Industrial Research and Consultancy Center
Indian Institute of Technology Bombay
October 2016
IIT Bombay at a glance

Teaching and Research

9,839 students on roll (1-9-2016 data; may change)
3090 Bach., 989 DD, 2955 Masters, 2805 PhD
2886 B.Tech., 144 B.S., 60 B.Des.

130+ Post-doctoral fellows
1250+ Project staff (Technical)

27 Academic Units + 19 Research Centres

609 full-time faculty, 42 adjunct faculty (Aug 2016)
Academic units @ IIT Bombay

- Department of Aerospace Engineering
- Department of Biosciences & Bioengineering
- Department of Chemical Engineering
- Department of Chemistry
- Department of Civil Engineering
- Department of Computer Science & Engineering
- Department of Earth Sciences
- Department of Electrical Engineering
- Department of Energy Science and Engineering
- Department of Humanities and Social Sciences
- Department of Mathematics
- Department of Mechanical Engineering
- Department of Metallurgical Engg. & Materials Sci.
- Department of Physics
- Center for Environmental Science & Engineering
- Center for Policy Studies (IDP)
- Center for Research in Nanotechnology & Science
- Center for Technology Alternatives to Rural Areas
- Center for Urban Science and Engineering
- Center of Studies in Resources Engineering
- IDP in Climate Studies
- IDP in Education Technology
- IDP in Industrial Engg. & Operations Research
- IDP in Systems & Control Engineering
- IITB Desai Sethi Centre for Entrepreneurship (IDP)
- Industrial Design Center
- Shailesh J. Mehta School of Management
Academic programs and degrees

**Applied Statistics & Informatics**
- Aerospace Engineering
- Chemical Engineering
- Civil Engineering
- Electrical Engineering
- Mechanical Engineering

**Chemistry**

**Geology**

**Geophysics**

**Mathematics**

**Physics**

**Design**

**Education Technology**

**Entrepreneurship (minor)**

**Humanities & Social Sciences**

**Management**

**Policy Studies**

**Biomedical Engineering**

**Biotechnology**

**Climate Studies**

**Computer Science & Engineering**

**Energy Science & Engineering**

**Environment Science & Engineering**

**Geoinformatics & Natural Resources Eng.**

**Industrial Eng & Operations Research**

**Metallurgical Eng & Material Science**

**Nanotechnology & Science**

**Systems and Control Engineering**

**Technology & Development**

**Urban Science & Engineering**

BTech, BS, PhD, MTech, MSc, MDes, MMgmt, MPhil

Dual degree programs (BTech+MTech, MTech+PhD, MTech+MSc, MSc+PhD)

Minors and Honors for BTech students
Research Centers @ IIT Bombay

- Biomedical Engineering and Technology Incubation Centre [RGSTC, Maharashtra Govt + DST]
- Centre for Aerospace System Design & Engineering [ARDB + MoD]
- Centre for Formal Design and Verification of Software [DAE]
- Centre for Computational Engineering and Science [DAE]
- Centre of Excellence in Nanoelectronics [MCIT]
- Centre of Excellence in Steel Technology [MoSteel]
- Centre of Propulsion Technology [DRDO]
- Forbes Marshall Energy Efficiency Laboratory [Industry]
- Geospatial Information Science and Engineering (@CSE) [DST]
- National Centre for Aerospace Innovation and Research [DST, NAL, HAL, Boeing, DMG Mori, Sandvik, DelCam]
- National Centre for Mathematics (with TIFR) [NBHM, DAE]
- National Centre for Photovoltaic Research and Education [MNRE]
- National Centre of Excellence in Technology for Internal Security [MEITY]
- National Mission on Education through ICT [MHRD]
- National Solar Thermal Research, Testing and Simulation Facility [MNRE]
- Power Anser Laboratory [TCS + TCE]
- Tata Center for Technology Development [Tata Trusts]
- Tata Teleservices - IIT Bombay Centre of Excellence in Telecommunication [Tata Teleservices]
- Wadhwani Research Center for Bioengineering [Alumnus]

Exploratory, with seed funding
Healthcare Research Consortium
IITB + Hospitals + Corporates
Research Centers @ IIT Bombay

- Healthcare Research Consortium
- Forbes Marshall Energy Efficiency Laboratory
- National Centre for Mathematics
- Centre for Formal Design and Verification of Software
- Tata Centre Technology and Design, IIT Bombay
- National Solar Thermal Research, Testing and Simulation Facility
- Wadhwani Foundation
- CAS/DE
- CoEST Centre of Excellence in Steel Technology
- CoPT
- CCES
- IITB-TTS Center for Excellence in Telecommunication
- NCETIS National Center of Excellence in Technology for Internal Security
- Indian Institute of Technology Bombay
Research & Development @ IIT Bombay

- **1200 (Journal) + 487 (Conference)**
  - No. of Research Publications in 2015 (calendar year)

- **82**
  - No. of companies incubated so far

- **130**
  - No. of Indian patent applications filed in 2015 (calendar year)

- **325**
  - Number of PhD degrees awarded in 2016 Convocation

- **2190**
  - UG and other PG degrees awarded in 2016 Convocation
Research publications

![Research publications chart]

- No. of Publications: Journal Papers, Conference Proceedings
- Year: 2006 to 2016 (As on 2.10.16)
Visibility of IITB Publications – citations

No. of Citations

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<td>23535</td>
<td>27920</td>
<td>28959</td>
<td>As on 2.10.16</td>
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As on 2.10.16
Patent applications filed

Year | International | National | Total
--- | --- | --- | ---
2011 | 30 | 70 | 100
2012 | 40 | 60 | 100
2013 | 10 | 90 | 100
2014 | 10 | 90 | 100
2015 | 100 | 40 | 140
Representative examples
Technology transferred

- Multi-utility heat pumps deployed as 3.52 kW Residential to 55 kW Industrial Heating
- SHR_WH deployed on 1 TR to 270 TR Air Conditioning and Refrigeration Systems
  Proven reliability: working for the last 8+ years without a service call
  Installed @ McDonalds, hotels, hostels, Club Mahindra, Worli Dairy, M&M, ...
- Applications: Heating Air / Water / Process Fluid, Cooling Air / Water / Potable Water / Process Stream
Rover – remotely operated vehicle

- Wireless control
- Climb steps
- Remote inspection and removal of suspicious objects
- Remote disposal of IEDs
Biomedical Engineering and Technology (incubator) Center

- BETiC – started in 2014, a translational research center
- Catalyzes indigenous medical device innovation
- Brings together doctors, researchers and manufacturers.
- Develop a range of diagnostic devices, surgical instruments and patient aids covering medical specialties like orthopedics, internal medicine, cardiology and rehabilitation.
- Funding: RGSTC and DST
- Have developed over 100 medical devices, filed 20 Indian patents, and transferred 3 technologies to industry
Biomedical Engineering and Technology (incubator) Center

Ideas room of BETiC

Surgeon testing laparoscopic device

Medical Device Innovation Conclave

Indian Medical Device Exhibition in Dervan
Societal relevance

- Ascender: climbing wheelchair
- Bed for the Elderly
- Online Farmer Knowledge Exchange
- Super Critical Fluid extraction
- Riding Type Power Tiller
- Communicator for children with cerebral palsy
- LPG Stove for Visually Impaired
- Education & Creativity based Board Games
- Technologies and Tools for Cane and Bamboo Craft
- Solar Urja Lamp
- Indian Rupee symbol
Societal relevance

- Water treatment for removal of arsenic, pesticides, herbicides, etc.
- Hand-pump attachable filters developed using indigenous material
- Each unit caters to around 200 families

- 50+ units - Assam, Bihar, UP, West Bengal.
- Each unit costs around Rs. 70K.
- Low maintenance (Rs. 1000/year)

Air quality monitoring, waste water treatment, solid and hazardous waste management, environmental system modeling, ...
Detection of sickle cell disease by microscopy

SUCHEK
Mobile-based urine and blood glucose analyzer

Paperfluidics for affordable diagnostics
### Extra-mural funding for R&D activities

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<th>Financial Year</th>
<th>Research Funding (in Crores INR) (rounded off to the nearest integer)</th>
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<td></td>
<td>National organizations</td>
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<tr>
<td>2011-12</td>
<td>181</td>
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<td>2012-12</td>
<td>278</td>
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<td>2013-14</td>
<td>199</td>
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<td>2014-15</td>
<td>227</td>
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<tr>
<td>2015-16</td>
<td>236</td>
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Student initiatives

- IITB Racing
- Pratham satellite
- Mars Rover, Land Robot
- Intelligent ground vehicle
- Shunya at Solar Decathlon
- Biosynth: a biodiesel plant
- Rakshak: Unmanned Aerial Vehicle
- Matsya: Autonomous Underwater Vehicle
- Drishti: auto-tunable lens for universal eye glasses
Laboratory safety

Customized safety videos
Available also on YouTube

Machine Safety
Unguarded moving parts of machines/equipment and the sudden or uncontrolled release of their power systems
Partnership with Industry

- Seek help to solve specific problems
- Sponsor laboratories, students
- Deploy IPs
- Support basic research for knowledge creation
- Form Consortia
- Visits of Scientists and Engineers
- Exploit complementarity
- Carry out industry relevant research
- Human resource development
- Train industry personnel
- Seed high-tech spin offs
## Strengthening partnership with industry

| Education Offerings | • Continuing Education Program  
|                     | • Customized programs  
|                     | • External Ph.D. student  
| Students            | • Promotion of manpower development  
|                     | • Internships for "hands-on" exposure  
|                     | • Support for student technical projects  
| Endowment           | • Chair Professorship and R&D Support  
| Building bridges    | • Faculty as visiting scientists  
|                     | • Industry scientist/engineer as visiting faculty  |
R&D Receipts (FY 2015-16)

- Others 9%
- Industry 20%
- Government (71%)
Entrepreneurship ecosystem

**IIT Bombay**
- Desai Sethi Centre for Entrepreneurship
- Policy changes: deferred placement

**ECell**
- Student body for entrepreneurial activities

**SINE**
- SINE Labs (Elec, Mech, etc.)
- More industry & international tie-ups

**Alumni**
- Mentor network (IASCEND)
- Funds for prototyping (IITB Innovate)
Online, streamlined processes for filing for IP protection

Costs borne by IIT Bombay

Can file as a single student inventor also!
IIT Bombay Laboratory Notebook
Completion of work

Pre-publication draft for filing patent

Patent filed while the manuscript is under review
• Technology Business Incubator of IIT Bombay set up in 2004; a not-for-profit entity
• Facilitates conversion of IIT Bombay R&D into commercial entities
• Helps in building business models / plans, fund raising, approaching clients
• Governing Board members includes IIT Bombay faculty and industry experts
• Incubate companies that have a potential to create economic growth and/or have a strategic or social value
• Intellectual property created by IIT Bombay faculty, students, staff, alumnus
Facilities @ SINE

INFRA-STRUCTURE
- Offices
- Access to IITB labs

FUNDING
- Seed funds
- Angels & VCs
- Govt. Grants

VISIBILITY
- Events
- Media

NETWORKING
- Mentors
- Investors

ADVISORY
- Business plans
- Mentor network
- Legal, IP, Finance

Pre Incubation
Regular Incubation
Virtual Incubation
### Impact and outcome of SINE

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<th><strong>83</strong> companies incubated so far</th>
<th><strong>Current:</strong> 28</th>
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<tr>
<td><strong>Folded:</strong> 20</td>
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<tr>
<td><strong>Graduated / acquired:</strong> 35</td>
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**2,000+ jobs created during incubation**

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<th><strong>40</strong> companies funded by Angels / VCs. US$ 75k to &gt;25mn</th>
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<td><strong>18</strong> companies funded by Banks / Govt.</td>
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<th><strong>IITB IP commercialized</strong></th>
<th><strong>25</strong></th>
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<td><strong>Faculty involved startups</strong></td>
<td><strong>21</strong></td>
</tr>
<tr>
<td><strong>Companies with social innovation</strong></td>
<td><strong>07</strong></td>
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<tr>
<td><strong>Equity returns (partial exits)</strong></td>
<td><strong>INR 3+ crores</strong></td>
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Policies and procedures emulated in many other colleges
Spectrum of incubatee companies (05/2016)

ICT – Software - 30
Healthcare - 12
CleanTech/ Energy - 7
Mechatronics – 6
Media - 5

ICT – Hardware - 6
Education - 4
FinTech - 4
Big Data/ IoT - 2
Other - 6
SINE... success stories

• **Sedemac Mechatronics** – technology company – products focused on controls for small engines and powertrains; Turnover >100 crores; >200 employees

• **Seclore** – data security – one of 3 startups shortlisted for billion dollar project of Silicon Valley Chapter of TiE; > 300 employees; moved to the Silicon Valley

• **idea Forge** – technology company – empanelled supplier of UAV for GoI; >50 employees

• **Zeus Numerix** – CFD – enlisted vendor of GoI – software + services; >50 employees

• **Webaroo** – cloud and mobile messaging platform; Turnover: >200 Cr; > 200 employees

• **Purple Squirrel Eduventures** – education sector; >150 employees

• **Covacsis** – targets manufacturing industries – data analytics – 15+ clients; bn $ revenue

• **Vegayan** – networking products
SINE... new developments and updates

• SINE + DST + Intel India have launched Plugin, a hardware and system products accelerator program

• SINE will conduct an acceleration program for impact startups with SAP as CSR partner

• SINE applies to DST to be a Centre of Excellence (Incubation center) – application is only by invitation

• SINE + SBI MoU to support fintech startups – SBI will help test applications and products developed and promote the startups through its connect with the industry.

• SINE to set up a Bio/Med Tech incubator - funding from BIRAC (DBT, GoI)
Industrial Research and Consultancy Center

IRCC Manages and coordinates all R&D activities

- Sponsored & Consultancy projects
- Sponsored Labs / Centres
- Centres of Excellence / Research Consortia
- IP Management Technology Transfer
- Research Internships
- Research Infrastructure
- Dissemination of Information
- Online Information Management
Thank You