In a technology-driven world, it is the academic & industrial research that fuels a nation's economic growth. This is especially true in the present scenario with a strong emphasis on attaining self-reliance in technological prowess.

The IRD Unit of IIT Delhi manages the research funding and industrial interactions of the institute and fosters active collaborations with the industry and other academic and research institutions of eminence. Committed to long-term research in frontier areas the IRD unit strives towards making concerted efforts in aligning the R&D focus of the Institute with the national goal of achieving technological self-reliance to usher in the era of ‘Atmanirbhar Bharat’ in its true sense.

The research projects undertaken by IRD are in the thrust areas of science and engineering. Socially relevant research with a scope for technological output as against only research publications are given preference. However, blue skies research which are futuristic are always encouraged for long-term benefits to humanity.

Networking is a crucial factor in determining the success of an individual and an organization in the present world. In keeping with this, the IRD Unit too has ongoing academic and research collaborations with key national and international universities, government agencies and industries. In order to keep pace with expanding frontiers of knowledge, national policies and global developments, we have a continuous process of evaluation and upgradation. This is reflected in our impressive list of research projects, which cater to both our national and global development and continue to uphold the Institute’s eminence at the cutting-edge of research at national and global level.

Through **IRD Connect**, the newsletter of IRD we share the highlights of the latest R&D initiatives at the Institute undertaken through the IRD Unit, with our institute fraternity. This edition of IRD Connect brings to you the key updates in the R&D front that happened in the last six months.

Sometimes, in a bigger picture, we overlook the crucial entities that drive the whole system. And that is ‘You’ - the ‘Researcher’! You may be a young faculty who has started guiding research, or a PG student who is getting initiated into the fascinating world of research. Each one of you is a crucial entity that ensures that we deliver on our commitments - to the Institute and to society at large. We urge you to do your bit with zeal and passion, focusing on that bigger picture and the larger vision and match your passion with your profession at this dream institute.
CII’s Global Science, Innovation, & Research Summit
Under the Technology Mission, the Confederation of Indian Industries (CII) held a Global Science, Innovation & Research Summit at IIT Delhi on 2nd May 2023 with the aim of strengthening academic and industry collaborations. The meeting was attended by Prof. Rangan Banerjee, Director IIT Delhi, and Dr. Parvinder Maini, Scientific Secretary, Office of PSA, GoI among others.

Semicon India Future DESIGN Roadshow
To give impetus to semiconductor design and manufacturing in the country the Ministry of Electronics & Information Technology (MeitY), organized the 3rd Edition of Semicon India at IIT Delhi on 12th May 2023 under the Design Linked Incentive scheme. This was part of a series of roadshows organized by MeitY across the country to stimulate the next-gen Semiconductor Designers, Promote the culture of Co-development and joint ownership of IPs with active industry participation and Indigenously Develop Semiconductor Chips for Automobile, Mobility, Communication & Computing.

AIIMS-ICMR-IIT Delhi Tripartite MoU Signing, ICMR CoE Inauguration at AIIMS, New Delhi
Indian Institute of Technology, Delhi signed an MoU with AIIMS (All India Institute of Medical Sciences, New Delhi) and Indian Council of Medical Research (ICMR), New Delhi on 2nd August 2023 for setting up the ICMR Centre of Excellence for Neurosurgery Medical Devices at AIIMS Delhi. This CoE will focus on the development of Make-in-India multifunctional surgical instrument for critical neurosurgeries & Computer-Assisted-Neurosurgery navigation system for skill development.

Visit of H.E. Ms. Delcy Rodriguez, Executive Vice President and Finance Minister of the Bolivarian Republic of Venezuela
The Executive Vice President and Finance Minister of the Bolivarian Republic of Venezuela, H.E. Ms. Delcy Rodriguez, visited IIT Delhi on 3rd August 2023 where she met Prof. Rangan Banerjee, Director, IIT Delhi, and discussed opportunities for collaboration between Venezuela’s academic institutions and IIT Delhi. She also interacted with the faculty members of the CBME, IIT Delhi about their ongoing research projects and visited the MedTech mPRAGATI facility at the Institute’s R&I Park.

Workshop on MedTech and Healthcare Ecosystem for Upcoming IIT Delhi-Jhajjar Campus Organized
On 14th August 2023, a day-long workshop was organized at IIT Delhi where medics and healthcare industry experts discussed the MedTech and Healthcare Ecosystem for the upcoming IIT Delhi-Jhajjar Campus. Dr. V.K. Paul, Member-Health, NITI Aayog; Shri V. Srinivas, Secretary, DAR & PG, and Director General, NCGG; Dr. Upendra Kumar Singh, DG-Life Sciences, DRDO; Prof. M. Srinivas, Director, AIIMS, New Delhi; and Prof. Rangan Banerjee, Director, IIT Delhi, inaugurated this workshop.

AIIMS-IITD joint MoU Renewal
AIIMS and IIT Delhi jointly renewed their MoU on “AIIMS-IITD Collaborative Platform” for another five years at the inaugural ceremony of MedTech and Healthcare Ecosystem for Upcoming IIT Delhi-Jhajjar Campus held on 14th August 2023 at IIT Delhi. The collaborative platform involves academic, research, product, process and human resource development which will have a profound social and economic impact for our country. The MoU envisages collaboration by application of engineering principles and design in healthcare.

Student Start-up and Discover & Learn 1-2-3-4 Review
A review of ongoing IRD Student Startup Action & Discover & Learn (1-2-3-4) Projects was carried out on 18th August 2023 a poster presentation by enthusiastic student teams. The projects in the thematic research areas included Environment, Electric Vehicles, Medical Devices, Agricultural Technology, Energy, Protective textiles, etc.
<table>
<thead>
<tr>
<th>Project Description</th>
<th>Sponsorship Details</th>
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<tbody>
<tr>
<td>Turbulent resilient FSO systems</td>
<td>Sponsored by C-DAC</td>
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<tr>
<td>Fully Hybrid Optical Communication Link</td>
<td>Sponsored by C-DAC</td>
</tr>
<tr>
<td>LiFi Networks</td>
<td>Sponsored by C-DAC</td>
</tr>
<tr>
<td>Reconfigurable Optical Filter</td>
<td>Sponsored by C-DAC</td>
</tr>
<tr>
<td>Secure Networks and Edge-Computing Hardware for Industry 4.0</td>
<td>Sponsored by Meity, Ministry of Textiles, Government of India</td>
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<tr>
<td>Thermo-acoustic Insulation Textiles for Automotive</td>
<td>Sponsored by NITM, Ministry of Textiles, Government of India</td>
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<tr>
<td>Consortium for collective and engineered phenomena in topology concept</td>
<td>Sponsored by DST</td>
</tr>
<tr>
<td>Development of large area 152.4 mm x 152.4 mm -23% efficient silicon heterojunction solar cells, and ~28% efficient tandem cells of 50 mm x 50 mm area</td>
<td>Sponsored by DST, Ministry of Earth Sciences, Government of India</td>
</tr>
<tr>
<td>Integrated quantum light sources using LNOI</td>
<td>Sponsored by DRDO, Ministry of Defence, Government of India</td>
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<tr>
<td>Mission for Developing Aerogels Based Textile Materials for Civilian, Industrial and Defense Applications</td>
<td>Sponsored by NITM, Ministry of Textiles, Government of India</td>
</tr>
<tr>
<td>Cut, Slash, Stab and Impact-Cut Resistant Textiles for Protection</td>
<td>Sponsored by NITM, Ministry of Textiles, Government of India</td>
</tr>
<tr>
<td>High Temporal Resolution sensors for Collision Detection in Automotive Applications</td>
<td>Sponsored by Meity, Ministry of Textiles, Government of India</td>
</tr>
<tr>
<td>Development of long lasting and biodegradable electrospun/needlepunch nonwoven composite mulch using natural fibrous wastes</td>
<td>Sponsored by NITM, Ministry of Textiles, Government of India</td>
</tr>
<tr>
<td>Continuous monitoring of water vapour isotopes in Western Himalayan region: Modern vs Paleoperspective</td>
<td>Sponsored by Min. of Earth Sciences, Government of India</td>
</tr>
<tr>
<td>Hybrid numerical-empirical WIND Speed forecasting for renewable energy applications (HYWINDS)</td>
<td>Sponsored by Min. of Earth Sciences, Government of India</td>
</tr>
<tr>
<td>Hybrid numerical-empirical WIND Speed forecasting for renewable energy applications (HYWINDS)</td>
<td>Sponsored by Min. of Earth Sciences, Government of India</td>
</tr>
</tbody>
</table>
Sponsored Projects Undertaken
(Apr-Sep 2023)

Total **132** Sponsored Projects worth **₹ 152.09 Crores**

Consultancy Projects
(Apr-Sep 2023)

Total **174** Consultancy Jobs worth **₹ 16.60 Crores**
Regional Centre for Biotechnology
The second call for joint collaborative research proposals between the Regional Centre for Biotechnology (RCB) and the Indian Institute of Technology Delhi (IITD) were invited from all fields, especially where a synergistic benefit (either basic/applied/translational) can be demonstrated by inter-institutional collaboration. Four (4) RCB-IITD joint project proposals have been approved in the broader areas of Agricultural Disease management, Cancer Identification and Treatment.

4 RCB-IITD Joint Projects

- Latarcin derived membrane active peptides for powdery mildew disease management in leguminous crops
  Prof. Archana Chugh
  KSBS

- Sensitizing cells to the chemotherapeutic SMAC-mimetics and investigating the dependence on cellular differentiation status
  Prof. Manoj B. Menon
  KSBS

- Regulation of miRNA expression and maturation via targeting G-quadruplex conformations using small molecules for glioma therapy
  Prof. Ritu Kulshrestha
  DBEB

- Tracking protein dynamics in cells using clusteroluminescence
  Prof. Soumik Siddhanta
  Dept. of Chemistry

Delft University of Technology (TUD)
Delft University of Technology (TUD) and IITD to jointly support five (5) projects in the research areas of biofuel, plastic hotspots identification, wave propagation characteristics of bone, rockmass deformational behavior characterization, and the optimization of Electric Vehicle battery pack housing manufacturing.

5 TUD-IITD Joint Projects

- Bio-oil upgradation to fuel range hydrocarbons via integrated hydrodeoxygenation and aqueous phase reforming
  Prof. Sreedevi Upadhyayula
  Dept. of Chemical Engineering

- Wave propagation characteristics of bone
  Prof. Rajan Prasad
  Dept. of Mechanical Engineering

- Experimental characterization of the multi-scale deformational behaviour of lab-scale analogues of a jointed rockmass
  Prof. Deepanshu Shirole
  Dept. of Civil Engineering

- SPIHSI: “Self-supervised learning for Plastic Hotspots Identification from Satellite Images”
  Prof. Sudipan Saha
  Yardi School of Artificial Intelligence

- Digital Twin-Enabled Optimization of Electric Vehicle Battery Pack Housing Manufacturing (BatHMan)
  Prof. Abhishek Das
  Dept. of Mechanical Engineering
The University at Buffalo (UB) and IITD to jointly support eleven (11) research project proposals in the areas of Biomedicine-Biotechnology, Nanomaterials Photonics, and Artificial Intelligence/Robotics.

<table>
<thead>
<tr>
<th>Project Title</th>
<th>Principal Investigators</th>
</tr>
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<tbody>
<tr>
<td>Interaction of Nanoparticles with Microbial Cells: toxicity evaluation, removal, and valorization of heavy metals</td>
<td>Prof. Prashant Mishra, DBEB &amp; Prof. S K Khare, Dept. of Chemistry</td>
</tr>
<tr>
<td>Spatially entangled photon pairs generation assisted by metasurfaces for imaging applications</td>
<td>Prof. Parvendra Kumar, Prof. Joby Joseph, Prof. Deepak Jain, Prof. Dheeraj Pratap, Optics and Photonics Centre &amp; Prof. Jasleen Lugani, SeNSE</td>
</tr>
<tr>
<td>Linear and Nonlinear Photoluminescence due to Aggregation-Induced Enhanced Emission from 2D Layered Nanomaterials</td>
<td>Prof. Leena Nebhani, Dept. of Material Science &amp; Engineering &amp; Prof. Ashok Kumar Ganguli Dept. of Chemistry</td>
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<tr>
<td>Lanthanide doped nanoscintillators and photon convertors</td>
<td>Prof. Ashok Kumar Ganguli Dept. of Chemistry</td>
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<tr>
<td>Learning Physically Grounded Models for Robot Manipulation from Visuo-linguistic Interactions</td>
<td>Prof. Rohan Paul &amp; Prof. Mausam Yardi School of Artificial Intelligence &amp; Prof. Souvik Chakraborty, Dept. of Applied Mechanics</td>
</tr>
<tr>
<td>Nasal delivery of polyphenols to brain for treatment of neurodegeneration and evolution of Alzheimer in TBI patients</td>
<td>Prof. Shashank Deep Dept. of Chemistry</td>
</tr>
<tr>
<td>Detection, prevention, and removal of biofilms on catheters as well as dental and orthopedics implants, non-invasively</td>
<td>Prof. Sunil Kumar Khare, Dept. of Chemistry &amp; Prof. Prashant Mishra, DBEB &amp; Prof. Amit Mehndiratta, CBME</td>
</tr>
<tr>
<td>Cancer Nanotherapeutics using Non-coding RNA based Therapy</td>
<td>Prof. Ritu Kulshrestha DBEB</td>
</tr>
<tr>
<td>Portable Sensor for disease detection using volatile organic compounds in breath and skin emissions</td>
<td>Prof. Ankur Gupta &amp; Prof. Samaresh Das, CARE &amp; Prof. V Ramgopal Rao, Dept. of Electrical Engineering</td>
</tr>
<tr>
<td>Machine Learning-enabled Rational Design of Materials and Catalysts for Carbon Capture and CO Reduction</td>
<td>Prof. M C Ramteke &amp; Prof. M. Ali Haider, Dept. of Chemical Engineering &amp; Prof. Anoopkrishnan Mana, Dept. of Civil Engineering</td>
</tr>
<tr>
<td>Smart Transportation Systems with Connected and Autonomous Vehicles</td>
<td>Prof. Kolin Paul Yardi School of Artificial Intelligence</td>
</tr>
</tbody>
</table>
National Yang Ming Chiao Tung University (NYCU), Taiwan

In the second call for the joint research projects between NYCU and IIT Delhi, seventeen (17) joint research projects have been approved in the areas of Semiconductors, Medical Sciences & Technology, Civil Engineering and Nanomaterial for Biosensors.

<table>
<thead>
<tr>
<th>Project Title</th>
<th>Researcher(s)</th>
</tr>
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<tbody>
<tr>
<td>Development of a multiscale network-based model for rational design of covalent binders for allosteric modulation of GTPases</td>
<td>Prof. Gaurav Goel, Dept. of Chemical Engineering</td>
</tr>
<tr>
<td>Identification and diagnosis of hypervirulent <em>Klebsiella pneumoniae</em></td>
<td>Prof. Vivekanandan Perumal, KBS</td>
</tr>
<tr>
<td>Fabrication and Reliability Characterization of Ferroelectric based GaN-HEMT Devices for Power Applications</td>
<td>Prof. Abhisek Dixit Sr., Dept. of Electrical Engineering</td>
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<tr>
<td>Optimal fuzzy logic controller for hybrid suspension system using evolutionary algorithms</td>
<td>Prof. Husain Kanchwala, CART</td>
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<tr>
<td>Stability of GaN RF and High-power HEMTs under radiation and extreme temperature environment</td>
<td>Prof. Rajendra Singh, Dept. of Physics</td>
</tr>
<tr>
<td>Nanoconfinement of hydrides in hybrid heteroatom-doped carbon scaffolds enabling tunable hydrogen release</td>
<td>Prof. Leena Nebhani &amp; Prof. Suryanarayana Vikrant Karra, Dept. of Material Science &amp; Engineering</td>
</tr>
<tr>
<td>Development of electrode materials for high-performance and cost-effective sodium ion batteries</td>
<td>Prof. Rajendra Singh Dhaka, Dept. of Physics</td>
</tr>
<tr>
<td>Development of CMOS Compatible and CMOS MEMS Tunable MEMS Pirani gauge for vacuum characterization of packaged devices</td>
<td>Prof. Pushpapraj Singh, CARE, Prof. Dhiman Mallick, Dept. of Electrical Engineering &amp; Prof. Pravin Popinand Ingole, Dept. of Chemistry</td>
</tr>
<tr>
<td>Smart grid Connected and Energy Harvesting enabled Wireless Communication Networks</td>
<td>Prof. Swades Kumar De, Bharti School of Telecommunication Technology &amp; Management</td>
</tr>
<tr>
<td>Metal Chalcogenide-Based Yolk-Shell Nanostructured Semiconductors for Highly Efficient Solar Hydrogen Generation via Photocatalytic (PC) and Photoelectrochemical (PEC) Water Splitting</td>
<td>Prof. Pravin Popinand Ingole, Dept. of Chemistry</td>
</tr>
</tbody>
</table>
Multi-Institutional Faculty Interdisciplinary Research Projects (MFIRP) (contd.)

Designing of Soft Functional Elastomeric Materials for Soft Robotics

Prof. Shib Shankar Banerjee
Dept. of Material Science & Engineering

2D Materials Based Terahertz (THz) Sensors

Prof. Samaresh Das
CARE

Stimulus-responsive compartmentalized nanoparticles for drug/gene delivery and deep-tissue imaging for cancer treatment

Prof. Sampa Saha, Dept. of Material Science & Engineering
& Prof. Rajendra Singh, Dept. of Physics

Developing self-assembled protein like particle based theranostic system for biomedical application

Prof. Tapan Kumar Chaudhuri & Prof. Manideepa Banerjee
KSBS

Development of a porous 3D printed CoCrMo implant for medical application

Prof. Jayant Jain
Dept. of Material Science & Engineering

Centres of Excellence (CoEs)

Nayara Centre of Excellence on Process Safety and Risk Management

An MoU was signed between Nayara Energy Limited and IIT Delhi for setting up a Centre of Excellence on Process Safety and Risk Management in the areas of oil and gas/ process industries/ Hydrogen economy. The objective of this CoE is to provide assistance in the Process Safety and Risk Management to the oil & gas, and process industries and to uplift India as a Hydrogen economy.

Wipro Center of Excellence on Generative Artificial Intelligence (AI)

An MoU was signed between WIPRO LIMITED (Wipro), Bangalore and IIT Delhi on 28th June 2023 for setting up a CoE on Generative Artificial Intelligence (CoE Generative AI). This CoE will serve as an R&D hub, bringing together Wipro researchers with the faculty and students of the Institute's Yardi School of AI to address at-scale real-world problems.

MoUs/ MoAs

Sree Chitra Tirunal Institute for Medical Sciences & Technology

IIT Delhi and Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), Trivandrum signed an MoU on 12th April 2023 for initiating collaborative research led by Professor V Haridas, Department of Chemistry focusing on the Development of Peptide Molecules for biomedical interest.

ICMR & AIIMS, New Delhi for Neurosurgery Medical Devices

IIT Delhi signed an MoA with AIIMS, New Delhi and Indian Council of Medical Research (ICMR), New Delhi on 2nd August 2023 for setting up the ICMR Centre of Excellence for Neurosurgery Medical Devices. This CoE at AIIMS will focus on the development of Make-in-India multifunctional surgical instrumentation for critical neurosurgeries & Computer-Assisted-Neurosurgery navigation system for skill development.
WORKSHOPS / SEMINARS / EVENTS

- Global Science, Innovation, & Research Summit by the Confederation of Indian Industries - 2.5.2023
- 3rd SemiconIndia Future Design: Design Linked Incentive (DLI) Conference/Roadshow - 11.5.2023
- Grand Challenge Review Meeting - 14.6.2023
- Visit of New Zealand University Delegates at IIT Delhi - 19.6.2023
- WIPRO MoU Signing (Online) - 26.6.2023
- Annual Review Meeting for the Project under Grand Challenge (GC) Scheme - 4.7.2023
- Hebrew University of Jerusalem, Israel (HUJI) Seminar of Ongoing MIFRP Projects - 19.7.2023
- AIIMS-ICMR-IIT Delhi Tripartite MoU Signing, ICMR CoE Inauguration - 2.8.2023
- Visit of H.E. Ms. Delcy Rodriguez, Executive Vice President and Finance Minister of the Bolivarian Republic of Venezuela - 3.8.2023
- Renewal of AIIMS-IITD Joint MoU at MedTech Workshop - 14.8.2023
- Student Start-up Action and Discover & Learn 1-2-3-4 Projects Review and Poster Demonstration - 18.8.2023
- University of Waterloo Seminar of Ongoing MIFRP Projects - 15.9.2023

Glimpses of the R&D Activities

- Workshop on MedTech and Healthcare Ecosystem for Upcoming IIT Delhi - Jhajjar Campus & Renewal of AIIMS-IITD Joint MoU
- Student Start-up Action and Discover & Learn 1-2-3-4 Projects Review and Poster Demonstration
- Visit by high-level delegation from Bolivarian Republic of Venezuela & R&I Park Visit by the delegation