# PARTNER WITH US

FEBRUARY 2018

INDUSTRY

## INDIAN INSTITUTE OF TECHNOLOGY BOMBAY

## Benefits of Partnership

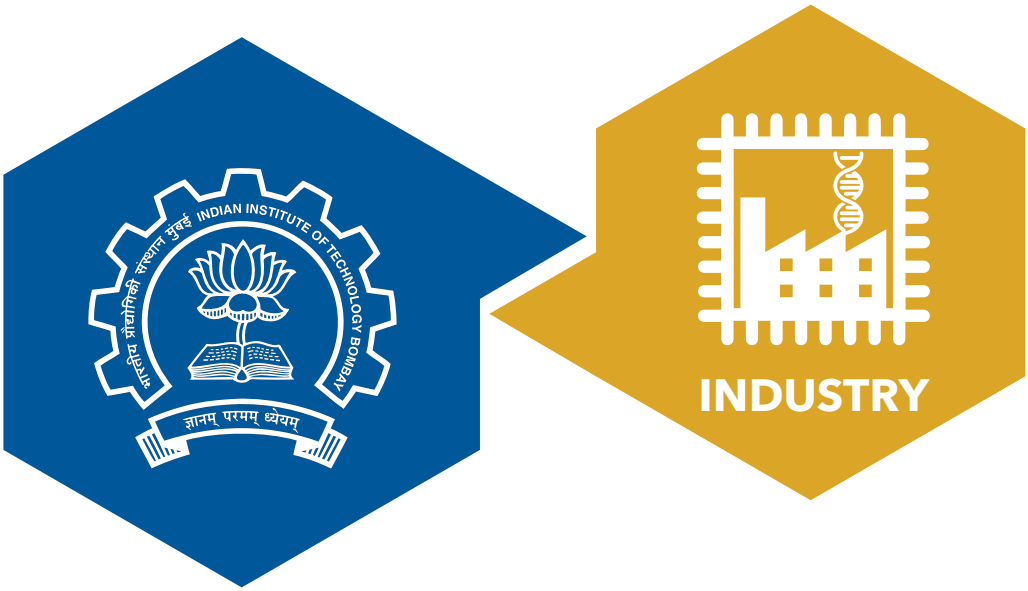
Sponsor Laboratories, Students

Solve Specific Problems

Train Industry Personnel

Carry Out Industry Relevant Research

Form Consortia




Deploy IIT Bombay IPs

Support Basic Research for Knowledge Creation

Visits of Scientists and Engineers

High-Tech Spinoffs

Human Resource Development

## Director's Message

IIT Bombay engages in research, technology development, education, training and related activities in most areas of science and technology. Today, it is a centre of academic excellence in the country and is rated on par with some of the best institutions in the world.

IIT Bombay has 27 academic units encompassing a range of disciplines that include traditional science and engineering, management, humanities, social sciences and design. The Institute has consciously nurtured interdisciplinary areas such as industrial engineering and operation research, systems and control engineering, urban science and engineering, education technology and climate studies. Institute's current student population is just over 10,000; of these, 60% are enrolled in post-graduate programs and provide a strong impetus to research activities. This is visible in various metrics of R&D such as number of publications, patents and funding.

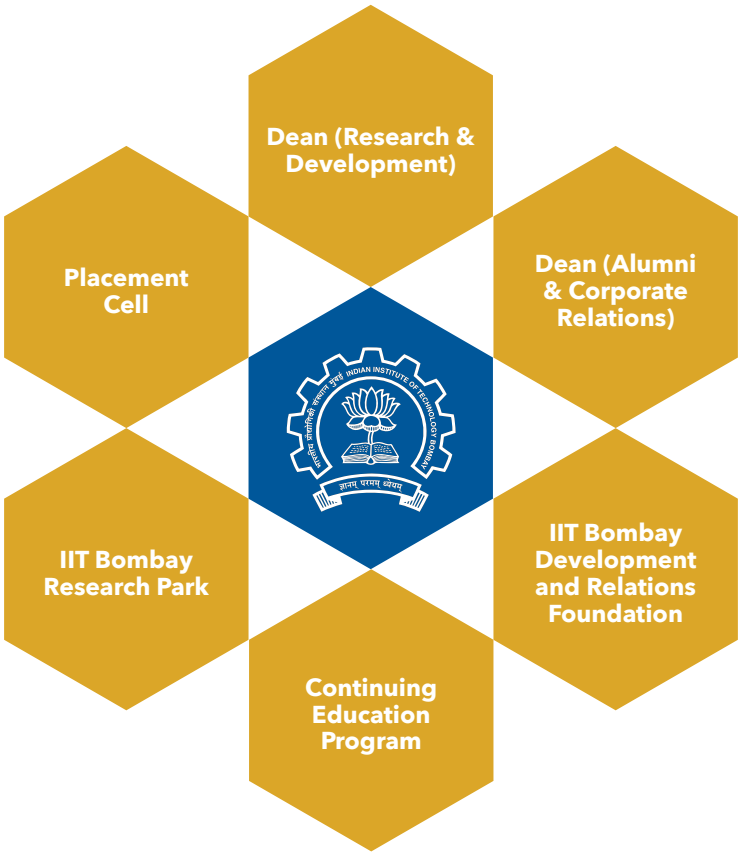
IIT Bombay is mindful of the needs of society and country at large, and develops technologies / products that improve the quality of life for both urban and rural population. The Tata Centre for Technology and Design (TCTD) and Centre for Technology Alternatives for Rural Areas (CTARA) have made significant progress in developing technologies that cater to the needs of people at the bottom of the pyramid.

IIT Bombay has a thriving entrepreneurship ecosystem thanks to its very successful technology business incubator, SINE. The Entrepreneurship Cell and Desai Sethi Centre for Entrepreneurship are other entities that provide further support. The Institute has reaped rich dividends by promoting on-campus entrepreneurs and start-ups. Some of these start-ups have graduated and become role models in their respective domains.

IIT Bombay has ongoing interactions with a large number of industries and public sector organisations through a variety of modes that include providing solutions to specific problems through short term consultancy projects, medium to long term sponsored research projects, endowments, student sponsorship, etc. Continuing Education Program is another useful platform of academia-industry collaboration whereby IIT Bombay designs and imparts customised training programs to industry personnel based on their requirements. The Institute is committed to partnering with Industry in its endeavour to promote *research that makes a difference*.

Prof. Devang Khakhar

# Industry Interfaces at IIT Bombay




## IIT Bombay Research Park

Facilitates establishment of an innovation hub inside IIT Bombay through industry - academia collaboration

Joint IIT Bombay - Industry Research & Development groups for stronger impact

info@iitbresearchpark.com

Tel: +91 22 2572 0292

www.respark.iitb.ac.in

## Continuing Education Program (CEP)

Assists working professionals in widening their knowledge base and improving their skills

Single point contact for all courses and industry specific programs

pic-cep@iitb.ac.in

Tel: +91 22 2576 7006

www.cep.iitb.ac.in

## Society for Innovation and Entrepreneurship (SINE)

SINE is the technology business incubator at IIT Bombay

A platform to support technology start ups founded by IIT Bombay community or are based on IIT Bombay technologies

sine@sineiitb.org

Tel: +91 22 2576 7016

www.sineiitb.org

## Dean (Alumni and Corporate Relations)

Promote and strengthen engagement with the Alumni and Corporations

Manage utilisation and enhancement of the Institute's endowments and gifts from well-wishers

dean.acr.office@iitb.ac.in

Tel: +91 22 2576 7023

www.iitb.ac.in/alumni/en

## IIT Bombay Development & Relations Foundation (IITB-DRF)

Foster lifelong relationship with alumni, friends and organisations that results in goodwill and philanthropic engagement

cdo@iitb.ac.in

Tel: +91 22 2576 4881

www.iitbdrf.org

## Dean (Research and Development)

Create and maintain an environment, including research infrastructure and support staff for R&D

Facilitate collaboration, both within and outside the Institute

Liaise with funding agencies and industry, provide support for MoUs and agreements

Exploit IIT Bombay R&D through licensing and commercialisation

Provide administrative support for R&D

dean.rnd.office@iitb.ac.in

Tel: + 91 22 25767039

www.ircc.iitb.ac.in

## Dean (Academic Programs)

Course curriculum, academic programs

Student sponsorships and fellowships

dean.ap.office@iitb.ac.in

Tel: +91 22 2576 7049

www.iitb.ac.in/acad

## IIT Bombay Placement Office

Responsible for campus placement, student internships at IIT Bombay

Excellent infrastructure and student volunteer teams to coordinate activities

placementcell@iitb.ac.in

Tel: +91 22 22576 7092

www.placements.iitb.ac.in


Bio Fuel Processor

Gram Marg

Soil Sens

## R&D Projects at IIT Bombay

Industrial Research and Consultancy Centre (IRCC) at the office of the Dean (R&D) is the nodal unit responsible for managing and coordinating all activities related to research and development at the Institute. It has streamlined processes for financial, manpower and intellectual property management. IRCC has also initiated many schemes for incentivising and supporting researchers. It facilitates interactions with various external agencies for funding and licensing activities.


### Consultancy Projects

- Short term projects to solve specific problems of industry
- Scope of work and deliverables are well defined

### Sponsored R&D Projects

- Long term projects for new knowledge generation in current, emerging and futuristic areas
- Deliverables may include IP generation, manpower development and publications

Hybrid Cooling System

Tech for broadband access

Biliscope: Jaundice detection in neonates

GynaeCam: Cervical cancer screening

### Research Cell for collaborative projects

- Fairly long term research collaboration in broadly defined areas of mutual interest to industry and IIT Bombay
- Multiple research projects to be executed by IIT Bombay faculty with industry feedback
- Industry can define problem statements, collaborate on the projects, receive ownership for IPs and commercially exploit new technologies

## Some examples of collaborative research

| | |
|---|---|
| Smart infrastructure | Synthetic chemistry |
| Renewable energy systems | Data analytics |
| Power system analysis | Corrosion studies |
| Biomedical devices | Cloud communications |
| Environmental impact assessment | Internet of things |
| Modeling and simulation | Rural technology |
| Structural characterisation | Photovoltaics |
| Energy storage device | Information and communication technology |
| Structural reliability | Artificial Intelligence |
| Steel technology | Sensors |
| Bio-systems engineering | Remote sensing and GIS |
| Communication network | Signal processing |
| Computer Aided Design & Manufacturing | Machining and machine tool design |
| Device and circuit performance | Air Conditioning and Refrigeration |
| Polymers | Catalysis |
| Semiconductors | Nanotechnology |
| Materials | Ergonomics |
| Financial engineering | Project management |

## Sponsored Research Laboratories at IIT Bombay

A research facility / laboratory sponsored by an industry in an area of interest, helping build the infrastructure at IIT Bombay.

Such facilities and laboratories will be shared with the sponsoring industry and may also be open to others on a case-to-case basis.






1. **Forbes Marshall Energy Efficient Lab** – a resource centre to enable implementation of industrial energy efficiency and collaborative research
2. **Cummins Engine Research Facility** – Integration of new engine and renewable fuels technologies
3. **Applied Materials Manufacturing Laboratory** to promote research in nanoelectronics, nano-manufacturing and solar photovoltaic technology
4. **Parimal and Pramod Chaudhari Laboratory** for cell culture funded by Praj Industries, Pune for drug discovery, nanotechnology and microfluidics applications
5. **SrijaTI - TI Innovation Laboratory** for academic and research in analog IC applications, power management and embedded systems

# Models for IP commercialisation at IIT Bombay

## Collaborative development and licensing

- Joint ownership of IP
- First option for exclusive licensing
- IP ownership to industry on mutually agreed terms

Additives for better fuel efficiency


Blood monitor

Steer by wire technology

## Licensing of IP generated in the Institute

- IP generated through academic / unrestricted sponsored research
- Exclusive or non-exclusive license (preferred) offered to interested Industries

Network router

Tube-tube heat exchanger

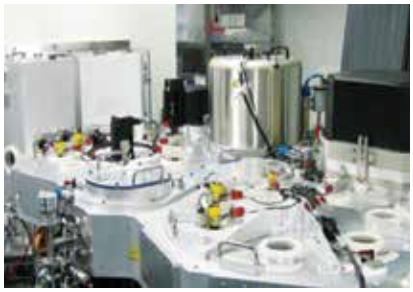
Portable microscope for sickle cell disease

## Incubation / Entrepreneurship

- Through Society for Innovation and Entrepreneurship (SINE), the technology business incubator of IIT Bombay
- IIT Bombay IP taken up in the start-up companies, promoted by faculty, students and alumni
- IP licensed to incubatee companies

# Consortia and Centres of Excellence at IIT Bombay

CoEST
Centre of Excellence in Steel Technology




**Centre of Excellence in Steel Technology (COEST)**

For R&D in steel technology and creation of high quality manpower for the industry

Funded by Ministry of Steel, GoI

**Centre of Excellence in Nanotechnology (CEN)**

To design, fabricate, characterise traditional CMOS Nano-electronics, novel material based devices, micro-mechanical systems, Bio-MEMS, etc.

Funded by Ministry of Communication and Information Technology, GoI

**National Centre for Aerospace Innovation and Research (NCAIR)**

Aims to provide economically viable, sustainable solutions to Indian aerospace manufacturers

Founding members DST, IITB, Boeing, HAL, NAL

NCETIS
National Center of Excellence in Technology for Internal Security
Indian Institute of Technology Bombay

**Solar Energy Research Institute for India and the United States (SERIIUS)**

To accelerate development of solar electric technologies

Identify and quantify the critical technical, economic and policy issues for solar energy development and deployment in India

**National Centre for Photovoltaic Research and Education (NCPRE)**

Provides R&D and educational support for India's ambitious 100GW solar mission

Funded by Ministry of New & Renewable Energy, GoI

**National Centre of Excellence in Technology for Internal Security (NCETIS)**

Takes up activities towards developing indigenous technology and self-sufficiency in the areas of Electronics Systems Design and Engineering for the strategic sector of internal security


**Biomedical Engineering and Technology (Incubation) Centre BETiC**

Integrated facilities for design, analysis, prototyping and testing of medical devices

Funded by DST & Govt of Maharashtra

TICET

**TTSL IITB Centre of Excellence in Telecommunication (TICET)**

Capacity building, design and fabrication, advisory support to industry

Joint initiave of IITB, Tata Teleservices, Dept of Telecommunication, GoI

**Tata Centre for Technology and Design (TCTD)**

Aims to develop solutions to challenges faced by resource constrained communities

Supported by Tata Trusts

**Shenoy Innovation Studio**

To create a paradigm shift in design, conducts industry workshops and facilitates in-house innovation


**Parimal & Pramod Chaudhari Centre for Learning & Teaching**

To facilitate and support pedagogy by promoting innovation, evidence - based practices and collaboration

FICTT

**Focus Incubation Centre in Technical Textiles (FICTT)**

Initiative funded by Ministry of Textiles, GoI to serve as a translational platform

To work towards disruptive innovation in the field of technical textiles

## Industry – Academia Partnership at IIT Bombay

- Partner with IITB through consortia for mutual benefit of all stakeholders
- Enables pooling resources for research in emerging areas
- Industry - Academia - Government consortia also possible

### Few examples:

- Industry partnership in aerospace innovation and research through NCAIR
- Industry affiliate program in the area of photovoltaics through NCPRE
- Corporate affiliate program for research and technology development in bioengineering through Wadhwani Research Center for Bioengineering (WRCB)
- Partnership between academia, hospitals and Industries in the healthcare domain through Healthcare Research Consortium
- Membership for R&D collaboration at CoEST in the area of steel technology
- IITB, TCS and TCE consortia to offer software services for the power sector, to realise sectorial and organisational efficiencies

# Academic Disciplines at IIT Bombay

## Engineering

Mechanical, Civil, Electrical, Computer science, Aerospace, Metallurgy and materials science, Chemical

## Education Technology

Research and education in the area of technologies to promote the learning-teaching process

## Pure Sciences & Mathematics

Chemistry, Physics, Mathematics, Applied statistics, Biosciences

## Nanotechnology & Biomedical engineering

## Systems and Control

Nonlinear control, robotics, embedded systems, coordination of autonomous vehicles, combinatorics, modelling and optimization of stochastic processes

## Industrial Engineering and Operations Research (IEOR)

A blend of theory, modelling and application, draws from traditional as well as modern areas of operations research, together with a systems view derived from long-standing principles of industrial engineering

## Design

Industrial design, Visual communication, Animation, Interaction design, Mobility and vehicle design

## Policy studies

## Geology & Geophysics

## Entrepreneurship

Imparts a structured training to aspiring student entrepreneurs

## Climate studies

Fundamental understanding and problem-centred analysis of climate change

## Energy

## Urban Engineering

Research, teaching and skilled manpower development with the primary mandate of improving urban quality of life

## Rural Technology

Perspectives, policies, and practices pertaining to technology, development, and the interrelationship between the two in the rural context

## Environmental Science

## Geoinformatics and Natural Resources Engineering

## Humanities and Social Sciences; Economics

## Management

## Research Infrastructure at IIT Bombay

The institute provides high end infrastructure facilities and laboratories to support research activities. These facilities are open to external agencies as well.

Bio-Atomic Force Microsope

Molecular Beam Epitaxial Growth System

Fluorescence Activated Cell Sorting

High Resolution Mass Spectrometer

High Resolution XRD System

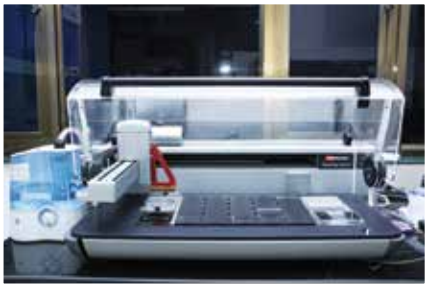
Environmental Scanning Electron Microscope

High Resolution Liquid Chromatography

Surface Plasmon Resonance

Multi Frequency Electron Paramagnetic Resonance Spectroscopy

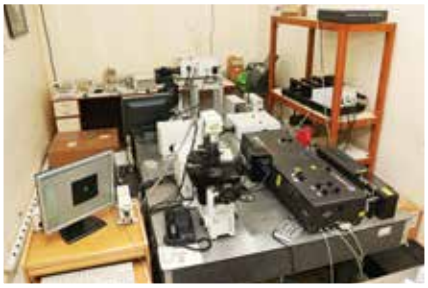
Scanning Probe Microscopy Facility



Microarrayer

Cryo High Resolution Transmission

Field Emission Gun Based TEM



Confocal Microscope Facility

Nuclear Magnetic Resonance


Protein Crystallography

MALDI-TOF

SQUID Vibrating Sample Magnetometer

IIT Bombay students on a visit to United Phosphorous Ltd.

## Exchange Visits


### IIT Bombay faculty at Industry

Sabbatical like visit

- May, June, December
- Primarily for ice breaking:
  - » Interact with R&D staff
  - » Seminar / lecture
  - » Site tour
- Not for consultancy

Other types of visits

- Any time of the year
- Customise
  - » Frequency of visit
  - » Duration of visit
  - » Scope of work

### Industry personnel at IIT Bombay

- Frequency / duration flexible
- NDA prior to visit
- Industry responsibility
  - » Health / accident insurance
  - » Salary / remuneration
  - » Accommodation / transport

### Student Internship

- Credit based internship
  - » In a core industry
  - » Faculty mentor from IIT Bombay
- Non-credit based

# Industry Sponsorships and Fellowships at IIT Bombay

## Industry Sponsored Chair Professorship

| |
|---|
| Kamalnayan Bajaj Chair |
| D. L. Shah Chair |
| HAL R&D Chair |
| Praj Industries Chair |
| Shailesh Mehta Chair |
| Bajaj Group Chair |
| Forbes Marshall Chair |
| L&T Chair |
| Romesh Wadhwani Chair |
| TATA Chair |

## Sponsored PhD and Masters Program

- Objective is to jointly promote research and manpower development
- Industry can sponsor students to work in an area of its interest
- Sponsorship includes monthly stipend (amount not less than that given by Government of India funding agencies) and a contingency grant
- Industry may define project scope
- Flexible IP norms

## Prime Minister Fellowship

- Scholarship from GoI as per norms
- Additional matching amount from partnering industry
- Duration of the Fellowship is four years
- Up to 100 new Fellowships are provided every year

## 2+1 Year MTech model:

| | |
|---|---|
| Year 1 | Course Work |
| Year 2 | MTech project working on a research problem identified by Industry; Student will graduate with MTech degree |
| Year 3 | Continue to complete project work at IITB or field |

## Industry Sponsorship / Fellowship

| Program | Duration | Amount (in ₹) |
|---|---|---|
| Post-Doctoral Fellow | Variable | 55,000 – 85,000 per month (+ HRA as applicable) |
| PhD | 5 years | 23,00,000 + HRA as applicable (as per Visvesvaraya PhD Scheme) |
| MTech (2+1 Year Model) | 2 years (Year 2 & 3) | 13,00,000 (higher funding for Year 3 due to out of campus expenses) |
| Masters | 2 years | 7,00,000 |


SIEMENS
HAL
ओएनजीसी
ONGC
SAMSUNG
JOHN DEERE
BASF
The Chemical Company
इसरो ISRO
Ambuja Cement
Reliance
TATA
Micron
intel
Castrol
IBM
INDIAN INSTITUTE OF TECHNOLOGY BOMBAY
CISCO
commtel
NETWORKS
Let's reach the next level
DMG MORI
Chemtrols
MAHAGENCO
praj
!dea
BOEING
Texas Instruments
Johnson&Johnson
APPLIED MATERIALS
Cummins
BHEL
ISPAT
QUALCOMM
Microsoft
Mercedes-Benz

## IIT Bombay at a Glance

| | |
|---|---|
| Academic units | 27 |
| Research centres | 23 |
| Full time faculty | ~630 |
| Adjunct & visiting faculty | ~50 |
| Students | ~10,100 (3000 PhD) |
| Postdoctoral fellows | ~130 |
| Project staff (Research) | ~1400 |
| Total R&D receipts for FY 2016-17 | ~₹ 390 Cr |
| Patents, trademarks, copyright applications filed in 2017 | 111 |
| Technology transfers / deployment so far | ~150 |
| Total degrees awarded in 2017 | 2612 |
| PhD degrees awarded in 2017 | 357 |
| Master degrees awarded in 2017 | 1398 |
| Bachelor degrees awarded in 2017 | 857 |
| Research publications since inception | ~26,000 |
| Research publications in 2016 | 1982 |
| Citations for publications since inception | ~3,00,000 |
| Companies incubated since inception of SINE | ~117 |

No. of industries currently collaborating with IIT Bombay

**490**

No. of ongoing industry projects

**720**


**Dean (Research & Development)**
**Industrial Research and Consultancy Centre (IRCC)**

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