Kovvali, *Ph.D. (Texas A&M)*
Industry Experience in Road Safety, Traffic Engineering & Technology to Conduct Research on Technological-based Solutions for Road Safety Problems.

IIT EXCHANGE PROGRAMME FACULTY

Suresh Jain, *Ph.D. (IIT Tirupati)*

INTRODUCTION

The Transportation Research and Injury Prevention Programme has been operational for two decades and has now been established as a Centre and renamed the TRIP-Centre. It is based at the Indian Institute of Technology (Delhi) and is an interdisciplinary academic unit focusing on the reduction of adverse health effects of road transport. TRIP-Centre attempts to integrate all issues concerned with transportation in order to promote safety, active mobility, cleaner air, and energy conservation. Faculty members are involved in planning safer urban and inter-city transportation systems, and developing designs for vehicles, safety equipment and infrastructure for the future. Activities include applied research projects, special courses and workshops, and supervision of student projects at postgraduate and undergraduate levels. The centre works closely with vehicle industry both nationally and internationally. The centre will also promote collaboration with construction (highway) industry and public transport agencies. TRIP Centre also organises short-term courses and workshops on road safety and transport issues regularly.

ACADEMIC PROGRAMMES

Ph.D. Programme

IITD-TRIPP (now known as TRIP Centre) has been running Ph.D. programme since May 2004. At present there are six institute fellowships allocated to TRIP Centre. Additional fellowship are available through industry/ research project partnerships. The Ph.D. programme is administered as per the IIT Delhi current norms.

M.S. (Research)

The M.S. (Research) programme (TRY) will comprise 15 credits of the coursework and 36 credits of the research work. In the first semester, the student has to register compulsory for two core courses, TRL700 and TRL701, and earn a minimum of 09 and a maximum of 15 credits. In the first semester, the part-time students can only register for coursework with minimum and maximum limits of 3 and 12 credits, respectively. The coursework must be completed by the end of the third semester; otherwise, the registration of the student will stand cancelled.

RESEARCH AREAS

Transportation Planning; Traffic flow modeling, simulation, and optimization, public transport systems; Sustainable Urban Transport; Travel Behaviour Modeling; Pedestrian Dynamics and Evacuations; Construction Safety and Work Zone Safety; Highway Safety; Vehicle Crash Modeling; Road Traffic Injury Prevention; Human Body Modeling and injury estimation; Pedestrian and non-motorized vehicle safety; Freight modelling, Road accident costing; network modelling; climate change; human migration; driving simulators, vehicle dynamics; intelligent transport systems.

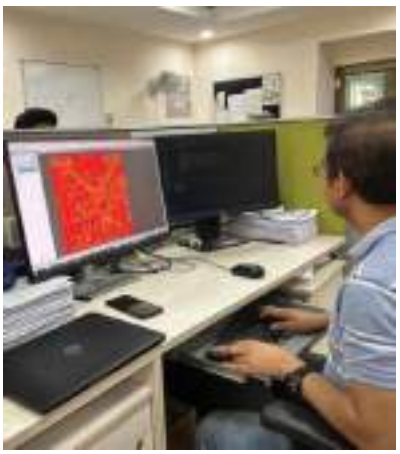
Thrust Areas

The broad areas of interest (indicative) are as follows:

1. Road planning and design interventions associated with traffic safety.
    a. Road safety studies in collaboration with Industry and government organizations
    b. Development of Intelligent Transport Systems including data analytics
2. Road user behaviour associated with traffic safety and sustainable transport systems
    a. Sustainable transport policies inclusive of environment and safety
    b. Development of modern innovative public transport systems for Indian metropolitan cities including electric mobility.
3. Safety aspects of new vehicle technology in mixed traffic.
    Safety of autonomous vehicles, electric vehicles safer bus designs.








AMAR NATH AND SHASHI KHOSLA
SCHOOL OF
INFORMATION TECHNOLOGY






Kolin Paul, *Ph.D. (Bengal Engineering College, Calcutta)*
Professor (Microsoft Chair)
Affordable Health Care, Embedded Systems.
Department of Computer Science & Engineering

Head of the School

Sanjiva Prasad, *Ph.D. (Stony Brook Univ.)*
Professor
Medical Applications of Computing.
Department of Computer Science & Engineering

Associated Faculty from Dept. of Computer Science & Engineering

Chetan Arora, *Ph.D. (IIT Delhi)*
Computer Vision and Machine Learning.

Sorav Bansal, *Ph.D. (Stanford Univ.)*
Operating Systems, Compilers.

Srikanta Bedathur, *Ph.D. (IISc., Bangalore)*
Data Management, Knowledge Discovery and
Data Mining, Natural Language Processing.

Rahul Garg, *Ph.D. (IIT Delhi)*
Machine Learning, Big Data Analytics,
Neuroimaging, High Performance Computing.

Abhilash Jindal, *Ph.D. (Purdue University)*
Operating Systems, Mobile Systems, Programme Analysis.

Prem Kumar Kalra, *Ph.D. (EPFL, Switzerland)*
Computer Graphics, 3D Animation.

Vireshwar Kumar, *Ph.D. (Virginia Polytechnic Institute and State University (Virginia Tech))*
Security and Privacy in Cyber-physical Systems, Applied
Cryptography, Adversarial, Adversarial Machine Learning.

Mausam, *Ph.D. (University of Washington, Seattle)*
Artificial Intelligence, Natural Language Processing.

Rahul Narain, *Ph.D. (University of North Carolina at Chapel Hill)*
Computer Graphics, Animation, Numerical Simulation.

Preeti Ranjan Panda, *Ph.D. (University of California, Irvine)*
Embedded Systems, CAD for VLSI.

Rohan Paul, *Ph.D. (Oxford University)*
Human Robot Interaction,
Language Grounding, Symbolic Reasoning.

Maya Ramanath, *Ph.D. (IISc., Bangalore)*
Database and Information Retrieval Techniques for Semantic Web Data
Management, Information Extraction and Opinion Mining.

Huzur Saran, *Ph.D. (Univ. of California Berkeley)*
High Speed Networks Graph Theory, Algorithms.

Smruti Ranjan Sarangi, *Ph.D. (University of Illinois)*
Computer Architecture, Operating Systems.

Aaditeshwar Seth, *Ph.D. (Univ. of Waterloo)*
Computer Networks, Social Network Analysis, Information and
Communication Technologies for Development.

Rijurekha Sen, *Ph.D. (IIT Bombay)*
Mobile and Embedded Systems (Hardware Architecture,
OS, Sensing, Efficient Processing, Security),
Computational Sustainability.

Subodh Sharma, *Ph.D. (University of Utah)*
Formal Methods, Program Analysis, Concurrent Systems.

Parag Singla, *Ph.D. (University of Washington, Seattle, WA)*
Machine Learning, Artificial Intelligence,
Nuro-symbolic Reasoning.

Associated Faculty from Dept. of Design

P.V.M. Rao, *Ph.D. (IIT Kanpur)*
Product Design & Realization,
Computer Aided Design & Manufacturing.

Associated Faculty from Dept. of Electrical Engineering

Harshan Jagadeesh, *Ph.D. (IISc., Bangalore)*
Wireless Networks, Coding Theory, Security,
Distributed Storage, Information Theory.

Sumeet Agarwal, *D.Phil. (University of Oxford)*
Machine Learning, Complex Networks, Systems Biology,
Evolution and Evolvability, Computational Linguistics,
Cognitive Science, Public Health Informatics.

Associated Faculty from Dept. of Mathematics

Niladri Chatterjee, *Ph.D. (University of London)*
Machine Translation, Artificial Intelligence, Reasoning,
Statistical Modelling and Semantic Web.

Associated Faculty from Dept. of Mechanical Engineering

Anoop Chawla, *Ph.D. (IIT Kanpur)*
CAD, CAE, Dynamics, Bio-Mechanics, Road safety,
Impact and Blast Mechanism.

ADJUNCT AND VISITING FACULTY

A K Bhateja, *Ph.D. (IIT Delhi)*
Cryptography, Cryptanalysis, Biometrics, Biometric Security, Artificial Intelligence, Machine Learning, Algorithms.

Anupam Joshi, *Ph.D. (Purdue University)*
Computer security, Artificial intelligence, Mobile computing.
University of Maryland, Baltimore County, USA

B. Chandra, *Ph.D. (Delhi University)*
Machine Learning, Deep Learning and Data Analytics.

Mahesh Chowdhary, *Ph.D. (The College of William and Mary, Williamsburg, Virginia)*
Internet of Things, Advanced Signal Processing, MEMS, Sensor Fusion.
Fellow and Director of Strategic Platforms and IoT Excellence Centre, STMicroelectronics, USA

Manik Verma, *D.Phil. in Engineering (University of Oxford)*
Machine Learning, Computer Vision, Computational Advertising.
Microsoft

Pawan Sinha, *Ph.D. (Massachusetts Institute of Technology)*
Neuroscience, Cognitive science, Artificial intelligence.
Massachusetts Institute of Technology, Cambridge, USA

Ashish Suri, *M.B.B.S., M.Ch., D.N.B., M.N.A.M.S.*
Neurosurgery, Skull base and Cerebrovascular Surgery, Endoscopic Neurosurgery, Neuro-oncology, Epilepsy Surgery.
Professor, Department of Neurosurgery, AIIMS, Delhi

Volker Sorge, *Ph.D. (Universit at des Saarlandes, Germany)*
Scientific Doc Analysis, Accessibility, Computer Algebra, Abstract Algebra, Logic and Automated Reasoning.

INTRODUCTION

The Amar Nath and Shashi Khosla School of Information Technology was established with an endowment from the distinguished IIT Delhi alumnus, Vinod Khosla (B. Tech, EE 1976). The objective of the School is to foster inter-disciplinary, goal-oriented research, innovation and post-graduate education in Information Technology. The School undertakes research in several interdisciplinary areas where there is a significant application of Information Technologies. The School has its own supporting staff and students, and its own joint faculty but encourages the participation of faculty members and students from other departments who have an interest in novel applications of computing sciences and technologies.

ACADEMIC PROGRAMMES

POSTGRADUATE

The School offers Ph.D. and M.S. (Research) programmes in Information Technology.

The M.S. (Research) programme is a 2 year inter-disciplinary programme that admits students with various backgrounds. The school also develops and offers academic courses in a variety of application areas, for which interested students from diverse disciplines may enroll.

In addition, the school also conducts an Interdisciplinary Program specializing in Cyber Security (jointly with Maths, Management Studies, Electrical Engineering and Computer Science).

RESEARCH AREAS

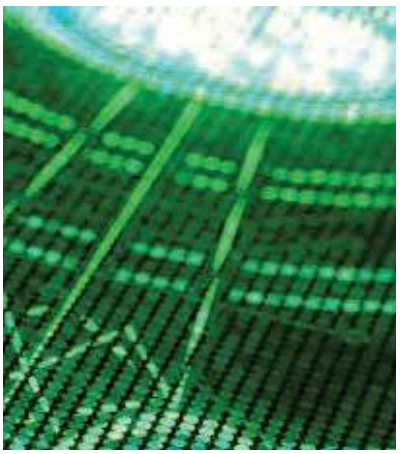
Doctoral research is being carried out in:

Scalable & Dependable Computing, Information Security, Biometrics, Information Storage and Retrieval, Data Analytics, Social Network Analysis, High Speed Networks, Sensor Networks, Mobile and Web Based Computing, Multimedia Systems, Embedded Systems, VLSI Design Automation, Internet of Things, Image Processing, Computer Vision, Robotics and Intelligent Systems, Medical Applications of IT, Computational and Systems Biology, Computational Neuroscience and Neuroimaging, Assistive Technologies, Human Computer Interfaces, Information and Communication Technologies for Development, Data Science for Development, Computational Sustainability, Geographical Information Systems, Blockchain Technologies, Location Based Services, Other areas aligned with school activities.

LABORATORY FACILITIES

The School has its own building, which houses specialized laboratories for collaborative and funded research activities.

- Assistech Lab
- ICTD Lab
- Medical Applications of IT Lab
- Mobile & Machine to Machine Lab



BHARTI
SCHOOL OF
TELECOMMUNICATION TECHNOLOGY AND MANAGEMENT

Huzur Saran, *Ph.D. (Univ. of California Berkeley)*
Professor
Wireless 5G & High Speed Networks,
Systems & Security.

Head of the School

Associated from Dept. of Electrical Engineering

Manav Bhatnagar, *Ph.D. (Oslo University)*
Ranjan Bose, *Ph.D. (University of Pennsylvania)*
Shouribrata Chatterjee, *Ph.D. (Columbia University)*
Arpan Chattopadhyay, *Ph.D. (IISc., Bangalore)*
Santanu Chaudhury, *Ph.D. (IIT Kharagpur)*
Amol Choudhary, *Ph.D. (Univ. of Southampton, UK)*
Swades De, *Ph.D. (State Univ. of New York)*
Abhishek Dixit, *Ph.D. (Ghent University, Belgium)*
Gourab Ghatak, *Ph.D. (Telecom ParisTech, France)*
Tapan Gandhi, *Ph.D. (IIT Delhi)*
Shiv Dutt Joshi, *Ph.D. (IIT Delhi)*
I.N. Kar, *Ph.D. (IIT Kanpur)*
Subrat Kar, *Ph.D. (IISc., Bangalore)*
Sandeep Kumar, *Ph.D. (IIT Kanpur)*
Lalan Kumar, *Ph.D. (IIT, Kanpur)*
Harshan Jagadeesh, *Ph.D. (IISc., Bangalore)*
Brejesh Lall, *Ph.D. (IIT Delhi)*
Ranjan K. Mallik, *Ph.D. (Univ. of Southern California)*
Sukumar Mishra, *Ph.D. (Sambalpur University)*
Saif K. Mohammed, *Ph.D. (IISc., Bangalore)*
B.K. Panigrahi, *Ph.D. (Sambalpur University)*
Seshan Srirangarajan, *Ph.D. (University of Minnesota, USA)*
Vivek Venkataraman, *Ph.D. (Cornell Univ.)*

Associated from Dept. of Computer Science and Engineering

Prem Kalra, ***Ph.D. (EPFL, Switzerland)***
Smruti Ranjan Sarangi, *Ph.D. (Univ. of Illinois)*
Kolin Paul, *Ph.D. (Bengal Engg. College, Calcutta)*
Vireshwar Kumar, *Ph.D. (Virginia Polytechnic Institute and State Univ. (Virginia Tech)*

Associated from Dept. of Mathematics

S. Dharmaraja, *Ph.D. (IIT Madras)*

Associated from CARE

Monika Aggarwal, *Ph.D. (IIT Delhi)*
Ananjan Basu, *Ph.D. (University of California)*

Associated from Dept. of Management Studies

Harish Chaudhary, *Ph.D. (IIT Delhi)*
Arpan Kumar Kar, *Ph.D. (XLRI)*
P. Vigneswara Ilavarasan, *Ph.D. (IIT Kanpur)*
Mahim Sagar, *Ph.D. (IIITM, Gwalior)*
Ravi Shankar, *Ph.D. (IIT Delhi)*

Professor-of-Practice

Krishna Kumar Sirohi, *M.E. (IISc. Bangalore)*
Atanendu Sekhar Mandal, *Ph.D. (IIT Delhi)*
Debashis Mitra, *Masters in Software Systems (Pilani)*

Adjunct Faculty

S.K. Subidh Ali, *Ph.D. (IIT Kharagpur)*
Commdt R.K. Arora, *Ph.D. (Banasthali Vidyapeeth)*
Anand Baswade, *Ph.D. (IIT Hyderabad)*
Vimal Bhatia, *Ph.D. (University of Edinburgh, UK)*
Maj. Gen. Pritam Bishnoi, VSM (Retd.), *Ph.D. (DAVV, Indore)*
Arzad Alam Kherani, *Ph.D. (IISc., Bangalore)*
Dilip Krishnaswamy, *Ph.D. (University of Illinois)*
Aashish Mathur, *Ph.D. (IIT Delhi)*
Soumava Mukherjee, *Ph.D. (IIT Kanpur)*
Commodore R.K. Rana, *Ph.D. (IIT Madras)*
Dhiman Saha, *Ph.D. (IIT Kharagpur)*
Arun K. Singh, *Ph.D. (Telecom ParisTech, France)*
Anand Srivastava, *Ph.D. (IIT Delhi)*

INTRODUCTION

The Bharti School of Telecommunication Technology and Management (BSTTM) functions jointly with the Departments of Electrical Engineering, Computer Sc & Engineering, Mechanical Engineering, CARE, Mathematics and Management Studies.

The Bharti School was set-up in the year 2000 through a grant from Bharti Enterprises with the following objectives:

- To be a centre of excellence for education and research relating to all facets of Telecommunication Technology and Management.
- To host state-of-the art laboratories and infrastructures, and a research environment so as to attract the best faculty and students.
- To invite and encourage the best talent in telecommunications to be a part of the activities of the School.
- To run graduate academic programs (including M.S, M.Tech., M.B.A., Ph.D.) in collaboration with the various Departments and Centres at IIT Delhi.
- To run continuing education programmes for personnel of the Telecom Industry.

ACADEMIC PROGRAMMES

The school offers the following postgraduate programmes:

Master of Technology (JTM): The M.Tech. (Telecom Technology and Management) programme is of 2 years (4 semester) duration. It is a full-time programme with classes during the normal working hours. Part-time and Sponsored M.Tech is also there, but at present there are no students under this program.

Master of Science (Research) (BSY): M.S.(R) is a two-year programme for full-time students and three-year programme for part-time students. Its emphasis is on research, with the thesis carrying 2/3rd of the credits.

Doctor of Philosophy (BSZ): Ph.D. full-time admissions are based on performance in M.Tech./B.Tech. as well as GATE Scores. Part-time admissions require 2 years' experience in lieu of GATE scores.

Master of Business Administration (SMT): The MBA (with focus on Telecom Systems Management) is a 2 years (4 semesters) programme. It is designed to be convenient for practising professionals, with most classes scheduled in the morning or evening.

RESEARCH LABS

- **Research Scholar Lab:** The research group focuses on performance analysis of wireless communication systems which is helpful in practical link design. Specifically, the work is on Cognitive radio, and Smart grid technologies, Visible Light Communication (VLC), Free Space Optical (FSO) communication over large Multi-InputMulti-Output (MIMO) systems. These technologies play an important role in enabling 5G communication. Another area is, providing routing solutions and designing protocols for best path selection to enable wireless data transfer with high coding and diversity gain. In 5G wireless networks, energy saving is an important area of research, for increasing lifetime of the devices and networks. The activities are aimed at addressing various security issues arising due to a presence of energy harvesting nodes in the network. For indoor communication in future 5G networks, VLC and FSO technologies provide enhanced data rates, high energy efficiency at lower costs. Work on optimizing power allocation in FSO for different channel models by exploiting channel state information is also done in this lab.

  Underwater acoustic channels are generally recognized as one of the most difficult communication media in use today. Random fluctuations, large delay and Doppler spread, small bandwidth of

the acoustic signal and frequency dependent absorption make this channel extremely complex. The advent of vector sensor recently has provided an opportunity to correct this bleak scenario to some extent. In our research, we emphasize on performance analysis of underwater acoustic communication system such as capacity, BER, outage probability and system design by using vector sensors. In this lab, we are also planning to work on underwater optical and hybrid (acoustic and optical) communication.

Security is non-negotiable and reliability is vital when it comes to defense applications. We are also developing a scheme for identification of the channel coding type and estimation of channel coding parameters of an intercepted demodulated satellite signal in collaboration with DRDO.

- **Pervasive Telecom Lab:** The pervasive telecom lab hosts several unique research initiatives. Central to the theme is the idea that telecom devices can be made ubiquitous, and deployed in numbers which are so large that data they gather is at a very high resolution. This data may be multi-dimensional but even with two dimensions - of space and time - it is extremely useful. The resulting Internet of Things and the Big Data flowing there from requires innovations in protocol stacks, hardware at layers 1, 2 and 3 in large distributed back-end repositories and in inference engines for the analytics. We have provisioned cloud repositories and have web-enabled several application domains such as healthcare, agriculture and animal management.
- **AI & Machine Learning Lab:** Artificial Intelligence and machine learning have become today's hot topics as AI and ML technologies increasingly find their way into everything from advanced quantum computing systems and leadingedge medical diagnostic systems to consumer electronics and "smart" personal assistants.

  AIML lab aims at improving the quality of life of students through technology by bringing end to end multi- disciplinary researches to a single place.
- **6G & Beyond Wireless Communication Lab:** The "6G and Beyond Wireless Communication lab" is focused on developing wireless communication technologies for 6G (e.g., modulation waveforms for 6G high mobility scenarios, joint communication and radar sensing).

  Emphasis will be on development of algorithms for 6G technologies. Government and industry funding will be sought to setup an experimental facility for verification of 6G algorithms and technologies. Ph.D./M.Tech. students will also get trained in the design of 6G communication systems.
- **Advanced Communications Systems Lab:** Advanced Wireless Laboratory (IIA-107), led by Prof. Manav Bhatnagar, focuses on cutting edge research on wireless communications, with a primary focus on limited feedback-based wireless communications, free-space optical communication, power line communications (PLC), molecular communications, smart grid communications, satellite communication, and underwater wireless optical communications. The lab engages in research to ensure the security and privacy of wireless communication techniques employed in the aforementioned areas. Research outcomes are disseminated via journal publications, conference presentations, and presentations. Students pursuing Ph.D, M.Tech, and B.Tech in IIT Delhi implement communication techniques in hardware using USRP kits.
- **Samsung Digital Academy Innovation Lab:** Samsung Samsung Innovation Lab is a state of the art research lab of Bharti School, IIT Delhi under supervision on Prof. Brejesh Lall. With many PhD students working in area of Computer Vision, Deep Learning and AI on many novel research ideas for solving novel social as well scientific problems. The lab boasts multiple CUDA capable rack servers, workstations and high end edge computing capabilities required for performing analytics on humongous data that is captured by multiple sensors, cameras etc. A brief description of some of the research activities being performed by the various Ph.D scholars along with support from PG and UG students follows: Sakshi Ahuja is pursuing her work in brain tumor analysis performing segmentation

of tumor from multiple modalities and estimating tumor growth from pre and post-operative brain MRI database using deep learning. Anushikha Singh performs computer aided diagnosis of Pulmonary Tuberculosis for the Indian Subcontinent. This project involves segmentation of lung area in chest X-ray images followed by rib suppression and identification of abnormalities present in different zones of chest X-ray image. Ronak Gupta works on developing novel video compression methods for VR videos. He's also working on problems of detecting Traffic violation by vehicles from videos captured from a camera mounted on a car. One of the sub-problems is to localize and classify the type of vehicles such as car, bus, truck, auto & motorbike, pedestrians which are jaywalking or endangering on the road. Vinay Kaushik is working on developing novel algorithms to map real world terrain using an inexpensive camera in real time for AI based AR/VR apps such as gaming, navigation, automated driving, etc. Aditi is analysing marine environment by detecting and tracking aquatic animals and predicting their long term behaviour under water. She aims to predict the health of water bodies and also analyse the underwater ecosystem. Piyush is working on characterizing deep networks for better understanding how AI works and how can we make it better. Ayan is developing algorithms for better multirate signal processing. There has also been research in developing salience based segmentation methods for image retargeting, video super-resolution for future displays, action recognition framework based on compressive sensing using Deep AI. There are several interesting cool projects going on in Samsung Innovation Lab. There's work on Air pollution monitoring and prediction, Agriculture based projects for predicting health and various plant diseases aimed at benefiting farmers in India and smart touch displays for classes. This lab is also part of organizing interesting challenges like Celestini Project India where researchers help undergrads solve real world problems like air pollution, vehicle to vehicle communication and women's safety. The lab works for developing cutting edge technology for solving novel problems in India.

- **Systems R&D Labs:**
  a. **Central Research Facility on Advanced Electrical Characterization (CRF-AEC) Lab:** This lab houses some of the high-end electrical characterization equipment meant for wafer and chip level characterization of electronic devices and circuits down to cryogenic temperatures as well as mm-wave frequencies up to 67 GHz. The lab also has facility to perform low frequency noise measurements, DC measurements, and a solar simulator.

  b. **UltraFast Optical Communications and High-performance Integrated Photonics Lab (UFOCHIP) :** In this laboratory, we work in the domain of optics and photonics for enhancing communication networks. We process high-frequency and high-bandwidth RF signals using photonic techniques such as microwave photonics, nonlinear optics and integrated optics to increase the flexibility and functionality of traditional wireless systems. Furthermore, we are developing integrated laser sources for quantum communications and telecommunication applications and are developing a Terabits-persecond coherent optical communication system.

  c. **5G & Beyond Wireless Communication Lab:** The lab is designed to house the core equipment of the proposed communication systems test and R&D bench at IIT Delhi as an Academia-Industry Collaborative R&D exercise towards faculty research translation, industry-grade systems/product development, and technology incubation. One of the key goals is to enable ourselves to come up with the technology development capabilities for the Indian Strategic Needs in the area of or involving Communication Engineering.

LABORATORY FACILITIES

Teaching Labs

The lab has following facilities:

- **Wireless Research Lab:** Spectrum Analysers, Function Generators, Signal Generators, Network

Analysers, Antenna Measurement Kits, Simulation Software: CST Microwave Studio, Commsim and EDA, Virtual Wireless Lab.

- **Communication System and Signal Processing lab:** This Eco-friendly Lab provides about 45 personal dedicated workstations. This secured access monitored lab is open for student access on 24/7/365 basis . The lab houses equipment for advanced experimentation in Signal Processing and embedded Systems for use in modern communication systems.

  This lab uses open source software – versions of Ubuntu - on all compute nodes. The other equipment/ facilities include Arduino, Raspberry Pi Boards, SDR (USRP) Boards, DSP and FPGA Boards, tool chains for FPGA, DSOs with CAN/LIN triggering, Digital Multi-meters, EFI workstation, ESD workstation with Soldering and De-soldering station, SMD Rework Station, Oscilloscope with FlexRay Trigger Capability, Logic Analyzers , Protocol Analyzers.

KUSUMA
SCHOOL OF
BIOLOGICAL SCIENCES

Head of the School

Bishwajit Kundu, *Ph.D. (Inst. of Microbial Tech.)*
Professor
Protein Misfolding and Aggregation.

Manidipa Banerjee, *Ph.D. (UCSD)*
Professor
Hepatitis A Virus Entry, Using Viruses as Nanoparticles for Drug Delivery.

Tapan K. Chaudhuri, *Ph.D. (Bose Institute)*
Professor
Chaperone Assisted Protein Folding, Protein Engineering and Molecular Biophysics.

Archana Chugh, *Ph.D. (Delhi Univ.)*
Professor
Cell Penetrating Peptides, Marine Bioprospecting, Plant-based Therapeutics, IPRs and Governance in Naval Life Science Technologies.

Chinmoy S. Dey, *Ph.D. (Jadavpur Univ.)*
Professor
Insulin Resistant (Type 2) Diabetes and Leishmaniasis, Signal Transduction.

Saran Kumar, *Ph.D. (National Univ. of Singapore)*
Assistant Professor
Vascular Biology, Cancer Metabolism, Tumor Heterogeneity, Vascular Aging, Cancer Stem Cells, Cardiovascular Biology.

James Gomes, *Ph.D. (Tulane Univ.)*
Professor
Neurodegenerative diseases, systems theory, network biology.

Manoj B. Menon, *Ph.D. (Hanover Medical School, DE)*
Assistant Professor
Cell Biology and Signalling, Septin Cytoskeleton, Regulation of Autophagy and Cell Death.

Shilpi Minocha, *Ph.D. (University of Zurich)*
Assistant Professor
Regulation of Gene Expression, Metabolism, Liver Regeneration, Non-alcoholic Fatty Liver Disease, Hepatocellular Carcinoma.

Aditya Mittal, *Ph.D. (Drexel Univ.)*
Professor
Kinetics and Self Assembly in Biological Systems.

Santanu Mandal, *Ph.D. (IISc. Bangalore)*
Assistant Professor
Chemical Biology, Cancer Therapeutics, Drug Delivery, Therapeutics against Protein Aggregation.

Amitabha Mukhopadhyay, *Ph.D. (Inst. of Microbial Tech.)*
Professor
Modulation of Host Intracellular Trafficking by Pathogens.

Tapan K. Nayak, *Ph.D. (IISc. Bangalore)*
Assistant Professor
Ion Channel and Receptor Biology.

Vivekanandan Perumal, *Ph.D. (CMC Vellore)*
Professor
Hepatitis B Virus, Hepatocellular Carcinoma, microRNA in Liver Cancer, G-quadruplexes in Virus Genomes.

Ashok K. Patel, *Ph.D. (IMS, BHU)*
Associate Professor
Biomolecular X-Ray Crystallography, Molecular and Structural Virology, Chromatin Remodeling and Diseases.

Saurabh Raj, *Ph.D. (The Institute of Photonic Sciences)*
Assistant Professor
Single molecule biophysics, DNA-protein interactions, Kinetic studies of CRISPR-Cas interactions, Cellular mechanochemistry.

Anita Roy, *Ph.D. (Saha Institute of Nuclear Physics)*
Assistant Professor
Myeloid Hematopoesis, Megakaryopoesis and Platelet Biology, Myeloid Leukemia.

B. Jayaram, *Ph.D. (City Univ. NY)*
Emeritus Professor
Computational Biology, Molecular Design.
Department of Chemistry

INTRODUCTION

The School of Biological Sciences at Indian Institute of Technology Delhi was established in December 2008, with a vision to promote innovative interdisciplinary research by interfacing modern biology with applied engineering sciences, and to train scholars to be the next generation scientists capable of addressing problems affecting human health and welfare.

The establishment of the School was guided by a National Advisory Committee (NAC) co-chaired by Prof. Surendra Prasad, former Director IIT Delhi and Prof. M. Vijayan, Indian Institute of Science (IISc), Bangalore. The mandate of the School is to work in the broad thematic areas of infectious diseases and non-communicable disorders.

Currently, the School has 18 faculty members, 96 students and 5 postdoctoral fellows conducting inter- and multi-disciplinary research at molecular, structural and systems levels. In addition to a vibrant Ph.D. programme, the School offers an M.S.(Research) course, and a Minor degree programme in Biological Sciences for IIT Delhi B.Tech. students. 68 students have graduated with PhDs, and 15 students have graduated with M.S.(Research) degrees. The School has advanced equipment facilities and is funded by IIT-Delhi, Kusuma Trust, DST, DBT, ICMR etc.

Vision:

To become the pioneers of modern interdisciplinary biological sciences by integrating emerging disciplines with biological sciences, and to nurture and sustain a vibrant comprehensive programme in research and instruction.

Mission:

Promoting goal-oriented innovative interdisciplinary research by interfacing modern biology with applied engineering sciences to address problems affecting human health and welfare, and training scholars to be the next generation scientists.

ACADEMIC PROGRAMMES

Currently, the School offers a Ph.D. Programme M.S. (Research) and a Minor Area option in Biological Sciences for undergraduate students. The key strengths of these programmes are their multi- and inter-disciplinary perspective of biological sciences. The flagship UG course of the School is SBL 100: Introductory Biology for Engineers, a core requirement for all incoming UG students. This course, with a laboratory component, is aimed at introducing students to modern biology with an emphasis on evolution of biology as a multi-disciplinary field. Students are made aware of application of engineering principles in biology and how to engineer robust solutions inspired by biological examples.

Ph.D. Programme: In general, there will be no restriction on the background of the student in terms of the qualifying degree. However, it is expected that the student's prior academic career will demonstrate interest in the broad field of biological sciences. A student applying to the programme can have a B.Tech., B.E., M.Tech., M.E., M.Sc. or M.S. in any discipline of science and engineering. Interested/deserving candidates are encouraged to apply as per the procedures at the IIT Delhi admissions website. Selection of Ph.D. students is based on a written test (for the eligible applicants) followed by an interview (of those screened from the written test). The written test will examine the analytical ability of students with examples from biology, and does not require memorization of any biological terminologies. A sample question paper is available on the School's website.

After admission to the Ph.D. programme, the background needed for carrying out research work by the students will be developed through a selection of courses from those developed for this Ph.D. programme, and from existing courses in the Institute. The courses for the Ph.D. programme will be evolving continuously with the aim of training the next generation of researchers in biological sciences. These courses will bring together a combination of experiment and theory for understanding how biological systems work from the cellular to the systems level.

Minor Area Programme: Academia and industry are realizing the rapid transformation of society driven by bio-based economy. The impact of biological sciences on all aspects of human life, particularly, healthcare and utilization of biodiversity for sustainable future, is evident. The creation of new technology and its management will need a new genre of skilled human resources knowledgeable in the field of biological sciences. Emerging technologies are now being created where biology meets the engineering sciences, physics, chemistry, computer science and mathematics. Engineering new materials and devices inspired by nature, engineering drug delivery systems are but a few of a plethora of opportunities arising at the interface of biological sciences. Keeping in view, the potential of biological sciences in various spheres of life, the School of Biological Sciences has floated a Minor Area programme for undergraduate students. Through this programme, a student will discover biology from an engineering science viewpoint. A student will have the opportunity to explore a variety of areas within the diverse field of biological sciences or specialize in a certain aspect of biological sciences by choosing courses in an area of interest.

DOCTORAL

In general, there will be no restriction on the background of the student in terms of the qualifying degree. However, it is expected that the student's prior academic career will demonstrate interest in the broad field of biological sciences. A student applying to the programme can have a B.Tech., B.E., M.Tech., M.E., M.Sc. or M.S. in any discipline of science and engineering. Interested/deserving candidates are encouraged to apply as per the procedures at the IIT Delhi admissions website.

The background needed for carrying out research work by the students will be developed through a selection of courses from those developed for this Ph.D. programme, and from existing courses in the Institute. The courses for the Ph.D. programme will be evolving continuously with the aim of training the next generation of researchers in biological sciences. These courses will bring together a combination of experiment and theory for understanding how biological systems work from the cellular to the systems level.

M.S. (RESEARCH)

The M.S. (Research) programme was initiated to enhance existing teaching and research activities being carried out by the School. Students will be trained on newer technologies currently desirable in the industry and academia. The technological focus on the M.S. (Research) programme would be to provide students with practical knowledge.

The School will admit students from different academic backgrounds and levels of preparation. The board guidelines for admission are:

i) Bachelor's or Master's degree in any engineering discipline.

ii) Bachelor's (four - year programme) or Master's degree in any Chemistry, Physics, Mathematics or Life Sciences.

The admission will be according to Institute rules once a year. A student may enroll as a full-time or a part-time candidate. Student admitted to the programme will be assigned course work according to the requirements of the research problem. The credits and the minimum CGPA requirements will be according to the Institute rules. The courses will be awarded to build the student's background and to impart knowledge in specific area. The student must take the all courses under the compulsory category and the remaining credits from the other courses of the School or relevant courses from the Institute. The research problems will be given by the faculty from their area of expertise. The student will complete the problem assigned by the supervisor, execute the research work and write ca thesis that merits the award of M.S. (Research) degree.

LABORATORY FACILITIES

The school has all facilities to carry out research in biological sciences. These include:

- Spectrophotometers
- Refrigerated tabletop centrifuges
- Ultracentrifuges
- Fast protein liquid chromatography (FPLC) and high pressure liquid Chromatography (HPLC) systems
- Gel imaging and documentation equipment
- PhosphorImager
- Cell culture facilities including hoods
- Incubators and inverted microscope
- CD machine
- Fluorimeter
- Real time PCR system for quantification of nucleic acids
- ELISA washers and readers
- Confocal microscope for advanced cell biological studies

The new major equipment include:

- FACS Aria III
- Microarray platform comprising of Affymetrix system Gene chip 7G
- Gene chip Scanner 3000 7G
- Gene chip Fluidics Station
- Gene chip Hybridization Oven
- Real time PCR system (MX3000P)
- Lab chip GX
- Zephyr genomics workstation
- Cryo-EM system
- XRD
- Pent a Flipper

In addition to all these, the school has access of a range of software licensed by the Insititute for teaching and research. It has inter- and intra-net and dedicated access to the supercomputing computing facility of IIT Delhi.

The view from quadrangle of the School building





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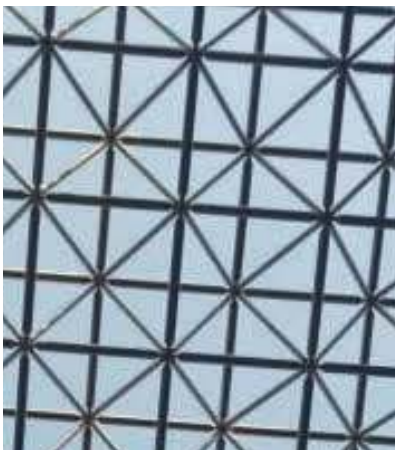
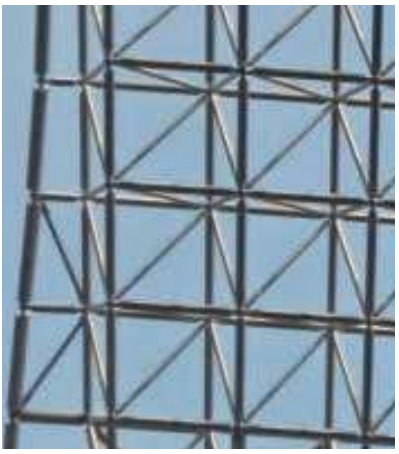
IIT Delhi


SCHOOL OF
INTERDISCIPLINARY RESEARCH







Hemant K Kashyap, *Ph.D. (S. N. Bose National Centre for Basic Sciences, Jadavpur Univ.)*

Professor

Theoretical and Computational Chemistry, Molecular Dynamics, Modern Battery Electrolytes, Ionic Liquids, Deep Eutectic Solvents, Biomembranes, Biomaterials.

Head of the School

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Narsing Kumar Jha, *Ph.D. (IISc. Bangalore)*
Suresh Neelakantan, *Ph.D. (TU Delft)*

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Ishaan Gupta, *Ph.D. (EMBL & University of Heidelberg, Germany)*
Ritu Kulshreshtra, *Ph.D. (University of Delhi)*
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Shilpi Sharma, *Ph.D. (Ludwig Maximilians University of Munich, Germany)*
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Surya Prakash Singh, *Ph.D. (IIT, Kanpur)*

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Devendra Kumar Dubey, *Ph.D. (Purdue University, USA)*
Mayank Kumar, *Ph.D. (Massachusetts Institute of Technology, USA)*
Amit Gupta, *Ph.D. (University of Central Florida)*
Kusum Meena, *Ph.D. (Auckland University of Technology, New Zealand)*
Pulak Mohan Pandey, *Ph.D. (IIT Kanpur)*
R.K. Pandey, *Ph.D. (Banaras Hindu University)*
Subir Kumar Saha, *Ph.D. (McGill Univ.)*
S.P. Singh, *Ph.D. (IIT Delhi)*
Kaushik Mukherjee, *Ph.D. (IIT Kharagpur)*

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Dalip Singh Mehta, *Ph.D. (NPL Delhi/CCS Univ. Meerut)*
Rajendra Singh, *Ph.D. (IUAC, JNU, New Delhi)*

Department of Textile and Fibre Engineering

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B.K. Bahera, *Ph.D. (IIT Delhi)*
Apurba Das, *Ph.D. (IIT Delh)*
S.M. Ishtiaque, *Ph.D. (Tech. Univ. of Liberec)*
Bipin Kumar, *Ph.D. (IIT Delh)*
Abhijit Majumdar, *Ph.D. (Jadavpur University)*
Bhanu Nandan, *Ph.D. (MSRDE, Kanpur University)*
Javed N. Sheikh, *Ph.D. (I.C.T. Mumbai)*
Harun Venkatesan, *Ph.D. (The Hong Kong Polytechnic University, Hong Kong S.A.R)*

Centre for Applied Research in Electronics

Samaresh Das, *Ph.D. (IIT Kharagpur)*
Ankur Gupta, *Ph.D. (IIT Bombay)*
Pushparaj Singh, *Ph.D. (NTU, Singapore)*
Srinivas V. Veeravalli, *Ph.D. (Cornell University, Ithaca, US)*

Centre for Atmospheric Sciences

Sagnik Dey, *Ph.D. (IIT Kanpur)*
Sandeep Sahany, *Ph.D. (IISc., Bangalore)*
Dilip Ganguly, *Ph.D. (Physical Res. Lab., Ahmedabad)*

Centre for Automotive Research and Tribology

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Deepak Kumar, *Ph.D. (IISc., Bangalore)*

Center for Biomedical Engineering

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Dinesh Kalyanasundaram, *Ph.D. (Iowa State University, USA)*
Sachin Kumar B., *Ph.D. (IISc. Bangalore)*
Sandeep Kumar Jha, *Ph.D. (Bhabha Atomic Research Centre, Mumbai)*

Kusuma School of Biological Sciences

Tapan K. Chaudhuri, *Ph.D. (Bose Institute, Calcutta)*
Manidipa Banerjee, *Ph.D. (UCSD)*
James Gomes, *Ph.D. (Tulane University)*
Saran Kumar, *Ph.D. (National University of Singapore)*
Shilpi Minocha, *Ph.D (University of Zürich, Switzerland)*
Amitabha Mukhopadhyay, *Ph.D. (Jadavpur University, Kolkata)*
Ashok Kumar Patel, *Ph.D. (IMS, BHU)*
Vivekanandan Perumal, *Ph.D. (CMC Vellore)*

Optics & Photonics Centre

Kedar Khare, *Ph.D. (University of Rochester, NY, USA)*
Rangan Banerjee, *Ph.D. (IIT Bombay)*

Center for Rural Development and Technology

V.M. Chariar, *Ph.D. (IIT Delhi)*
Pooja Ghosh, *Ph.D. (JNU, New Delhi)*
Hariprasad P., *Ph.D. (University of Mysore)*
Priyanka Kaushal, *Ph.D. (IIT Delhi)*
Anushree Malik, *Ph.D. (IIT Delhi)*
Satya Narayan Naik, *Ph.D. (IIT Delhi)*

School of Interdisciplinary Research

S.S. Yazdani, *Ph.D. (JNU, New Delhi)*

School of Public Policy

Santosh Kumar Bhatted, *Ph.D.*
Ambuj D. Sagar, *Ph.D. (Massachusetts Institute of Technology)*

Associated Faculty from outside IIT Delhi

Arti Kapil, *Ph.D. (Department of Panchakarma, All India Institute of Ayurveda, New Delhi)*
Ambuj Roy, *Ph.D. (Dept. of Microbiology, AIIMS, New Delhi)*
Sarita Mohapatra, *Ph.D. (Cardiology, AIIMS, Delhi)*
Krishna Kishore Inampudi, *Ph.D. (AIIMS, New Delhi)*
Rajesh Malhotra, *Ph.D. (AIIMS, New Delhi)*
Suman Jain, *Ph.D. (Orthopaedics, AIIMS, New Delhi)*
Anand Krishna, *Ph.D. (Physiology, AIIMS, Delhi)*
Sanjay Puri, *Ph.D. (AIIMS, New Delhi)*
Manindra N. Thakur, *Ph.D. (School of Physical Sciences, JNU)*
Paulraj Rajamani, *Ph.D. (CPS, SSS, Jawaharlal Nehru University)*
Sushil Kumar Jha, *Ph.D. (SES, JNU, Delhi)*
Ankit Chaudhary, *Ph.D. (SLS, JNU)*
Shailja Singh, *Ph.D. (JNU, New Delhi)*
Anand Ranganathan, *Ph.D. (SCMM, JNU)*
Sanya Anees, *Ph.D. (SCMM, JNU)*
Smita Kulkarni, *Ph.D. (Electronics and Communication Engg. IIITG)*
Vinod Kumar, *Scientist G & Head, (Virology Division, ICMR-National AIDS Research Institute, Pune)*
David Graham, *Ph.D. (Bioenergy/Biomass Systems,Centre for Climate and Environmental Protection, Cranfield University, UK)*
Ejaz Ahmad, *Ph.D. (School of Engineering, Newcastle University, UK)*
Sudeep Verma, *Ph.D. (Microbial Engineering, ICGEB, New Delhi)*
Tian Li Wu, *Ph.D. (SSPL)*
Phani Teja Bankupalli, *Ph.D. (NCTU, Taiwan)*
G.K. Sivaraman, *Ph.D. (SRM IS&T)*
Rohan Jain, *Ph.D. (CIFT-ICAR, Chochin)*
Neel Sarovar Bhavesh, *Ph.D. (HZDR)*
Sumanth Gandra, *Ph.D. (ICGEB)*
Vikas Manchanda, *Ph.D. (Washington University St. Louis, USA)*
Udayraj, *Ph.D. (Dept. of Microbiology, MAMC)*
Amarnath Reddy Allu, *Ph.D. (ME, IIT Bhilai)*
Anil K. Chaudhary, *Ph.D. (Energy Materials & Devices Division, CSIR-CGCRI)*
Pascal Piveteau, *Ph.D. (ICAR-CPRI, Shimla UR OPAALE, RENNES, INRAE)*

INTRODUCTION

The School was founded in October 2017 with the objective to actively encourage our researchers and students to stretch their boundaries and to collaborate with people from other disciplines to help bring broader perspectives and ideas to research problems of different kinds. It is envisioned that the school will not only accelerate growth of interdisciplinary research at IIT Delhi but also would enable to engage with faculty across other Institutes such as AIIMS, JNU, NII etc. It is expected that over a period of time the School would be able to "seed" a number of inter-disciplinary programmes that are unnoticed today. IIT Delhi already has a number of strategic interdisciplinary research groups working on various issues including a few related to societal problems but with limited scope.

We believe that SIRe will serve as an ideal platform for the growing numbers of Centres of excellence and MOUs with other organizations/institutes/research laboratories to undertake problems that require solutions from completely different perspectives.

SIRe is a virtual school. Currently the School runs a Ph.D. programme. All faculty who have a registered Ph.D. student at SIRe are associated faculty members of the School. Currently, SIRe has 112 Ph.D. students registered at this School with 143 faculty members from 15 Departments, 07 Centres, 03 Schools of IIT Delhi and several others from institutes like AIIMS, JNU, NII, SSPL, ICGEB. All areas of science, engineering, humanities and management pursued at IIT Delhi are considered under the umbrella of SIRe. IIT Delhi has signed MoUs with many national and international institutions. Many students are already registered jointly with these institutions. Other institutions are welcomed to participate in this endeavor and sign an MoU with IIT Delhi to enable them to register Ph.D. students at SIRe.

MISSION AND VISION

IIT Delhi is a research-intensive institute. It has created SIRe to promote interdisciplinary research. Over the past six decades, the institute has established several strong disciplines in the area of engineering, science and humanities. The disciplines will remain a central element of the academic system but SIRe serves as a catalyst to bring together people from various departments and neighbouring academic institutions and industries to solve complex questions and problems in cross disciplinary research. It inculcates scientific curiosity, and encourages faculty and students to congregate at the interfaces and frontiers of disciplines and foster new research avenues.

SCHOOL OF
PUBLIC POLICY

Head of the School

Sanjiva Prasad, *Ph.D. (SUNY Stony Brook University)*
Professor
Public Policy Related to Issues Regarding Data and Computation, and their Confidentiality and Integrity, in Particular Health-related Data Systems. Issues of Higher Education, Pedagogical Processes and Affordable Access to Educational Materials.

Suma Athreye, *Ph.D. (University of Sussex)*
Professor
Economics and Management of Intellectual Property, Financing of R&D, Researcher Incentives and the Commercialisation of Technology in Universities and Public Sector Labs, COVID Vaccines and Pharmaceutical Capability in Emerging Markets, Measuring the Impact of Inclusive Innovation, Open Innovation and Technology Licensing, Industry 4.0 and Software in Emerging Markets.

Soutrik Basu, *Ph.D. (Wageningen School of Social Sciences (WASS))*
Assistant Professor
Science Policy, Innovation Systems, Agrarian Studies, Agri-innovation, Policy Studies.

Rathin Biswas, *Ph.D. (IIT Bombay)*
Assistant Professor
Water Sanitation and Hygiene (WASH), Technology for Society, Health Happiness & Well-being, Governance, PwD & Accessibility.

Surajit Chakravarty, *Ph.D. (University of Southern California)*
Associate Professor
Urban Policy - Housing, Mobility, Public Participation, Small Towns, Digital Transformation of Cities. Planning Theory - Informality, Planning Ethics, Diversity and Inclusion, Public Space and Public Time.

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Assistant Professor
Energy Policy, Political Economy of Infrastructure and Finance, Industrial History, State Capitalism.

Rajarshi Dasgupta, *Ph.D. (Kyoto University Japan)*
Assistant Professor
Forest and Conservation Policy, Land use Policy, Environmental Scenarios, Geo-spatial Application in Environmental Decision Making.

Kaveri Iychettira, *Ph.D. (Delft University of Technology)*
Assistant Professor
Policy Design and Analysis; Energy Transitions in Developing Countries; Institutional Analyses; Modelling for Policy Analysis (Computational Social Science, Agent-Based Modelling); Electricity Market Design; Decarbonizing Electricity, Mobility; Water-Agriculture-Energy Nexus.

Abhishek Malhotra, *Doctor of Science (ETH Zurich)*
Assistant Professor
Policy Design for Low-Carbon Development, Innovation in Clean Energy Technologies, Green Industrial Policy, Technological Capabilities and Capability-building.

Debananda Mishra, *Ph.D. (University College London)*
Assistant Professor
Higher Education; Public Values and Publicness; Knowledge Systems; Start-Ups and Innovation; Organisational Theory and Development; Public Administration.

Sanjay Mitra, *Master of Public Administration (Harvard University)*
Professor of Practice
Governance and Decentralization, Public Formulation, National Security, Electricity Policy.

Anshu Ogra, *Ph.D. (Jawaharlal Nehru University)*
Assistant Professor
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Pooja Prasad, *Ph.D. (IIT Bombay)*
Assistant Professor
Agricultural Water Management, Climate Resilient Agriculture, Sustainability Science, System Dynamics, Uncertainty and Risk.

Ambuj D. Sagar, *Ph.D. (Massachusetts Institute of Technology)*
Professor
Science, Technology and Development, Innovation Policy for Meeting Sustainability and Inclusivity Challenges, Energy Innovation Policy and Strategies, Climate Change Policy and Politics, and Higher Education Policy.

Nandana Sengupta, *Ph.D. (Tepper School of Business at Carnegie Mellon University)*
Assistant Professor
Econometrics, Machine Learning, Survey Design, Skilling, Indian Labour Market.

Upasna Sharma, *Ph.D. (IIT Bombay)*
Associate Professor
Disaster Risk Reduction and Management, Information and Communication Technologies for Agriculture, Climate Change Adaptation.

Tiesta Thakur, *Ph.D. (University of Minnesota)*
Assistant Professor
Agricultural Economics, Environmental Economics, Labor & Personnel Economics, Pest Management, Bio-diversity Conservation and Payment for Environmental Services (PES).

INTRODUCTION

The School of Public Policy is a newly-established entity in the Indian Institute of Technology Delhi, which is one of India's premier engineering and education and research institutions. The IITD-SPP aims to be an academic centre of excellence for domestic and global policy research, with a particular emphasis on science, technology, innovation (STI), and development that will contribute positively and significantly to national and global policy processes on key issues of importance to India and other countries.

As a premier institute of technology, IIT Delhi is uniquely placed to engage with broader issues relating to science and technology. It has the analytical and quantitative culture needed for engaging in STI policy issues. Furthermore, many faculty members on campus already are engaged is some form or fashion with S&T policy through their own work. As an academic institution, IIT Delhi offers a value-neutral location for engaging with multiple/conflicting perspectives and its high profile also gives it convening power to bring together stakeholders as well as engage with policy makers. The School will also link with emerging programs at IIT Delhi such as those involving design, innovation, and entrepreneurship. Overall, we expect the SPP to add to policy-analytical knowledge and capabilities in the country, with a special, and much-needed, focus on issues with a scientific and technical content, and couple this work to decision-making processes at the local, national, and international levels.

Specific objectives of the IITD-SPP are to:

- Carry out world-class research on a range of topics that relate to the production and use of scientific and technical knowledge for developmental goals in a changing global and domestic context;
- Develop policy proposals to address specific developmental challenges as well as strategies for their implementation;
- Engage with high-level policy makers on 'policy needs', implementation strategy, and monitoring & assessment;
- Promote a public dialogue with citizens, academics, and policy makers on policy and societal implications of major scientific and technological changes;
- Help build local capacity for policy analysis and implementation through the training of the next generation of scholars and practitioners and through the upgrading of the skills of existing personnel; and
- Enhance IIT Delhi's educational offerings, research profile, as well as social impact

ACADEMIC PROGRAMMES

Ph.D. Programme

IITD-SPP offers a full-time and a part-time Ph.D. programme to highly motivated individuals interested in working on research problems related to STI policy in the areas of Energy and Environment; Agriculture, Food and Water; Internet, Digital Information and Society; Innovation Systems and Processes; Industry and Economy; Technical Higher Education and Sustainable Habitats. IITD-SPP conducted its first round of intake for the Ph.D. programme in May 2019 and has since then admitted a talented pool of students into its Ph.D. programme in each successive round of admissions.

Master of Public Policy Programme

IITD-SPP has a flagship 2 year Master of Public Policy (MPP) programme focused on in Science Technology and Innovation (STI) and Development. The objective of the program is to provide rigorous interdisciplinary training to students from diverse backgrounds and to transform them into top-quality policy professionals and policy scholars.

Future Plans for Academic Programmes

In the near term, once we recruit sufficient faculty, we anticipate the development of a minor in Science, Technology and Public Policy (allowing focus on areas such as Technology and Innovation Policy, Technology and Development, or Law and Technology, which would involve a structured sequence of courses. Core courses for the minor will be designed in collaboration with various departments to enhance the general education of undergraduate students by ensuring that they have basic exposure to, and familiarity with, policy, legal, and societal aspects of science and technology issues. Courses may also be organized as seminars to provide the opportunity for students to engage in cutting-edge discussions on current public policy topics aligned with the School's research areas that includes Science, Technology, and Sustainable Development; Industrial Innovation and Organization; Health Systems and Innovations; Science, Technology, the Future of Agriculture; Information Infrastructure; and Sustainable Habitats. With further recruitment, we also expect eventually to develop Executive Education courses for policy-makers as well as other senior personnel from relevant governmental, intergovernmental, and private organizations. Over time, we can also imagine the exploration of a B.Tech.-MPP dual degree programme.

RESEARCH AREAS

While the School of Public Policy is only just beginning to get off the ground, some faculty members at IIT Delhi have been engaging in STI policy research projects through a major grant from the Department of Science and Technology – the DST-Center for Policy Research – as well as some smaller research grants to individual faculty members. These include studying the productivity of technically-skilled returnees, linkages of MNC R&D centers to the Indian innovation ecosystem, effectiveness of academia-industry knowledge linkages, factors affecting the performance of publicly-funded incubators and ICT-based agro-metrological advisories. We also have contributed to the development of a draft technology-led innovation policy for DST and also held a number of workshops on various topics (such as inclusive innovation and technology assessment). For further details, please visit *https://spp.iitd.ac.in*

Energy and Environment

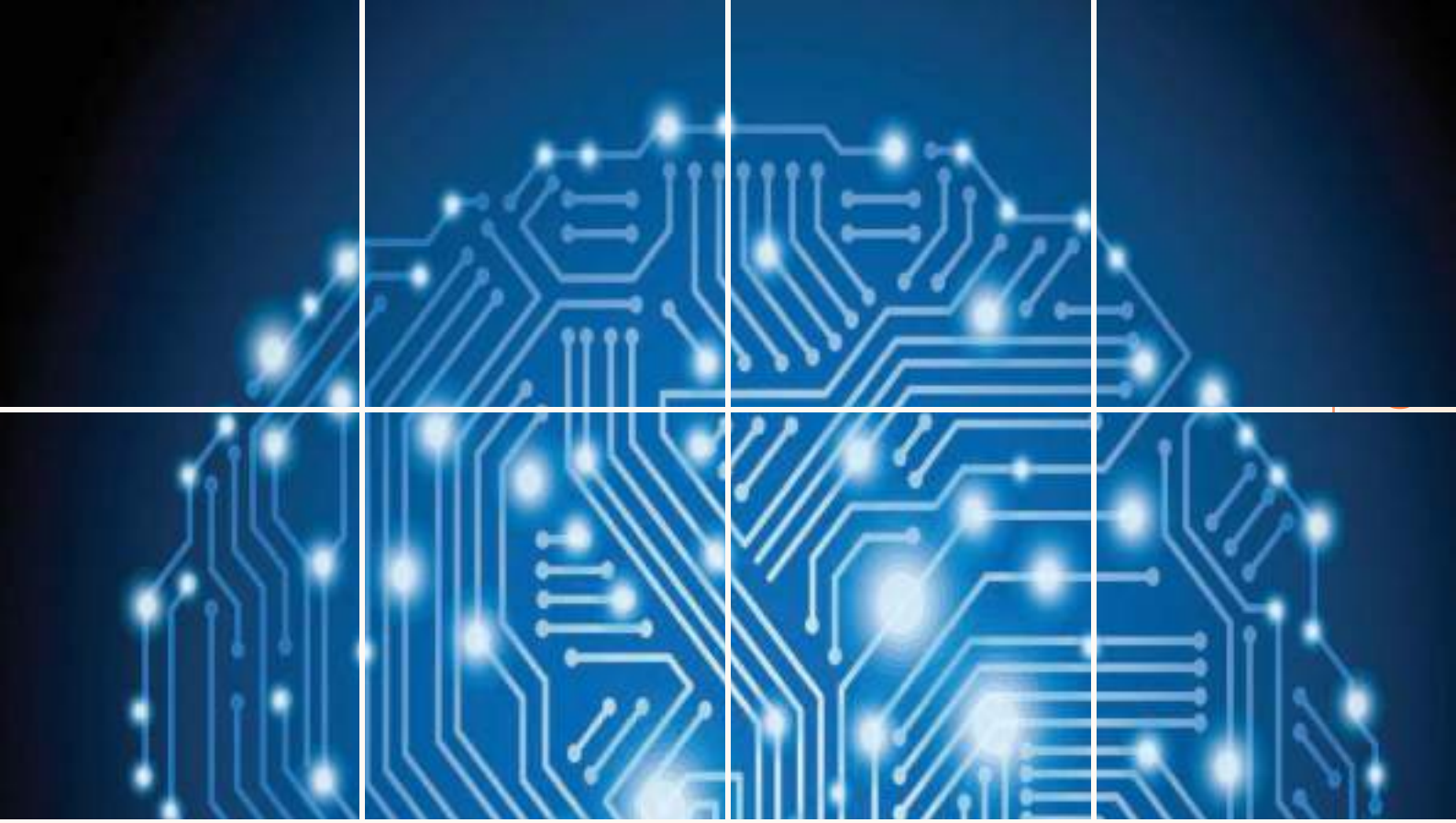
Agriculture, Food and Water

Internet, Digital Information and Society

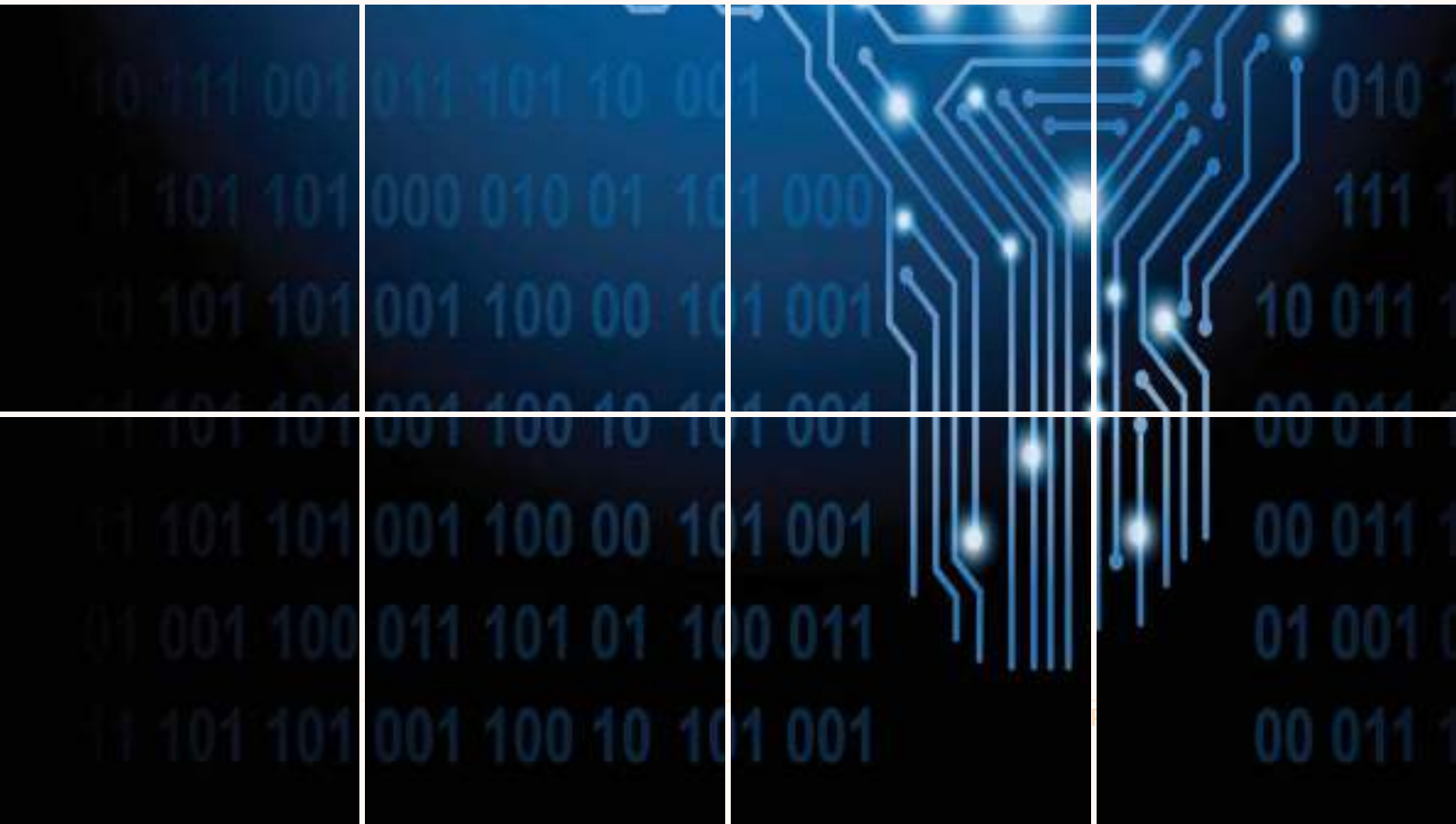
Industry and Economy

Innovation Systems and Processes

Technical Higher Education



YARDI
SCHOOL OF
ARTIFICIAL INTELLIGENCE



Mausam, *Ph.D. (University of Washington, Seattle)*
Professor (Jai Gupta Chair)
Neuro-Symbolic AI, Sequential Decision Making under Uncertainty, AI Applications to Crowd-Sourcing and Education, Natural Language Processing, Markov Decision Processes, Web Information Extraction, Intelligent Information System, Question Answering, Dialog Systems.

Head of the School

CORE FACULTY

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Yardi School of Artificial Intelligence

JOINT FACULTY

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Department of Electrical Engineering

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Department of Computer Science & Engineering

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Department of Computer Science & Engineering

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Department of Applied Mechanics

Niladri Chatterjee, *Ph.D. (University College London)*
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Artificial Intelligence, Natural Language Processing, Machine Learning, Data Science, Statistical Modeling, Mathematical Reasoning.
Department of Mathematics

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Computational Social Science and Management Theory Building, Governance of AI /ML Enterprise Applications, Digital Transformation and Social media.
Department of Management Studies

Hariprasad Kodamana, *Ph.D. (IIT Bombay)*
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Department of Chemical Engineering

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Department of Civil Engineering

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Optimization, Machine Learning, Graphical Models, Signal Processing, Geometric Deep Learning.
Department of Electrical Engineering

Rohan Paul, *Ph.D. (University of Oxford)*
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Robotics and Artificial Intelligence, Learning, Estimation and Planning. Assistive Technologies.
Department of Computer Science & Engineering

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Department of Computer Science & Engineering

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Soft Robotics & Biomechanics, Artificial Muscle, Bioinspired Engineering, AI in healthcare, Surgical Simulation, Medical Device, Data Driven Computational Mechanics, Adaptronics and Smart Structure, Machine Learning.
Department of Applied Mechanics

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Department of Chemical Engineering

ASSOCIATED FACULTY

Ankush Agrawal, *Ph.D. (Indira Gandhi Institute of Development Research, Mumbai)*
Agricultural Economics, Economics of Education, Health Economics and Demography, and Human Development, Applied Econometric, Development economics, India's official statistics.
Department of Humanities & Social Sciences

Manish Agarwal, *Ph.D. (IIT Delhi)*
System Architect – High Performance Computing, Large Scale Molecular Simulations, Parallelization of Analysis Codes, Enhancing efficiency of various codes.
Computer Service Centre

Amitabha Bagchi, *Ph.D. (Johns Hopkins Univ.)*
Professor (Jasvinder and Tarvinder Chadha Chair)
Data Algorithmics and Analytics, Probability and Networks, Data Science.
Department of Computer Science & Engineering

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Department of Computer Science & Engineering

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Department of Computer Science & Engineering

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Department of Electrical Engineering

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Department of Electrical Engineering

Nitya Nand Gosvami, *Ph.D. (NUS, Singapore)*
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Department of Materials Science & Engineering

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Department of Management Studies

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Department of Biochemical Engineering & Biotechnology

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Department of Chemical Engineering

Tarak Karmakar, *Ph.D. (JNCASR, Bangalore)*
Machine Learning (Artificial Intelligence In Chemistry), Development of Advanced Simulations Methods, Molecular Dynamics & Enhanced Sampling Simulations.
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Lalan Kumar, *Ph.D. (IIT Kanpur)*
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Department of Electrical Engineering

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Quantitative Biomedical Imaging, Clinical Radiology, Rehabilitation of Stroke Patients, Medical Image processing (Algorithm Development and Analysis), Neuro-Assistive Technologies in Rehabilitation.
Department of Biomedical Engineering

Aparna Mehra, *D.Phil. in Engg. (University of Delhi)*
Mathematical Programming, Fuzzy Optimization, Financial Mathematics.
Department of Mathematics

Mani Mehra, *Ph.D. (IIT Kanpur)*
Wavelets Methods for Partial Differential Equations, Numerical Methods.
Department of Mathematics

Preeti Ranjan Panda, *Ph.D. (IIT Kanpur)*
Energy-Efficient Embedded Systems, Cache Management and Memory Technologies, Electronic Design Automation and Design Methodology.
Department of Computer Science & Engineering

Kolin Paul, *Ph.D. (Bengal Engineering College, Calcutta)*
Affordable HealthCare -Science to Systems, Hardware and Embedded Systems.
Department of Computer Science & Engineering

Maya Ramanath, *Ph.D. (IISc., Bangalore)*
Database Systems and Information Retrieval, Semantic Web Data Management, Knowledge Graph Construction and Applications.
Department of Computer Science & Engineering

Manoj C. Ramteke, *Ph.D. (IIT Kanpur)*
Modeling and Optimization of Chemical and Polymeric Systems, Meta-heuristic Algorithms, Process Planning and Scheduling, Machine Learning, Novel computing methods.
Department of Chemical Engineering

Manabendra Saharia, *Ph.D. (Univ. of Oklahoma, USA)*
Statistics and Machine Learning, Data Assimilation, Land Surface/ Hydrologic Modeling, Hydrologic Extremes, Flood and Drought Forecasting.
Department of Civil Engineering

Smruti Ranjan Sarangi, *Ph.D. (University of Illinois Urbana-Champaign)*
Computer Architecture, Parallel Algorithms, Operating Systems, Use of ML Algorithms for Temperature and on-chip Traffic predictions, Design of AI/ML Accelerators, AI/ML Algorithms on ultra-low power processors, Architectures for Stereo-Vision(Based on AI/ML Algorithms).
Department of Computer Science and Engineering

Rijurekha Sen, *Ph.D. (IIT Bombay)*
Mobile and Embedded Systems (Hardware Architecture, OS, Sensing, Efficient Processing, Security), Computational Sustainability.
Department of Computer Science and Engineering

Shaurya Shriyam, *Ph.D. (University of Southern California)*
Data-Driven Optimization in Automation, Logistics and Healthcare; Complex Resource Distribution Networks; Multi-agent Planning and Reinforcement Learning, Simulation modelling, Heuristics optimization..
Department of Mechanical Engineering

Anup Singh, *Ph.D. (IIT Kanpur)*
Medical Imaging, Quantitative Multi-parametric MRI, ML Applications to Healthcare, Diagnosis, Treatment Planning & Monitoring of Cancer and Osteoarthritis, Mathematical Modelling, Application of machine learning
Department of Biomedical Engineering

Manan Suri, *Ph.D. (INPG, France)*
Non-volatile Memory, Neuromorphic & AI Hardware, Semiconductor Cyber Security, Specialized hardware for edge and enterprise AI, Edge AI Application.
Department of Electrical Engineering

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Bioinformatics, Computational Genomics, Genome Engineering, Synthetic Biology, AI in Healthcare and life science.
Department of Biochemical and Biomedical Engineering

Ashwini Vaidya, *Ph.D. (Univ. of Colorado, Boulder)*
Event Structures in Language, Multilingual Lexical Resources, Computational and Cognitive Models of Language.
Department of Humanities & Social Sciences

Prabhu Babu, *Ph.D. (Uppsala University, Sweden)*
Signal Processing and Communications, Machine Learning, Nonlinear Optimization, Sparse Parameter Estimation Aka Compressed Sensing, Bioinformatics, Big Data Analysis, Financial Data Modeling.
Centre for Applied Research in Electronics (CARE)

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Climate Modelling, Indian Summer Monsoon, Climate Change.
Centre for Atmospheric Sciences

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Department of Computer Science and Engineering

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Department of Electrical Engineering

ADJUNCT FACULTY

Dinesh Garg (IBM Research), *Ph.D (IISc., Bangalore)*
Machine Learning, Deep Generative Models, Latent Variable Models, Deep Adversarial Nets, Deep Nets for NLP, Convex Optimization, Game Theory, Mechanism Design, and Auction Theory, Algorithm and Theory, Reasoning, Operations Research.

Prathosh A.P., *Ph.D. (IISc., Bangalore)*
Vision and Image Processing Audio, Speech and Music Analytics and Learning (deep learning, sequential modelling, and transfer learning).
Department of Electrical Engineering

Manik Varma (Microsoft Research), *D. Phil. (Univ. of Oxford)*
Machine Learning, Computer Vision, Extreme Classification.

Pradeep Shenoy (Microsoft Research), *Ph.D. (University of Washington)*
Data Mining and Modeling , Machine Intelligence, Natural Language Processing, Machine Perception, Neuroscience, Cognitive science, Machine Learning.

INTRODUCTION

Indian Institute of Technology (IIT) Delhi established 'School of Artificial Intelligence (ScAI)' on its campus in September 2020 to strengthen education and research in AI, Machine Learning and Data Science. IIT Delhi is already one of the leaders in the country for research and educational activity in this broad area of artificial intelligence. The goal of ScAI is to strengthen education and research in AI, Machine Learning and Data Science, and to enable societal and commercial applications. ScAI has already brought together various IIT Delhi faculty members individually invested in different aspects of the field, including (1) fundamental areas of AI, such as deep learning and data science, (2) bridge areas, which connect the fundamental techniques to specific domains based on the nature of data such as natural language processing and computer vision, (3) application areas that apply AI techniques to specific domains such as healthcare and transportation, and (4) policy and societal aspects pertaining to the widespread application and ethical adoption of AI.

ACADEMIC PROGRAMMES

The school has already started its Ph.D. and MS (Research) programmes. It is starting an M.Tech. in Machine Intelligence & Data Science (MINDS) in July 2022. Concurrently with the MTech programme, the school will also start a dual degree M.Tech (Advanced Standing) in MINDS for IIT Delhi's undergraduate students. In due course, ScAI also envisions starting an Executive programme taught primarily via evening and weekend classes. This programme will cater to the growing global demand by training industry and government professionals in modern AI techniques, thus enriching country's AI ecosystem. A key aspect of all of ScAI's programs is that they are open to all students irrespective of their undergraduate discipline.

RESEARCH AREAS

The research goals of ScAI are not only to create new knowledge, but also to seed start-ups and products that will have a long-lasting economic impact on the nation. The school will have a four-fold research agenda focusing on fundamentals of AI, bridge areas such as computer vision and natural language processing, areas allied with AI such as policy, ethics, and cognitive science, and will have a strong focus on applications of AI to domains such as healthcare, manufacturing, and intelligent robotics. Some exemplar areas of research are as follows:

CORE & BRIDGE AI RESEARCH

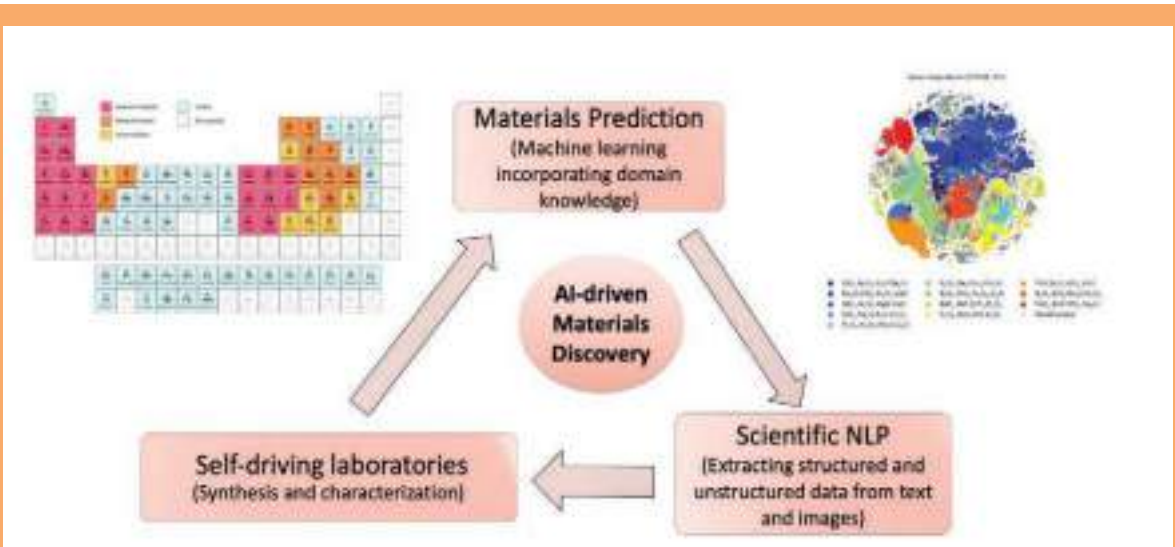
- Deep Learning
- Reinforcement Learning
- Data Mining
- Probabilistic Graphical Models
- Information Retrieval, Knowledge Graphs
- Computer Vision
- Natural Language Processing
- Responsible AI

APPLIED AI RESEARCH

- Healthcare
- Manufacturing Process Optimization
- Social Media
- Transportation
- Materials Discovery
- Robotics & Physical AI

- Law Enforcement & Judicial Systems
- IoT & Hardware

Core & Bridge AI Research: Natural Language Processing



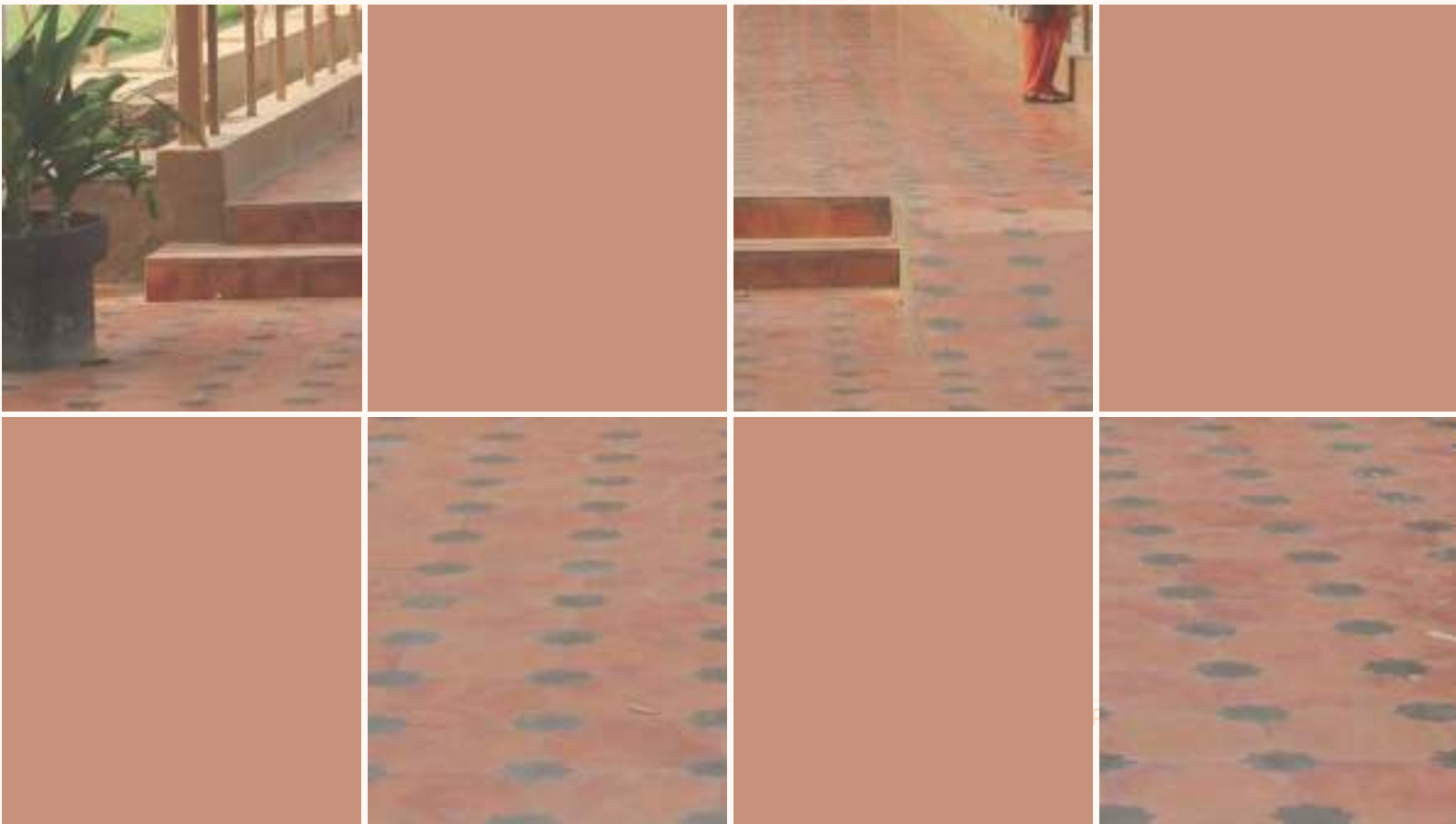
Applied AI Research: Materials

LABORATORY FACILITIES

The institute has allocated over 10,000 sq ft of space to School of AI, in which four computational laboratories are being constructed for Ph.D., Masters and undergraduate students working on ScAI projects, which are expected to be completed later in 2022. One AI-specific high performance supercomputer facility is also expected to be functional in a year's time. This cluster will comprise a large number of GPU-heavy machines for training deep neural models and performing GPU-bound simulations. This will be in addition to the institute-wide generic high-compute cluster that already exists on campus. In the medium term, ScAI expects to invest in more robotic and sensor equipment and develop labs for these research areas.

INTERDISCIPLINARY

RESEARCH PROGRAMMES



INTERDISCIPLINARY RESEARCH PROGRAMMES

VLSI Design Tools and Technology Programme

VLSI Design, Tools, and Technology is an interdisciplinary Masters level programme course offered by IIT Delhi. The course is run by three departments : Electrical, Computer Science and CARE.

This is a completely sponsored programme, in which each candidate is sponsored by an industry or a sponsored research project. Current and past sponsors include Qualcomm, Texas Instruments, Cypress, Cadence, Intel, Analog Devices, Nokia, NXP, Freescale, Mentor Graphics, Nvidia, IBM, and ST Microelectronics.

Streams offered under VDTT are: Embedded Intelligence, ASIC and SoC Design, Micro and Nano Devices.

Scope for projects in analytics and IoT domain. Design your own Application Specific ICs or model your own Semicon devices.

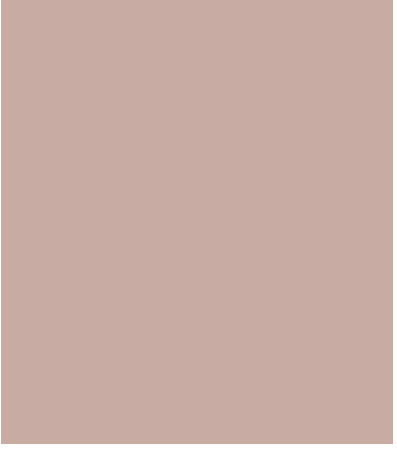
Once admitted, the students study in IIT Delhi for the first three semesters and have to work on a project at the company site in the 4th semester. *For more details visit: http://vdtt.iitd.ac.in/*

Opto-electronics and Optical Communication Research Programme

The programme is focused for research in the field of Fibre Optics and Optical Communication. Main participating departments / centres are Physics, Electrical Engineering, IDDC and CARE. This programme has received fundings from the Government agencies like MHRD, DST, DIT (formerly DoE), and DoT. In addition, R&D work has also attracted considerable international collaboration from universities in UK, France and National Institute of Standards and Technology in USA. The development work has led to commercialisation of a fibre optic educational kit and an erbium doped fiber amplifier.

The programme carries research in the following areas

Analytical and numerical modelling of the propagation characteristics of optical fibres and integrated optical waveguides, design and simulation of novel in-line fibre optic components such as polarizers, directional couplers, and mode filters, characterisation of birefringent fibres, development of optical fibre-based sensors, nonlinear interactions in fibre and integrated optical waveguides, Optical Amplifier, Coherent optical communication, Optical Networks, QoS issues of WDM Networks, SONET / SDH, fiber in Access Networks, Erbium Doped Fibre Amplifiers (EDFA), Raman Fiber Amplifiers, Dispersion Compensating Fibres (DCF), Fibre Bragg Gratings (FBG), fibre optic sensors for civil engineering structures, photonic band gap fibres, free space optical systems, OCDMA systems, etc. *For more details visit: http://oeoc.iitd.ac.in/jop/*





INTERDISCIPLINARY

M.TECH. PROGRAMMES



INTERDISCIPLINARY M.TECH. PROGRAMMES

Besides a number of regular courses that are offered at the postgraduate level by the academic departments/ centres, the Institute offers Interdisciplinary M.Tech. programmes which are managed by the Programme Executive Committees and Programme Advisory Committees that are constituted by nominating faculty from the concerned departments and centres. Each programme is looked after by the Programme Coordinator who is appointed by the Director.

Masters of Technology Programmes

The institute recognises and actively supports academic activities jointly conducted by faculty across the departments and centres. Such activities encourage teaching, research and industry/professional interactions, these are listed below. The Interdisciplinary Post Graduate programmes are in the following specializations:

Industrial Tribology and Maintenance Engineering: Various basic and applied aspects of tribology, including wear and maintenance engineering are covered in this programme. Students are introduced to diagnostic maintenance, reliability, availability and maintainability engineering as well as failure analysis.

Instrument Technology: This programme includes students to various instruments, electronic techniques for signal conditioning and instrument design. The electives cover a wide range of topics in instrumentation, electrical engineering, mechanical engineering and physics.

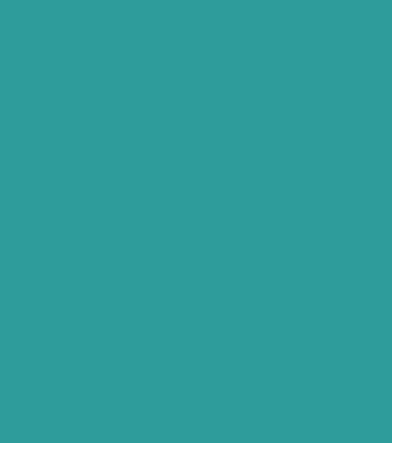
Opto-Electronics and Optical Communication: This programme is jointly offered by physics and electrical engineering departments. The courses cover a wide variety of basic and applied courses in fibre optics, optical-electronics and digital communication.

VLSI Design Tools and Technology: This programme is taught by the faculty of computer science and engineering, electrical engineering departments and CARE. The coursework includes courses on MOS, VLSI and VLSI design and VLSI system. The students gain proficiency in the use of state-of-art tools in VLSI design. The programme is largely supported by industries engaged in VLSI design.

Telecommunication Technology Management: A set of courses in digital communication and systems, wireless communication and telecommunication management form the core of this programme. Faculty of electrical engineering and management studies departments participate in the teaching of this programme.

M.Tech. in Cyber Security: This programme is offered to students who are interested in advanced learning and research in any area of Cyber Security.

M.Tech. in Robotics: The Master of Technology in Robotics provides students with a multidisciplinary curriculum that prepares them to create innovative and intelligent products and systems to address today's challenges in developing Robotics platforms and applications. The programme is designed to be heavy on experiential learning coupled with firm theoretical foundations. It includes courses in Mechanical Engineering, Electrical Engineering, and Computer Science.





7. MAJOR CENTRAL FACILITIES




7. MAJOR CENTRAL FACILITIES

The Institute has following central facilities for smooth functioning of Academics, Research and Outreach.

- Central Research Facility (CRF)
- Industrial Research and Development Unit (IRD)
- Central Workshop
- Nanoscale Research Facility (NRF)
- Office of Career Services (OCS)
- Central Library

7.1 Central Research Facility (CRF)

Purpose and Aim of CRF

Central Research Facility (CRF) is a common instrument and fabrication facility of IIT Delhi created to support students in their research activities. CRF has state-of-the-art analytical and instruments manned by qualified personnel to provide sample testing and analysis to UG, PG, PhD students and other research staff. The facilities are also made available, on payment basis, to other academic and research institutions, industries and organizations in the neighborhood.

Various Facilities under CRF

Institute Central Research Facility is equipped with the following instrument and fabrication facilities.

CRF Hauz Khas Campus facilities

A. ELECTRON MICROSCOPY FACILITIES

1. Cryo HR-Transmission Electron Microscopy (Cryo HR-TEM)
2. Transmission Electron Microscopy (TEM)
3. High-resolution Transmission Electron Microscopy (HRTEM)
4. Field Emission Scanning Electron Microscope (FESEM) with Oxford-EDX
5. Scanning Electron Microscopy (SEM)
6. Ultramicrotomy
7. Atom Probe Tomography
8. Field Emission Scanning Electron Microscope with EDS
9. Atomic Force Microscope (AFM)
10. Electron Probe Microanalyzer (EPMA)
11. Femto Second Laser Cutting System

B. SPECTROSCOPY FACILITIES

1. Nuclear Magnetic Resonance Spectroscopy (300 MHz, 400 MHz and 500 MHz)
2. NMR 400MHz with Liquid and Solid Probe
3. Inductively Coupled Plasma-Mass Spectrometry (ICP-MS)
4. MALDI-TOF/TOF Mass Spectrometry
5. Micro Raman Spectroscope
6. Electrospray Ionization- Liquid Chromatography (ESI-LC)-Mass Spectrometry
7. Fourier Transform Infrared Spectrometer (FTIR)
8. Gas Chromatography–Mass Spectrometry (GCMS)

C. OTHER FACILITIES

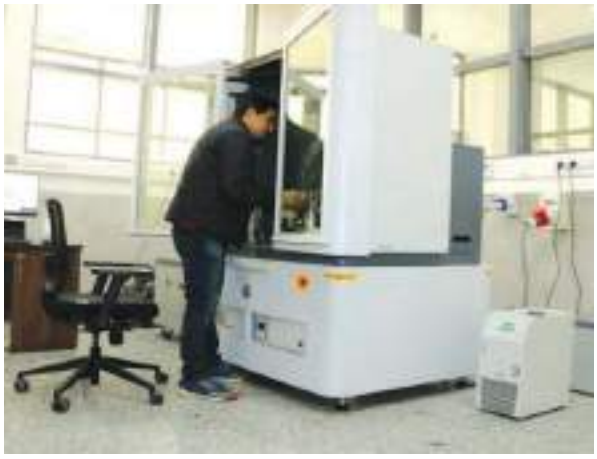
1. Liquid Nitrogen Facility
2. Glass Blowing Workshop
3. 3D Printing
4. Laser Cutting
5. Advanced Electrical Characterization, the facility is equipped with 4 instruments, namely:
   - Cryo Prober
   - DC & LF Noise Setup
   - Solar Simulator
   - RF & Loadpull System
6. Synthesis Lab: In-situ IR, Microwave synthesizer, Rotary Evaporator, 2-port Glove box

D. CRF SONIPAT FACILITIES

1. Physical Property Measurement System (PPMS)
2. X-Ray Diffraction (XRD)
3. Small Angle X-Ray Scattering (SAXS)
4. Brunauer - Emmett - Teller (BET) Surface Area Analyzer
5. Cell Biology Lab : Fluorescence-Activated Cell Sorting (FACS) & Confocal Microscope
6. Electron Paramagnetic Resonance (EPR) Spectroscopy Lab
7. Ion Milling System
8. Thermal Series
   a) Differential Scanning Calorimeter DSC2500
   b) Simultaneous Thermal Analyzer SDT650
   c) Thermo Mechanical Analyzer TMAQ400
   d) Dynamic Mechanical Analysis DMA850
9. Time-of-Flight Secondary Ion Mass Spectrometry (TOF- SIMS)
10. Universal Testing Machine (UTM)

For more details on various CRF facilities, please visit the website *www.crf.iitd.ac.in*

CRF Sonipat Facilitiy



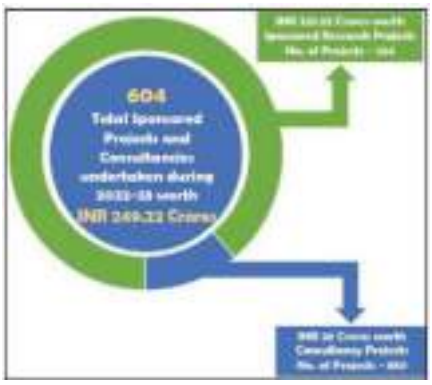
7.2 Industrial Research and Development Unit (IRD)

The Indian Institute of Technology Delhi lays strong emphasis on sponsored research and industrial interactions. The Industrial Research & Development (IRD) unit was specifically set up in the Institute to provide specialised administrative and managerial support for the operation of sponsored research projects, consultancy jobs and other related research and development activities. Over the years, the Institute has set up many modern laboratories and is supporting infrastructure through these sponsored projects. The Institute has given due emphasis to jobs of varied nature like trouble-shooting, product and process development, design checks and investigation of problems of direct relevance to the needs of the country through time-bound sponsored research projects and consultancy projects. The Institute is actively involved in collaborative programmes with national and international organisations and universities. The IRD unit manages these projects and always looks forward to supporting projects of national importance that are also socially useful and for the benefit of the common man.

IRD RESEARCH FUNDING - TRENDS & STATISTICS

Sponsored Projects & Consultancy Jobs

A total of 604 sponsored projects and consultancies with a total funding of ₹249.22 Crores were undertaken through the IRD unit in the financial year 2022-23.



The IRD runs many schemes to encourage Research and Development among the faculty and students of IIT Delhi.

IRD'S Role has diversified over the years

IRD Support to Faculty Members within the Institute

- **Research Grant for New Faculty Members:** IRD provides a one-time grant of Rupees One Lakh to each new faculty member who joins the Institute. This grant has been given to forty-eight new faculty members during the Financial Year 2022-2023 to initiate new projects.

- **Equipment Matching Grant for New Faculty:** The Equipment Matching Grant allows a new faculty to purchase equipment sanctioned under a sponsored project. Faculty can avail of the grant within two years of joining, with a ceiling of ₹30 Lakh or an amount equivalent to the funds sanctioned by the funding agency for the equipment under the project, whichever is lower. Equipment Matching Grants to the tune of ₹690.24 Lacs have been sanctioned to thirty-four new faculty members during the financial year 2022-23, which strengthens the pool of Central Research Facility (CRF) of the Institute.
- **Sponsored Research Enhancement Actions (SREA) :** Under SREA (1, 2 & 3) schemes, IRD provides support to senior staff to facilitate and enhance sponsored research activities, both in formulating/ writing research project proposals and coordinating research projects.

  SREA 1: Assistance for formulating/writing major research project proposals involving multiple faculty members from IIT Delhi or involving multiple Institutes with IIT Delhi as the Coordinating Institute. The funds proposed for IIT Delhi should be ₹5.0 Crore or more. IRD also provides financial assistance for hiring a Project Consultant for two months during project proposal preparation.

  SREA 2 : For a sponsored research project with a funding of ₹2.5 - 5.0 Crores, IRD provides top-up funds required for hiring one Principle Project Officer for the project duration.

  SREA 3 : For a sponsored research project with a funding of ₹5.0 Crores or more, IRD provides top-up funds required for hiring one Project Consultant for the project duration.

Project Administrative Assistants (PAA)

IRD Unit also implemented a scheme of providing a Project Administrative Assistant (PAA) to a group of five PIs who have ongoing projects. These PAAs are assigned for secretarial support to the PIs in project-related administrative and office work. At present more than 100 Principal Investigators (PIs) are utilising the facility. Further, one extra PAA is also allocated to departments or centres on request.

IRD SCHEMES FOR FACULTY MEMBERS

Faculty Interdisciplinary Research Project (FIRP): The FIRP scheme aims to enhance interdisciplinary and collaborative research within the Institute. A call for proposals is announced in research areas of national/ societal importance. The project proposals are evaluated by a team of external experts based on their merit. Selected projects are given an initial grant of ₹10 lakhs for a duration of two years. It is expected that the joint research team will submit at least one research project to an external funding agency at the completion of the first year. The IRD has funded a total of 108 FIRP projects so far.

Multi-Institutional Faculty Interdisciplinary Research Project (MFIRP): In order to meet the current global research challenges, IRD unit has initiated Multi- Institute Faculty Interdisciplinary Projects (MFIRP) with national and international institutions of eminence.

Under the scheme, funding is provided for joint MFIRP projects to a team of faculty members from two or more institutions. There will be at least two PIs (one from each Institute), and the total seed grant, in general, will be ₹20 lakhs for two years, equally shared by IIT Delhi and the partnering institutions. So far, IRD has sponsored 112 joint projects with National Universities and 110 International Universities, amounting to a total of 222 MFIRP projects.

IRD SCHEMES FOR STUDENTS

Student Startup Action & Discover & Learn (1-2-3-4) Schemes: To enhance research aptitude among undergraduate & graduate students and promote learning through research, IRD launched a Student Startup Action & Discover & Learn (1-2-3-4) schemes from the year 2016 onwards. Since then, twenty-one (21) IRD Student Startup Action projects and twenty-five Discover & Learn (1-2-3-4) projects have been awarded in various research areas of national interest.

Summer Undergraduate Research Award (SURA): The SURA scheme is one of the most aims to encourage research & development activities among undergraduate students. The students are encouraged to take the

initiative in identifying investigations and analysing research problems, and formulating solutions. A total of twenty-four students were supported in Financial Year 2022-23 under this scheme.

Assistantships/Fellowships are provided by IRD to the Ph.D./M.Tech./M.S.(R) students. The IRD unit provides support in the form of Gap Period Assistantships for both M.Tech./M.S.(R) and Ph.D. students who are drawing their fellowship/assistantship from the projects. These assistantships will be provided to the students once the projects get over and there is no other project to pay for their assistantship. M.Tech./M.S.(R) students can be supported for a maximum gap period of six months and Ph.D. students would be supported for a maximum gap period of one year. Eleven students were supported in Financial Year 2022-23 under this scheme.

IRD Early-Doc Fellowships are provided to Ph.D. students after successful completion of the PhD viva examination. The main objective is to support a Ph.D. scholar in completing the manuscript writing related to thesis work. A monthly fellowship of ₹40,000/- per month (including HRA) will be given to a full-time Ph.D. student of IIT Delhi for a maximum period of 3 months w.e.f. the date of his/her Ph.D. viva. Eighty-six IRD Early-Doc Fellowships were approved during Financial Year 2022-2023.

Research Excellence Travel Award (RETA): Highly Highly meritorious research scholars (full-time as well as part-time) are awarded Research Excellence Travel Award (RETA) amounting to ₹1,50,000/- from IRD promotional funds. RETA can be used only for a single conference travel. A total of forty students have been awarded for RETA during Financial Year 2022-23.

Research Scholar Travel Award (RSTA): All the research scholars are awarded a travel grant under the Research Scholar Travel Award (RSTA) up to a maximum of Rs 80,000/- from the IRD Research Promotion Fund, over and above an initial grant of ₹20,000/- provided by the Institute. A total of one thousand five hundred seventy-four students have been granted RSTA in the Financial Year 2022-23.

ACADEMIC INTERNATIONAL COLLABORATION

Academic cooperation through an MoU signed between IIT Delhi and National Yang Ming University (NYCU) - Taiwan. The following are the highlights:

- The National Chiao Tung University (NCTU), Taiwan and the National Yang Ming University (NYMU) of Taiwan merged to become a new entity National Yang Ming Chiao Tung University (NYCU).
- The coordination office at IIT Delhi has been fully functional and operational for the past five years.
- Admission is open throughout the year, and the details are available on the website: ***https://nctu-iitd.iitd.ac.in/***
- A total of 11 students under the Joint Doctoral Degree Programme (JDP) have proceeded to NYCU, Taiwan for research work.
- 16 Ph.D. students who are jointly registered are pursuing coursework/ research activities at their respective institutions.
- The first JDP research scholar was awarded a Ph.D. degree at the Convocation held at IIT Delhi in November 2022.
- A NYCU-IIT Delhi Joint virtual meeting was organized to monitor the progress of the Joint Doctoral Programme (JDP) to understand the challenges faced by the students.
- 17 collaborative projects between National Yang Ming Chiao Tung University (NYCU) and IIT Delhi under the Multi-Institutional Faculty Interdisciplinary Research Project (MFIRP) are currently operational in the areas of:
  - (i) Semi-conductors
  - (ii) Wireless Communication Network
  - (iii) Artificial Intelligence, Sensors, Robotics, Renewable energy/clean energy, Biotechnology, Drug development and biomedical devices.

MOUS EXECUTED & IMPORTANT RESEARCH INITIATIVES

This year, the Institute has signed **Six** major MoUs with International and National organisations/universities:

(i) Co-operation Agreement for Joint Multi-Institutional International Education, Research, and Training with the University of Buffalo (UB), USA (17th May 2022)

(ii) Centre for Development of Telematics (C-DOT) and IIT Delhi signed an MoU (27th September 2022)

(iii) National Hydroelectric Power Corporation Limited (NHPC) signed an MoA with IIT Delhi on (21st November 2022)

(iv) Renewal of MoU between IIT Delhi and Arun Duggal Centre of Excellence for Research in Climate Change and Air Pollution (formerly CERCA) done (9th Jan 2023).

(v) Ministry of Micro, Small and Medium Enterprises, Government of India (MSME) signed an MoU under the MSME Innovative (Incubation, Design, IPR) scheme" - a component of the MSME Champions Scheme (6th Feb 2023)

(vi) Central Electricity Authority (CEA) signed an MoU (17th March 2023)

NEW CENTRES OF EXCELLENCE (CoEs)

Centre of Excellence (CoE) on Quantum Technologies: IIT Delhi has established a Centre of Excellence (CoE) on Quantum Technologies to bring ongoing Quantum research activities in various departments under a single umbrella. The CoE on Quantum Technologies at IIT Delhi will focus on thrust areas, including Quantum Computing, Quantum Communication, Quantum Sensing and Metrology and Quantum Materials and Devices etc.

1. **GMR Power and Urban Infra Limited (Mumbai)** and IIT Delhi signed an MoU on 21st December 2022 for establishing the GMR CoE on New Energy Technologies at IIT Delhi. The CoE will undertake research and academic activities for interdisciplinary research and innovation in new energy technologies.
2. **Nayara Energy Limited:** MoU was signed between Nayara Energy Limited and IIT Delhi on 9th March 2023 to set up a Centre of Excellence on Process Safety and Risk Management in the oil and gas/ process industries/Hydrogen economy.

Highlights of IRD activities in 2022-23

- A total of 604 sponsored projects and consultancies with a total funding of ₹249.22 Crores were undertaken through the IRD.
- A new Faculty grant has been given to 48 new faculty members (₹0.48 crores).
- The Equipment Matching grant has been given to 34 faculty members (₹6.90 crores)
- Under Faculty Interdisciplinary Research Project (FIRP) scheme, 108 projects have been funded by the IRD unit so far for a cost of ₹9.96 crores.
- Under the Multi-Institutional Faculty Interdisciplinary Research Project (MFIRP) scheme, 222 projects were selected for IRD support so far for a cost of ₹14 crores.
- Four projects have been supported under the Student Startup and Discover & Learn schemes for a cost of ₹16 lakhs.
- Under the Research Excellence Travel Award (RETA), 40 students have been granted RETA this year for a cost of ₹26.86 lakhs.
- Under the Research Scholar Travel Award (RSTA), 1574 students have been granted RSTA this year for a cost of ₹4.98 Crores.
- A total of 73 Project Administrative Assistants (PAAs) have been attached to faculty members of the Institute this year for a cost of ₹2.66 Crores.

7.3 Central Workshop

Central Workshop is one of the pivoting units of the institute which teaches conceptually "how" a product comes to its present form by way of imparting core manufacturing education to all the first year students of IIT Delhi. It also provides product manufacturing support to entire institute community in general and undergraduate students in particular. More than 900 undergraduate students in their first year acquire hands-on manufacturing skills in the Central Workshop. The Central Workshop not only introduces art and science of manufacturing but also infuses confidence to take up product design and manufacturing activities in future. The Central Workshop is also a place where B.Tech. students of Mechanical Engineering and B.Tech. students of Production & Industrial Engineering acquire training and knowledge in specialized areas of manufacturing like Metal Casting, Metal Forming, Metal Machining, Welding & Joining, CNC programming and 3D Printing, Plastic Product manufacturing etc. M.Tech. students of Production Engineering also use the Central Workshop facilities for their practical classes in various courses as well as for project and research work. It also caters to the fabrication needs of students doing product design & manufacturing courses, minor projects, B.Tech. project, Master's thesis and Doctoral research. Large number of students use this facility to build products and compete at national and international level product building competitions like Formula student car, mini Baja, Robocon etc. The facility can also be used by external agencies for their manufacturing and training needs during the vacation period.

The Central Workshop has eight different sections covering all areas of manufacturing technology. The Central Workshop is fully equipped with traditional machine tools and presses as well as latest power tools and other facilities. A new 'CNC and 3D Printing Lab' has been added to imbibe product realization through computer generated geometries. A rapid prototype model can also be visualized by use of state of art 3D Printing technology in this new shop of Central Workshop. Laser cutting facility has also been added recently. A state-of-art Robotic Welding Cell with Metal-inert-gas welding technology has been added as a facility and demonstrator of Industry 4.0 technologies connected through Industrial IoT and enhanced learning through Augmented Reality. Smart Manufacturing initiatives to demonstrate Central workshop as Smart Factory through connected machines, capturing data and implementing manufacturing analytics are undergoing which will give exposure to students on latest technologies driving Industry 4.0.

The Central Workshop has undertaken efforts to reorganize, modernize and prepare for continuously changing global manufacturing scenario. Efforts are also on to prepare students for a broader view of manufacturing which involves planning and deploying optimum ways to transform raw material into goods by integration of people, capital, processes, systems and enterprises to deliver products of value to the society.

7.4 Nanoscale Research Facility (NRF)

The Nanoscale Research Facility (NRF) consists of class 100/1000 clean rooms with several state-of-art fabrication/thin film deposition instruments and characterization facilities. The research program of NRF has been focused on both thematic areas of national importance and basic research with importance to the development of nanoscience and nanotechnology. More than 150 faculty members from different departments/centers of IIT Delhi are participating in cutting edge research at Nanoscale Research Facility. Using the facilities at NRF, several deliverables related with nanophotonics, nanomagnetics, nanomechanics, nanophotovoltaics, nanoelectronics and biosensing have been successfully demonstrated. The current research in NRF is mainly focused to develop nanoscale devices for health, agriculture, safety and energy sector. The emphasis is to develop micro/nanoscale devices which can be given to users. It is also planned to explore new concepts/strategies for developing future potential nanoscale devices.

Objective of the NRF

- To design, build and demonstrate nanoscale structure & devices.

- To investigate new concepts and fundamentals for nanoscale processes.
- To run and maintain different fabrication and characterization facilities.
- To provide exposure to students to the area of nanotechnology.

Facilities available

NRF has adequate characterization lab facilities with more than 20 equipments like XRD, SEM, SPV, RAMAN, PL, AFM, UV-Vis, FTIR, DLS, GCMS, HPLC, AGM, Semiconductors characterizations and others. There is a fabrication lab with EBL, Maskless lithography, Mask aligner, Electron Beam Evaporation System, Sputtering System, and others. These facilities can be accessed through online booking after registration to NRF website (*https://nano.iitd.ac.in/*). Presently more than 2000 users (faculty members and students of different departments and centres) of IIT Delhi are registered for the access to these facilities. These facilities are also open to the other institutes and industries across the country.

Seminars, visitors and training

Seminars, workshop, visitors and training to the students in the area of use of clean room and various facilities are integrated regular feature of NRF. Ph.D./M.Tech./M.Sc./B.Tech. students are quite often given exposure to these facilities at NRF through visits and demonstrations and many of them are given hands on training to run the fabrication and characterization facilities.

The presence of NRF has facilitated several collaborating projects with foreign countries such as UK, Japan, Singapore, Germany, Norway etc. Time to time, delegations and distinguish scientists from national and international universities have been visiting NRF.

7.5 Office of Carrer Services (OCS)

OCS interacts actively with organisations across the globe with the dual aim of ensuring that the students are given adequate technical exposure and subsequently enabling them to get employment.

Internship

Students of B.Tech. and Dual Degree Programmes (from 2nd year to pre-final year), can opt for practical training/internship during summer vacations. Students may avail credits for this towards partial fulfilment of their Design & Practical Experience (DPE) component requirements subject to departmental norms of their parent department.

Summer Internships for pre-final year students of M.Des., M.Sc. (Cognitive Science), M.Sc. (Economics), M.Sc. (Maths), M.Sc. (Physics) and M.Sc. (Chemistry) are also facilitated by OCS.

Placement

An active and dynamic programme of securing job opportunities for students graduating from the Institute is initiated by inviting organisations from across the globe to conduct selection processes and interviews.

Organisations that have hitherto not participated in Training or Placement of the students are contacted actively.

Support Services

OCS organizes lectures, seminars, and workshops throughout the academic year on various subjects such as: career counselling, resume building, interview techniques, communication skills, soft skills etc. for students to supplement the above information. A career fair is also organised annually to help students make better career choices as well as explore career opportunities.

7.6 Central Library

The IIT Delhi Library System comprises a Central Library and about 36 Unit Libraries of departments, centres, schools, etc., that collectively support the teaching, research, and extension programmes of the Institute. The Central Library is the early adapter of new and emerging technologies and provides state-of-the-art user support services, which include; ICT based services using Baadal cloud, Video Library, E-Resources including E-Journals, E-Databases, E-Books, Computer and Networking Facilities, RFID Technology, Faculty Profiling System (IRINS), Library App, Discovery Service as a Single Window Search for Library Resources, eNewsClipping Service, New Arrivals, Ask the Librarian, Research Support Services and Outreach Programs, Institutional Repository, Remote Login Facility etc. Central Library is also the National Resource Centre for Library and Information Sciences of the Ministry of Education, Govt. of India, for offering the ARPIT MOOCs programme on SWAYAM platform.

Memberships

All the students, faculty and staff of the Institute are entitled to make use of the library facilities. Similarly, industrial establishments can avail of library services by taking corporate membership. Retired teaching, non-teaching staff and alums of the Institute can also avail of the library facilities. Membership privileges are available at: *https://library.iitd.ac.in/membership*.

Anybody, by being an Institute student, staff, faculty, or campus resident, automatically becomes eligible to avail of library facilities. Still, to use the Issue/Return facility, one needs to get the smart card/ID card tagged by the Library by completing some formalities from the Front Desk/Circulation Counter on the first floor. The Library currently has about 12,000+ members and a seating capacity of over 1000.

Library Hours

The Library remains open throughout the year, barring a few declared holidays. All of the week, from 8:00 am to 3:00 am, and during examinations, remains open 24 hours.

Library Collection

The Central Library has over 1,90,990 substantial physical collections of books pertaining to physical sciences, engineering, technology, biotechnology, computer and information technology, humanities, social sciences, management, etc. It also has over one lakh bound volumes of printed journals. It is equipped with a video viewing facility and has a sizeable collection of CDs of video lectures, kept in the Computer Applications Division/ Lab on the Ground floor. The Library maintains a separate reference collection consisting of encyclopaedias, dictionaries, handbooks, technical data, almanacks, atlases, bibliographies, in print apart from online resources. It has built up a good collection of books in Hindi, including books on various subjects being taught and researched at the Institute and general reading books.

The Library has a Book Bank collection which holds multiple copies of the selected textbooks and facilitates students to borrow up to six books for the entire semester. It is a valuable service that supports students in their academic pursuits and helps to reduce the financial burden of purchasing textbooks.

e-Resources and Databases

The Institute has access to over 71,464 full-text electronic journals/proceedings/standards, including 2,900 journal archives, 8 bibliographical databases/standards, and over 59 full-text resources (packages). The Institute has 8300 collections of eBooks (including e-textbooks) from different Indian and foreign publishers. The Institute also subscribes to Grammarly Software for English Correction and ChemDraw, which helps create and edit chemical structures, reactions, and spectra.

Almost all the electronic journals/proceedings/standards/eBooks/databases are accessible remotely using the Single Sign-On (SSO)/Off-Campus system based on Shibboleth. The Library has a dedicated page *(https://idp.iitd.ac.in)* for accessing these resources remotely from outside the campus using Institute Login and Password/Kerberos. A detailed guide and list of resources accessible from your places of residence outside of campus is available at: *https://idp.iitd.ac.in*

Facilities and Services

The Central Library has been using RFID technology since 2010, which facilitates the users: self-check-out, self-check-in (Book Drop), to control theft, to find misplaced reading material, sorting, inventory accuracy, stock verification procedures, security control, video surveillance, people counter, etc. The Central Library also has a well-equipped computer lab facility with an internet connection for users to access electronic resources and for their study, research, and academic work. This lab is also being used for hosting training and workshops.

Central Library migrated from the commercial LibSys to Koha, an Open Source LMS and has customized the user-centric Online Public

Access Catalogue, through which you can check the availability of the printed books and your record like Issue/Return/Overdue Books/Fine, etc. For every transaction, an automatic email is sent to the registered email to stop the misuse of your library card. The Web OPAC (Book Search) is accessible at: *https://libcat.iitd.ac.in*. The Library also arranges Printed Books or Journal Articles from other Libraries which are not available in IIT Delhi through an Inter-Library Loan, request for the same may be sent through email or through Library Circulation Counter (DELNET). The Library has a very good Photocopying, Scanning, Digital Printing, and Binding Facility within its premises through an external vendor on a payment basis.

Institutional Repository

Extended abstracts of the Theses have also been made accessible through Library's DSpace based Institutional Repository, available at: *http://eprint.iitd.ac.in* and full-text of the Theses are accessible via Shodhganga: a reservoir of Indian theses at: *https://shodhganga.inflibnet.ac.in/jspui/handle/10603/421373*.

IITD Faculty Profiling System

Central Library updates the IRINS instance with the profiles of all faculty members, which highlights publications, patents, projects and other scholarly activities of the faculty members. One can see the profiles of all the Faculty Members at: *http://iitd.irins.org*.

Book Recommendation System

Central Library has a flexible book recommendation system in offline and online formats. Suppose you are interested in recommending a book for the Library. In that case, whether you are a faculty member, staff or student, you may do so by filling out the recommendation form available on the website: *https://library.iitd.ac.in/book-recommendation*. Central Library has developed the new Online Book Recommendation System using Koha (Open Source LMS) to facilitate faculty members. The faculty members can recommend the book(s) for Central Library and concerned departmental libraries through the online system. To access the New Online Book Recommendation System click here, & Use your Kerberos ID and Password to Login.

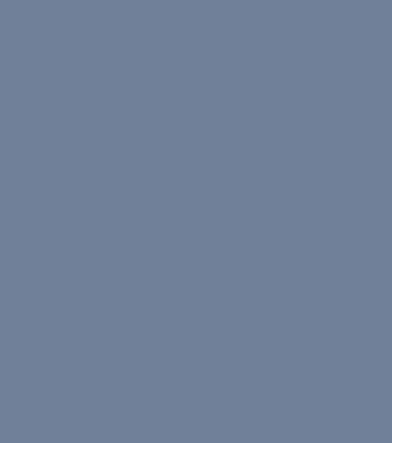
Outreach Activities

The Central Library also hosts regular Workshops/Training for the users on various research activities such as author workshops, plagiarism user awareness programs, publishing ethics, open access and open science, training on databases, etc. The recorded Videos/PPTs are available library website at: *https://library.iitd.ac.in/workshop-recording*.

Library App

The Library Mobile App is very useful and can be installed on Android through the name: *https://play.google.com/store/apps/details?id=com.iitd.cl*.

Overall, the Central Library at IIT Delhi plays a crucial role in supporting the Institute's teaching, research, and innovation, VISSION, MISSION, and VALUE by providing high-quality scholarly information and services. For further information about the Central Library and its Services, you may visit: *https://library.iitd.ac.in* or download the Handbook *https://library.iitd.ac.in/pdf/LibraryHandbook.pdf or explore the short Orientation Video: https://www.youtube.com/watch?v=XqTnzmJvPOI&t=1s.*





8. ADMINISTRATIVE STRUCTURE




THE VISITOR

Smt. Droupadi Murmu
(Hon'ble President of India)

CHAIRPERSON, BOARD OF GOVERNORS

Dr. R. Chidambaram

DIRECTOR

Prof. Rangan Banerjee

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Prof. T.R. Sreekrishnan *(Operations)*
and
Prof. Ambuj D. Sagar *(Strategy and Planning)*

DEANS

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Prof. Naresh Bhatnagar : *Research & Development*
Prof. James Gomes : *International Programmes*
Prof. Aditya Mittal : *Student Affairs*
Prof. Abhijit R. Abhyankar : *Infrastructure*
Prof. P.V. Rao : *Planning*
Prof. Preeti Ranjan Panda : *Corporate Relations*
Prof. P.V.M Rao : *Alumni Relations*
Angelie Multani (Ms.) : *Diversity & Inclusion*

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Prof. C.T. Dhanya (Ms.) : *Academics (PG Research)*
Prof. Subodh V. Sharma : *Academics (ONI)*
Prof. Nidhi Jain (Ms.) : *Faculty*
Prof. Rajendra Singh : *Research & Development*
Prof. Pramit K. Chowdhury : *Students Events*
Prof. B.K. Panigrahi : *Hostel Management*
Prof. Tanusree Chakraborty (Ms.) : *Student Welfare*
Prof. D.R. Sahoo : *Infrastructure (Electrical)*
Prof. Shashank Bishnoi : *Infrastructure (Renovation)*
Prof. Dipayan Das : *Infrastructure (Maintenance)*

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Dr. Deepika Bhaskar (Ms.)

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(Director)

Deputy Directors

T.R. Sreekrishnan ***(Operations)***

Ambuj D. Sagar ***(Strategy & Planning)***

Deans

Narayanan D. Kurur
Krishna AchutaRao
Naresh Bhatnagar
Gamesh Gomes
Aditya Mittal
Abhijit R. Abhyankar
P.V. Rao
Preeti Ranjan Panda
P.V.M. Rao
Angelie Multani (Ms.)

Associate Deans

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Shouribrata Chatterjee
Subodh V. Sharma
Rajendra Singh
Pramit K. Chowdhury
B.K. Panigrahi
Tanusree Charaborty (Ms.)
Dipti Ranjan Sahoo
Dipayan Das
Shashank Bishnoi
Nidhi Jain (Ms.)

Applied Mechanics

Sanjeev Sanghi
S.V. Veeravalli (on sabbatical)
Anupam Dewan (on sabbatical)
Santosh Kapuria
B.P. Patel
Maloy Kumar Singha
Puneet Mahajan Sawan (on sabbatical)
Sawan Sinha
S. Pradyumna
Amitabh Bhattacharya

Biochemical Engineering and Biotechnology

Ritu Kulshrestha (Ms.)
D. Sundar
Sunil Nath
T.R. Sreekrishnan
Atul Narang
Shilpi Sharma (Ms.)
K.J. Mukherjee
Preeti Srivastava (Ms.)

Chemical Engineering

A.K. Saroha
A.N. Bhaskarwar
Rajesh Khanna (on EOL)
Vivek Vitthal Buwa (on sabbatical)
Anil Verma
Shantanu Roy
Sreedevi Upadhyayula (Ms.)
Anurag Singh Rathore
Sudip Kumar Pattanayek
Anupam Shukla
Suddhasatwa Basu
Shalini Gupta (Ms.) (on EOL)
Jayati Sarkar
Paresh Chokshi
K.K. Pant (on deputation)

Chemistry

Siddharth Pandey
Ashok K. Ganguli
N.D. Kurur
Ravi Shankar
Jai Deo Singh
Nalin Pant
Anil Jacob Elias
N.G. Ramesh
V. Haridas
Shashank Deep
Sameer Sapra
S. Nagendran
Ravi Prakash Singh
Sunil Kumar Khare

Civil Engineering

Arvind K. Nema
G.V. Ramana
Alok Madan
A.K. Keshari
V.R. Gunturi
B.R. Chahar
Rakesh Khosa
R. Ayothiraman
J.T. Shahu
Suresh Bhalla
R.R. Kalaga
Dev Raj Kaushal
B.J. Alappat (on sabbatical)
Neeraj Kumar Jha
Vasant Annasaheb Matsagar
Bappaditya Manna
D.R. Sahoo
Tanusree Chakraborty (Ms.)
Arun Kumar

Computer Science and Engineering

Prem Kumar Kalra
Sanjiva Prasad
Huzur Saran
S. Arun Kumar
Kolin Paul
Amit Kumar
S. Banerjee (on EOL)
Amitabha Bagchi
Subodh Kumar
Rahul Garg
P.R. Panda
Smruti Ranjan Sarangi
Naveen Garg

Design

Aneesha Sharma (Ms.)
P.M.V. Rao

Electrical Engineering

I.N. Kar
Jayadeva

THE SENATE *(contd.)*

M. Jagadesh Kumar (on lien)
S.D. Joshi
Ranjan Kumar Mallik
Ranjan Bose (on deputation)
Santanu Chaudhury (on lien)
M. Veerachary
Shankar Prakriya
Manav Bhatnagar
Brejesh Lall
Nilanjan Senroy
Sumantra Dutta Roy
Shouribrata Chatterjee
Abhisek Dixit
Subrat Kar
V. Ramgopal Rao
Mukul Sarkar
Shaunak Sen
Shubhendu Bhasin
Saif Khan Mohammad
Anuj Dhawan

Energy Science and Engineering

Vamsi K. Komarala
K.A. Subramanian
Ramesh Narayanan

Humanities and Social Sciences

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Angelie Multani (Ms.)
Pritha Chandra (Ms.)
Sanil V. (on sabbatical)
Ravinder Kaur (Ms.)
Vibha Arora (Ms.)
Pritha Chandra (Ms.)
Kamlesh Singh (Ms.)
Jayan Jose Thomas
Arjun Ghosh
Abhijit Banerji
Reetika Khera (Ms.)
Mahuya Bandyopadhyay (Ms.)
Sarbeswar Sahoo

Management Studies

Mahim Sagar
Seema Sharma (Ms.)
Ravi Shankar
M.P. Gupta
P. Vigneswara Ilavarsan
Surya Prakash Singh
Shveta Singh (Ms.)
Kanika Tandon Bhal (Ms.)

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Aparna Mehra (Ms.)
S. Dharmaraja
R.K. Sharma
Amitabha Tripathi
S.C.S. Rao
B.S. Panda
K. Sreenadh
N. Chatterjee
Mani Mehra (Ms.)

Mechanical Engineering

M.R. Ravi
Anoop Chawla
B. Premachandran
Sudipto Mukherjee
S.K. Saha
Anjan Ray
S.P. Singh
J.K. Dutt
Harish Hirani
Raj Kumar Pandey
Ashish K. Darpe (on sabbatical)
Subodh V. Modak
Sujeet K. Sinha (on sabbatical)
S. Aravindan
Pulak Mohan Pandey (on lien)
Prabal Talukdar
Sunil Jha
Sangeeta Kohli (Ms.)
Sudarsan Ghosh
Nomesh Bolia (on sabbatical)
Amit Gupta
P.V. Rao

Materials Science and Engineering

Rajesh Prasad
Josemon Jacob
Bhabani Kumar Satapathy

Physics

Pankaj Srivastava
Ratnamala Chatterjee (Ms.)
V. Ravishankar
Rajendra Singh
Neeraj Khare
Sujeet Chaudhary
D.S. Mehta
Hitendra K. Malik
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Aloka Sinha (Ms.)
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J.P. Singh
Santanu Ghosh
A.K. Shukla
Amruta Mishra (Ms.)
Sankalpa Ghosh
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R. Alagirusamy
R.S. Rengasamy
B.K. Behera
Manjeet Jassal (Ms.)
Mangla Joshi (Ms.)
Apurba Das
Dipayan Das
Abhijit Majumdar
Sourabh Ghosh
Amit Rawal
Bhupendra Singh Butola
A.K. Agrawal
Samrat Mukhopadhyay
Deepti Gupta (Ms.)
Bhanu Nandan
Rajiv K. Srivastava

THE SENATE *(contd.)*

Applied Research in Electronics
Ananjan Basu
Arun Kumar
Monika Aggarwal (Ms.)

Atmospheric Sciences
Somnath Badiya Roy
Manju Mohan (Ms.)
Krishna Mirle Achutarao
Sagnik Dey

Automotive Research and Tribology
B.K. Panigrahi

Biomedical Engineering
Naresh Bhatnagar

Computer Services Centre
K. Narayanan
Pardeep K. Gupta
P.K. Babu
Sriram Hegde

Educational Technology Services Centre
Smruti Ranjan Sarangi

National Resource Centre for Value Education in Engineering
Purnima Singh (Ms.)

Optics and Photonics
Joby Joseph
P. Senthilkumaran

Rural Development and Technology
P.M.V. Subbarao
Anushree Malik (Ms.)
Satyawati Sharma (Ms.) (on sabbatical)
V.K. Vijay
V.M. Chariar
Vivek Kumar

Sensors, Instrumentation and Cyber-physical Systems Engineering
Anuj Dhawan
Gurfan Sayeed Khan

Transportation Research and Injury Prevention Centre
Kalaga R. Rao

Amar Nath and Shashi Khosla School of Information Technology
Kolin Paul

Bharti School of Telecommunication Technology and Management
Swades De
Suma S. Athreye

Kusuma School of Biological Sciences
Bishwajit Kundu
Tapan Kumar Chaudhuri
Aditya Mittal
Chinmoy Sankar Dey
Amitabha Mukhopadhyay
James Gomes
Vivekanandan Perumal
Manidipa Banerjee (Ms.)
Archana Chugh (Ms.)

School of Interdisciplinary Research
Hemant Kashyap

School of Public Policy
Sanjiva Prasad
Upasna Sharma (Ms.)

Yardi School of Artificial Intelligence
Mausam

Librarian
Nabi Hasan

Head, Central Workshop
S. Aravindan

One of the Warden
Joyee Ghosh (Ms.) (Kailash Hostel)

Chairperson, Grades & Registration (UG/PG)
Divesh Bhatia

Chairperson, Time Table Committee (UG/PG)
Shaikh Z. Ahammad

Six Members of the Faculty for their special knowledge
Gaurav Goel
Seshan Srirangarajan
Smita Kashiramka (Ms.)
Leena Nebhani (Ms.)
Dilip Ganguly
Neetu Singh (Ms.)

Three Educationists from Outside IIT Delhi
Venu Gopal Achanta
Shahid Jameel
Bharat Bhasker

Three Alumni Representatives as Special Invitee
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Sanjay Gupta
Rajiv Malhotra

Four Student Representatives
Kartik Raj Khandelwal (Gen. Secy., SAC)
Sahil Chauhan (Gen. Secy., CAIC)
Manish Raj (M.Tech. Rep)
Vishakha Yadav (Ms.) (Research Scholar)

Permanent Invitee
JR / DR / AR (Academics)

Registrar
Deepika Bhaskar (Ms.)
(Secretary)

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Narayanan D. Kurur	Board for Academic Programmes

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Pramit Chowdhury *(President)*	Board of Recreational and Creative Activities (BRCA)
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Vivekanandan Perumal *(President)*	Board for Sports Activities (BSA)
Tanusree Chakraborty (Ms.) *(President)* *Assoc. Dean, (SA) (SW) Ex-Officio*	Board for Students Welfare (BSW)
Naresh Datla	Vice President, BSW & Coordinator, Student Mentorship Programme
Pushparaj Singh	Vice President, BSA
Pragya Jain (Ms.)	Vice President, BRCA

LIBRARY

Ashwini K. Agrawal	Chairperson (ACL)

OTHERS

Gaurav Singh	Advisor, Foreign Students
Samrat Mukhopadhyay	Coordinator, NSS
Simona Sawhney (Ms.)	Advisor, SC/ST Students
Vikram Singh	Advisor, Persons with Disabilities (PwD) Students
Sourabh Bikas Paul	Coordinator, NCC
Sumedha Chakma	Coordinator, SC/ST Preparatory Course

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Vivek Kumar	Chairperson, JEE (Advanced-2023)
Rajendra S. Dhaka	Vice-Chairperon, (Advanced-2023)
Ashwini K. Agrawal	Advisory Committee for Library (ACL)
R. Ayothiraman	Chairperson (GATE/JAM-2023)
Nilanjan Senroy, G.V. Prakasha	Vice-Chairperson (GATE/JAM-2023)
Tanusree Charaborty (Ms.) *President, BSW (Ex-Officio)*	Head, Students Counselling Services (SCS)
Neeraj Kr. Chaurasia	Hindi Cell (Head)
Divesh Bhatia	Chairperson, Grades & Registration (UG & PG)
Shaikh Ziauddin Ahammad	Chairperson, Time Table Committee (UG & PG)

Anil Verma	Head, QIP/CEP/OCDC
Manav Bhatnagar	Associated Head, QIP/CEP/OCDC

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P.G. Programmes

Kaushik Saha	Energy Science & Engineering
Abhisek Dixit	VLSI Design Tools & Technologies (EE/CS&E/CARE)
Satish K. Dubey	Centre for Sensors, Instrumentation Cyber-Physical System Engineering (SeNSE)
Gorab Ghatak	Bharti School of Telecom Technology and Management (BSTTM)
Huzur Saran	Cyber Security
Subodh Kumar	Robotics

M.Tech. and Research Programmes

Joyee Ghosh (Ms.)	Opto Electronics & Optical Communications (OEOC)
Amol Choudhary	

Others

V.K. Vijay	Unnat Bharat Abhiyan (UBA) Cell

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(Located in Departments/Centres)

S. Aravindan	3D Printer & Laser cutting
Sitikantha Roy	AFM
Ankur Goswami	Atom Probe Tomography
Bishwajit Kundu	Bio AFM
Manidipa Banejee (Ms.)	Cryo HRTEM
Tapan K. Chaudhuri	ESI-LC-MS
Archana Chugh (Ms.)	FACS
Suresh Neelkanthan	FESEM EDS Block - 4
Naresh Bhatnagar	Femto Second Laser Cutting System
Javed Shiekh	FTIR
Sayantan Paria	Glass Blowing Workshop
Pravin P. Ingole	HRTEM
Shaikh Z. Ahamad	ICP-MS
Sujeet Chaudhury	Liquid Nitrogen Facility
Bishwajit Kundu	MALDI-MS
S.R. Roy	NMR 300, 400 & 500 MHz (Liquid Probe)
J.P. Singh	SEM
Santanu Ghosh	SQUID Magnetometer
Bipin Kumar	TEM CRF & Ultra Microtome
Jayant Jain	TEM, CPSE
Bhanu Nandan	XRD
Jay Dhariwal	Makespace
Rajendra Singh, Abhisek Dixit, Samaresh Das	AECL-Advanced Electrical Characterization Lab
Ashwini K. Agrawal	Under SMITA Research Lab (a) Micro Raman Spectroscope (b) FE SEM + EDS (c) NMR 400 MHz with Liquid and solid probe

CRF SONIPAT

Jayant Jain	Ion Milling
Ratnamala Chatterjee (Ms.)	PPMS
B.P. Tripathi	Rheometer
Bhanu Nandan	SAXS
Ashwini K. Agarwal	Thermal Series Equipment
Dinesh Kalyanasundaram	UTM
P.K. Muduli	XRD
James Gomes, Neetu Singh (Ms.), Shilpi Sharma (Ms.), Amitabha Mukhopadhyay	Cell Biology Lab
Sameer Sapra	XPS
Nirat Ray (Ms.)	HRTEM (200keV)
J.P. Singh	AFM
Pintu Das	STM
Sayantan Paria	EPR
Ashwini K. Agarwal	TOF-SIMS
Leena Nebhani (Ms.)	BET
Rajendra Singh	MBE

CENTRAL WORKSHOP

S. Aravindan	Professor and Head

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Narayanan D. Kurur, *Dean (Acad.)*	Institute Lecture Series Committee
Narayanan D. Kurur, *Dean (Acad.)*	Standing Committee for Convocation 2023
Narayanan D. Kurur, *Dean (Acad.)*	Kendriya Vidyalaya Mangement Committee
Narayanan D. Kurur, *Dean (Acad.)*	Nursery & K.G. School Advisory Committee
Abhijit R. Abhyankar, *Dean (Infra.)*	Commercial Establishments & Licencing Committee
Abhijit R. Abhyankar, *Dean (Infra.)*	Commercial Establishments Monitoring Committee
Abhijit R. Abhyankar, *Dean (Infra.)*	House Allotment Committee
Abhijit R. Abhyankar, *Dean (Infra.)*	Air-conditioning Committee
Shashank Deep, *Chemistry*	Hospital Advisory Committee
A.K. Saroha, *Chemical Engg.*	Employees Welfare Committee
Kanika T. Bhal (Ms.), *DMS*	Institute Grievance Committee
T.R. Sreekrishnan, *D.D. (Operations)*	Managing Committee of the Benevolent Fund Scheme
T.R. Sreekrishnan, *D.D. (Operations)*	Executive Committee of IITD Staff Welfare Scheme

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Ankush Agarwal	Jwalamukhi
Joyee Ghosh (Ms.)	Kailash
Ankur Goswami	Karakoram
Sri Harsha Kota	Kumaon
Pintu Das	Nilgiri
Arnab Chanda	Shivalik
Prashanth Vangla	Vindhyachal

N.M. Anoop Krishnan	Girnar
Sumedha Chakma	Zanskar
Jayant Jain	Udaigiri
Priyanka Kaushal (Ms.)	Himadri
Hariprasad Kodamana	Satpura
Anup Singh	Dronagiri
Sahab Fatima (Ms.)	Sahyadri
Paroma Sanyal (Ms.)	Saptagiri
M.C. Ramteke	Nalanda / IP / New Vindhyachal / Transit Accommodation
Sangeeta Santra (Ms.) (Associate Warden)	Nalanda / IP / New Vindhyachal / Transit Accommodation

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Professor-in-Charge (LHC)	Shaikh Z. Ahammad
Professor-in-Charge (EHLS Unit)	Nalin Pant

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HINDI CELL

Head	Neeraj Kumar Chaurasia

STUDENT COUNSELLING SERVICE

Head	Tanusree Chakraborty (Ms.)

ADMINISTRATIVE COMPUTERISATION SUPPORT SERVICE

Head	K. Narayanan

CVC

Chief Vigilance Officer	S.K. Saha

RTI

Public Information Officer	Shiv Prakash Yadav
First Appellate Authority	Kalyan K. Bhattacharjee
Transparency Officer	Deepika Bhaskar (Ms.)

HOSPITAL SERVICES

Head	Lily Khosa (Ms.)

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Librarian & Head	Nabi Hasan
Deputy Librarian	Neeraj Kumar Chaurasia
Assistant Librarian (SS)	Shankar B. Chavan
Assistant Librarian (SS)	Vijay Kumar Verma
Assistant Librarian (SS)	Vanita Khanchandani (Ms.)
Assistant Librarian	Mohit Garg
Assistant Librarian	Manu T.R.

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K.K. Bhattacharjee	Joint Registrar (FAA, E-I, RTI, R&I, Travel Desk, Planning)
Atul Vyas	Joint Registrar (Academics, Publication Cell)
Mohd. Shamim	Deputy Registrar (Accounts)
N. Bhaskar	Deputy Registrar (Health Unit, Vigilance Matters, Nodal Officer for Public Grievances (PG), Director's Office, Gender Grievances & Related Works)
Alan V. Sinate	Deputy Registrar (Store Purchase Section)
Mukesh Chand	Deputy Registrar (Hostel Accounts)
Deb Ranjan Mukherjee	Deputy Registrar (Accounts, IRD Accounts)
Amitabh Mukherjee	Deputy Registrar (Audit)
Raj Kumar Gupta	Consultant (On contract)
Sanjay Pande	Assistant Registrar (E-II)
Anand Prakash	Assistant Registrar (Student Affairs, IRD)
Rama Sharma (Ms.)	Assistant Registrar (Recruitment Cell, Hindi Cell)
Pankaj Prasad	Assistant Registrar (Accounts)
Rajeev Kumar	Institute Engineer (On deputation)
Anuj Gaur	Executive Engineer
Ashok Kumar	Executive Engineer
Kripa Shanker Tripathi	Executive Engineer (On deputation)
Ashish Kumar Vinodiya	Executive Engineer
Rafat Jamal	Executive Engineer
Raju Ram Parihar	Executive Engineer (On lien to IIT Jodhpur)
Prem Kumar Singhal	Assistant Executive Engineer
Pradip Karamarkar	Assistant Executive Engineer
Virbhan Singh	Assistant Executive Engineer
Prem Singh Rawat	Assistant Executive Engineer
Shiv Prakash Yadav	Public Relations Officer & PIO (RTI)
Bhupender Singh	Principal Technical Officer
Uday Dadwal	Technical Officer
Lily Khosa (Ms.)	CMO (SAG), (Additional charge, Head, Hospital Services)
Ajay Kumar Jain	CMO (SAG) & Associate Head, Hospital Services
M.K. Sagar	CMO (SAG)
Anila Khosla (Ms.)	CMO (SAG)
P.K. Rajesh	CMO (Homeopathy)
Md. Ashafaque Hussain	CMO

Sayed Yasmeen Raunaq (Ms.)	Sr. Medical Officer
L. Pangerlemba	Sr. Medical Officer
Rajlaxmi Borah (Ms.)	Medical Officer
Shalini Singh (Ms.)	Medical Officer (Dental) (On contract)
Deepak Negi	Sports Officer
Anishya Madan (Ms.)	Industrial Liaison Officer & Head, Office of Career Services
Shachi Mathur (Ms.)	Student Counsellor
Aakriti Astha (Ms.)	Assistant Student Counsellor
Sandeep Sharma	Security Officer & Incharge, Transport Unit

INDIAN INSTITUTE OF TECHNOLOGY DELHI
THE HONOUR CODE

I ....., Entry No. ..... do hereby undertake that as a student at IIT Delhi :

1. I will not give or receive aid in examinations; that I will not give or receive unpermitted aid in class work, in preparation of reports, or in any other work that is to be used by the instructor as the basis of grading; and
2. I will do my share and take an active part in seeing to it that others as well as myself uphold the spirit and letter of the Honour Code.

I realise that some examples of misconduct which are regarded as being in violation of the Honour Code include :

- Copying from another's examination paper or allowing another to copy from one's own paper;
- Unpermitted collaboration;
- Plagiarism;
- Revising and resubmitting a marked quiz or examination paper for re-grading without the instructor's knowledge and consent;
- Giving or receiving unpermitted aid on take home examinations;
- Representing as one's own work, the work of another, including information available on the internet;
- Giving or receiving aid on an academic assignment under circumstances in which a reasonable person should have known that such aid was not permitted; and
- Committing a cyber-offence, such as, breaking passwords and accounts, sharing passwords, electronic copying, planting viruses, etc.

I accept that any act of mine that can be considered to be an Honour Code violation will invite disciplinary action.

Date : .....

Student's Signature .....

Name .....

Entry No. .....

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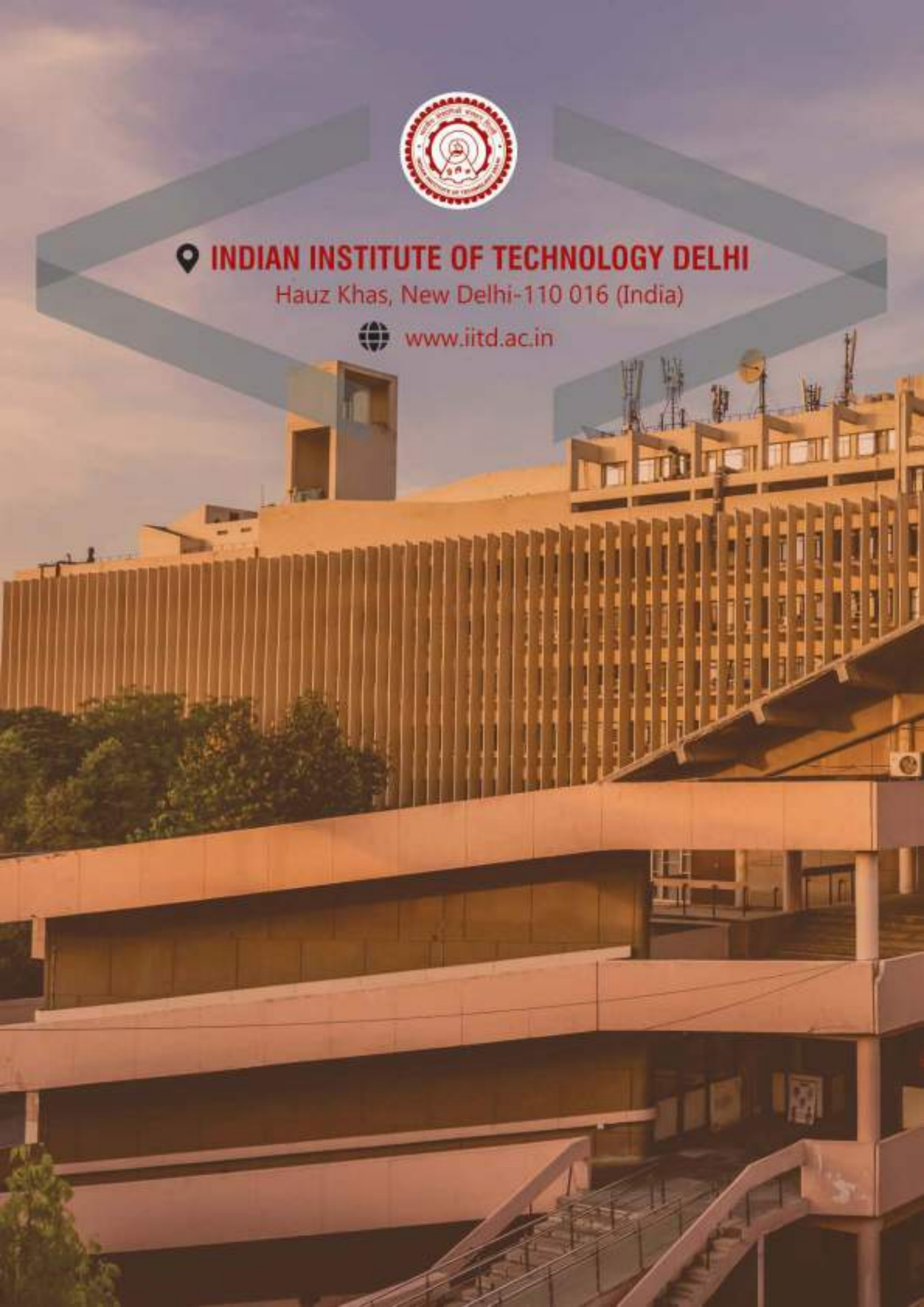

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