



भारतीय प्रौद्योगिकी संस्थान कानपुर  
**Indian Institute of Technology Kanpur**  
Celebrating 60 years of excellence



वार्षिक प्रतिवेदन  
**Annual Report**

2018-19



## संचालक मण्डल

### अध्यक्ष

श्री आर सी भार्गव	18 अक्टूबर, 2018 तक
प्रोफेसर अभय करंदीकर	19 अक्टूबर, 2018 से 18 फरवरी, 2019 तक
डॉ. के राधाकृष्णन	19 फरवरी, 2019 से प्रभावी

### सदस्य

प्रोफेसर मणीन्द्र अग्रवाल	17 अप्रैल, 2018 तक
प्रोफेसर अभय करंदीकर	18 अप्रैल, 2018 से प्रभावी

### परिषद के सदस्य

प्रोफेसर गिरीश चन्द्र त्रिपाठी	10 जुलाई, 2018 तक
प्रोफेसर जयंत के भट्टाचार्य	10 जुलाई, 2018 तक
प्रोफेसर पी. बलराम	10 जुलाई, 2018 तक
श्री कृष्णामूर्ति वेंकटरमन	10 जुलाई, 2018 तक
डॉ. सुखबीर सिंह संधू	11 जुलाई, 2018 से प्रभावी
श्री दीपक घैसास	11 जुलाई, 2018 से प्रभावी
प्रोफेसर त्रिलोक नाथ सिंह	11 जुलाई, 2018 से प्रभावी
प्रोफेसर उदय शंकर दीक्षित	11 जुलाई, 2018 से प्रभावी

### राज्य सरकार द्वारा नामित सदस्य

प्रोफेसर श्रीनिवास सिंह

### सीनेट द्वारा नामित सदस्य

प्रोफेसर देबोपम दास  
प्रोफेसर एम. एल. एन. राव

### सचिव

श्री कृष्ण कुमार तिवारी  
कुलसचिव

## BOARD OF GOVERNORS

### CHAIRMAN:

Shri R.C. Bhargava	[upto 18 Oct., 2018]
Prof. Abhay Karandikar	[w.e.f. 19 Oct., 2018]
	to
Dr. K. Radhakrishnan	[18 Feb., 2019]

### Members:

Prof. Manindra Agrawal	[upto 17 April, 2018]
Prof. Abhay Karandikar	[w.e.f. 18 April, 2018]

### Council Nominees:

Prof. Girish Chandra Tripathi	[upto 10 July, 2018]
Prof. Jayanta K. Bhattacharjee	[upto 10 July, 2018]
Prof. P. Balram	[upto 10 July, 2018]
Shri K. Venkataramanan	[upto 10 July, 2018]
Dr. Sukhbir Singh Sandhu	[w.e.f. 11 July, 2018]
Shri Deepak Ghaisas	[w.e.f. 11 July, 2018]
Prof. Trilok Nath Singh	[w.e.f. 11 July, 2018]
Prof. Uday Shankar Dixit	[w.e.f. 11 July, 2018]

### State Government Nominee:

Prof. Shriniwas Singh

### Senate Nominees:

Prof. Debopam Das  
Prof. M.L.N. Rao

### Secretary:

Shri Krishan Kumar Tiwari  
Registrar



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# Convocation Report of the Director



Honourable Shri BVR Mohan Reddy, Smt. Sudha Murty, Dr. Tessa Thomas, Shri Pullela Gopichand, Dr. K Radhakrishnan, Honourable Chairman, Board of Governors of the Indian Institute of Technology Kanpur, Members of the Board of Governors, Members of the Academic Senate, all graduating students and their family members, members of faculty, alumni, staff and student community, invited dignitaries, guests, and members of the media: I heartily welcome you all to the Fifty Second Convocation of the Indian Institute of Technology Kanpur. I would also like to congratulate the graduating students and their families on this joyous occasion.

## Academic Activities

The academic session ending in May 2019 has been immensely rewarding, and it is a privilege for me to recount some of its major highlights.

It is a moment of pride for me to inform you that the total number PhD degrees being awarded at this Convocation is 208. The number is by far the highest in the history of our Institute.

To encourage outstanding scholars to join the doctoral programme directly after their bachelors programme, the Senate approved the provision for an additional masters degree to be awarded along with PhD, subject to the fulfillment of a defined set of academic requirements. I am delighted to inform you that 12 of our students are graduating in the first batch of M.Tech and PhD (Joint Degree) at this Convocation all, 1626 degrees are being awarded at this Convocation and the details are reproduced below:

Degree	Number of Recipients
PhD	196
MTech and PhD (Joint Degree)	12
MTech	333
MBA	50
MDes	14
MS (By Research)	47
PGPEX-VLFM	38
MSc (5-Year)	1
MSc (2-Year)	118
Double Major	17
BTech-MTech (Dual Degree)	110
BTech-MDes (Dual Degree)	1
BTech-MS (Dual Degree)	3
MS-PD (MS part of Dual Degree)	9
BS-MS (Dual Degree)	52
BTech	551
BS	74
<b>Total</b>	<b>1626</b>

In keeping with the flexibility that IIT Kanpur academic programme is known for, 29 students are graduating with two Minors whereas 136 students are graduating with one Minor. This year one of our graduating students is graduating with 3 Minors.

Number of students completing one Minor:	136
Number of students completing two Minors:	029
Number of students completing three Minors:	001

Apart from this, by spending one additional year at the Institute, 166 undergraduate students are graduating with a Masters degree along with their Bachelors while 17 undergraduate students are graduating with a Second Major. As already stated, 12 postgraduate students are graduating with an additional Masters along with their PhD degree.

Of the 808 students in the bachelors and bachelors-masters dual degree programmes who are being awarded the degree today, 169 students are graduating with Distinction (CPI of 8.5 and above).

To keep pace with the evolving knowledge in science, technology and other areas, 04 new undergraduate courses and 42 new postgraduate courses were approved by the Senate in the Academic Year 2018-19.

## Academic Initiatives

Several academic initiatives that are likely to impart strength to our academic programmes in the long run were undertaken this year while some others are still in the pipeline.

- **Academic Review 2020-21:** The Institute began the periodic review of its academic programmes in November 2018. This mammoth exercise, conducted once every decade, is expected to be completed by July 2021. The existing undergraduate and postgraduate programmes of the Institute and the associated curricula will be reviewed taking into account the requisite inputs from all the constituents of the academic community at IIT Kanpur. The existing academic administration and processes also come within the purview of this review. Since the postgraduate programmes of the Institute have undergone a major expansion over the last decade, in a significant break from the tradition, the ongoing



academic review of the undergraduate and postgraduate programmes is being conducted by two distinct bodies.

- **Social Outreach:** The Institute has implemented some of the important socially relevant initiatives spearheaded by Government of India including supernumerary allocation of seats for the Girl Child and reservation for Economically Weaker Sections (EWSs). With JEE (ADVANCED)-2019, the supernumerary allocation of seats for the Girl Child touches 17%. The EWS reservation of 10% is being implemented across all our UG and PG programmes in a ratio of 4% (2019-20) and 6% (2020-21). With these initiatives in place, the enrollment in undergraduate and postgraduate programmes is going to augment significantly.
- **MTech and PhD (Joint Degree):** The Institute has initiated the award of additional Masters with PhD, whereby an additional MTech/MDes degree is awarded to students with the PhD degree subject to the fulfillment of academic requirements stipulated by the Senate. This provision was introduced by the Institute Senate for candidates who join the PhD programme directly after BTech/BS and other bachelors programmes. This year 12 PhD students will be graduating with an additional masters degree awarded on the basis of additional credits earned by these students through courses and dissertation work.
- **Incentives for PhD Students:** A series of measures were undertaken to incentivize the quality research at doctoral level. Notable among these is the financial support provided to the PhD students for presenting their work in reputed international conferences abroad. The provision was introduced in August 2018 and over 200 PhD students have since benefitted from it. This support is in addition to the travel grants for national conferences made available to the PhD students.

#### On the Anvil

- **Academic Rehabilitation Programme:** The Institute initiated efforts for an Academic Rehabilitation Programme (ARP) for undergraduate students who need additional support to maintain their academic performance at requisite levels. Through this initiative, we hope to create a sustainable academic and operational structure for remedial instructional programmes at the institute.
- **Department of Cognitive Science:** The proposal to establish a department of Cognitive Science (currently an Interdisciplinary Programme) is on the anvil. Research in various areas of cognitive science has huge potential in informing the stakeholders in varied arenas like education, defense services, human-computer interaction design, product design, mental health etc. Through this new department, we will be exploring pathways to collaborate with various industry partners,

psychiatric clinics, and government agencies to take up problems from their fields and make our contribution to solving them.

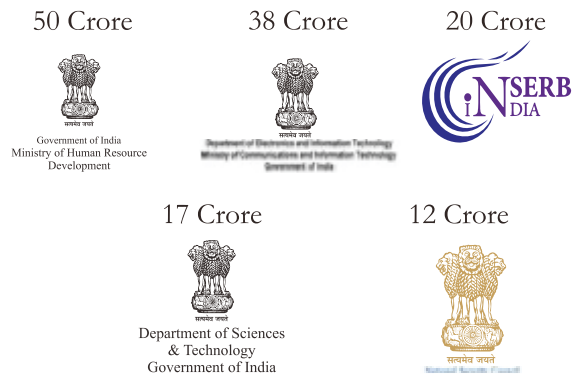
- **Online Masters Programme:** A proposal for online Masters in specialized areas such as Data Structures, Financial Engineering, Telecom, Manufacturing and several others that are perceived as emerging areas or areas that are in acute need of re-training is under the Institute's consideration. The programme is being proposed with a special emphasis on the continuing education of those already employed in the industry

#### Research And Development

IIT Kanpur has registered steady growth in its research and development activities this year. Some of the highlights are mentioned below:

- 780 externally funded ongoing projects with a total sanctioned amount of Rs. 812.52 crore.
- 240 sponsored projects got sanctioned during 2018 - 2019 worth Rs. 158.74 crore.
- 125 consultancy projects got sanctioned during 2018 - 2019 of Rs. 20.61 crore.
- During the year 2018-19, total funds received for sponsored projects are Rs. 211 crore and for consultancy projects, Rs. 25 crore.

#### Leading Funding Agencies of the year



#### Leading Funding Industry Partners of the year



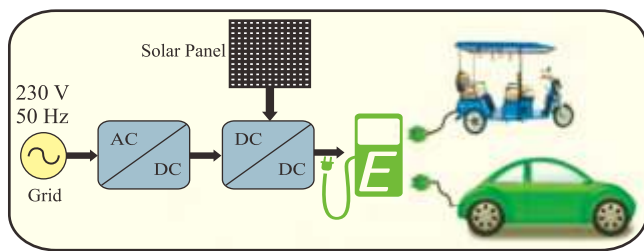
#### MAJOR PROJECTS SANCTIONED

Some of the major projects sanctioned during 2018-19 are briefly described below:

**Mix-Energy Source Electric Vehicle Charging System Design**, funded by the Department of Science & Technology (Mission Innovation Scheme): India is



planning to become 100 % EV by 2030 and it is a huge challenge for the distribution grid. This proposal aims to study the technical feasibility of this approach and proposes development of feasible, robust, and cost-effective technologies and methodologies to facilitate this plan, using a hybrid-energy-mix approach.



The primary objective of this proposal is to design Electric Vehicle chargers in the Indian context and study its impact on the distribution grid. The specific objectives are to design EV chargers with Input from multiple sources such as Grid and Solar PV and the study of impact of EV chargers on distribution grid.

**Delhi Air Quality Experiment: A Paradigm Shift in Source Apportionment**, funded by Central Pollution Control Board (CPCB): Understanding the sources of ambient Particulate Matter (PM) is important for cost effective emission reduction. However, the mixing of the different sources of emission together with atmospheric dynamics and topographical conditions makes the understanding of source-receptor linkage complex especially in winter season. Source apportionment of PM is performed using source-receptor modeling which needs prior information on the potential sources. However, filter based source apportionment studies have limitations as variations in concentrations and composition of aerosols in atmosphere are captured in low temporal resolution. Studies employing these methods in the past have shown very low contribution (<30%) from secondary organic aerosols (SOA) in the total organic concentration levels.

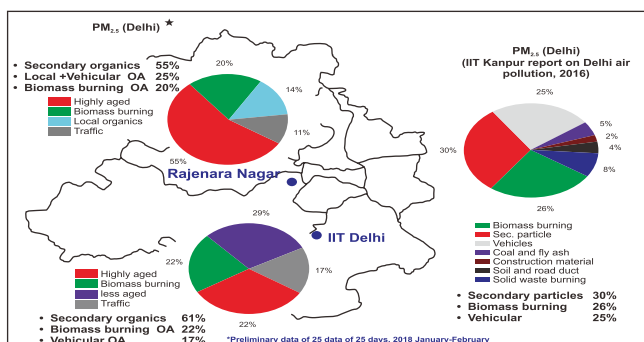
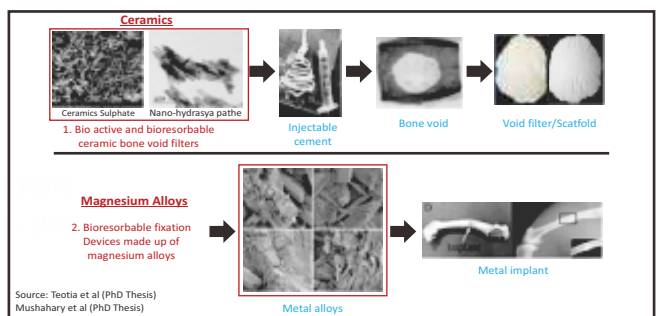


Figure : Sources of winter aerosols in Delhi. The figures on the left indicate the real-time source identification (unpublished data). The right hand side shows the source identification in Delhi using offline analysis.

Considering the fast physical and chemical transformation and transportation of the emissions in the atmosphere, the above mentioned study couples the real-time PM<sub>2.5</sub> measurements from advanced online mass spectrometry instruments and offline analysis of filter samples (for more time and spatial coverage) using mass spectrometry techniques to understand the sources of aerosols in detail.

**Fabrication of New Generation of Self-Resorbing Implants and Devices from Bioactive and Biodegradable Materials for Orthopedic Applications** in association with Industrial Partner Ortho Regenics Pvt. Ltd. (ORPL), Hyderabad and funded by Ministry of Human Resource Development (MHRD) and Indian Council of Medical Research (ICMR): Bone injury is the most common medical condition in any accidental or occupational trauma situation. Presently, for bone fracture fixations, metal implants are made up of non-biodegradable materials and with high mechanical strength, this causes stress shielding of bone leading to bone loss and implant failure.

A new generation biomaterial for orthopedic application with properties like Bioresorbable, Bioactive, and with Mechanical properties matching to bone are envisaged.



**Strategic University Network to Revolutionise Indian Solar Energy (SUNRISE)**, funded by EPSRC (UK): SUNRISE is a joint UK-India project aimed at developing efficient, low-cost solar technologies and their deployment in rural India. The SUNRISE network unites 12 leading universities and several industrial collaborators from the UK and India in an equitable research collaboration. This international network aims to develop and implement the technology necessary to build a minimum of five solar-powered building demonstrators in rural Indian villages.

**Automated Synthesis of Motion Plans for Large-Scale Multi-Robot Systems from Complex Specifications**, funded by Defence Research & Development Organization (DRDO): The aim of the project is to accelerate the state-of-the-art in multi-robot motion planning in the following dimensions:

- Complexity in the specifications
- The size of the multi-robot system
- The complexity in the dynamics of the robots
- The capability of the robot in dealing with sensing uncertainty and dynamism in the environment.

The project aims to develop a software system powered by formal method technique which will be able to produce reactive motion plans that are provably correct with respect to the specification, and can be installed in the robotic systems easily in the form of embedded software.

**Continuous Monitoring of New Jubilee Railway Bridge: Instrumentation Design And Health**

**Assessment**, funded by Eastern Railways Zone-Indian Railways (ER-IR): The Project relates to the New Jubilee Bridge over the Hooghly river connecting Naihati and Bandel in West Bengal. The bridge provides a gateway to West Bengal, with many important trains running over it. The bridge is of unique construction, being a continuous arch-type bridge, first time in Indian Railways.



project of complete instrumentation and continuous monitoring is a one-of-a-kind structural health monitoring project, taken up by the Railways for the first time in India. The instrumentation will involve a wide variety of state-of-the-art sophisticated sensors for real-time monitoring.

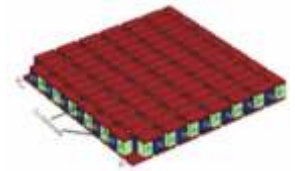
**Center of Excellence for Defence Corridor**, funded by Uttar Pradesh Expressways Industrial Development



Authority (UPEIDA): In February 2018, the Government of India announced setting up of a defense corridor in Uttar Pradesh. It was envisaged that a number of defense equipment manufacturing units will be set up along the corridor resulting in significant expansion of the industrial base in the state. At the time, Government of UP agreed to collaborate in the technological domain with the Institute as a technological partner of the government. The Institute is committed to developing relevant technologies in four domains, namely, Advanced Materials (wound-healing material, stealth material, etc.), UAVs (vertical takeoff and landing drones of different weight classes), Cyber Security (hardened OS, malware protection, etc.), and Electronics and Communications (long distance radars, etc.).

**Development of Solid-State Thermoelectric Power Generator for Electricity Generation from Waste Heat In Steel Plant**, funded by Science & Engineering Research Board (SERB): The aim of this project is to design, fabricate and test thermoelectric (TE) modules for

electricity generation from waste heat in Steel plant. In order to tap huge amount of waste heat generated in steel plant, it is required to develop highly efficient TE materials, which are stable chemically as well as thermally above 1000 K. The project intends to use recently developed novel perovskites-based oxides and nano-composites to design TE generator. Furthermore, finite element modeling will be performed to optimize the size, geometry and other design parameters of TE legs in order to reduce energy loss for maximizing power output and efficiency. A state-of-the-art testing facility will be developed to evaluate the performance of TE generator especially at high temperature.



**UAY-Biodegradable Polymers For Packing Applications**, jointly funded by Ministry of Human Resource Development (MHRD) and Hindustan Unilever Limited: The project aims at developing biodegradable polymers for packaging of fast moving consumer goods (FMCG). The project aims to improve the strength and barrier properties of the otherwise weak and permeable natural polymers. The outcome of the project will be ecologically responsible packaging materials especially for single use products.

A list of some of the other sophisticated facilities established in the Institute during this year is given at the end of this report.

**Centre for Technology for Sustainable Development:**

The BOG approved the proposal for the creation of a Centre for Technology for Sustainable Development at IIT Kanpur. The Center will leverage its research strength in key areas to address selected Sustainable Development Goals (SDGs) from the UN Charter to allow for development of technologies or solutions for UP/Indian Government. In particular, it is possible to provide leadership in the following areas of SDG mandate:

- Intervention for healthy lives and well-being
- Quality education and outreach
- Clean, accessible water and sanitation
- Sustainable and modern energy solutions
- Industries, innovation and infrastructure
- Climate action

Various departments at IIT Kanpur will be involved for achieving success and for creating impact in addressing challenges concerning Technology for Sustainable Development.

**LEAP Program:**

The Institute organized Leadership for Academicians Programme (LEAP) in November 2018. LEAP is a MHRD funded leadership development training program intended for the second level leadership in major government-held technology institutes. The objective of the program is to prepare second tier academic heads who are potentially likely to assume leadership roles in the



future.

Leading experts from the academia and industry delivered lectures covering different aspects of leadership. Brainstorming sessions were organized every day with non-hierarchical discussion among all participants, guest faculty and the organizing faculty. Participants also visited different research facilities and the establishment of IIT Kanpur.

### Ranjit Singh Rozi Siksha Kendra

IIT Kanpur alumuns Late Dr. Ranjit Singh (BT/MME/1965) donated 1.9 Million Dollars to set up Ranjit Singh Rozi Siksha Kendra and Ranjit Singh Chair. The Kendra would work for technology interventions for enabling education at college and/or vocational training centers and for technology interventions for enabling job guarantees for the unemployed. This would be in line with IIT Kanpur Centre for Technology for Sustainable Development and would strive towards enabling Equitable Prosperity for all.

### Industry Collaboration

IIT Kanpur is a premier technological institute in the country which engages in the state-of-the-art research in almost all fields of engineering and sciences. The focus is on generating new ideas, creating innovative solutions, and revealing basic principles of matter with an emphasis on using this knowledge for developing practical engineering and technological applications. In this process, the Institute works closely with industry partners with the objective of adding value to their products and services, the larger goal being to bring in novel solutions to the society at large.

### Technopark@iitk

Since its inception, the Institute has successfully forged strong ties with the industry and R&D organizations. To further boost strategic partnerships with the industry, the Institute has started a new endeavor and that too a very significant one. IIT Kanpur Research and Technology Park Foundation is the institute's first research and technology park started to enable translational research and two-way flow of knowledge and resources between academia and industry. The park functions under the brand name of Technopark@iitk.



Technopark@iitk is a not-for-profit independent section 8 company registered on 7th February 2019 under the Companies Act, 2013. With the aim of becoming a hub of R&D activities spanning all industrial sectors and innovating in critical sectors of economy, Technopark@iitk offers intellectual capital, research infrastructure and physical spaces to industries to relocate their R&D centers and have both short- and long-term strategic collaboration with the faculty and students of IIT Kanpur. The facility was inaugurated formally on 8th April 2019 by the Chairperson, Board of Governors of IIT Kanpur, Dr. K. Radhakrishnan.

In a short span of time, Technopark@iitk has succeeded in establishing connect with the local industry. On 6th April 2019, it held its first local Industry-Academia Meet that was well attended by over forty big and small Kanpur-based industries like the Lohia Group, Injectoplast,



Kanpur Fertilizer and Chemicals, MKU, VAAU Manpower Solutions and several other MSMEs. During the meet, several patents developed at IITK were exhibited which garnered huge attention from the participants. Currently, Technopark@iitk is hosting 6 noteworthy clients namely, VTOL, Promorph, Injectoplast, iSMRITI, Kanopy Solutions and E-Spin and is in dialogue with many national and international companies.

### National Science Day

The Institute's Space Technology Cell (STC) organized a thematic programme to celebrate National Technology Day on 11th May 2019. For the year 2019, the theme of National Technology Day was "Space Technologies & ISRO." In keeping with this theme, STC invited two well-known scientists in the field of space technology for talks.



The first talk was delivered by Dr. B.S Munjal, Space Applications Centre (SAC), ISRO who spoke on "Technology Applications in Space/Ground Segment of SATCOM Domain". This was followed by a talk by Dr. Mehul R Pandya, SAC, ISRO, who spoke on "Eye in Space for Earth and Planetary Observations". A number of students from the city attended the event.

To mark the celebration of National Science Day, the Cognitive Science Programme in coordination with the Dean, Research and Development Office has organized a one-day symposium titled: "Through the looking glass: Interdisciplinary Perceptions on Cognition" on 26th February 2019.



### **Innovation and Incubation**

During the year, 45 patents including 2 design patents were filed, and 24 previously filed patents were granted, besides getting 2 technologies licensed for commercialization. Amount received from licensed technologies during 2018-19 is Rs. 7.08 lakh.

To date, 32 design patents and 463 Indian patents have been filed, out of which 86 patents have been granted so far. Altogether, 57 technologies have been licensed for commercialization to date.

A total of 61 companies are currently incubated at Startup Innovation & Incubation Centre (SIIC), IIT Kanpur and 60 have graduated so far.

Notable recent achievements of the incubator are as follows:

- SIIC won the Platinum Award ISGF Innovation Awards 2018 under the category of Smart Incubator of the Year.
- Received second round of funding under NIDHI PRAYAS scheme of DST for Rs. 1.2 crore to support innovators/ early stage startups for prototype funding.
- DST sanctioned funds of Rs 5 crore under NIDHI Seed Support System for supporting physically incubated startups at SIIC.
- Under the Bio Ignition Grant of BIRAC, 7 innovators/startups were sanctioned funding support.
- Under the PRISM program of DSIR, 2 innovators were sanctioned funding for building their prototypes.
- Sanction of funds for Rs. 12 cr. under the India Agritech Incubation Network (IAIN), an initiative funded jointly by the Bill and Melinda Gates Foundation (BMGF) and the Tata Trusts. The initiative will be programme managed by CInI and Social Alpha along with IITK.

Notable recent achievements of a few Incubated Companies are as follows:

E-spin Nanotech Pvt. Ltd

- Appointed as water research expert and member of Center for Excellence in Produced Water Management (CEPWM) at University of Wyoming, USA.

### **Bioscan Research Pvt. Ltd**

- Winner of Innocity Pitch 2018 at CIIE, IIM Ahmedabad
- Winner of India Israel Innovation Challenge 2018 in Healthcare
- Among top 4 startups in India by Lufthansa Runway to Success 2018
- Among top 10 women led deeptech startups by AICTE Canada India Acceleration Program 2018

- Among top 15 women led biotech startups by TIE-BIRAC WinER Award 2018
- Among Top 47 Product Innovations in India by Design Impact award of TATA Trust 2018
- BIRAC BIG Grantee 2018 Winner of CIIE Startpreneur Award 2018

### **Aarna Biomedical Products Pvt. Ltd.**

- Selected to showcase Poorti at Rashtrapati Bhawan – Festival of Innovation
- In Top-8 Social Innovations out of 3000 (India Innovation Growth Program – Lockheed Martin, Tata Trusts and DST)

### **Incredible Devices Pvt. L.td.**

- Won Design Impact Awards 2018 by TITAN
- Winner of DST Lockheed Martin India Innovation Growth Programme Winner of MARICO Innovation Award 2018

### **Help Us Green- Kanpur Flower cycling Private Limited**

- Winner of UN Young leader award
- Nominated for the Goalkeepers Awards by the Bill and Melinda Gates Foundation
- Recipient of BIRAC's Biotechnology Ignition Grant 2018
- Featured in Forbes's 30 under 30

### **Oxen Farm Solutions**

- Winners of most influential CNBC Awaaz Entrepreneur viewer's choice Award in Social Enterprise category

### **SIIC Incubation model and the pipeline of incubates**

SIIC has a strong pipeline from IIT Kanpur Ecosystem and Entrepreneurial Ecosystem outside of IIT Kanpur through various channels. These channels include outbound and inbound leads generation activities conducted by SIIC team throughout the year.

- New Faculty Entrepreneurship Policy along with new Faculty Evaluation Policy of IIT Kanpur
- Student Entrepreneurship Policy that offers deferred placement option to graduating student taking entrepreneurial route
- Tech Talk, i-Death on, and various B-plan event organized by E-cell and Techkriti
- IITK KGMU Bio-Immersion Program and Startup Internship Programs
- Startup Master Class and Social Enterprises and Entrepreneurs organized by IITK AA which has received a mandate from NITI Ayog
- Fellowships and Grants to support early prototype development as an efficient channel for product based startup

- INVENT program has brought more than 40 technology-based social impact focused startups and it continues to bring some great startups for SIIC.
- SIIC also developed partnerships with Janhit Jagran Challenge and also with some similar programs where SIIC is incubation partner for technology-based applicants.

### International Academic Collaborations

Recognizing the value of international cooperation, the Institute has signed MoUs and Joint degree programs with many foreign institutions for collaboration in academic and research activities.

The list includes La Trobe University from Australia; Heidelberg University from Germany; ECAM Lyon School of Engineering from France; The University of Pavia from Italy; Hokkaido University from Japan; The University of Tokyo from Japan; Chaoyang University from Taiwan; National ChiaoTung University from Taiwan; Tamkang University from Taiwan; Asian Institute



of Technology from Thailand.

### Financial Resource Mobilization

Out of the total amount of around Rs. 400 Million (\$5.7 Million @ Rs.70/\$) pledged by donors in the last 12 Months, a total of Rs. 166 Million (\$2.4 Million) has been received this year as compared to Rs. 14.06 Crore last year and the balance is expected to be received based on the milestones achieved as set by the donor in the next one year.

Some Notable Contributions: (All Figures are in Millions)	Pledged (Rs.)	Recd (Rs.)	Balance (Rs.)	Pledged (\$)	Recd (\$)	Balance (\$)
Mehra Foundation Endowment	175.00	0.00	175.00	2.50	0.00	2.50
Ranjit Singh Endowment	133.00	21.00	112.00	1.90	0.30	1.60
BVR Mohan Reddy Family Endowment	10.00	10.00	0.00	0.14	0.14	0.00
1963 Batch Fund (YOP 1968)	7.29	7.29	0.00	0.10	0.10	0.00
1997 Batch Fund (YOP 2001)	3.93	3.93	0.00	0.06	0.06	0.00
1994 Batch Fund (YOP 1994)	1.10	1.10	0.00	0.02	0.02	0.00
1968 Batch Fund (YOP 1973)	1.13	1.13	0.00	0.02	0.02	0.00
Mr. & Mrs. Gian Singh Bindra Chair	1.04	1.04	0.00	0.01	0.01	0.00
Neelam and Anil Singh Scholarship	1.25	1.25	0.00	0.02	0.02	0.00

Next Generation Broadcasting Chair	6.22	6.22	0.00	0.09	0.09	0.00
Opportunity School Building	10.69	10.69	0.00	0.15	0.15	0.00
Physics Dept Travel Grant award	2.06	2.06	0.00	0.03	0.03	0.00
Sudarshan Kasturia Memorial Scholarship	0.55	0.55	0.00	0.01	0.01	0.00
Ram Sahai, Vidyawati and Tara Ghate's Scholarships	3.24	3.24	0.00	0.05	0.05	0.00
Shanti and Ramkishore Sahai Scholarship	0.68	0.68	0.00	0.01	0.01	0.00
Bishamber and Anguri Gupta Scholarship	0.68	0.68	0.00	0.01	0.01	0.00
Durga Devi Memorial Scholarship	0.92	0.92	0.00	0.01	0.01	0.00
Kent RO Systems Ltd.	12.50	6.25	6.25	0.18	0.09	0.09
<b>Total</b>	<b>371.29</b>	<b>78.04</b>	<b>293.25</b>	<b>5.30</b>	<b>1.11</b>	<b>4.19</b>

### Alumni Impact

#### A. Selected Notable achievements in the field of science and technology by our alumni:

Our alumni have been proud recipients of various honours and awards in various categories during F.Y. 2018-19 as per the following details:

Category of Award	Number of Awards
Academic Awards	50
Industrial Awards	4
Government Awards	2

Some of the major achievements are as follows:

Award	Name of Alumni	Award Endowed by
Shanti Swarup Bhatnagar Prize 2018	Dr. Nitin Saxena (B/T/PhD/CSE/2002/2007) Dr. Amit Agrawal (B/T/ME/1996) Dr. Amit Kumar (B/T/CSE/1997)	The Council of Scientific & Industrial Research (CSIR)
Fellowship	Dr. Kapil Hari Paranjpe (MS c5/MTH/1982) Dr. Anil K. Jain (BT/EE/1969)	The World Academy of Sciences (TWAS)
Fellowship	Dr. Ratnesh Kumar (B/T/EE/1987) Dr. Upmanu Lall (BT/CE/1976) Dr. Manvendra K. Dubey (MS c5/CHM/1979)	The American Association for the Advancement of Science (AAAS)
National Women Bio- scientist Award 2018	Dr. Ruchi Anand (MS c2/CHM/1998)	Department of Biotechnology, New Delhi
Fellowship	Dr. Debabrata Goswami (MS c2/CHM/1988) Dr. Siddharth Ramchandran (B/T/MME/1991)	SPIE, the international society for optics and photonics
Fellowship	Dr. Justin R. David (MS c5/PHY/1994) Dr. Amit Kumar (BT/CSE/1997)	Indian Academy of Sciences (IASc)
Irving Langmuir Prize 2019	Dr. Devarajan Thirumalai (MS c5/CHM/1977)	American Physical Society
Google Brain Fellowship	Mr. Archit Sharma (B/T/EE/2018)	Google
Research Excellence Award 2018, IEEE Computer Society's 2019 Computer Pioneer Award	Dr. Jitendra K. Malik (B/T/EE/1980)	International Joint Conference on Artificial Intelligence (IJCAI), IEEE Computer Society
Fellowship	Dr. Veena Sahajwalla (B/T/MME/1986)	Australian Academy of Science
Indian Police Medal	Mr. Avi Prakash (B/T/AE/1994)	Govt. of India
Honorary Doctorate in Science	Dr. Ashutosh Sharma (B/T/CHE/1982)	State University of New York (SUNY), Buffalo

## B. Notable entrepreneurial endeavours by some of our alumni

Name of the Alumni	Entrepreneur in the field of
Mr. Deepanshu Malviya (BT/MME/2006)	Co-founder of Gurgaon based startup 'Shuttl'. The company has raised Rs. 48.3 crore from Sequoia Capital, Light Speed Venture Partners & Times Internet.
Mr. Gautam Chokhani (BS/ECO/2015) Mr. Aman Tiwari (BT/EE/2015) Mr. Ameya Sathe (BT/MSE/2016)	Founder of Vaultra Energy Solutions. The company bags the prestigious National Entrepreneurship Award 2018 in the Renewable Energy and Waste Management Category, organised by the Ministry of Skill Development and Entrepreneurship.
Mr. Abhinav Jain (BT-MT/CSE/2009) Mr. Aditya Gupta (BT/CSE/2008)	Co-founder of Mumbai-based Shop101, a mobile storefront and commerce platform for sellers, has received Rs 34 crore funding from Stellaris Venture Partners.
Mr. Kapil Raizada (BT/CHE/1993)	Founder of RailYatri, a travel startup, raises Series B funding from Omidyar Network. Launched in 2013, The company uses deep-analytics technology to make predictions that will help travellers make smart decisions for their travel.
Mr. Sachin Sinha (BT/ME/1997)	Founder and CEO of IQLECT Software Solutions, raises \$2.5 million in a bridge round of funding. IQLECT is a Bengaluru-based big data analytics firm that has built a hardware-software converged platform to collect, process and visualise data in real time and offers a platform-as-a-service on cloud that can also be shipped as a converged box.
Mr. Ashwani Gaur (BT/EE/2008)	Founder of HRBOT, an AI -driven recruitment platform. The company was selected in top 10 startup to be part of google's 2nd Batch of Launchpad Accelerator Program.
Mr. Vishwajeet Sinha (BT/CHE/2005) Mr. Piyush Dharnidharka (MSc5/MTH/2014)	Co-founder of Oxen Farm Solutions. The company has been voted the most influential CNBC Awaaz Entrepreneur viewer's choice Award in Social Enterprise category. The company is providing advanced combined harvesting machinery on pay per use and tech enabled format.
Mr. K. Sri Harsha (BT-MT/CE/2015) Mr. Sagar Setu (BT-MT/AE/2013)	Co-founder of Kritsnam Technologies. The company bags the 'Best Start-Up Award' in the category-Social Impact at Melting Pot2020 innovation Summit. Kritsnam Technologies is a company in the field of IoT with focus on water resource management solutions
Mr. Onkar Prasad (MT/IME/2013)	Founder of Promorph Solutions (EmpowerU). The company has been selected as one of the top 100 finalists at Maharashtra Startup Week 2019. EmpowerU is an Analytical Platform for Real-time Monitoring of Quality of Education & Effective Governance of Higher Education Institutions & Government Schools.

## C. Notable Professional Achievements by our alumni

Name of the Alumni	Position
Dr. Archana Shukla (PhD/HSS/1989)	Appointed Director of Indian Institute of Management (IIM) Lucknow.
Dr. Vijay K. VijayRaghavan (BT/MT/CHE/1975/1977)	Appointed Head of Prime Minister's Science, Technology & Innovation Advisory Council (PM-STIAC) set up by PMO India.
Dr. Krishnamurthy Subramanian (BT/EE/1994)	Appointed the new Chief Economic Advisor to the Finance Minister for a period of three years.
Mr. Radha Krishna Mathur (BT/ME/1975)	Appointed the Advisor to the Chief Minister of Tripura Shri Biplab Kumar Deb.
Dr. Dheeraj Sanghi (BT/CSE/1986)	Appointed Director of the Punjab Engineering College.
Dr. Ajay Bhushan Pandey (BT/EE/1983)	Appointed the Union Revenue Secretary.
Mr. Ram Sewak Sharma (MSc2/MTH/1977)	Reappointed the Chairman of Telecom Regulatory Authority of India (TRAI).
Dr. Inder K. Bhat (MT/PhD/ME/1982/1987)	Appointed the Chancellor of Manav Rachna University.

## INSTITUTE FACULTY

### Recruitment

In the past one year, the Institute has offered 77 faculty positions against a rigorous selection from 899 applicants. Out of these, 34 new faculty members and an Engineer have joined the Institute. The appointments per department are mentioned below:

Department	Number of New Faculty
Aerospace Engineering	1
Biological Sciences and Bioengineering	3
Chemical Engineering	1
Chemistry	7
Civil Engineering	4
Earth Sciences	1
Electrical Engineering	1
Humanities and Social Sciences	3
Mathematics & Statistics	6
Mechanical Engineering	3
Physics	4
Samtel Centre for Display Technologies	1



During this period, we have also made 42 offers of post-doctoral fellowships, 08 visiting faculty, 07 adjunct faculty, and 01 Distinguished Honorary Professor.

### Awards and Honours

Our faculty have played a significant role in pushing the frontiers of knowledge. This has been duly recognized in the form of various awards and honors, including fellowships of professional societies and editorships of international journals.

I am extremely happy to share with you the wonderful news that papers authored by Dr. Arun Shukla (BSBE) and Dr. S.N. Tripathi (CE) are published in prestigious journals named Nature Structural and Molecular Biology and Nature Communications respectively.

Professor Arun K. Shukla (BSBE) has been selected for the Swarnajayanti Fellowship in Life Sciences by the Department of Science and Technology, Govt. of India. Professor Animangsu Ghatak (CHE) has been elected Fellow of the Indian National Academy of Engineering, India. Professor Nishith Verma (CHE) has been awarded the Fulbright-Nehru Academic and Professional Excellence Fellowship to conduct research and teaching at Stony Brook University, New York. Professor J. K. Bera (CHM) has been awarded the J. C. Bose National Fellowship by Science and Engineering Research Board (SERB), a statutory body of DST, Government of India. Professor Manas K. Ghorai (CHM) has been elected a Fellow of the Indian Academy of Sciences (FASc), India. Professor Debabrata Goswami (CHM) has been elected a Fellow of The Institute of Physics (IOP), UK. Professor Manabendra Chandra (CHM) has been selected for Young Faculty Research Fellowship by MEITY, Govt. of India. Professor Yogesh Singh Chauhan (EE) has been selected for the Swarnajayanti Fellowship in Engineering Sciences by Department of Science and Technology, Govt. of India. Professor Aditya K. Jagannatham (EE) with his students Mr. Suraj Srivastava and Ms. Saumya Dwivedi, Department of Electrical Engineering, have been selected for the Qualcomm Innovation Fellowship (QInF) 2018-2019. Professor Rajiv Sinha (ES) has been selected for COFUND Senior Research Fellowship by Durham University, UK. Professor Subhas C. Misra (IME) Engineering, has been elected a Fellow by the British Computer Society London. Professor Subhas C. Misra (IME) Engineering, has been elected Fellow of the Institution of Electronics and Telecommunication Engineers, UK. Professor Mohua Banerjee (Math) has been nominated a Fellow of the International Rough Set Society (IRSS). Professor Avinash K. Agarwal (ME) has been admitted Fellow of The Royal Society of Chemistry (FRSC). Professor Avinash Agarwal (ME) has been elected Fellow of the National Academy of Sciences, India (NASI). Professor Anshu Gaur (MSE) has been selected for Visvesvaraya Young Faculty Research Fellowship, Digital India Corporation, MeitY, Govt. of India.

Professor Sathesh Mariappan (AE) has been selected for

the INAE Young Engineer Award, India. Professor D. P. Mishra (AE) has been conferred the National Design Award in Mechanical Engineering-2018 for his outstanding contribution in the field of engineering design by the Institution of Engineers, India. Professor D. P. Mishra (AE) has been chosen for the Excellence in Aerospace Award (2017) by The Aeronautical Society of India. Professor Arun Shukla (BSBE) has been chosen Rajib Goyal prize for young scientists. Professor Arun Shukla (BSBE) has been selected one of the recipients of the National Bioscience Award of DBT, New Delhi. Professor Arun Shukla (BSBE) has been selected for the Professor Rita Mulherkar Lecture Award by the Indian Society of Cell Biology. Professor Arun Shukla (BSBE) has been selected for the Shakuntala Amir Chand Prize 2017 by the Indian Council of Medical Research (ICMR). Professor Arun Shukla (BSBE) has been selected for the Young Researcher Award of the Lady Tata Memorial Trust. Professor Ashutosh Sharma (CHE) has been selected to receive a State University of New York Honorary Doctorate in Science. Professor Raju Kumar Gupta (CHE) has been selected for the Young Scientist Award by the Council of Science and Technology, Uttar Pradesh. Professor Sandeep Verma (CHM) has been chosen for the Goyal prize. Professor Debabrata Goswami (CHM) has been honored by the International Society for Optics and Photonics (SPIE) as SPIE Fellow (2019). *Inorganica Chimica Acta*, a prominent international journal of Inorganic Chemistry, has published a special issue in honor of Professor R. N. Mukherjee (CHM) on the occasion of his 65th birthday. Professor Debabrata Goswami (CHM) has been awarded the 2018 ICO Galileo Galilei Award by the International Commission for Optics. Professor J. N. Moorthy (CHM) has been selected for the Silver Medal of the Chemical Research Society of India (CRSI). Professor S. P. Rath (CHM) has been selected for the C N R Rao National Prize in Chemical Sciences instituted by C N R Rao Educational Foundation and Chemical Research Society of India (CRSI) for promotion of Chemical Research. Professor Vinod K. Singh (CHM) has been awarded the Professor Subramania Ranganathan Memorial Medal (2018) of Indian National Science Academy. Professor Salil Goel (CE) has been selected for the Young Geospatial Scientist 2018 award and the Rachapudi Kamakshi Memorial Gold Medal. Professor Tarun Gupta (CE) has been selected for the INAE Innovator Entrepreneur Award 2018. Professor Sachchida Nand Tripathi (CE) has been awarded 2018 UP Ratna Award, Government of Uttar Pradesh. Professor Nitin Saxena (CSE) has been awarded the S. S. Bhatnagar Prize (2018) in Mathematical Sciences. The award recognizes his outstanding work on the Polynomial Identity Testing Approach in the field of Complexity Theory. Professor Mainak Chaudhuri (CSE) has been honoured by Intel Corp Technology Excellence Award as an expression of Intel India's gratitude for his exemplary contribution, commendable collaboration, and purposeful engagement with Intel India. Professor S. C. Srivastava (EE) has received the Malaviya Award for Excellence in Power Systems 2018. Dr. Santanu Mishra (EE) has received the



2018 Premium Award for best paper in IET Power Electronics. Professor Yogesh Singh Chauhan (EE) has been chosen for the CNR Rao Faculty Award. Professor Ketan Rajawat (EE) has been selected for INSA Medal for Young Scientist 2018. Professor R. R. K. Sharma (IME) received the Quarterly Franklin Membership award given by Editorial Board of London Journals Press (UK) 2019 for impactful research contribution in management and industrial engineering. Professor Monica Katiyar (MSE) has been selected for this year's Metallurgist of the Year Award from the Ministry of Steels and Mines, Government of India. Professor Tanmoy Maiti (MSE) has been awarded 2019 Early Career Scholars in Materials Science by Journal of Materials Research, MRS. Professor Krishanu Biswas (MSE) has been selected by the Electron Microscopy Society of India (EMSI) for Excellence in Microscopy award 2018. Professor Shalabh (Math) has been selected for the Vigyan Ratna Award by the Council of Science and Technology, UP under the category of Science Awards. Professor Somnath Jha (Math) has been awarded the INSA Medal for Young Scientist 2018. Professor K. Muralidhar (ME) has been recommended by ASTFE Honours and Awards Committee to become a Fellow of The American Society of Thermal and Fluids Engineers (ASTFE) in recognition of his outstanding contributions to the field of Thermal and Fluids Engineering. Professor Gautam Biswas (ME) has been conferred Honorary Doctorate by Aristotle University of Thessaloniki, Greece. Professor P. Venkitanarayanan (ME) has been selected for the prestigious 2019 F. Zandman award of the Society of Experimental Mechanics based in CT-USA. Professor Mahendra Verma (PHY) received the Dr. A. P. J. Abdul Kalam Cray HPC award on 21st April 2018 at NIAS Bangalore. Professor Amit Agarwal (PHY) has been awarded the "IPA N. S. Satya Murthy Memorial Award in Physics-2016" of the Indian Physics Association. The full lists of awards received by the faculty as well as students are given at the end of the report.

## STUDENT ACTIVITIES

Students' Gymkhana, IIT Kanpur has strived to provide a platform for the students to hone their skills in extracurricular activities, and has become one of the most robust student-driven bodies in the nation. Believing in the importance of societal and humane engagements for the holistic development of an individual, it has always been supported by the Institute in pursuing cultural activities, sports or exploring technical opportunities and other possible avenues to help students explore their interests. Here are some of the highlights over the last year:

### Entrepreneurship Cell

Entrepreneurship Cell (E-Cell), IIT Kanpur is a non-profit student's organization dedicated to promoting the spirit of entrepreneurship amongst the campus community.

Throughout the academic year, E-Cell conducts a plethora of events, lectures and workshops with **eSummit** as the annual flagship entrepreneurial event of IIT Kanpur. This

year, eSummit'18 hosted several prominent entrepreneurs, industrialists, and businessmen including Dr Mahesh Gupta (Chairman & Managing Director, Kent RO), Sandeep Jain (GeeksForGeeks Founder), P.S. Jayakumar (CEO & Managing Director of Bank of Baroda) and many more. Also, several workshops and competitions were conducted as part of this event which witnessed significant participation from all across the country.

E-Cell also conducted **Startup Master Class (SMC)** and **Social Entrepreneurs and Enterprises (SEE)** in association with Alumni Association – these events had around

100 Speakers, a number of competition and workshops and 1500+ attendees. E-Cell also conducted a week-long event named '**Business Week**' where a number of competitions were conducted, and monthly '**Campus Hangouts**' were organized to enhance entrepreneurial know-how of our students.

### Vox Populi

Vox Populi, the student's journalism cell of the institute continued its growth towards achieving excellence and upholding the spirit of journalism on campus. The body in last one year furthered its reach on Facebook from about 7,000 to over 15,000. It also launched itself across new online platforms.



Vox Populi, through its efforts during the General Elections' 19 did justice to its responsibility in this regard. Investing for the first time in investigative journalism, the body's efforts to bring out the malpractices in the elections were commendable. They also carried out an extensive study of the 'Mental Health Issues' on campus.



### Community Welfare Cell

The Community Welfare Cell is a student group that is committed to learning, understanding and helping the society within the institute as well as in its vicinity. The different wings of the Cell worked on several important aspects catering to the well-being of the Community some of these are:

**Prayas** works in the field of education for the marginalized sections of society. Apart from regular classes held for the underprivileged children of the workers in the institute, the wing organized the Prayas Premier League, an annual function, a cultural week, a science week and a picnic.

**Prakriti** worked in the field of environmental awareness, social innovations, and impact assessment. The group organized a paper collection drive, a tree plantation drive (in which 50 trees in hall 6 and 150 trees in hall 13 were planted), and a clothes distribution and cleanliness drive.

### Media and Cultural Council

Comprising over 14 clubs and hobby groups, the highlights of the Media and Cultural Council this year were

- Students' Opinion Society organized “**Policy Conclave**” from 24th to 27th of January, 2019. It was the first of its kind to be held at IIT Kanpur. It was an intra campus event designed only for the campus community of IIT Kanpur.
- Fine Arts and Design Club organised wall painting, in Baikunthpur village under **Unnat Bharat Abhiyan** (UBA), where school students were encouraged to paint walls, with messages of 'save earth' and 'save water'.
- **EK Bharat Shreshtha Bharat** (EBSB): It is an initiative by the MHRD of India to promote the spirit of national integration, celebrate the Unity and Diversity of our Nation and to create an environment which promotes learning between the states by sharing its cultural heritage. Media & Cultural council organised EBSB cultural days of more than ten pairing states of India.

### Science and Technology Council

Several events were conducted under the Science and Technology Council. Please include:

#### 7<sup>th</sup> Inter IIT Tech Meet - IIT Bombay

The 7<sup>th</sup> Inter IIT Tech Meet was held in IIT Bombay during 18-20 December 2018. IIT Kanpur participated with a contingent of about 50 students in all the competitive and non- competitive events. Being appreciated at the non-competitive events, we also bagged medals in 6 (**5 Silver and 1 Bronze Medals**) in 9 competitive events.



#### Participation in Techkriti 2019 and TechFest 2018

Several students participated in Techkriti 2019 and TechFest 2019 in various competitive events and with the aid provided by the council, they won on several platforms.

#### Student Autonomous Underwater Vehicle (SAVe) 2019 – NIOT

In the sixth edition of Student Autonomous underwater Vehicle (SAVe) 2019 competition conducted by National Institute of Ocean Technology (NIOT), held at IIT Madras, AUV-IITK won the **First Runner up trophy**.



#### iGEM 2018, Boston

The team represented IIT Kanpur at the Giant Jamboree to be held at Hynes Convention Center, Boston, MA from 24-28th October 2018 and won a **Silver Medal** for the institute.



#### MegaATV Championship 2019

Team IITK Motorsports participated in MegaATV Championship 2019 held at Querim Beach, Goa during 18th-20th March and secured 13th position **overall out of 100 participating teams**.



Three other teams are set to represent IIT Kanpur in their respective international competitions during the summer session itself.

#### Council Activities for Student Body

The five clubs and six hobby groups associated with the council organized several lectures and workshops for the student body on Motor Control, PID, IoT, Computer Hardware, etc. to broaden their interests.



#### Games and Sports Council

IIT Kanpur successfully hosted a number of non-club workshops including archery, ultimate, golf, fencing, kabaddi, horse riding and a District Football Championship on the campus. Adventure club has increased its activities, the highlights being reaching the Khardung La top by cycle and completion of long distance runs like Garwal Ultra Run (74 km) and others. All the clubs carried out their club activities throughout the year to engage the campus community in games and sports.

#### Inter IIT Sports Meet

IIT Kanpur participated in 54th Inter IIT Aquatics Meet held at IIT Guwahati this year securing the silver medal in Water Polo (Men) and overall 3rd position in Women's swimming.



The entire contingent participated in the coveted 53rd Inter IIT Sports Meet held at IIT Guwahati. We managed



to score 6th position among the 23 IITs which participated. We stood 6th in the Men's category and 5th in the Women's category. We got silver medals in cricket, basketball (men) and Water polo and 3rd position in Athletics (men), Weightlifting and Swimming (women). Our chess team also showcased its talent at 4th Inter IIT chess meet held at IIT Guwahati this year.

### Festivals

The overriding objective of large-scale events of the Institute such as Antaragni (the cultural festival), Techkriti (the technical and entrepreneurship festival) and Udghosh (the sports festival) is to infuse a sense of richness and purpose in the lives of students. All these social, cultural and sporting activities play a crucial role in the transformation of students into complete human beings. These festivals have vastly improved participation levels, both from within the Institute and also from students from other national and international institutions. The revenues generated for conducting these festivals saw an impressive growth last year, which is a tribute to the managerial and logistic skills of our students.

### Antaragni

The cultural festival, Antaragni reached new heights in its 53rd edition where the team successfully managed a festival, with a footfall of over 1.25 lakh.



The theme of the festival was 'enRoute Nirvana,' and lasted from 25th to 28th October 2018. These four days were flooded by magnificent performances by students from around 250 colleges of the country, accompanied by showcases by national and international artists of varied styles and art forms.

The festival started off with performance by the band, The Local Train. This was followed by a performance from the world renowned DJ Quintino. The festival also included a melodious performance from 'The Jesus of Guitar' - Guthrie Govan which led us to the final night, concluded by the performance of Amit Trivedi.

IIT Kanpur successfully hosted a number of non-club workshops including archery, ultimate, golf, fencing, kabaddi, Horse riding and a District Football Championship on the campus. Adventure club has increased its participation, with the highlights being reaching the Khardung La top by cycle and completion of long distance runs like Garwal Ultra Run (74 km) and others. All the clubs carried out their club activities throughout the year to engage the campus community in games and sports.

### Techkriti

The technical and entrepreneurship festival, Techkriti saw its silver jubilee edition with Techkriti '19. With the theme of 'Forging the Matrix', representing the

endless possibilities and plethora of opportunities for everyone to forge their elevated self, the festival 'Forged the Matrix' with its 25th Edition.



Apart from the various technical exhibitions and competitions, Techkriti '19 witnessed various Tech-Talks. To name a few,

- Anjali Joshi (Vice President, Product Management, Google)
- Michael Berry (Theoretical Physicist, University of Bristol)
- Jay Vijayan (CEO and founder, Tekion Corp., former CIO at Tesla)
- Peter Atkins (Founding Chairman, IUPAC)
- Michael Foreman (Former NASA Astronaut)

The silver jubilee edition also witnessed the technical summit on the theme Industry 4.0; the fourth industrial revolution that heralds the revolution in data automation and data exchange, for the first time in India by any institution. The technical extravaganza comprised enlightening workshops, talks and panel discussions with various distinguished personalities.

Techkriti presented interactive session by Girliyapa, Comedy Night Show by Zakir Khan, the much awaited Bollywood Night by Benny Dayal and awe-inspiring and thrilling performance by Nucleya and KTM bike stunt show.

### Udghosh

The 2018 edition witnessed more than 60,000 people with more than 2100 participants from more than 200 colleges all across India. With the introduction of new events like Tae- kwon-do, Women's football and Women's Squash and newer initiatives like Udaan (sports for differently abled), which were received well by the community.



This year Udghosh invited famous Football freestylers from Poland : Dawid Krzyzowski and Pawel Skora. Apart from sports, Udghosh also witnessed Indian-Rock concert (Indian Ocean) and Comedy Night by Aakash Gupta and Nishant Tanwar, Talks by Mira Erda (First female Formula Racer), Ira Singhal and Youtubers from Filter Copy. The festival also included performances of Mallkambh artists and concluded with the symphonic voice of Bollywood Singer Amit Mishra.

## COUNSELLING SERVICE

### Overview and Team Strength

The Counseling Service (CS) primarily provides emotional, academic and financial assistance to students. The CS tries to bring the human touch in a highly competitive academic environment and lends a helping hand to those students who are in emotional, academic or financial distress, thereby trying to create a home away from home.

CS consists of a team of professional counselors, psychiatrists and a group of student volunteers dedicated towards the welfare of the student community. Currently, there are

3 professional counselors, 1 assistant counselor and 3 psychiatrists who regularly visit the Institute.

The student team comprises an undergraduate wing and a postgraduate wing. The UG wing has 5 core team members. They have 13 assistant coordinators and 6 guidance team members. Further there are approximately 140 student guides, 115 academic mentors and 3 volunteers, whereas the PG wing has 8 Core Team members and 75 volunteers.

### Sessions by the Counselors and Psychiatrists

Students typically meet the counselors in two modes – they sometimes approach the counselors of their own volition or they are referred to the CS by their friends, faculty members, psychiatrists or the doctors at the Health Centre. Students with academic difficulty are also encouraged to meet the counselors for relief. In the 2018-19 session, 1872 counselor sessions were held.

The psychiatrists typically visit the campus at least twice a month. If the need arises, then, they visit more often. One of the psychiatrists visits the Health Center every Saturday, and, many of the students in need consult him there. In times of an emergency, the student is directly sent to the psychiatrist's clinic, along with an attendant. All the activities related to a psychiatrist's visit are coordinated by the Counseling Service.

The Counseling Service started two new initiatives in the 2018-19 session. The first was the de-addiction clinic, which addresses the problems of students facing any kind of addictions. The second was a mental health initiative titled "Samvad." Numerous programs were held over the calendar year under the banner of Samvad. The programs have had a lot of impact on the community.

### Financial Assistance

Through the STUDENTS BENEVOLENCE FUND (SBF), the Counseling Service provides financial assistance to needy students in the form of scholarships. This is available for those financially needy students, who have been unable to acquire any other financial assistance from the institute. The SBF scholarship is Rs.1500 per month and given for a period of 9 months. Apart from this, SBF Loans are also available to those who are in dire

need of money.

### Academic Assistance

Academic assistance is provided to students facing difficulty in coping with the academic load. The support exists both at an individual level as well as at a group level and is free of cost.

- Remedial Classes: Remedial classes are organized by academic mentors (senior students) to help academically deficient students.
- Study Hours: For underperforming students, study hours are organized by academic mentors during the week before the examinations.
- Technical Terminology Classes: To help the students facing difficulty in understanding technical terms in English, the Technical Terminology Classes are organized towards the beginning of the semester where these technical terms are explained to them in their native language. These are mostly attended by students not proficient in English.

### Support to Students under Probation

The Counseling Service provides emotional as well as academic support to the students on academic probation/warning. This year the students in AP/WR were allotted a guide from the operations or guidance team, whose responsibility was to look after his/her allotted counselee and also to act as a link between the student and the counselor. Individual counseling sessions are offered by the counselors to improve the academic performance as well as to resolve emotional issues. A session for the first year students in probation/warning was conducted by the counselors in which they motivated them to perform better. This had a positive impact on the students.

### Orientation Programme

Each year, the Orientation Program is organized for the freshmen before the beginning of the new academic session in July, to acquaint them with the facilities, services, personnel, rules and regulations of the institute and to facilitate a smooth transition into life at the institute. A similar session is again organized the PG team in December.

The core team members, student guides, student volunteers attached to the Counseling Service help the newcomers in this process. The students are also introduced to the Institute Counselors, whom they are encouraged to approach whenever they are confronted with any issues. This time the orientation program was held from the 23rd to the 28th July 2018 with students reporting on the 22nd July.

Gymkhana Presentations, sessions with the counselors, group activities and wing competitions were organized as part of the Orientation Program. To tackle the issue of substance abuse, a session to sensitize the students was conducted by the psychiatrist Dr. Mahendru. This session was followed by an interactive session, where the students raised concerns regarding this issue. A series of talks by



some alumni of the institute were also organized during the orientation program and they were very inspiring to the incoming batch of students and were well received. There were talks by the doctors at the Health Center as well during the orientation program.

### Other Activities

Throughout the year, several programs were conducted by the CS. A food fest and a zumba session were organized during the course of the year. Amongst other activities, a lantern lighting session and a cleanliness drive were also held. Numerous activities were conducted during the mental health awareness week in September 2018.

### Skill Enhancement Workshops/Classes

1. English Conversation Classes: English Conversation Classes are organized during the semesters for the students who face difficulty in understanding and communicating in English. These classes are free of cost and are open to all the students.

### Sessions on Other Broad Issues

1. Explore your department: This session was organized for the second and third-year undergraduate students with the aim of helping them explore and get a better understanding of their respective departments.
2. Session on Study Techniques: A session designed to help students learn better study techniques.
3. Intern Gyan: Senior students share their experiences and knowledge about the various possible opportunities available to their immediate junior batches through this platform.
4. ESO/SO awareness Session: ESO/SO session was organized primarily to guide the first year students who were going to take ESOs and SOs for the first time.

### SURGE Program

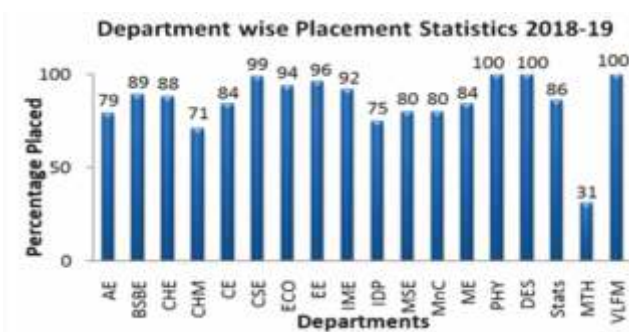
IIT Kanpur launched an 8-week SURGE (Students-Undergraduate Research and Graduate Excellence) program in the summer of 2006. Under this program, a small number of selected undergraduate students from top engineering colleges from all over India are given an opportunity to explore research and to experience the academic atmosphere of IIT Kanpur. Students in second and third year of their academic program are selected from a large pool of applicants. The students get selected on the basis of their academic record, their research proposal and their technical achievements.

No.	Particulars	SURGE 17	SURGE 18
01.	No. of Applications	1200	2000
02.	No. of Participants	103	123
03.	No. of Faculty members from IIT Kanpur mentoring	73	85

Under the SURGE program, students undertake short-term intensive research projects and push their intellectual abilities beyond those driven by the classroom.

### STUDENT PLACEMENT

1041 students registered with Student Placement Office for Campus Recruitment Drive 2018-19. As with previous years, recruitment drive for the academic year 2018-19 was held in two phases. Phase 1 of recruitments officially started on 1st of December and extended till 15th December 2018. Approximately 294 recruiters visited our campus during Phase 1 to hire students for full time employment. 44 top tier firms from various sectors visited our campus for recruitment on December 1st where an unprecedented 238 job offers were made to IITK students. Based on hiring numbers, the top recruiter for placement season was Intel Corporation who visited campus on day one and hired 34 students. Other top recruiters for the season were HSBC, EXL Services, OYO and Reliance Jio Infocomm Ltd. Phase 2 of recruitments started in January and extended till May 2019. More than 324 companies visited IITK campus for recruitment during the two phases of placements. A summary of department-wise placement record for the current placement season is included in figure below.



Approximately 88.4 percentage of the graduating batch (920 out of the 1041 registered students) were placed through Student Placement Office during the academic year 2018-19. This includes students at both UG and PG levels. Approximately 90.3 percentage of registered students in B. Tech and B.S. degree programs (437 out of 484) were placed during the current placement season. UG placement count given above also includes 95 Pre-Placement Offers (PPO's) extended to IITK students as part of academic internship provided through Student Placement Office. Approximately 86.7 percentage of registered PG students (483 out of 557) were also placed through SPO during campus recruitment drive.

### EPILOGUE

I feel immensely happy that I am a part of this special day of your life and congratulate you with all my heart on this momentous occasion. As a fellow alumnus, I must say that this day becomes even more special considering that you are graduating from an eminent institute like ours.

The institute has not only trained you to be world-class scientists, engineers and researchers but has also taught you to be creative and sensitive individuals aware of your responsibilities towards our society. As you chart your

professional career, I urge you to be deeply conscious of how privileged you have been to study in the IIT system and of your responsibility to pay back to the society and the nation. Be ready to work hard and sacrifice for a prosperous new India. As Swami Vivekananda had said, “Be Moral, Be Brave, Have faith in yourselves; All power is within you and you can do anything and everything. While you possess the energy of youth, rouse yourselves and aspire for working for the welfare of humanity.”

I am very confident that these formative years spent at IITK will empower you to steer your life to the path of

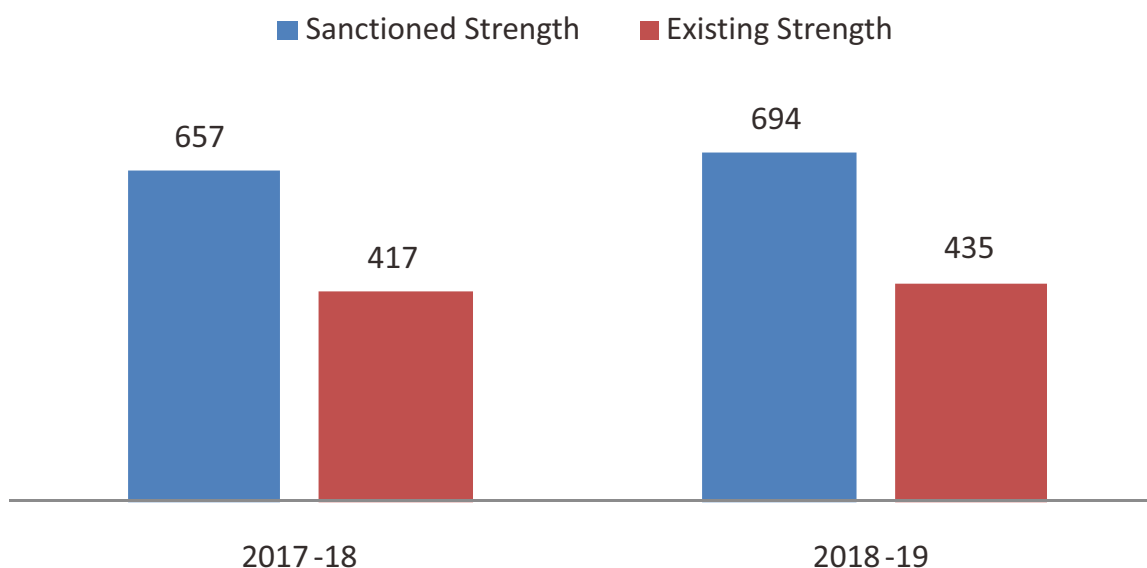
success. May the Almighty bless you and lead you all to the fulfillment of your aims. I wish you all the best in your professional career and assure you that IIT Kanpur will always be there to support you. Stay in touch with your Alma Mater and enhance its glory and fame wherever you go!

For a new beginning and for a new India!

**Link:** <https://iitk.ac.in/dord/data/Annual-Report-2018-19/Books-Published.pdf>

## INSTITUTE AT A GLANCE

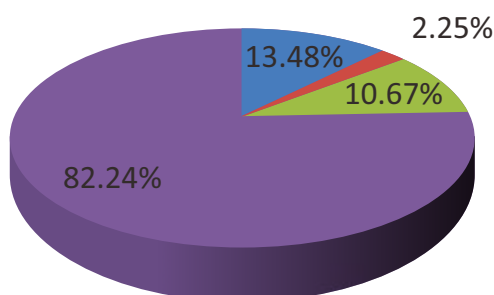
### Faculty Strength



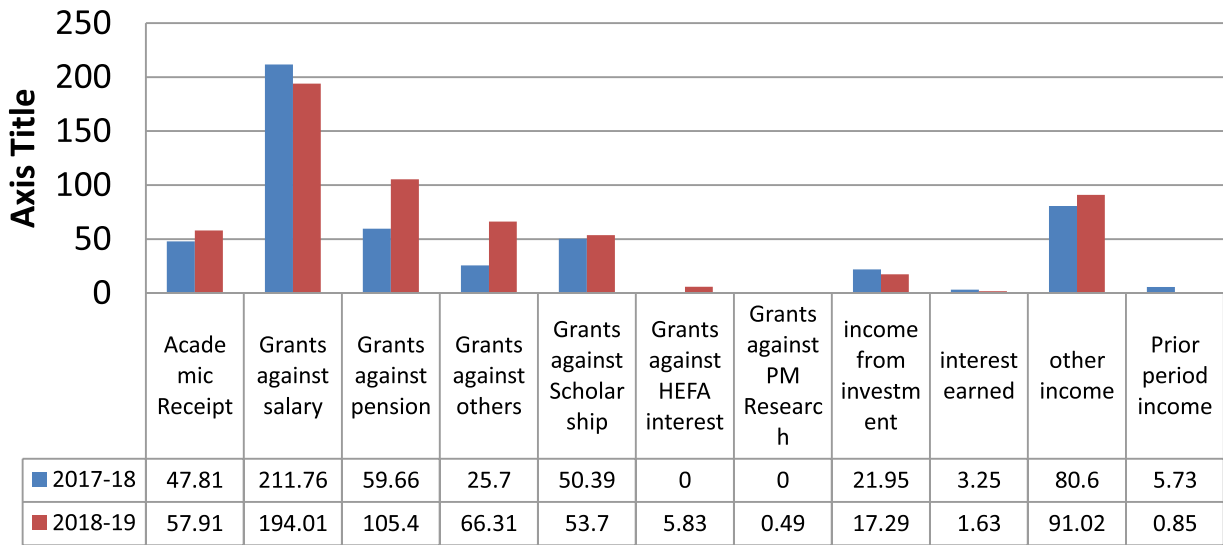
### Plot Area (Ground Coverage)

**42,69,433.52 m<sup>2</sup>**

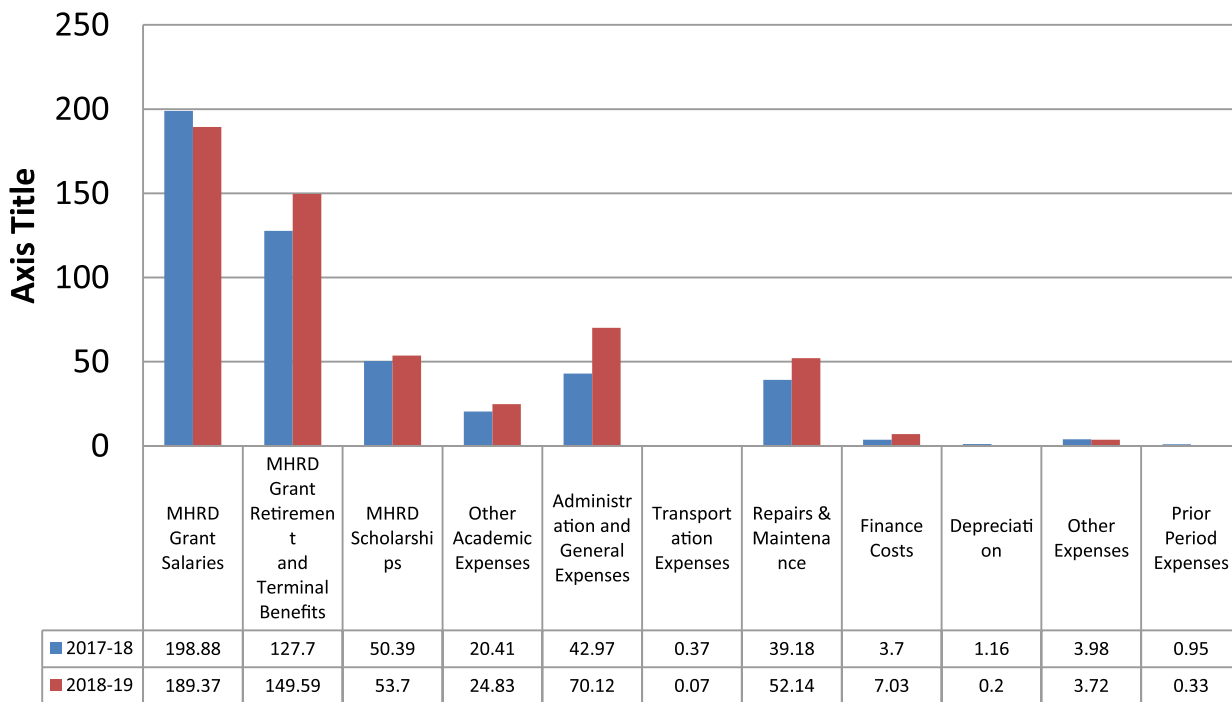
- Existing Buildings 5,75,461.00
- Parking area 95,947.00
- Road Area 4,55,402.00
- Open Area 35,11,182.13



## Details of Income (Rs. in crore)



## Details of Expenditure (Rs. in crore)





**ORGANIZATION**  
(as on 31st March 2019)

**List of Members of the Board of Governors**  
**[From 01 April, 2018 to 31 March, 2019]**

**CHAIRMAN:**

**Shri R.C. Bhargava** [upto 18 Oct., 2018]  
Chairman, BOG, IIT Kanpur  
Maruti Udyog Ltd.  
220, Sector 15A  
Noida – 201 301

**Dr. S. S. Sandhu** [w.e.f. 11 July, 2018]  
Additional Secretary (Technical Education)  
Ministry of Human Resource & Development  
Shastri Bhawan,  
New Delhi – 110001

**Prof. Abhay Karandikar** [w.e.f. 19 Oct., 2018 to  
18 Feb., 2019]  
Chairman  
Indian Institute of Technology, Kanpur  
Kanpur – 208016

**Shri Deepak Ghaisas** [w.e.f. 11 July, 2018]  
Chairman & Chief Mentor  
Gencoval Strategic Services Pvt Ltd.  
501 Windfall, Sahar Plaza Complex,  
Andheri- Kurla Road, Andheri (East),  
Mumbai-400059  
(Maharashtra)

**Dr. K. Radhakrishnan** [w.e.f. 19 Feb., 2019]  
Chairman, BOG, IIT Kanpur  
Antariksh Bhavan  
New B.E.L. Road  
Bengaluru – 560 231

**Prof. T. N. Singh** [w.e.f. 11 July, 2018]  
Vice-Chancellor  
Mahatma Gandhi Kashi Vidyapith (MGKVP)  
Varanasi – 221 002  
Uttar Pradesh

**Members:**

**Prof. Manindra Agrawal** [upto 17 April, 2018]  
Officiating Director  
Indian Institute of Technology, Kanpur  
Kanpur – 208016

**Prof. Uday Shanker Dixit** [w.e.f. 11 July, 2018]  
Department of Mechanical Engineering  
IIT Guwahati  
Guwahati – 781039  
(Assam)

**Prof. Abhay Karandikar** [w.e.f. 18 April, 2018]  
Director  
Indian Institute of Technology, Kanpur  
Kanpur – 208016

**State Government Nominee:**

**Prof. S.N. Singh**  
Vice Chancellor  
Madan Mohan Malaviya University of Technology  
Deoria Road,  
Gorakhpur – 273010  
Uttar Pradesh

**Council Nominees:**

**Prof. Girish Chandra Tripathi** [upto 10 July, 2018]  
Professor of Economics  
Senate House Campus  
University Road, Old Katra  
Allahabad, Uttar Pradesh – 211002

**Senate Nominees:**

**Prof. Debopam Das**  
Department of Aerospace Engineering  
Indian Institute of Technology Kanpur  
Kanpur – 208 016  
Uttar Pradesh

**Prof. Jayanta K. Bhattacharjee** [upto 10 July, 2018]  
36 C, Lake Road  
Kolkata – 700029  
(WB)

**Prof. P. Balaram** [upto 10 July, 2018]  
Molecular Biophysics Unit  
Indian Institute of Science  
Bangalore - 560 012

**Prof. M.L.N. Rao**

Department of Chemistry  
Indian Institute of Technology Kanpur  
Kanpur – 208016  
Uttar Pradesh

**Shri Krishnamurthi Venkataramanan** [upto 10 July,  
2018]  
CEO & MD  
Larsen & Toubro Limited  
'C' Building, Gate No. 1  
Saki Vihar Road, Powai  
Mumbai – 400 001  
(Maharashtra)

**Secretary:**

**Shri K.K. Tiwari**  
Registrar  
Indian Institute of Technology Kanpur  
Kanpur – 208016  
Uttar Pradesh

**List of Members of the Finance Committee**  
**[From 01 April, 2018 to 31 March, 2019]**

**CHAIRMAN:**

**Shri R.C. Bhargava** [upto 18 Oct., 2018]  
Chairman, FC, IIT Kanpur  
Maruti Udyog Ltd.  
220, Sector 15A  
Noida – 201 301 (U.P.)

**Prof. Abhay Karandikar** [w.e.f. 19 Oct., 2018 to  
18 Feb., 2019]  
Chairman, FC  
Indian Institute of Technology, Kanpur  
Kanpur – 208016

**Dr. K. Radhakrishnan** [w.e.f. 19 Feb., 2019]  
Chairman, FC, IIT Kanpur  
Antariksh Bhavan  
New B.E.L. Road  
Bengaluru – 560 231

**Members:**

**Prof. Manindra Agrawal** [upto 17 April, 2018]  
Officiating Director  
Indian Institute of Technology, Kanpur  
Kanpur – 208016

**Prof. Abhay Karandikar** [w.e.f. 18 April, 2018]  
Director  
Indian Institute of Technology, Kanpur  
Kanpur – 208016

**Prof. Girish Chandra Tripathi** [upto 10 July, 2018]  
Professor of Economics  
Senate House Campus  
University Road, Old Katra  
Allahabad, Uttar Pradesh – 211002

**Shri R. Subrahmanyam** [upto 10 July, 2018]  
Additional Secretary (Technical Education)  
GOI, Department of Higher Education  
Ministry of Human Resource Development  
Shastri Bhawan, New Delhi – 110 001

**Dr. S.S. Sandhu** [w.e.f. 11 July, 2018]  
Additional Secretary (Technical Education)  
GOI, Department of Higher Education  
Ministry of Human Resource Development  
Shastri Bhawan, New Delhi – 110 001

**Smt. Darshna M. Dabral**  
Joint Secretary & Financial Adviser  
GOI, Department of Higher Education  
Ministry of Human Resource Development  
Shastri Bhawan, New Delhi – 110 001

**Shri Deepak Ghaisas** [w.e.f. 11 July, 2018]  
Chairman & Chief Mentor  
Gencoval Strategic Services Pvt Ltd.  
501 Windfall, Sahar Plaza Complex,  
Andheri- Kurla Road, Andheri (East)  
Mumbai-400059

**Prof. M.L.N. Rao**  
Department of Chemistry  
Indian Institute of Technology, Kanpur  
Kanpur – 208016

**Secretary:**  
**Shri K.K. Tiwari**  
Registrar  
Indian Institute of Technology Kanpur  
Kanpur – 208016

**List of Members of the Building and Committee**  
**[From 01 April, 2018 to 31 March, 2019]**

**CHAIRMAN:**

**Prof. Manindra Agrawal**  
Officiating Director  
Indian Institute of Technology, Kanpur  
Kanpur – 208016

**Prof. Abhay Karandikar** [w.e.f. 18 April, 2018]  
Director  
Indian Institute of Technology, Kanpur  
Kanpur – 208016

**Members:**

**Prof. Manindra Agrawal**  
Deputy Director  
Indian Institute of Technology, Kanpur  
Kanpur – 208016

**Prof. Debopam Das**  
Department of Aerospace Engineering

Indian Institute of Technology, Kanpur  
Kanpur – 208016

**Prof. Manoj Mathur**  
Department of Architecture  
School of Planning & Architecture  
New Delhi – 110 002

**Shri A.K. Jain**  
Retd. Special DG, CPWD (Electrical)  
Flat 9-B, Tower-X, Meghdutam Apartments  
Plot F-21-C, Sector-50  
Noida (UP) – 201 301

**Shri B.M. Agarwal**  
Retd. Engineer-in-Chief, UP Irrigation  
102, Ravinder Garden  
Sector-E, Aliganj,  
Lucknow – 208016

**Prof. Y.N. Singh**  
Dean of Infrastructure & Planning  
Indian Institute of Technology, Kanpur  
Kanpur – 208016

**Secretary:**  
Shri K.K. Tiwari  
Registrar  
Indian Institute of Technology Kanpur  
Kanpur – 208016

### THREE NOMINEES OF THE CHAIRMAN, BOARD OF GOVERNORS FROM SENATE

- |   |   |
|---|---|
| <b>1. Prof. N.B. Singh</b><br>Vice Chancellor<br>Harcourt Butler Technical University<br>Kanpur                       | Professor, Deptt. of Cardiology<br>King George's Medical University,<br>Lucknow                                     |
| <b>2. Dr. Rishi Seth</b><br>MD, DM FRCP (Edinburgh)<br>National Executive Member of<br>Cardiological Society of India | <b>3. Prof. Neeraj Dwivedi</b><br>Dean (Programs)<br>IIM Lucknow<br>Prabandh Nagar, IIM Road<br>Lucknow UP – 226013 |

## THE FACULTY

### Recruitment

In the past one year, the Institute has offered 77 faculty positions against a rigorous selection from 899 applicants. Out of these, 34 new faculty members and an Engineer have joined the Institute. The appointments per department are mentioned below:

Department	Number of new faculty
Aerospace Engineering	1
Biological Sciences and Bioengineering	3
Chemical Engineering	1
Chemistry	7
Civil Engineering	4
Earth Sciences	1
Electrical Engineering	1
Humanities and Social Sciences	3
Mathematics & Statistics	6
Mechanical Engineering	3
Physics	4
Samtel Centre for Display Technologies	1

During this period, we have also made 42 offers of post-doctoral fellowships, 08 visiting faculty, 07 adjunct faculty, and 01 Distinguished Honorary Professor. For details please visit following link:

**Link:**<https://iitk.ac.in/dord/data/Annual-Report-2018-19/Awards-and-Honors.pdf>  
<https://iitk.ac.in/dord/data/Annual-Report-2018-19/List-of-Faculty.pdf>

## ACADEMIC PROGRAMMES

### EDUCATIONAL GOALS

Education in the Engineering Stream should produce trained manpower for maintaining and advancing technological growth. The scope of engineering education should evolve based on the evaluation of technological growth for its relevance to the prosperity of

the country. The educational strategy in this context should help to develop a knowledge industry and the systems involved in this endeavor should strive for furtherance of knowledge.

The academic goals of the Indian Institute of Technology



Kanpur from the viewpoint of its teaching programme are as follows:

- To prepare the students for the highest level of excellence in science and technology and to produce competent, creative and imaginative scientists and engineers.
- To promote a spirit of free and objective inquiry in different fields amongst the students and motivate them for higher studies and research.
- To foster an inter-disciplinary approach, and promote the concept of virtual research departments by bringing together faculty and students into activities of mutual interest.

## TEACHING PROGRAMMES

The Institute offers instruction in various disciplines of science and engineering, both at undergraduate (UG) and postgraduate (PG) levels. These programmes are planned and implemented by the Academic Senate of the Institute. Micro-management of these programmes is carried out by the Senate Undergraduate Committee (SUGC) and the Senate Post-graduate Committee (SPGC), respectively. The development of these programmes is monitored by the recently introduced Senate Curriculum Development and Monitoring Committee (SCDMC). Apart from this, the programmes are subject to a comprehensive review once every 10 years by the Academic Review Committee (ARC) constituted for this purpose.

### Undergraduate Programme

The Institute offers the following undergraduate programmes:

- Four-Year BTech Programmes in Aerospace Engineering, Biological Sciences & Bio-engineering, Chemical Engineering Civil Engineering, Computer Science and Engineering, Electrical Engineering, Materials Science and Engineering, and Mechanical Engineering.
- Four-Year BS Programmes in Chemistry, Earth Sciences, Economic Sciences, Mathematics & Scientific Computing, and Physics.

The four-year undergraduate programme consists of two parts having duration of about four semesters each. The first part is primary the Core Programme common to all students, and is carefully planned to give the students a strong base of basic education in Mathematics, Physics, Chemistry, Technical Arts, and Humanities and Social Sciences. The second part of the undergraduate programme consists of the Professional Courses and a project in the chosen branch of specialization.

### Two-Year MSc Programme

The Institute also offers Two-Year MSc Programmes in Physics, Chemistry, Mathematics and Statistics, where students with B.Sc. (Hons.) background are admitted through an all-India entrance examination known as JAM (Joint Admission Test to Master of Science). These programmes have been largely responsible for the scientific manpower in Indian research institutes and

universities.

### Postgraduate Programme

The postgraduate programme is intended to prepare students to enter their professions with a perspective and breadth of knowledge related to the principal areas in their respective fields of specialization through courses as well as specialized research experience. A postgraduate student is typically enrolled for three or four courses each semester until he/she advances to a point where the principal requirements of the programme left to be fulfilled are research and thesis.

### Mtech Programme

We have MTech Programmes in all the core Engineering Branches of Aerospace Engineering, Biological Sciences & Bio-engineering, Chemical Engineering Civil Engineering, Computer Science and Engineering, Electrical Engineering, Materials Science and Engineering, and Mechanical Engineering. In addition, there are MTech Programmes in interdisciplinary areas such as Photonics Science and Engineering, Materials Science, Nuclear Engineering and Technology, and Environmental Engineering and Management. The MTech students are chosen through an all-India examination known as GATE and further written test/interview in some cases.

### MBA Programme

The MBA Programme is offered by the Department of Industrial Management and Engineering (IME). The students admitted to this programme are selected through an all-India examination known as CAT followed by the interview and group discussions.

### MDES Programme

The MDes Programme is offered by the Interdisciplinary Programme in Design. The students are selected through the all-India examinations, CEED and/or GATE, followed by the written test/interview.

### Doctor of Philosophy (PhD)

The academic programmes leading to the degree of Doctor of Philosophy (PhD) exists in all the Engineering Departments and the Interdisciplinary Programmes (IDPs) of Cognitive Science, Design, Environmental Engineering and Management, Nuclear Engineering and Technology, and Photonics Science and Engineering. The PhD Programmes are also offered in the Departments of Chemistry, Earth Sciences, Economic Sciences, Mathematics & Statistics, Physics, and Humanities and Social Sciences (English, including Literature, Linguistics, and Language Teaching, Fine Arts, Philosophy, Psychology and Sociology).

The PhD programme culminates in research on a selected topic leading to a thesis submitted in partial fulfillment of the requirements for the degree.

### MS By Research

The Institute also offers a Postgraduate Programme

known as MS (By Research) in the following disciplines: Aerospace Engineering, Chemical Engineering, Civil Engineering, Computer Science and Engineering, Electrical Engineering, Environmental Engineering and Management, Mechanical Engineering, and Photonics Science and Engineering. The objective of this programme is to promote research at the Masters level, including industry sponsored research.

### **MS-PhD Dual Degree**

The Department of Physics offers a MSc-PhD Dual Degree Programme. The admission is through JAM (Joint Admission Test to Master of Science), and the MSc students migrate to the PhD Programme after the completion of their MSc Programme.

### **MTech and PhD Joint Degree**

The Institute has initiated the award of additional Masters with PhD, whereby an additional MTech/MDes degree is awarded to students with the PhD degree subject to the fulfillment of certain specified academic requirements. This provision has been introduced for candidates who join the PhD programme directly after BTech/BS and other bachelors programmes.

The MTech, MDes, MS ®, and PhD students receive financial support through research/teaching assistantships.

### **RESEARCH ENVIRONMENT**

IIT Kanpur has demonstrated its excellence in research in many areas. To cite a few areas: Finite Element Methods Using Domain Decomposition, Flow Induced Vibrations, Wind Tunnel Testing of Large Scale Prototypes, Computational Chemistry, Nano-materials and Nanotechnology, Geometric Optimization of Large Organic Systems, Genomics and Bio-Informatics, Electronic Structure Calculations, Aggregation and Etching, Molecular Dynamics, Thin Film Dynamics, Optical / EM Field Calculations, Computational Fluid Dynamics and Heat Transfer, Computer Aided Design and Rapid Prototyping, Tomography, Robotics, Multi-Body Dynamics, Geo-seismic Prospecting, Stress Analysis and Composite Materials, Vibration and Control, Semiconductor Physics, Photonics, Neural Networks and Genetic Algorithms, Earthquake Engineering, Spin Fluctuations in Quantum Magnets, Quantum Computation and so on.

Some of the more recent research initiatives include Alternative Energy, 5G Telecom Technology, Real Time Data Transmission, Air Quality Monitoring Systems, Development of Indigenous Blockchain Platform,

Unmanned Aerial systems, Aerospace Materials, Biodegradable Materials, Aircraft Engine Combustion Design, Wind Turbine Design, Waste Water Treatment, Supramolecular Chemistry, Catalysis, Two Dimensional Materials, High Performance Computing, Corrosion, Himalayan Glaciers, Biomaterials, New Drug Delivery Systems and so on.

### **CONTINUING EDUCATION AND OUTREACH ACTIVITIES**

National Programme on Technology Enhanced Learning (NPTEL), a joint initiative of the MHRD, IITs and IISc Bangalore, has 121 of its 600 courses developed by the faculty members at IIT Kanpur. NPTEL Phase IV has proposed several new activities that are in tune with the Central Sector Scheme (CSS) of MHRD and are compliant with the Massive Open Online Courses (MOOC) initiative. It is expected that the CSS and MOOC compliant e-content under NPTEL IV will play an important role towards an affordable and high-quality online and open access education drive of MHRD. The mooKIT, which has been developed from ground up, is a lightweight MOOC management system with several innovations. It comes in multiple versions including an offline version where the MOOC can be distributed over SD cards. More than 20 MOOCs have been delivered on it and more than 2,00,000 students from around 100 countries have learnt from it. It is likely to be released in open source by December 2018. The broad aim of the project CSS-MOOCs is to facilitate the competitiveness of Indian Industry in the global markets by improving the quality and reach of education. The operational objective of CSS-MOOCs is to make high quality learning material available to students of different institutions across the country. The target group for this project consists of students and faculty members of institutions offering Undergraduate/Postgraduate education in India.

In 2017, NPTEL Chapter of IIT Kanpur supported Abdul Kalam Technical University (AKTU) by conducting a white listed course, Non-conventional Energy Resources, for more than 45,000 BTech Final Year students from 273 affiliated colleges.

Under MHRD's Swayam Prabha initiative of taking education Directly to Home (DTH), thirty-two DTH channels have been started out of which IIT Kanpur is currently managing two. These channels broadcast the NPTEL course content in Mechanical Engineering, Humanities and Social Sciences, and Management 24x7.

**Link:** <https://iitk.ac.in/dord/data/Annual-Report-2018-19/Convocation-Data.pdf>

## **RESEARCH AND DEVELOPMENT**

IIT Kanpur has registered steady growth in its research and development activities this year. The number of externally funded ongoing projects has reached 780 with a total sanctioned amount of Rs. 812.52 crore. During 2018

– 2019, the Institute received sanctions for 240 sponsored projects worth Rs. 158.74 crore and 125 consultancy projects of value Rs. 20.61 crore.

Some of the major grants sanctioned by various agencies during the year include Ministry of Human Resource Development (MHRD, 50 crore), Ministry of Communication and Information technology (MCIT, Rs. 38 crore), Science & Engineering Research Board (SERB, 20 crore), Department of Science & Technology (DST, Rs. 17 crore), National Security Council (MHRD, Rs. 12 Crore).

Some of the major industries which have funded projects this year include Gas Authority of India Limited, Uttar Pradesh Power Corporation Limited, GE India Private Limited, TATA Consultancy Services, and Larsen & Toubro.

During the year, 45 patents including 2 design patents

were filed, and 24 previously filed patents were granted, besides two technologies titled “School Bag Convertible to Study Table” and “Intelligent Tutor System” are getting licensed for commercialization.

Till date, 32 design patents and 463 Indian patents have been filed, out of which 86 patents have been granted so far. Altogether, 57 technologies have been licensed for commercialization.

A total of 61 companies are currently incubated at Startup Innovation and Incubation Centre (SIIC), IIT Kanpur and 60 have graduated so far.

**Link:** <https://iitk.ac.in/dord/data/Annual-Report-2018-19/Patents-filed-by-the-Faculty-during-the-FY-2018-19.pdf>

## OUTPUT STATUS OF MHRD PROJECTS

**Project Number:** MHRD /ME /2016408H. Imprint Project No. 7464

**Project Title:** Development of an Open Source Solidification/Melting Platform – OpenSol

**Project Investigator:** Arun K. Saha, Department of Mechanical Engineering, Indian Institute of Technology Kanpur, [aksaha@iitk.ac.in](mailto:aksaha@iitk.ac.in)

**Co-Investigator(s)/Collaborators (if any):**

- Arvind Kumar, Indian Institute of Technology Kanpur, [arvindkr@iitk.ac.in](mailto:arvindkr@iitk.ac.in)
- Amarendra K Singh, Indian Institute of Technology Kanpur, [amarendra@iitk.ac.in](mailto:amarendra@iitk.ac.in)
- Malay K Das, Indian Institute of Technology Kanpur, [mkdas@iitk.ac.in](mailto:mkdas@iitk.ac.in)
- S. Karagadde, Indian Institute of Technology Bombay, [s.karagadde@iitb.ac.in](mailto:s.karagadde@iitb.ac.in)
- Pradip Dutta, Indian Institute of Science Bangalore, [pradip@mecheng.iisc.ernet.in](mailto:pradip@mecheng.iisc.ernet.in)
- Anirban Bhattacharya, Indian Institute of Technology Bhubaneswar, [anirban@iitbbs.ac.in](mailto:anirban@iitbbs.ac.in)

Project Initiated on: February 15, 2017

### Project objectives

- Development of a computational platform, OpenSol, for simulating solidification-based manufacturing processes.
- Simulator validation with existing data and in-house experiments.
- Customization of the platform for shaped casting, continuous casting, arc welding, and crystal growth.
- Provision to link with thermodynamic models and lower length scale models.

### Progress report

- Development and validation of clear/porous media module with/without phase change

including natural/forced convection in both 2D and 3D geometries.

- Development of URANS based turbulence model module for free convective flow both in 2D and 3D geometry for various Prandtl numbers, demonstration for continuous casting.
- Development of pure metal phase change module, validation and devising numerical benchmarks.
- Development of binary alloy phase change module, validation and devising numerical benchmarks.
- Development of experiments to investigate solidification transport phenomena.
- Development of efficient methodologies for multi-component and mushy-region simulations and interface tracking
- Development of shrinkage module.

### Highlights

- Undertaken comprehensive simulator development program for transport phenomena in solidification-based manufacturing processes.
- Initiated multi-institute activities and close collaboration with industries.
- Active focus on human resource development.

**Project Number:** MHRD/AE/2018357 (UAY Proposal id: IITK\_002)

**Project Title:** Aircraft Engine Combustor Design For Improved Operability, Durability, Pattern Factor And Emissions

**Project Investigator:** Prof. Abhijit Kushari (AE/IITK)

**Co-Investigator(s)/Collaborators (if any):** Dr. V. K. Arghode (AE/IITK), Mr. Hiranya Nath (GE, India)

**Project Initiated on:** 29-11-2018



## Project objectives

1. Detailed diagnostics of aircraft engine combustor to understand mechanisms of emission formations at realistic combustor operating conditions. This would enable to improve the combustion technology to meet regulations and reduce impact on environment
2. Estimate the impact of the changes in dilution hole geometry on the combustor performance at representative operating conditions.
3. Develop design guidelines for optimum combustor design for military and civilian aero-engines.

## Progress report

Five compressors are to be used to compress the incoming air upto 15 bar. The compressed air will be settled in the settling chamber and the heated inside the heaters and furnace upto 315 °C. Then this heated air goes to the combustor. The PO for the compressors have been issued.

The combustion experiments are to be isolated from the environment by installing the combustor inside a 15mm thick pressure vessel. The pressure vessel has been designed in consultation with the industry partner. There will be three optical access windows to get the laser and camera access to perform optical measurements.

The initial design of the combustor section has been completed by the industry partner. The industry partner is to get the components manufactured and assembled and supply to IITK as “in Kind” contribution.

The heater is to be used to heat the compressed air upto 315 °C. The heater has been designed based on mutual discussions between the vendor, IITK and GE. Tender for the supply of heater has been floated.

Detailed discussions have been conducted with the industry partner and the OEM of the PIV/PLIF system to upgrade the system for HCHO PLIF. Based on that discussion, a tender document has been developed and floated.

## Highlights

- First of its kind high pressure multi-cup sector rig to capture cup-to-cup interaction
  - ✧ Full optical access for detailed measurement of velocity, temperature and species field
  - ✧ High pressure and high temperature
  - ✧ Development of one-of-its kind testing facility
- Swirl – Cup Interaction and Combustor- Dilution Interaction studies for better design data
- Availability of high fidelity design data and emission predictions

**Project Number:** IMPRINT 6840

**Project Title:** Development of a smartphone camera-based sensor for detection and remediation of chromium pollution in water

**Project Investigator:** Dr. Abhas Singh Indian Institute of Technology Kanpur abhas@iitk.ac.in

**Co-Investigator(s)/Collaborators (if any):**

Samuel Raj Kumar Akvo Development Tools and Services Pvt. Ltd., Delhiaadvaark@gmail.com

Rakesh Kumar Jaiswal Eco friends (NGO)

Dr Harald Weigand THM University of Applied Sciences

Dr. Tim Mansfeldt University of Cologne

**Project Initiated on:** 08.02.2017

## Project objectives

- To develop a simple, low-cost, robust, field-deployable smart-phone enabled colorimetric analyzer to reliably detect chromium contamination in water and avoid health risks.
  - ✧ To target mitigation of hexavalent chromium from polluted groundwater by developing a low-cost chromate removal process, employable at the individual household scale.
  - ✧ To make above technologies acceptable to affected stakeholders by enabling people participation in monitoring and treatment of polluted waters.

## Progress report

Objective 1 is complete. We have developed 100 prototypes that have been field-tested under diverse conditions, matrices and interferences in ground and surface water. Specifically, this device has a detection limit of ~10 ugL<sup>-1</sup> making it sensitive in the lower Cr(VI) concentration range (10-50 ugL<sup>-1</sup>) as well. Objective 2 is ~90% complete. A prototype for a household-scale low-cost filter for Cr(VI) removal from contaminated groundwater has been developed. Final trials are on to increase the batch volumes of the water it can treat without replacement. Objective 3 is ~50% complete. We have ensured community participation in monitoring and are about to deploy the filter to the site.

## Highlights

- Successfully developed and tested field-deployable smartphone-enabled 100 prototypes on groundwater and surface water contaminated with trace levels of Cr(VI)
- Prototype for a filter for Cr(VI) removal from groundwater using ferrous sulfate dosing and electrocoagulation has been developed. Trials underway for ensuring it is deployable at household-scale.
- A publication titled - A Smartphone-based portable and low-cost field monitoring tool for hexavalent chromium in groundwater- on highlight 1 is under review in a reputed journal. A conference paper on highlight 2 received the second best oral presentation award in a recently concluded Environmental Engineering conference at IIT Bombay

**Project Number:** DIC MHRD /AE /2016142D

**Project Title:** Design And Development Of High

Efficiency Wind Turbine for Household Applications

**Project Investigator:** Dr. Abhishek

**Co-Investigator(s)/Collaborators (if any):** Dr. Abhijit Kushari

**Project Initiated on:** 29-07-2016

### Project objectives

To carry out design and development of vertical axis wind turbine prototypes through wind tunnel testing and simulation for power generation of 500 W through wind tunnel testing and simulations.

### Progress report

Variable pitch vertical axis wind turbine (VAWT), allows the straight blades to pivot about quarter of aerofoil so as to vary the airflow angle to reduce the tendency of the turbine blade stay in stall and thereby improve the performance. The change in pitch of VAWT is achieved using four bar linkage. The research was executed in three steps: 1) an analytical model was developed for prediction of performance and fundamental understanding of parameters affecting the performance of the VAWT with dynamic blade pitch change, 2) the simulation was used to carry out design and fabrication of experimental prototypes for carrying out wind tunnel testing to evaluate the performance of the design, and 3) development of a fully functional optimized VAWT prototype for commercial application. The project accomplished the first two goals, further experiments were needed to optimize the design. These changes have been made and final wind tunnel tests are being prepared for.

### Highlights

- Wind tunnel tests were conducted using two different instrumented prototypes and effect of key design features were evaluated. Design of a braking mechanism essential for wind turbine protection was also studied.
- Functional wind turbine prototypes with high efficiency have been fabricated.
- New prototypes have been fabricated based on the wind tunnel studies and subsequent tests are planned in coming months to create the optimal prototype for commercialization.

**Project Number:** 2018363

**Project Title:** IMPRINT India Initiative

**Project Investigator:** Prof. A. K. Singh, IIT Kanpur

**Co-Investigator(s)/Collaborators (if any):** Prof. S. Ganesh, Dean R&D, IIT Kanpur

**Project Initiated on:** 1 October 2015 – 31 Dec 2018 (2015208); 31 Dec 2018 onwards (2018363)

### Project Objectives

IMPActing Research, INnovation and Technology is a national initiative to address and resolve various societal problems of our country. IMPRINT attempts to solve the various issues under the living world and the material world. IMPRINT creates roadmap to propose the education and research policy to synergize with the

national mission.

### Progress report

Through IMPRINT India Initiative, 2612 proposals were received, 259 proposals were accepted by the Apex committee after rigorous review by Domain Expert Committees (DECs) in three phases. Among 259, 142 proposals were financially closed with 50% matching grant from the partner Ministry/ Department/ Industries. Partners have released the fund for 122 projects among 142 till date. As a nodal institute IIT Kanpur issued consolidated UC/SEs to MHRD, Science and Engineering Research Board (SERB), Indian Council of Medical Research (ICMR), Urban Development, Heavy Industries (DHI), Health and Family Welfare, Department of Scientific and Industrial Research (DSIR), ISRO, Ministry of Power and DRDO.

### Highlights

- MHRD has released the grant for 142 projects for both the FY 2016-17 and 2017-18. The same has been disbursed to all the PIs to their respective institutions. MHRD has also released a partial fund for FY 2018-19.
- Ministry of Power, Steel, SERB, ICMR, HUPA and Textiles had released their 50% matching grant for both the FY 2016-17& FY 2017-18. The same had been disbursed to the PI Institutes. Ministry of Urban Development, ISRO, Road & Transport, Heavy Industries, (DSIR), DRDO, Ministry of Health & Family Welfare and Ministry of Agriculture had released the 50% grant for FY 2016-17 and in turn disbursed to the PI Institutes
- A review meeting for the evaluation of all 142 projects was held in IIT Delhi on August 25-27, 2018 in presence of the National Coordinator and Domain Experts. For regular update on various projects, a web-based knowledge portal was launched for IMPRINT I this year (<https://imprint-india.org/knowledge-portal>). An exhibition of important technologies being developed under IMPRINT-I and UAY, originally scheduled to be held during February 9-10, 2019, is now planned to be organized at IIT Delhi in the third week of July, 2019.

**Project Number:** IMPRINT Project No. 8073

**Project Title:** Low Cost Indoor Occupancy and Climate Monitoring System For Energy Conservation

**Project Investigator:** Anoop Singh

**Co-Investigator(s)/Collaborators (if any):** YN Singh

**Project Initiated on:** 09/02/2017

### Project objectives

To develop a cost-effective monitoring system using programmable hardware for remote monitoring of

indoor occupancy and climate to provide real-time periodic actionable information for operating Heating Ventilation and Air Conditioning (HVAC) plants to conserve energy. Developed system would also include an Energy Management System (EMS) portal for monitoring indoor climate and provide estimate of energy and cost saving potential.

### Progress report

The achievements so far include development and deployment of programmable hardware and an Energy Management System (EMS) portal for monitoring indoor climate at air-conditioned public spaces (classrooms, labs, meeting rooms etc.). Alternate hardware configuration using different sensors have been tested against the commercially available data loggers.

The dashboards developed under the EMS enable the operator, the supervisor and the management of the observed aberrations beyond the desirable temperature range. Analytics of the observed data enables the EMS to suggest optimal operation schedule so as to reduce electricity consumption and the associated cost. Daily, weekly as well as monthly reporting enables the supervisor and the managers to ensure that desired savings are achieved.

### Highlights

- Cost-effective deployable programmable hardware and energy management system (EMS) as a retrofit to the manual HVAC systems
- Identify potential for energy savings across the air-conditioned spaces, thereby bringing accountability and improvement in operational performance.
- Enable overall reduction in electricity demand through the identified energy saving potential

**Project Number:** MHRD /PHY /2018560

**Project Title:** Sparc: Topology, Interaction And Environmental Control Of Quantum Information Processing

**Project Investigator:** Arijit Kundu (Indian) and Anatoli Polovnikov (Foreign)

**Co-Investigator(s)/Collaborators (if any):** Amit Dutta (Indian), Alessandro De Martino (Foreign), Herb Fertig (Foreign)

**Project Initiated on:** 15/03/2019

### Project objectives

1. Topologically classifying (interacting) steady states out of equilibrium through density matrix and master equation-based approaches. Signatures of the topological nature in quantum transport and entanglement properties will be explored to uniquely identify them. Effects of impurity and noise in the system will also be considered.
2. Finding decoherence free channels in many-body quantum system will be studied. State-

preparation based on modern techniques such reinforcement learning techniques will be studied, especially, for systems far from equilibrium. Fate of different quantum information theoretic measures will be studied in open quantum systems.

3. For some specific systems of interest, Weyl and Dirac semimetals, nature of the ground-state for experimentally viable finite geometries (such as slab geometry and nano-wire) will be studied. Collective excitations, such as plasmon and spin-density waves will be studied to explore the effect of surface to surface and surface to bulk coupling.

### Progress report

The project started at the end of the financial year. So far basic planning for visits has been made. Some progress has been made on the objective, but realistic progress will be made in the next annual year.

### Highlights

- Topological properties of systems out of equilibrium
- Decoherence free channels in many-body quantum system
- Finite geometry Weyl/Dirac semimetals.

**Project Number:** IMPRINT 6714

**Project Title:** Haemostatic Bandage for Trauma Care

**Project Investigator:** Prof. Ashok Kumar Department of Biological Sciences and Bioengineering, Indian Institute of Technology Kanpur

**Co-Investigator(s)/Collaborators (if any):** Dr Deepak Agarwal Department of Neurosurgery, JPN Apex Trauma Centre, All India Institute of Medical Sciences, New Delhi

**Project Initiated on:** 01-04-2017

### Project objectives

1. Development of a ready to use and easy to handle polymeric haemostatic bandage by cryogelation technology
2. Incorporation of various haemostatic agents to the developed bandage to enhance its efficiency
3. In-vitro and in-vivo characterization of the bandage for haemostatic efficacy

### Progress report

Currently, we have completed the study of in-vitro and in-vivo (rat models) for the developed product and the experimental study showed that the combination of polymeric matrix incorporated with haemostatic agents had integrated the advantages of both materials and provided efficient hemorrhage control by multiple hemostasis performance. The fast and high fluid absorption of the developed matrix was conducive to





concentrate platelet and clotting factors, thereby shortening the time lag for initial thrombin generation and the time to peak thrombin generation. Further hemadsorption induced by desired polymer on the surface of polymeric matrix was able to lead to the aggregation of RBCs and the formation of the blood clot. However, before the developed product may be processed into a commercially viable product, the clinical evaluation has to be completed. So, the product will be tested for clinical trials at AIIMS, New Delhi. The material for clinical testing will be produced in GLP facility at IIT Kanpur and will be soon tested by the collaborator at AIIMS.

### Highlights

- The material has a high fluid absorption rate and rapidly stops excessive bleeding thereby prevents a frequent change of dressing at the wound site.
- The developed bandage is ready-to-use and can be applied at the injured site by the person himself or any first respondent, thus no need of the trained person.
- The fabricated bandage has antiseptic properties and high shelf life besides being cost effective.

**Project Number:** UAY IITK-006

**Project Title:** “Fabrication of new generation self-resorbing implants and devices from bioactive and biodegradable materials for orthopedic applications”.

**Project Investigator:** Dr. Ashok Kumar  
Department of Biological Sciences and Bioengineering,  
Indian Institute of Technology Kanpur

**Co-Investigator(s)/Collaborators (if any):**

Dr. Vivek Verma  
Department of Material Science and Engineering  
Indian Institute of Technology Kanpur  
Kanpur-208016, UP, India Industry Partner Co-Principal Investigator (Co-PI)

Dr. Gopal Pande (Ph.D) & Dr. K. Sudhir Reddy (MBBS, MS, FRCS)

Door No.-1-2-26/3/NR, Plot No. 1,2,3 Survey No. 127, Mck Block-2, Hydernagar, Hyderabad-500085, Telangana, INDIA

**Project Initiated on:** 01-05-2018

### Project objectives

- Developing and characterizing bulk and functionalized alloys using magnesium (Mg).
- Performing precision machining and moulding processes for shaping selected materials into implants such as pins, screws, scaffolds etc. for use in human orthopedic applications.
- In-vitro and in-vivo characterization of these materials for the bioefficacy and safety.

### Progress report

We have fabricated new series of Mg alloys by considering the biological benefits of Sr, Zr, Zn & Ca to achieve appropriate mechanical strength, corrosion resistance

maintaining their biocompatibility and biodegradability. High purity Mg and other metals (Sr, Zr, Zn & Ca) (99.9%) and used for alloying, by melting and gravity casting under a protective argon atmosphere. Melt was then casted into mold in controlled environment to maintain alloy properties. The developed materials are further characterized using physical (XRD, SEM, EDX), mechanical (Tensile, compressive, bending, fatigue, Hardness) and chemical (Weight loss, corrosive) assays. Further cell-material interactions are also evaluated for fabricated Mg alloys for testing biocompatibility. Main challenging task is to enhance the corrosion resistance by alloying or surface modifications is prerequisite to improve their surface stability and prevent toxic ions from releasing.

Cytotoxicity of pure Mg and alloys has been evaluated, it was observed that protein adsorption on its surface reduces the degradation rate of metal and formation of salts like Magnesium carbonate and Magnesium sulphate. Cytotoxicity of Mg and alloys will be further comprehensively evaluated using viable cells and in-vivo studies. Casted Mg alloys has been cut and shaped into dental screw, tibial plate & screw and femur nail to perform evaluation on implant prototypes.

### Highlights

1. Developed four different type of alloys of different composition like **MgZr2Sr**, **Mg5Zr**, **Mg4Zr2Sr** and **Mg5Zn0.3Ca** to control its degradation rate.
2. Characterization evaluating physical, mechanical and chemical properties has been explored.
3. Fabricated magnesium alloys implant prototypes like dental screws, tibial plate & screw and femur nail has been fabricated

**Project Number:** 5163

**Project Title:** In vivo testing and up-gradation of prototype optical probe for cervical and oral precancer detection

**Project Investigator:** Prof. Asima Pradhan, IIT Kanpur

**Co-Investigator(s)/Collaborators (if any):**

Dr. Pradeep Kumar K, IIT Kanpur  
Dr. Kiran Pandey, GSVM Medical College Kanpur  
Dr. Asha Agrawal, GSVM Medical College Kanpur  
Dr. S.K. Kanaujia, GSVM Medical College Kanpur

**Project Initiated on:** 27/02/2017

### Project objectives

To deliver compact and cost-effective devices for early detection of cervical and oral precancer.

1. In vivo testing of prototypes for detection of cervical and oral precancer.
2. Augmenting prototype by wireless control and cost-effective fibre optic probe.
3. Up-gradation of oral cancer probe to an imaging device.

### Progress report

1. In-vivo detection of cervical precancer is continuing with the existing probe in GSVM

Medical College Kanpur and AIIMS Bhubaneswar. 50 patients have been tested. Preliminary in-vivo analysis on 12 patients indicates the efficacy of the intrinsic fluorescence based device.

2. For making the probe user-friendly, the part for the automated motion of the probe is ready.
3. In-vivo detection of oral precancer is continuing with the in-house developed probe. 141 patients have been tested. Classification of different stages of cancer by various statistical techniques shows promising results.
4. Oral pre-cancer detection probe has been upgraded to an imaging device and 27 patients have been tested.
5. Development of fibre optic probe is continuing.

### Highlights

1. Oral cancer imaging probe made user-friendly through designing of toolbox
2. Cervical cancer detection probe automated for data acquisition through designing of automation box.
3. Photospimedx Private Limited, the company to aid in the product launch, incorporated under the Companies Act, 2013 of Ministry of Corporate Affairs, Government of India.

**Project Number:** UAY Project ID: IITK\_10

**Project Title:** Design and Development of Adaptive Intelligent Pipe Health Monitoring Robots for Fuel Transportation Systems

**Project Investigator:** Dr. Bishakh Bhattacharya  
Mechanical Engineering, IIT Kanpur,  
Kanpur 208016, Tel: +91-512-259-7824

**Co-Investigator(s)/Collaborators (if any):** Name - Dr. P. K. Panigrahi, Mechanical Engineering, IIT Kanpur,  
Kanpur 208016, Tel: +91-512-259-7686

**Project Initiated on:** 27th March, 2017

### Project objectives (50 words):

To design and develop an effective and economic pipeline health monitoring system based on smart sensor integrated crawler robots and efficient data communication.

### Progress report

1. Complex and straight pipeline testbed of 25m and 62m long respectively has been installed and instrumented.
2. Mechanical system of PHMR has been developed and also tested in the complex pipeline.
3. Three Smart sensors (GMR, Optical sensor and Touch sensor) have been identified and installed on the robot.
4. All sensors are working inside the pipeline and corresponding sensor data have been recorded along the length of the pipe.
5. Sensor integration with PHMR and optimization

of PCB are under progress.

6. To maintain the constant speed of the robot a novel passive speed control unit has been designed and the manufacturing of the same is under progress.

### Highlights

- Development of a Passive Energy Harvesting Pipe Crawling Robot.
- Incorporation of three different types of sensors (Magnetic- flux, Dynamic-strain and Optical) for damage detection.
- Wireless data communication with Graphical User Interface (GUI).

**Project Number:** SPARC/2018-2019/P1256/SL

**Project Title:** Development of a precise gravimetric geoid for mainland India using terrestrial, airborne and satellite gravity data

**Project Investigator:** Dr. Balaji Devaraju

**Co-Investigator(s)/Collaborators (if any):** Prof. B. Nagarajan (IITK), Prof. Onkar Dikshit (IITK), Prof. Will Featherstone (Curtin University, Australia), Dr. Sten Claessens (Curtin University, Australia)

**Project Initiated on:** March 15, 2019

### Project objectives

1. Develop a gravimetric geoid model for India.
2. Develop an optimal combination strategy for the heterogeneous gravity data.
3. Develop the first high resolution (1") terrain correction map of India.
4. Update CartoDEM using the developed geoid from this project to provide orthometric heights.

### Progress report

The SRTM and Cartodem for the whole India have been constructed from the individual tiles of size  $1^\circ \times 1^\circ$ . The global geopotential models (GGMs) have also been downloaded for the evaluation. However, procuring of gravity and GNSS/levelling data is in process.

Meanwhile, two papers have been accepted in International Geodesy and Geophysics Union General Assembly-2019. First, titled "A gravimetric geoid model for India: challenges and current status" and second, titled "A numerical approach to the mass-prism integration for fast determination of terrain corrections."

### Highlights

- All the data is available except gravity and GNSS/leveling data (which are in procurement stage).
- Methodology is developed for evaluating GGMs.
- Two papers are accepted in the IUGG General Assembly-2019 to be held in Montreal, Canada.

**Project Number:** MHRD /HSS /2016142S

**Project Title:** Development of assistive touch screen



based interface for children with dyslexia and dysgraphia

**Project Investigator:** Prof. Braj Bhushan

**Co-Investigator(s)/Collaborators (if any):** Dr. Alok Bajpai & Prof. Shatarupa Thakurta Roy

**Project Initiated on:** 05/05/2017

### Project objectives

We intend to create a touch screen based interface to assist children with dyslexia and dysgraphia in self-training as well as under supervision. The assistive device was planned for Hindi speaking children. The device should enable them to read on screen assisted through auditory feedback and manipulate finger movement to learn formation of words. Integrating auditory inputs with finger manipulation and visual outcome should help the child retrain their brain networks in identifying the geometric patterns called 'words'

### Progress report

The primary objective if this project was to develop assistive touch screen based interface for dyslexic children. At the first step, we contacted several schools in Kanpur and finally began working with 64 children from these three schools. Our focus was only on children studying in classes Ist to Vth. For the initial identification, we asked Hindi and English teachers to identify supposedly academically poor students compared to others in these classes. For the purpose of psychological assessment, we administered WISC-IV to measure verbal comprehension index and perceptual reasoning index in these 64 children. Thereafter, Dyslexia Screening Test-Junior was administered to screen them for dyslexia. Meanwhile, the assistive device was also developed and tested on this sample.

### Highlights

- Training module involving visual and auditory feedback.
- Putting haptic sensation and motor movement in loop to facilitate understanding of basic geometric shapes of Hindi letters.
- The assistive device is ready for testing on a large sample of dyslexic children for validation



**KIT**

### Knowledge Incubation for TEQIP

Importance of technical education in India cannot go unnoticed. More than 600000 engineers pass out every year. This massive technical manpower can play a major role in the development of technical sector of India. As TEQIP entered its phase III, it has evolved into a major support to these technical colleges of India. massive technical manpower and large scale technological

innovation. To achieve this, there is an immediate need for improvement in the quality of technical education in India. KIT aims to upscale the quality of technical education and support excellence of Institutions in its quality circle. Primary goal of KIT is dissemination of knowledge and know-how to teachers, researchers and students through short-courses, workshops, seminars and thematic conferences. To achieve this goal, for last few years KIT at IIT Kanpur has organized several workshops, online courses, short courses and internship programs with the aim of building a common platform where teachers and students of several TEQIP institutes can come together to discuss academics with experts from all over the world and exchange ideas on how to improve/make changes in the academic environment of their institutes so that a vibrant and productive academic ambience can be created.

### OBJECTIVES



### TYPES OF KIT ACTIVITIES



### 1. TEQIP Workshop on Modal Analysis: September 17-21, 2018

Modal analysis has a wide range of applications, from aerospace engineering to food technology and almost everything one can think of. This 5-day workshop aimed at introducing the science and practice of modal analysis as a technique to solve vibration related problems through rigorous theory and lab sessions. Teachers, students and people from industry attended this workshop. This workshop provided a comprehensive review of vibration theory with focus on the practical implementation of experimental modal analysis testing which widened participant's understanding of vibrations. Concepts of digital processing of measurements, excitation and measurement techniques, details and functioning of vibration measuring instruments and detailed analysis of measured data were the main focus of this workshop. There were 16 lab sessions planned in this event to



provide instructive guidelines for dynamic testing, selection/placement considerations of sensors and actuators, and for system identification using modal parameter extraction methods.

**Webpage:**<http://www.teqipitk.in/workshop/2018/modal-analysis/>

**Report:**<https://www.teqipitk.in/Reports/modal-analysis.pdf>

**2. International Conference on Advances in Textile Materials and Processes: November 19-20,2018**

To acknowledge the scope and opportunity in this field, Knowledge Incubation for TEQIP at IIT Kanpur in association with U.P Textile Technology Institute, Kanpur organized International conference on Advances in Textile Materials and Processes 2018. It aimed at bringing researchers, academicians, industry experts, and students from all over the world to share a common platform to present and share their recent/ongoing research, discuss technological advancements, and exchange valuable ideas on the future aspects and development in this field.

**Webpage:**<http://www.teqipitk.in/workshop/2018/international-conference-on-textile/>

**Report:**<https://www.teqipitk.in/Reports/ATMP%202018.pdf>

**3. Pedagogical Workshop on Complex Fluids and Geophysical flows: December 03-16, 2018**

Knowledge Incubation for TEQIP, IIT Kanpur organized a Pedagogical Workshop on Complex Fluids and Geophysical Flows. This was held during 03-17 December, 2018. Galaxy of international researchers in this area including Jim Jenkins from Cornell, Herbert Huppert from Cambridge, John Brady from Caltech and many more gave pedagogical lectures to graduate students and faculty on a variety of topics on complex fluids and geophysical flows in this event.

**Webpage:**<http://www.teqipitk.in/workshop/2018/pedagogical/>

**Report:**<https://www.teqipitk.in/Reports/pedagogical.pdf>

**4. Short Term TEQIP Course on Fundamentals and Characterization of Solar Cells: February 19-23, 2019**

Solar Energy is one of the most promising sources of energy to meet the increasing energy demand as well as for curtailing environment deterioration due to the use of fossil fuels. The direct conversion of solar energy to electricity is achieved by Solar Photovoltaics (PV), making it extremely attractive. India, blessed with abundant incident Solar Energy and many sunny days throughout the year. The course aims to deliver concepts related to solar Photovoltaics and will provide a hands-on experience through various lab sessions to the participants, especially the research students.

**Webpage:**<https://www.teqipitk.in/workshop/2018/fundamentals-of-solar-cells/#about>

**Report:**[https://www.teqipitk.in/Reports/FUNSOL\\_Report.pdf](https://www.teqipitk.in/Reports/FUNSOL_Report.pdf)



**Project Number:** MHRD /EE /2016142V

**Project Title:** Development of thunderbird plugin based Peer to peer client for messaging with support to peer groups to replace intra-institutional mailing load for communication among the students within courses.

**Project Investigator:** Yatindra Nath Singh

**Co-Investigator(s)/Collaborators (if any):** Brijesh Pande

**Project Initiated on:** 05.05.2017

**Project duration ended on:** 04.05.2019.

**Project objectives**

P2P client development for messaging system for replacing intra organizational mailing load.

**Progress report**

The design of P2P messaging has been done. The code was successfully implemented. The services like encrypted VoIP calling and SMS was implemented. It has been successfully tested. The code is available at <http://brihsvn.iitk.ac.in/repos/> Further, now P2P web and P2P resilient distributed file storage has been taken up now and trying to seeks funding from various sources to enable achieving the new targets and build a more sophisticated server-less services by formation of user clouds.

The current code is being taken by defense sponsored student for use in their units.

**Highlights**

1. Innovative algorithm of Chord-Tapestry hybrid for distributed indexing invented and then implemented in this system.
2. Encrypted VoIP system is build where the encryption key changes every 10 minutes.
3. Secure and digitally signed messaging system has been implemented.

**GIAN Courses completed in year 2018- 2019**

Numerical Modeling of Multiphase Flows
Fundamentals of Bio-inspired Robotics
Differential Geometry and PDEs
Deformation Theory of algebraic structures and Twisted algebraic structures
Microwave and THz Imaging of the Stratified Media for Industrial and Biomedical Applications

Crystal Structure Determination: Principle and Application
Laser Materials Processing: Fundamentals and Applications
Ultra-Wide Band Partial Discharge Detection in In-Service High Voltage Equipment
Failure of Materials
Autonomous Systems
Advanced Techniques and Methodologies of Big Data in Science and Engineering
Helicopter Rotor Dynamics and Design
Sketching As A Tool For Processing Big Data
Control of Fluids: Theory & Computation
Selected Topics in Internet of Things
Multi objective Optimization Using Metaheuristics
Sustainable urban planning using remote sensing and GIS
Re-inventing fly ash into near-whitened material for generating white polymer composites: Technological advancements
Mathematical Foundations of Cardiac Electro Physiology
Network Information Theory
Stochastic Programming and Applications
Moment Analysis For Contaminant Fate and Transport
Data Analytics for Operations Research
Geochemical Monitoring of Rivers – Theory, Practice, and Data Interpretation
Principle and Application of Ultrafast and Nonlinear Spectroscopy
Natural Language Processing and Big Data for Psycholinguistics.
Hepatic and Bone Tissue Development for Drug Metabolism and Tissue Engineering

**Project Number:**

**Project Title:** Global Initiative of Academic Networks (GIAN)

**Project Investigator:** Professor Debasis Kundu

**Co-Investigator(s)/Collaborators (if any):**

**Project objectives**

The Union Cabinet has approved a new program titled Global Initiative of Academic Networks (GIAN) in Higher Education aimed at tapping the talent pool of scientists and entrepreneurs, internationally to encourage their engagement with the institutes of Higher Education in India so as to augment the country's existing academic resources, accelerate the pace of quality reform, and elevate India's scientific and technological capacity to global excellence.

Main Objective: To arrange Guest Lectures by international renowned experts.

**Highlights:**

- We had 9 pending courses approved in 2018-19.
- 25 courses have been completed. One is scheduled to be

organized in this year.

**Project Number:** MHRD/MET/2014258

**Project Title:** Virtual Lab – Phase II

**Project Investigator:** Kantesh Balani

**Co-Investigator(s)/Collaborators (if any):** none

**Project Initiated on:** 07-11-2014

**Project objectives**

In the Phase-II of Virtual Lab, idea is to make all the developed labs into an open source repository that is available to community/academic institutes, whether in India or abroad, for use and development. The idea is now to convert all the licensed content into a platform that is independent of any licensed software. Further, a target of creating nodal centers and achieve a target participation of 54,000 users in the current year.

**Progress report**

A user count of over 1 lakh is already obtained just from conducting the workshops till May 2019 (against a commitment of ~ 64,000 user counts). A total of 56 workshops have been conducted, which, again, exceeds the committed workshops of 48. A total of 56 nodal centers have been created with affiliation to IIT Kanpur. The objectives of the project are satisfied, but an effort towards stronger outreach is being attempted. An attempt is being made to recruit colleges/schools in the region of Bihar, and Uttarakhand.

Seeing its past success, a grand virtual lab workshop is being planned at IIT Kanpur sometime in Sept. 2019. This event is being organized to coincide the initiation of IIT Kanpur's Diamond jubilee celebrations.

**Highlights**

- Over 15 workshops were conducted between Apr. 2018-Mar. 2019
- Over 15 new nodal centers have been recruited at IIT Kanpur
- Have exceeded the committed user count and outreach activities.

**Project Number:** MHRD/MET/2016142E

**Project Title:** Layered steel for structural application

**Project Investigator:** Kallol Mondal

**Co-Investigator(s)/Collaborators (if any):** Prof. S. Sangal, Prof. S. Shekhar

**Project Initiated on:** 06/07/2017

**Project objectives**

1. Making of high toughness layered steels similar to Wootz steel with high wear and blunting resistant
2. Designing the stacking of different layers and processing to make seamless steel plates
3. Designing suitable combination of materials to impart optimum combination of strength, wear resistance and corrosion resistance

- Application analysis of these layered steels into making cutting tools and machine tools and structural application

### Progress report

- We have successfully made strong and tough layered steel with 128 layers with varying composition in each layer.
- We could successfully incorporate Cr powder layer in between two steel layer.
- Knives are made from these layered steel.
- Now wear and corrosion behavior as well as anti-blunting effect of the knife edges are being studied.



### Highlights

- We have made a product out our project. It needs farther support to take it to the market.
- It has yielded two Master Thesis:
  - Thesis: 2012 (BT-MT): Development of multi-layered steels with variable compositions – by V. Rama Satya Sandilya (Co-supervisor: Prof. S. Sangal)
  - 2016: Development of Multilayered Steel Composite and the Effect of Heat Treatment on Mechanical Properties – by Animesh Dutta (Co-supervisor: Prof. S. S. Singh)
- We have filed one patent on the process of making layer steel and published one paper in an reputed International Journal

### Patent:

Rama Satya Sandilya V, S. Sangal, S. Shekhar, K.Mondal, Harmonic Multilayered Steel with Variable Composition Patent \_led (2017) (Patent Application number: 201711017031)

### Paper:

Rama Satya Sandilya V., S. Shekhar, S. Sangal and K. Mondal (2018), A novel method for fabricating multi-layered steels, J. Mater. Process. Tech., vol 254, 38-51.

## Imprint project on High Strength, Wear and Corrosion Resistant Steel for High Speed Rail and Elastic Clip

**Project Number:** MHRD/MET/2016408J

**Project Title:** High Strength, Wear and Corrosion Resistant Steel for High Speed Rail and Elastic Clip

**Project Investigator:** Kallol Mondal

**Co-Investigator(s)/Collaborators (if any):**

Prof. Sandeep Sangal

Indian Institute of Technology Kanpur

Prof. C.S. Upadhyaya

Indian Institute of Technology Kanpur

Prof. Shashank Shekhar

Indian Institute of Technology Kanpur

Prof. Satyam Suwas

Indian Institute of Science Bangalore

Prof. Chandan Srivastava

Indian Institute of Science Bangalore

Prof. Sankaran

Indian Institute of Technology Madras

Prof. Somnath Bhattacharya

Indian Institute of Technology Madras

**Project Initiated on:** 20/02/2017

### Project objectives

We envisage integrated development of cost effective steels with control of composition, microstructures, processes and design of the final load bearing components, rails and elastic rail clips. It mainly caters to the improvement of strength, fracture toughness, wear and corrosion resistance of the above components.

### Progress report

- Calculation and design of composition for new bainitic rail and clip are done. Seven steels have been prepared. Clip steel has been finalized and talks are going on with Indian Railways to implement the steel into clip making.
- Property enhancement of the existing rail clip by making them lower bainitic structures.
- Better wear, corrosion and crevice corrosion resistance have been observed in the modified clip steels
- High strength nano-pearlitic steels have been produced from one of the steel compositions.

### Highlights

- One patent has been sent out for filing on the steels for clip making. (Title: A High Strength Bainitic Spring Steel for Elastic Rail Clip).
- The project has yielded one master thesis (and one PhD student is now on very advanced stage of PhD. A total of four journal papers are on preparation.
- Major output: One of the steels compositions has



been decided to make clips for Indian Railways. Serious talks are going on with Indian Railways. This steel has shown excellent mechanical properties and corrosion resistance much better than the existing clip. We shall make ~100 clips for advanced tests for actual implementation.

**Project Number:** Imprint 6134 (MHRD /ME /2016408I)

**Project Title:** 'Hierarchically Structured Micro-Nano Pore Nanocomposite Membrane made of Ferric-Oxide Decorated-Titania-Activated-Carbon-Flyash in Carbonized Epoxy Resin as Versatile Filters for Water Purifications: Removal of Organic-Dyes-Heavy- Metals-Microbial-Pathogens'

**Project Investigator:** Kamal K. Kar

**Co-Investigator(s)/Collaborators:** Malay K. Das (ME), IIT-Kanpur, Niraj Sinha (ME), IIT- Kanpur, Jaleel Akhtar (EE), IIT-Kanpur, M. Balasubramanian IIT-Madras, Praly Maiti, IIT- BHU, Pradip Paik, Uni Hyderabad, Ravisankar, IITG, I Singh, IIT-Rookee, P. Agnihotri, IIT-Ropar, A. Bhowmick, IIT-Kharagpur

**Project Initiated on:** 15-02-2017

#### **Project objectives:**

Processing cost of water is to be reduced from 10 paise to 9 paise per liter Specification: -Pollutant content in the purified water should be less than the critical limit suggested by the WHO standards or Indian Standards. - For example: pH-6.5- 8.5, Hardness- 0-75, Mercury: 1.0 $\mu\text{g/L}$ , Iron: 0.3 mg/L, Arsenic: 10.0  $\mu\text{g/L}$ , Lead: 10.0 $\mu\text{g/L}$ , Fluoride: 1.5 mg/L, Pesticide (total): 0.50 $\mu\text{g/L}$ , Pathogen: (not mentioned), etc

#### **Progress report:**

Synthesis and characterization of Zn, Mn co-doped TiO<sub>2</sub> nanoparticles photocatalyst have been made. The Zn, Mn co-doped TiO<sub>2</sub> are synthesized by the sol- gel method in five different (0, 0.5, 1.0, 1.5, 2.0 at.%) varying ratios. The structural characterization are carried out with XRD, Raman, SEM, TEM, EDX, XPS and FTIR, where XRD results confirm that with increasing doping content the crystalline size of TiO<sub>2</sub> decreases. The optical characterization is performed with UV-vis spectroscopy, revealing that the band gap of TiO<sub>2</sub> reduces with enhancing doping content. The photocatalytic activity of synthesized co-doped TiO<sub>2</sub> is evaluated with the degradation of methylene blue dye, an organic pollutant, under UV and visible irradiation both, where compared to others, 1.0 at.% Zn, Mn co-doped TiO<sub>2</sub> reveals the highest photocatalytic activity. The photocatalytic activity is further improved by modifying the nanostructure of TiO<sub>2</sub>. Synthesis of Zn, Mn co-doped TiO<sub>2</sub> spherical nanoparticles and nanorods, synthesized by solvothermal and hydrothermal techniques, respectively. In addition, Zn doped TiO<sub>2</sub> nanotubes are also prepared by anodizing the metallic titanium (Ti) foil in presence of fluoride-based electrolyte. The polymorphic phase in TiO<sub>2</sub> leads to the formation of heterojunction structure, which separates the charge carriers efficiently and therefore improves the photocatalytic properties of TiO<sub>2</sub>. To make

TiO<sub>2</sub> suitable for the removal of both, inorganic and organic impurities from water with ease of separation, the fabrication of nanocomposite of TiO<sub>2</sub> with carbon-based materials synthesized by simple solvothermal and pyrolysis techniques is studied. The TiO<sub>2</sub>/activated carbon (AC)/epoxy (CE) nanocomposite are synthesized by pyrolysis of AC at temperatures ranging between 200 and 400 °C. The adsorption results are examined by atomic adsorption spectroscopy, which shows that the synthesized nanocomposite adsorbs 97% of the heavy metals impurities. As the carbon structure, especially graphene has shown a great potential towards pollutants adsorption, the photocatalytic and adsorption capabilities of TiO<sub>2</sub> are investigated by making its composite with graphene oxide (GO) and ferric oxide (Fe<sub>3</sub>O<sub>4</sub>) Here, binary and ternary nanocomposite of TiO<sub>2</sub> with GO and Fe<sub>3</sub>O<sub>4</sub> are synthesized by simple wet chemical process and examined for the adsorption of As(III) and degradation of methylene blue from the water. The degradation and adsorption results reveal that compared to binary, the ternary nanocomposite shows excellent adsorption and degradation properties. The enhanced properties of ternary nanocomposite are attributed to the synergistic effect, established between adsorption and catalytic properties. Further, as the synthesis of TiO<sub>2</sub> photocatalyst and composites are not very much economical and environmentally friendly due to the complex processes adopted to synthesize them, new interest has generated towards the development of low cost adsorbent materials from natural materials. Thus, fabrication of multi doped (N-, O- and S) carbon (MCF) adsorbent by using the chicken feather fibers (CFF), a protein-rich natural biomass is made. It has been shown that presence of different surface functionalities onto the MCF significantly alters the adsorption activity significantly and MCF-6, which was synthesized at 600 °C, provides the highest adsorption capacity of 168.9 mg/g for methylene blue.

#### **Highlights:**

- Titania having different morphology of tube, rod and powders have been made to make membrane
- Activated carbon is made from feather fiber (bio waste), free of cost
- Degradation efficiency of organic dyes, methylene blue is ~ 80%, which is equivalent to the reported value
- Visible light degradation efficiency is ~75%, which is much higher than reported values
- Hierarchically structured membrane having micro-nano pores

**Project Number:** MHRD/MET/2018064

**Project Title:** Virtual Lab – Phase III

**Project Investigator:** Kantesh Balani

**Co-Investigator(s)/Collaborators (if any):** none

**Project Initiated on:** 25-04-2018

#### **Project objectives**

Main objective of Virtual Lab Phase III is to plug-in the gaps where the experiments are required in the repository of Virtual Labs.

### Progress report

The mandate was to develop 23 labs in the period of two years, and also extend outreach activities. So, in total over 57 workshops have been conducted and around 56 nodal centers have joined hands (against the targeted numbers of 24 and 48, respectively). Thus, Virtual Lab project at IIT Kanpur has exceeded its commitment. In addition, against the mandate of developing 23 new experiments, IIT Kanpur has proposed to the tune of 30 experiments, out of which 10 are already approved and other 20 are under review (or provisionally approved). Thus, again, around 25 experiments are being anticipated from IIT Kanpur.

Also, a boot-camp is being planned for making new v-labs sometime in July 2019 at REC Banda (one of the nodal centers affiliated to IIT Kanpur).

### Highlights

- Mandated 23 experiments have been proposed
- Outreach to colleges and schools is exceeding the commitment
- Colleges are heartily accepting the concept of virtual labs

### Fog Visibility Enhancement

MHRD/EE/2016142Y] **PI:** K S Venkatesh

**Email address:** [venkats@iitk.ac.in](mailto:venkats@iitk.ac.in)

**DIC Project Title** Fog Visibility Enhancement

**Project no & Project Investigator:**

MHRD/EE/2016142Y; K S Venkatesh

**Project Sanctioned Amount (in Lakhs)**

Rupees fifteen lakhs only

**Grant Received so far (in Lakhs)**

Rupees Eight lakhs only.

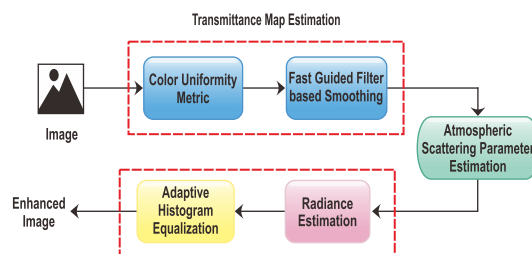
**Deliverable as per Project Proposal**

A software system for the enhancement of visibility in fog that can work in real time, or near real time.

**Achievement against Deliverable**

We have developed a real time system that can enhance the visibility of an imaging device in presence of haze. The system not only preserves the color information of the scene, but also can be used in near infra-red (NIR) imaging with further work, if supported.

**Product Developed (with brief description along with high resolution picture/schematics)**



**Fig: Block diagram of the developed algorithm**

Dehazing is a typical image enhancement technique. Image enhancement is a basic pre-processing step in different applications that require visual input. Hazing process is usually modelled as sum of contributions from scattered light component and scene component. The scattered light component induces haze in the scene. Thus, in other words, Hazing and fogging introduces a tint to the image of a scene. A tint can be explained as an addition of white light which varies in intensity across the image. And this intensity variation depends on how far the object lies from the camera. To tackle this issue of non-uniform tint across the image, the team applied a Color Uniformity Principle (CUP). CUP is asymptotic behavior of texture with respect to distance. Utilizing this asymptotic behavior, we estimate the transmission map which corresponds to visibility range of the scene. Utilizing estimated transmission map, scattered light component is estimated, which eventually leads to recovery of the scene. Enhancement of the scene is done in transformed color space such that the real colors present in the scene do not get affected. Figure shows some examples of such recovery utilizing proposed method.

Along with this enhancement algorithm, the developed solution can enhance the visibility of any imaging device significantly in real-time. The solution requires very limited computational resources to execute the task.

**Patent filed / granted**

**2 patents filed.**

1. METHOD AND SYSTEM FOR EXPANSION OF VISIBILITY RANGE OF AN IMAGE (*filing No. 201611011684*).
2. METHOD AND SYSTEM FOR DEHAZING VIDEOS AND IMAGES IN REAL-TIME (*filing No. 201811027075*).

**Publications**

1. Kumar, Himanshu, et al. "Design of smart video

- surveillance system for indoor and outdoor scenes." Digital Signal Processing (DSP), 2017 22nd International Conference on. IEEE, 2017.
- Nawal, Megha, Saumik Bhattacharya, and K. S. Venkatesh. "Improved scene capture in unfavorable lighting conditions." Image Processing (ICIP), 2017 IEEE International Conference on. IEEE, 2017.
  - Bhattacharya, Saumik, Sumana Gupta, and K. S. Venkatesh. "Dehazing of color image using stochastic enhancement." Image Processing (ICIP), 2016 IEEE International Conference on. IEEE, 2016.

#### List of Students Engaged (Mtech/Phd/MDes Thesis) (Ongoing/Published)

- Saumik Bhattacharya, Ph.D. (completed)
- Himanshu Kumar, Ph.D. (nearly completed)

#### List of Project Staff Engaged

- Siddharth J Singh
- Abhishek Pathak
- Nandani Roma
- Rajesh Bhatt

#### Facility created with list of Equipment, picture with title)

The actual development of the system required a considerable amount of experimentation and measurement and data collection under suitable atmospheric conditions. The theoretical formulation was developed and fine tuned on the basis of the experiments.

In its final form, the entire system was implemented in software, and can be run on any platform with suitable operating software loaded along with requisite code libraries like OpenCV. A picture of the current installation is shown below.



Equipment showing single comparative video frame with original view and view after applying the visibility enhancement. It is seen that the clarity of the view is increased tremendously by the process.

#### Exhibition of Results

Results of performance on both still images and videos can be found in the following link:

<https://drive.google.com/open?id=1f1jP8LPERLvKgxGZF44hYupPdkGphst5>

#### Itemized head expense (Consumable) in Rs.

1. Contingency:	3,48,342
2. Salary:	4,46,900
3. Others:	36,000
<b>Total:</b>	<b>8,31,242</b>

#### Itemized head expense (Non-Consumable) in Rs.

Rs.5,77,019

#### Business Plan

- Planning to develop and launch an Android app that can work in real-time to enhance visibility.
- Discussing with different organizations to develop solutions for automobiles and railway.

#### Any other achievement

Benefit and end results of the algorithm have been recently published by several national newspapers.

- <https://www.amarujala.com/uttar-pradesh/kanpur/iit-kanpur-created-real-time-dehazing-method>
- <http://newsonweb.in/?p=715>
- <https://m.dailyhunt.in/news/india/english/edexlive-e-paper-edex/iit+kanpur+students+develop+a+real+time+dehazing+method+that+allows+increased+visibility+in+foggy+weather-newsid-95688540>
- <https://www.jagran.com/uttar-pradesh/kanpur-city-now-the-fog-will-not-slow-the-speed-of-trains-also-run-in-zero-visibility-18377650.html>

#### Conclusion

As may be seen, the results of dehazing are quite positive for many images in terms of enhanced visibility. In a smaller number of images, the results may be said to be spectacular. Enhanced visibility results from improved spatial detail as well as improved color rendition. Both these are known to improve the speed of object detection for the human observer, giving more time for reacting in dynamic situations such as high speed traffic, or for taking appropriate action while taking off or landing an aircraft on the runway under foggy conditions, or allowing a railway pilot to operate at a higher speed in fog.

To the best of our knowledge, the results presented here are the cutting edge of defogging results available anywhere in the world, and meet or exceed any competing results reported in the literature. This dehazing system completely leverages in-house research accomplishments of the Computer Vision Lab IIT Kanpur in local enhancement such as the color uniformity principle, and are not based on theoretical results developed elsewhere. A few sample images are included below.







**Project Number:** DIC 2016142W

**Project Title:** BENEFICIAL UTILIZATION OF SUSTAINABLE INDUSTRIAL WASTE FOR THE DEVELOPMENT OF SELF-COMPACTING CEMENT BASED PRECAST PANELS

**Project Investigator:** Dr. K.V. Harish

**Co-Investigator(s)/Collaborators (if any):** Dr. Sudhir Mishra

**Project Initiated on:** Sep. 2017

### Project objectives

The main aim of the study is to develop a prototype specimen model (i.e., precast panels of dimension ~400 x 400 mm in plan) made of high strength self-compacting cement based composites produced using sustainable and environmentally friendly materials that can be economically produced for structural and other precast applications.

### Progress report

Results from the investigation suggested that supplementary cementing materials (SCMs) from Portland Pozzolana cement (PPC) can be used for developing complicated sections such as I-section, however, significant strength reduction of I-section was observed compared to that of equivalent cube. SCM specimens with 2% fiber addition showed higher ultimate strength, with toughness and impact energy several times higher than the respective specimens without fibers. The shear bond strength of SCM made from PPC showed higher strength than mixtures made with Ordinary Portland Cement (OPC) or OPC+silica fume blend. In addition, conventional beams made with a part layer of SCM containing PPC provided higher ultimate strength and strains compared to beams made with a part layer of OPC.

### Highlights

- The use of sustainable materials such as fly ash has the potential to improve the properties of

composites to be used for pre-cast applications

- Steel microfibers have proved to be promising for high impact applications
- The optimization of thermal curing has been achieved to understand the performance of sustainable materials

**Project Number:** MHRD/CHM/2016408T (IMPRINT Proj No.-6966)

**Project Title:** A Smartphone-Based Dark-Field Microscope for Point of Care(POC) Diagnosis of Blood-Cell Disorders in Lethal Diseases

**Project Investigator:** Dr. Manabendra Chandra

**Co-Investigator(s)/Collaborators (if any):**

Dr. Anindita Gayen, Dept of Chemistry, IIT Kanpur, agayen@iitk.ac.in

Dr. Manish Kulkarni, Nanoscience Center, IIT Kanpur manishm@iitk.ac.in

Dr. Raju K Gupta, Chem. Engg., IIT Kanpur, guptark@iitk.ac.in

Dr. Tanmoy Maiti, MSE, IIT Kanpur tmaiti@iitk.ac.in

Dr. Arnab Bhattacharya Computer Sci. Engg. IIT Kanpur arnabb@iitk.ac.in

Dr. S. Matheshwaran, BSBE, IIT Kanpur saran@iitk.ac.in

Dr. Sutapa Mondal, Health Center, IIT Kanpur sutapa@iitk.ac.in

**Project Initiated on:** 15-03-2017

### Project objectives

Our objective is to develop an optical microscopy-based smartphone attachment for accurate, quantitative and rapid diagnosis of human-blood samples. The proposed device will have resolution comparable to high-end laboratory microscopes and can detect abnormalities in number, size, shape, color-intensity of blood cells, and presence of target cells, fungi & parasites.

### Progress report

We have already built prototypes of the hardware part of the proposed optical attachment. To be specific, one bright field based microscope attachment and one dark-field based microscope attachment for smartphone camera have been developed. Using a smartphone camera coupled to these develop microscope attachment we can now image even small objects like platelets with clarity nearly as good as a table top optical microscope. We have also designed and fabricated a microfluidic-based slide that will allow a prick volume of blood sample to be channeled to the detection area.

### Highlights

- Bright-field based microscope attachment has been developed
- Dark-field based microscope attachment has been developed
- We have achieved the targeted image magnification and resolution; however, need to improve the flatness of field (plan correction)

**Project Number:** DIC 2016142B

**Project Title:** Multi- Electrode Electroporator Prototype for In vitro Electro-Chemo/Drug-Therapy(ECT / EDT) testing

**Project Investigator:** Manish M Kulkarni

**Co-Investigator(s)/Collaborators (if any):**Prabhat K Dwivedi, E-Spin Nanotech Pvt. Ltd (Industrial partner)

**Project Initiated on:**11-Jul-2016

### Project objectives

To develop a multi-electrode electroporation system with a design to be frequently used for in vitro cellular experiments (electro chemotherapy, gene electro chemotherapy, electro fusion, electro insertion etc.).

### Progress report

Designed and tested a printed circuit board (PCB) with the dimensions of the cover of the 24 well microplate on a single layer of FR4 material (PCB) plate. The plate was optimized by altering various parameters like inter-electrode spacing and electrode design i.e. in series and parallel. Hollow stainless steel electrodes were connected to the PCB via connectors. Both single cell and multiple cell testing platforms were tested in parallel as an initial platform using gram negative and positive bacterial cells. For S aureus cultures, we observed preferential PI uptake start rising when the voltage reaches 15V. At 30 V we observed an extensive S Aureus cell death, validating the design of setup.

### Highlights

- Designed and tested a printed circuit board (PCB) with the dimensions of the cover of the 24 well microplate on a single layer of FR4 material (PCB) plate
- Both single cell and multiple cell testing platforms were tested in parallel as an initial platform using gram negative and positive bacterial cells
- This prototype developed provides compliance to run experiments without any interventions and with versatile experimental designs (i.e. at variable concentrations and electric voltages)

**Project Number:** IMPRINT 5509

**Project Title:** Structure integrated sensors and actuators to monitor and renew machine tool performance

**Project Investigator:** Mohit Law, IIT Kanpur

**Co-Investigator(s):** Bishakh Bhattacharya, IIT Kanpur; Suparno Mukhopadhyay, IIT Kanpur, Abhijit Ganguli, IIT Tirupati

**Project Initiated on:** March 2019

### Project objectives

Main objectives are to monitor and improve machine tool operational performance by 100% using structure integrated sensors and actuators. Specifically, we will:

- Carry out in-process system identification to parameterize machine's dynamics
- Characterize machine performance with actuators

and dampers

- Indigenously develop new high-performance actuators and dampers
- Develop a hardware-in-the-loop simulator

### Progress report

- Two new actuators, an electro-hydraulic (EHE) and an electro-magnetic (EME) one have been developed. EHE and EME are being experimentally characterized before modifying them into dampers.
- A novel hardware-in-the-loop (HiL) mechatronic simulator that offers a new paradigm for investigations on chatter has been developed. Several active damping strategies were tested on the HiL and a ~75% improvement in damping was shown possible. The HiL is being extended for milling.
- An actuator and a small damper were integrated with a small machine tool to excite, sense and damp machine tool vibrations. A ~70% improvement in damping was experimentally demonstrated.

### Highlights

- The new electro-hydraulic actuator developed through this project has specifications better than any of those available commercially.
- The novel hardware-in-the-loop (HiL) mechatronic simulator developed through this project is the first of its kind in the country.
- Preliminary investigations with active damping on the HiL and on small machine show that it is possible to damp machine tool vibrations by up to ~75%, thereby paving the way for planned actual implementation on real machines to improve their operational performance by 100%, as targeted.

**Project Number:** SPARC MHRD /PHY /2018541

**Project Title:** Observation and Phenomenology of Ultra High Energy Cosmic Ray Neutrinos and at ANITA, ARA and ARIANNA and Other Detectors

**Project Investigator:** Pankaj Jain

**Co-Investigator(s)/Collaborators (if any):** Dave Besson (Univ. of Kansas), Sukanta Panda (IISER Bhopal), Danny Marfatia (Univ. of Hawaii)

**Project Initiated on:** 15-03-2019

### Project objectives

To simulate the reflection and refraction of radio pulses, generated by collisions of ultra high energy cosmic rays neutrinos with atmospheric and ice nuclei, from the Antarctica ice-air or ice-water interface using a recently developed technique termed local plane wave approximation and create a general simulation package. This can be used by experiments such as ANITA which aim to detect ultra high energy cosmic neutrinos.

### Progress report



The basic technique for reflection of spherical electromagnetic waves from curved surfaces has been developed. We are in the process of generalizing it to the case in which the detailed topographic information about the Earth's surface profile is available. We plan to use this information in order to reliably determine the incident pulse profile from the observed pulse. This will allow a more refined determination of the primary cosmic ray properties. We have already found that such a treatment provides a reasonable explanation of the observed mystery events by the ANITA detector. The doctoral student, Ms. Paramita Dasgupta, who have developed this procedure plans to visit our collaborators at the University of Kansas in order to implement this program. We also plan to run a two week course on Cosmic Neutrino Observations at Ultra High Energy towards the end of the current year. For this purpose the Co-PI, Prof. Dave Besson from University of Kansas plans to visit us.

### Highlights

- Development of a complete package to interpret the observed reflected radio wave pulses at ANITA.
- Explanation of the mystery events observed at ANITA.
- A reliable extraction of the primary cosmic ray properties using our developed package.

**Project Number:** IITK number: MHRD/CELT/16408AC (IMPRINT no. 4194)

**Project Title:** Optical coatings for high-reflection and anti-reflection applications

**Project Investigator:** Prof. R. Vijaya, IIT Kanpur

**Co-Investigator(s)/Collaborators (if any):** Nil

**Project Initiated on:** 9th May 2017

### Project objectives

(1) To design, fabricate and prototype infra-red (IR) protection optics for users of IR lasers in combat and non-combat operations.

(2) To fabricate and prototype (i) high-reflection coatings for research applications, (ii) anti-reflection coatings for night-time imaging applications in Defense, and (iii) coatings for IR lenses at user-specified wavelength range.

### Progress report

- Fully in-house design, fabrication and characterization
- Research work on quality testing through laser damage threshold measurement, excitation of Tamm plasmon on high-reflection optics and flexible substrate coating.
- All work carried out using the existing RF Magnetron sputtering system.
- One research paper published.
- High-reflection, anti-reflection, and selective-reflection coatings available.
- Ultra-wideband reflectors
- Coatings for IR lenses at any chosen wavelength

- Designs for narrow-band filters in reflection and transmission
- Nanostructured surfaces as top layer for improving the efficiency of solar cells
- Few layer designs, flexible/hard substrates, coatings for silicon devices

### Highlights

- Reflection lowered to 1.9% at 750 nm and 0.9% at 850 nm (IR) on NBK-7 lens for night-time imaging applications.
- Highest reflection of 99.9% at 600 nm on quartz and silicon substrates.
- Very-few layer designs; flexible/hard substrate coatings; silicon device coatings.

**Project Number:** UAY IITK\_004

**Project Title:** UAY: Engineering of security hardened cryptographic protocols for critical national infrastructure

**Project Investigator:** Sandeep Shukla, Manindra Agarwal (IITK)

**Co-Investigator(s)/Collaborators (if any):** Manish Bajpai (Nivetti Systems Pvt. Ltd)

**Project Initiated on:** 12th December 2016

### Project objectives

In network applications, the management of security features involves processing of cryptography algorithm. Major server processing cycles are exhausted in solving for cryptographic functions. To delegate the workload and to speed up the throughput, the processing chain is augmented with a hardware accelerator. The board we developed for this purpose has been named as "Kryptoceler".

### Progress report

Product and IP development Status: The 1st version of the board along with the firmware implementation is completed. Currently testing, debugging and client-side development is undergoing.

Patent Filing under process: Kryptoceler: A generic hardware framework for acceleration of cryptographic operations.

### Publication:

1. Mohamed Asan Basiri M and Sandeep K. Shukla, "Asynchronous Hardware Implementations for Crypto Primitives", Microprocessors and Microsystems, Elsevier, vol. 64, pp. 221-236, Feb. 2019.
2. Mohamed Asan Basiri M and Sandeep K. Shukla, "Low Power Hardware Implementations for Network Packet Processing Elements", Integration, the VLSI Journal, Elsevier, vol. 62, pp. 170-181, Mar. 2018.
3. Mohamed Asan Basiri M and Sandeep K. Shukla,



“Flexible VLSI Architectures for Galois Field Multipliers”, Integration, the VLSI Journal, Elsevier, vol. 59, pp. 109-124. Sept. 2017.

4. "Buffer Overflow Attack and Prevention for an FPGA Based Soft-Processor System", Chamandeep Singh, Sripadam Satish, Jubin Mitra, Sandeep Shukla, Innovations in Electronics and Communication Engineering - Proceedings of the 7th ICIECE 2018 - Lecture Notes in Networks and Systems, Springer
5. Mohamed Asan Basiri M and Sandeep K. Shukla, "Formal Hardware Verification of InfoSec Primitives", accepted at IEEE Computer Society Annual Symposium on VLSI, Miami, Florida, USA, July, 2019. (accepted for oral presentation)
6. Mohamed Asan Basiri M and Sandeep K. Shukla, "Efficient Hardware-Software Codesigns of AES Encryptor and RS-BCH Encoder", International Symposium on VLSI Design and Test (VDAT), Communications in Computer and Information Science, Springer, vol. 892, pp. 3–15, June 2018, India.

### Highlights

- FPGA based 10G communication interface implementation at the hardware level with application software is completed
- Hardware Acceleration of following Cryptography Algorithms are successfully completed: 23 types of CRC16, 9 types of CRC32 and SHA256 message digest. Each can able to operate at a rate suitable for 10gbps communication.
- Design integration and client side software development.

**Project Number:** IITKGP/CS/2016408Y

**Project Title:** FMSafe: A Networked Centre for Formal Methods in Validation And Certification Procedures For Safety Critical ICT Systems

**Project Investigator:** Prof. Sandeep Kumar Shukla

**Co-Investigator(s)/Collaborators (if any):**

**Co-Investigator:** Indranil Saha

**Collaborators:** Prof. Pallab Dasgupta (IITKGP), Prof. Partha Pratim Chakraborty (IITKGP), Prof. Soumyajit Dey (IITKGP), Prof. Aritra Hazra (IIT Kharagpur), Prof. Supratik Chakraborty (IITB)

**Project Initiated on:** 01-04-2017

### Project objectives

The objective of the project is to germinate a national knowledge centre for formal methods, targeting recent applications and safety standards in various ICT domains such as aeronautics, automotive, power, nuclear, railway, and space. Objectives include research, development of specific tools and tool repositories, industrial partnership and manpower training.

### Progress report

The IIT Kanpur Researchers have focused on the following two verification problems.

1. *Verification of OpenSSL protocol using UPPAAL and CodeSonar.* OpenSSL is a widely used library for SSL and TLS protocol implementation that secure communications over computer networks against eavesdropping. We verify OpenSSL protocol through Model Checking using UPPAAL and through static analysis using CodeSonar.
2. *Bug localization in Simulink/Stateflow model.* Simulink/Stateflow is the de-facto tool for capturing the models of cyber-physical systems. We use a falsification engine to find a trace in a given Simulink/Stateflow models, that does not satisfy the desired property. We design an algorithm to pinpoint the bug in the Simulink model precisely based on the feedback provided by the falsification tool.

### Highlights

- Security vulnerability detection for network protocols (special emphasis on SCADA protocols), and security property validation.
- Automated bug localization in Simulink/Stateflow models.
- Verification of autopilot software for a UAV is being carried out.

**Project Number:** UAY IITK\_004

**Project Title:** UAY: Engineering of security hardened cryptographic protocols for critical national infrastructure

**Project Investigator:** Sandeep Shukla, Manindra Agarwal (IITK)

**Co-Investigator(s)/Collaborators (if any):** Manish Bajpai (Nivetti Systems Pvt. Ltd)

**Project Initiated on:** 12th December 2016

### Project objectives

In network applications, the management of security features involves processing of cryptography algorithm. Major server processing cycles are exhausted in solving for cryptographic functions. To delegate the workload and to speed up the throughput, the processing chain is augmented with a hardware accelerator. The board we developed for this purpose has been named as “Kryptoceler”.

### Progress report

Product and IP development Status: The 1st version of the board along with the firmware implementation is completed. Currently testing, debugging and client-side development is undergoing.

Patent Filing under process: Kryptoceler: A generic hardware framework for acceleration of cryptographic operations.

## Publication

1. Mohamed Asan Basiri M and Sandeep K. Shukla, "Asynchronous Hardware Implementations for Crypto Primitives", *Microprocessors and Microsystems*, Elsevier, vol. 64, pp. 221-236, Feb. 2019.
2. Mohamed Asan Basiri M and Sandeep K. Shukla, "Low Power Hardware Implementations for Network Packet Processing Elements", *Integration, the VLSI Journal*, Elsevier, vol. 62, pp. 170-181, Mar. 2018.
3. Mohamed Asan Basiri M and Sandeep K. Shukla, "Flexible VLSI Architectures for Galois Field Multipliers", *Integration, the VLSI Journal*, Elsevier, vol. 59, pp. 109-124, Sept. 2017.
4. "Buffer Overflow Attack and Prevention for an FPGA Based Soft-Processor System", Chamandeep Singh, Sripadam Satish, Jubin Mitra, Sandeep Shukla, *Innovations in Electronics and Communication Engineering - Proceedings of the 7th ICIECE 2018 - Lecture Notes in Networks and Systems*, Springer
5. Mohamed Asan Basiri M and Sandeep K. Shukla, "Formal Hardware Verification of InfoSec Primitives", accepted at IEEE Computer Society Annual Symposium on VLSI, Miami, Florida, USA, July, 2019. (accepted for oral presentation)
6. Mohamed Asan Basiri M and Sandeep K. Shukla, "Efficient Hardware-Software Codesigns of AES Encryptor and RS-BCH Encoder", *International Symposium on VLSI Design and Test (VDATE)*, *Communications in Computer and Information Science*, Springer, vol. 892, pp. 3-15, June 2018, India.

## Highlights

- FPGA based 10G communication interface implementation at the hardware level with application software is completed
- Hardware Acceleration of following Cryptography Algorithms are successfully completed: 23 types of CRC16, 9 types of CRC32 and SHA256 message digest. Each can able to operate at a rate suitable for 10gbps communication.
- Design integration and client side software development.

**Project Number:** IITKGP/CS/2016408Y

**Project Title:** FMSafe: A Networked Centre for Formal Methods in Validation And Certification Procedures For Safety Critical ICT Systems

**Project Investigator:** Prof. Sandeep Kumar Shukla

**Co-Investigator(s)/Collaborators (if any):**

**Co-Investigator:** Indranil Saha

**Collaborators:** Prof. Pallab Dasgupta (IITKGP), Prof. Partha Pratim Chakraborty (IITKGP), Prof. Soumyajit

Dey (IITKGP), Prof. Aritra Hazra (IIT Kharagpur), Prof. Supratik Chakraborty (IITB)

**Project Initiated on:** 01-04-2017

## Project objectives

The objective of the project is to germinate a national knowledge centre for formal methods, targeting recent applications and safety standards in various ICT domains such as aeronautics, automotive, power, nuclear, railway, and space. Objectives include research, development of specific tools and tool repositories, industrial partnership and manpower training.

## Progress report

The IIT Kanpur Researchers have focused on the following two verification problems.

- *Verification of OpenSSL protocol using UPPAAL and CodeSonar.* OpenSSL is a widely used library for SSL and TLS protocol implementation that secure communications over computer networks against eavesdropping. We verify OpenSSL protocol through Model Checking using UPPAAL and through static analysis using CodeSonar.
- *Bug localization in Simulink/Stateflow model.* Simulink/Stateflow is the de-facto tool for capturing the models of cyber-physical systems. We use a falsification engine to find a trace in a given Simulink/Stateflow models, that does not satisfy the desired property. We design a algorithm to pinpoint the bug in the Simulink model precisely based on the feedback provided by the falsification tool.

## Highlights

- Security vulnerability detection for network protocols (special emphasis on SCADA protocols), and security property validation.
- Automated bug localization in Simulink/Stateflow models.
- Verification of autopilot software for a UAV is being carried out.

**Project Number:** MHRD /PHY /2016142T

**Project Title:** Development Of Low-Cost Multi-Photon Laser Micro-Writer For Lithography

**Project Investigator:** S. Anantha Ramakrishna

**Co-Investigator(s)/Collaborators (if any):** None

**Project Initiated on:** 08-05-2017

## Project objectives

Objective was to develop an inexpensive laser micro writer with a feature resolution of 1 micrometer using multi-photon processes by using a sub-nanosecond laser and molecules with large multi-photon cross-sections in the photoresists.

## Progress report

Project was closed in 2018 without any action due to cost escalation caused by rise of the US dollar rate from Rs. 54 to Rs. 69, which made acquisition of one of the critical

equipment, a sub-nanosecond laser, impossible within the approved budget. The entire amount was returned unspent.

### Highlights

- None.-

**Project Number:** MHRD/DESP/2015264

**Project Title:** Design Innovation Centre

**Project Investigator:** Prof Satyaki Roy

**Co-Investigator(s)/Collaborators (if any):** Prof Shantanu Bhattacharya

**Project Initiated on:** October 2015

### Project objectives

- To develop a research hub with its spokes for facilitating D-B innovation (Design to Business)
- To develop a design pedagogy to fuel a culture of innovation
- To not only feed the academia and industry but also shape entrepreneurs to drive an innovation-based economy

### Progress report

Design Innovation Centre (DIC) is aimed at D3 Innovation i.e. Developmental Design for Disruptive Innovation, where

- Our innovations are Developmental Goal centric.
- Innovative solutions lie in Frugal as well as cutting edge technology.
- Innovation lead to marketable products
- Culture of Innovation is being developed and nurtured.

During the course of project journey, our deliverables are in three dimensions i.e. Product Development, Course Development and outreach activities. To achieve our targets, so far, we are undergoing 12 Innovative Student projects, 1 Senior Fellow Projects along with 43 Faculty Projects. Apart from it, 11 courses based on new interdisciplinary methodology, have been developed. These courses synthesize design thinking with the behavioral and social sciences, economics, technological development, and business strategies which in turn create design solutions of a systemic nature rather than furnish small, often temporal component-specific response to a need.

While carrying out projects to achieve our intended targets, our students and Faculty get following recognitions and awards for their innovative products, as many as 24 patents have also been filed/granted.

- The project 'A novel brail tool with read and erase capability for visually impaired' was honored with Gandhian Innovation Award in 2017.
- Another project developed at the Hub titled 'The Low-Cost Dental Chair for Indian Dentistry Practice' is being carried forward for commercialization.

- TULO - An automated mandibular advancement device for the treatment of obstructive sleep apnea by Mr Vimal C has been honored with Gandhian Innovation Award in 2018.
- Dr. Abhijit Chandra Roy, received the Innovative Student Projects Award by INAE 2018 for his work on soft optical lenses.
- INAE Innovator and Entrepreneur Award 2018 Prof Tarun Gupta

### Highlights

- 18 Prototypes of innovative products in Education, Healthcare and Livelihood generation domain, developed so far (List Attached)
- Series of talks by the doctors from different specialized area, highlighting their problems faced during their treatment, operations and procedures to familiarize the faculty, staff and students of IIT Kanpur with real-world problems of doctors.
- 6000+ Students enrolled in different Courses, 150+ Students participated in Workshops & 150+ Students in Seminars, 120+ Students/Technical Enthusiast in Talk events. Two batches of almost 20 students visited KGMU to observe surgeries and identifying critical problems being faced by the surgeons of different department.

### Prototype Developed

1. 0.5 kW and 0.75 kW capacity Wind Turbines
2. Improved performance tri-leaflet Heart Valve
3. Real time system for enhance visibility of an imaging device in presence of haze.
4. 400x400x50mm Precast composite panel using sustainable industrial waste
5. Knives made from 128 layered of varying composition strong and tough steel.
6. Multiwell electrode electroporation setup
7. Paper based biosensor chip for an early detection of oral cancer in especially rural india
8. Paper based kit for early stage dengue NS1 detection
9. Low cost, maintenance free LED based phototherapy unit for treatment of neonatal jaundice.
10. Smartphone enabled microscope
11. Secure Grade Management System integrated with AppsPicket's Two Factor Authentication technology
12. Automated Subglottic aspiration device
13. Chord Tapestry Hybrid DHT algorithm for P2P secure VoIP system.
14. Onion Seed Extractor
15. Precision Seed Planter
16. Power Operated Winnower
17. Aqua Ferti Seed Drill
18. Low cost Acrylic Distemper made from Cow



### List of Patents with Details

1. Kundal A., Bhattacharya S., “Low Cost Dental Chair”. Patent Application filed
2. Pushpal Dey, Dr. J. Ramkumar, Dr. Vinita Agarwal “A Sample Extraction Device and Operator Thereof”. Patent Application no. 201811009657
3. Kaniska Biswas, Tarun Gupta, Santosh Pramanik “Air Sampler”. Patent Application no. 291998
4. Kaniska Biswas, Tarun Gupta, Santosh Pramanik “Air Sampler”. Patent Application no. 291999
5. Kaniska Biswas, Tarun Gupta, Santosh Pramanik “SENSOR FOR BLACK CARBON DETERMINATION OF AIR SAMPLER”. Patent Application no. 292000
6. Saumik Bhattacharya, Sumana Gupta, KS Venkatesh” METHOD AND SYSTEM FOR DEHAZING VIDEOS AND IMAGES IN REAL-TIME” Patent Application no 201811027075
7. Ramkumar, J., Kumar, Amal S., Gujrar, M. (SGPGI, Lucknow), “Automated Subglottic Aspiration Device”. Patent Application 201811016906, 4th may 2018
8. A NOVEL CARBON DIOXIDE SENSING BASED GUIDANCE DEVICE FOR ENDOTRACHEAL INTUBATION Bishakh Bhattacharya Patent Application filed
9. A WIRELESS PRESSURE SENSOR NODE FOR AN INFLATABLE STRUCTURE Bishakh Bhattacharya Patent Application filed
10. A Sample Extraction Device and Operator thereof, Patent Application 201811009657, Pushpal Dey, Dr J Ram Kumar, Dr Vinita Agarwal
11. Automated Subglottic Aspiration Device, Patent Application 201811016906, Amal Sudheendran, Dr J Ram Kumar, Dr Mohan gurjar

### Course for promoting Innovation Culture

1. Design Process & Methods
2. Management of Design Innovation
3. Design Thinking and Research Methods
4. Dynamics of Farm Machinery
5. Design of Storage Structures
6. Tractor Systems Design
7. Farm Drainage System Design
8. Design of Processing Plants
9. Advanced Farm Machinery Design
10. Machinery Systems for Precision Agriculture

**Project Number:** MHRD/MDES/2016261

**Project Title:** DTH Project

**Project Investigator:** Prof. Satyaki Roy

**Collaborators (if any):** 1) Prof. Munmun Jha.

2) Prof. Raghunandan Sengupta.

3) Prof. Shantanu Bhattacharya

**Project Initiated on:** 20th October, 2016

**Approval letter and date:** Approval letter dated 4th August, 2016

### Project objectives

The Ministry of Human Resource and Development launched 32 Direct-to-Home channels which would do a live telecast of classroom lectures from top institutions, including six IITs through its Swayam Prabha initiative.

The government is focusing to expand the reach of high quality education. Through the 32 DTH channels the aim is to ensure that live classrooms can be transmitted from ten 'Teaching Ends' out of which six will be from IITs located in Chennai, Mumbai, Delhi, Kharagpur, Kanpur and Guwahati.”

### Progress report

Out of 32 Swayam Prabha DTH channels (launched early this year), 8 channels are being managed by the NPTEL Core Team. The two channels (16 & 17) are currently being managed by IIT Kanpur. These channels broadcast the NPTEL course content in Mechanical Engineering, Humanities and Social Sciences, Economic Sciences, Management and Core Sciences. The channels are available for free on Doordarshan's Free Dish DTH platform and the students will only need a Set Top Box to receive them.

### Highlights

- The two channels are stream wise i.e channel 16 broadcasts courses from HSS, Economic Sciences and Management and channel 17 broadcasts courses from Mechanical Engineering.
- Besides the existing NPTEL Courses, 30 more courses are being developed this year in the field of Humanities and Social Sciences, Economic Sciences, and Management and Mechanical Engineering
- Lectures recorded at other institutes are also being sourced from here (Channel 16 and 17). We have also called for proposal's from other institutions and partner IITs for the addition of new courses in related areas. This online learning portal is not only beneficial for students, it is also useful for the faculty members and instructors.

**Project Number:** MHRD/DESP/2015437

**Project Title:** Central Sector Scheme For MOOCs- Complaint e-content creation (NPTEL Phase IV)

**Project Investigator:** Prof. Satyaki Roy

**Collaborators (if any):**

**Project Initiated on:** 31st August, 2016

**Approval letter and date:** Approval letter dated 31st March 2009 attached



### Project objectives

The broad aim of the project CSS-MOOCs is to facilitate the competitiveness of Indian Industry in the global markets by improving the quality and reach of education. The operational objective of CSS-MOOCs is to make high quality learning material available to students of different institutions across the country. The target group for this project consists of students and faculty members of institutions offering Undergraduate/Postgraduate education in India.

### Progress report

Since 2014 IIT Kanpur has offered 281 MOOCs courses till April, 2019.. In the upcoming July run IIT Kanpur is developing 53 courses of which 17 are new, 36 are reruns. As part of the NPTEL Phase IV initiative we have developed the concept of NPTEL Local Chapters across the country in the different universities and engineering colleges. There are close to 2557+ local chapters today with identified expert faculty members of these institutions serving as local mentors for the students enrolled in NPTEL courses. In the last 3 months we have conducted 11 workshops in the institutes in Uttar Pradesh, Uttaranchal, Jammu, Punjab, Madhya Pradesh, Rajasthan and Mizoram. These workshops aim at generating awareness about the NPTEL platforms, explaining difficult concepts from the course content by the subject matter experts and inviting more and more institutions with a dearth of good teaching staff to become local chapters and meaningfully utilize this platform initiated jointly by the IITs and supported by MHRD.

### Highlights

- AICTE & UGC have approved credit transfer for students in different subjects that they can enroll for free on the Swayam portal. About 20% of the courses each semester is permissible for credit transfer as per the norms.
- All India Council for Technical Education (AICTE) the statutory body and a national-level council for technical education, under Department of Higher Education, Ministry of Human Resource Development and NPTEL have signed an MOU on July 24, 2018 whereby advanced NPTEL online certification courses are approved for Faculty Development Programme (FDP) by AICTE.
- The MOOCs content is used for GATE examination preparation. Apart from this the students taking the courses are getting an opportunity to work as an intern with the faculty members. To improve the skills and employability of students and to prepare them for taking up jobs in the industry.
- Right now, we are engaged in translating the English text transcripts of NPTEL video contents into 8 different languages - Bengali, Gujarati, Hindi, Kannada, Malayalam, Marathi, Tamil and Telugu.

This endeavour ensures better and effective knowledge transfer, breaking the language boundaries.

**Project Number:** IMPRINT 7535

**Project Title:** Continuous discharge measurement in small open channels by using ultrasonic tomography

**Project Investigator:** Shivam Tripathi

**Co-Investigator(s)/Collaborators (if any):** Co-PIs: Naren Naik and Prabhat Munshi, IIT Kanpur;

**Collaborator:** K. Sri Harsha, Kritsnam Technologies Pvt. Ltd.

**Project Initiated on:** 06/02/2017

### Project objectives

1. To develop a continuous real-time discharge monitoring system for small open channels by tomographic reconstruction of ultrasonic transit-time measurements.
2. To test the developed system under laboratory and field conditions.
3. To convert the developed system into a user-friendly commercial product.

### Progress report

11 sets of ultrasonic transducers are identified, tested and ranked. Low noise circuit boards are designed to transmit and receive ultrasonic signals. An in-line ultrasonic flow meter (UFM) for pipes is developed and its performance is compared with commercially available flow meters. The results suggested that the developed flow meter can achieve similar performance but at a much lower cost. Next, an open channel experimental set-up is designed and fabricated for testing open-channel flow meters. The prototype open-channel flow meter is currently under testing. In addition, open channel flow simulations are being carried out to generate synthetic data for testing tomographic reconstruction algorithms.

### Highlights

- Ultrasonic transducers for flow measurements have been identified and associated circuitry has been developed.
- An in-line ultrasonic flow meter for pressurized flow has been developed and tested. It could achieve performance similar to commercial flow meters but at a much lower cost.
- An experimental set-up for testing open-channel flow meter has been designed and fabricated.

### Prof. S. Ganesh

#### Dean, Research & Development

The Scheme for Promotion of Academic and Research Collaboration (SPARC) aims at improving the research ecosystem of India's Higher Educational Institutions by facilitating academic and research collaborations between Indian Institutions and the best institutions in the world from 28 selected nations to jointly solve problems of national and/or international relevance.

The expected outcomes of this program include tangible results in terms of large quantity of high quality research publications, solution to key national and international problems, development of niche courses, high quality textbooks and research monographs, imbibing of best practices from top international academicians and researchers, strong bilateral cooperation, and improved world reputation and ranking of Indian Institutions. Eleven SPARC projects, with a total sanctioned amount of Rs.6,65,33,018, have been sanctioned to IIT Kanpur against the first call in the year 2018, and details of the projects are appended below:

Name of PIs	Project Title
Ashok Kumar	Sparc: Development Of 3d Printable Bone And Nerve Guiding Drug Eluting Composite Implants For Vertebral/Spine Trauma In Infection/Tuberculosis And Cancer
Arijit Kundu	Sparc: Topology, Interaction And Environmental Control Of Quantum Information Processing
B Bhattacharya	Sparc: Vibration Absorption Using Metamaterial Based Composites
Balaji Devaraju	Sparc: Development Of Precise Gravimetric Geoid Model For India Using Terrestrial, Airborne And Satellite Gravity Data
Laxmidhar Behera	Sparc:Deployment Of Low-Cost Multi-Rotor Mini-Uavs For Early Detection Of Crop Diseases And Development Of An Optimal System For Management Of Farming Activities
Pankj Jain	Sparc:Observation And Phenomenology Of Ultra High Energy Cosmic Ray Neutrinos At Anita, Ara And Arianna And Other Detectors
Salil Goel	Sparc:Park-It: Advanced Parking Information And Management For Indian Traffic
Santanu De	Sparc:Lean Premixed Prevaporized Combustion Of Diesel And Biofuels In A Laboratory-Scale Gas Turbine Combustor
Vipul Arora	Sparc: Machine Learning For Lattice Quantum Chromodynamics
S Ganesh	Sparc: Stabilizing Neurodegenerative Polyglutamine Repeat Fibrils By Sufex Chemistry: A Combined Synthetic And Biophysical Investigation
B V R Kumar	Sparc: Development And Neurological Application Of High Definition Fibre Tracking (Hdft)

**Project Number:** UAY IITK\_012

**Project Title:** Development and Scale Up of Ultrasmall Nanocatalysts for Hydrodesulfurization

**Project Investigator:** Dr. Sri Sivakumar

**Co-Investigator(s)/Collaborators (if any):** Dr. Raj Ganesh S. Pala

**Project Initiated on:** 2-14-2017

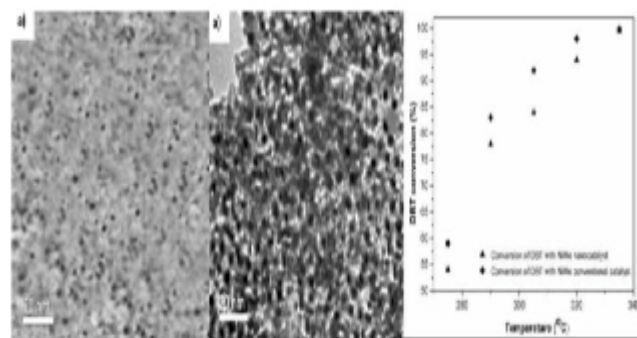
### Project objectives

Development of ultrasmall nanocatalysts by colloidal synthesis (e.g. microemulsion and ligand-based colloidal synthesis) supported on alumina with enhanced catalytic activity for the hydrodesulfurization of model compounds (dibenzothiophene (DBT) and 4,6-dimethyl dibenzothiophene (DMDBT)) and petroleum fraction in a packed bed reactor.

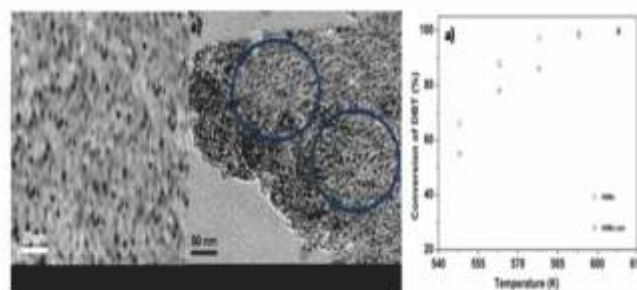
### Progress report

1. Microemulsion method: The NiMo and CoMo

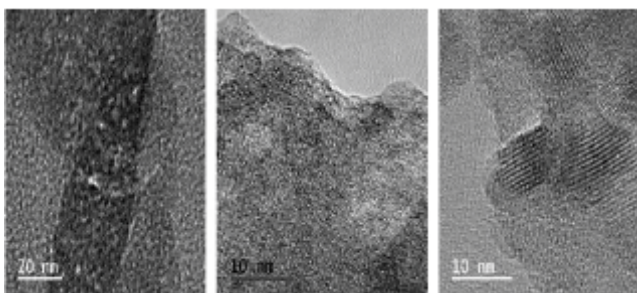
clusters are in the size of range of ~2 nm which has been confirmed by TEM images and the ratio of metals have been confirmed by XRF data. The catalyst supported on  $\gamma$ -Al<sub>2</sub>O<sub>3</sub> showed enhanced catalytic activity compared to wet impregnation method.



2. Ligand-based precipitation method: The NiMo and CoMo clusters are in the size of range of ~2 nm which has been confirmed by TEM images and the ratio of metals have been confirmed by XRF data. The catalyst supported on  $\gamma$ -Al<sub>2</sub>O<sub>3</sub> showed enhanced catalytic activity compared to wet impregnation method.



3. Insitu Supported Nanoclusters: NiMo and CoMo nanoclusters in range of ~4 nm which has been confirmed by TEM and metal content (80-90%) is measured by XRF. These catalysts are giving good characterization results and seems to mimic NEBULA catalyst properties.



### Highlights

1. Ultra small size bimetallic nanoclusters were formed and they showed enhanced activity compared to conventional wet impregnation method.
2. Method to prepared ultra small size nanoclusters and this method is very generic for other bimetallic clusters.
3. Scale up with this Insitu nanoclusters method will be easy as it includes only step

**Project Number:** DIC-MHRD /CE /2016142X

**Project Title:** Designing of a Novel, Off-Centric Nozzle



Impaction Based Automatic PM2.5 Air Sampler

**Project Investigator:** Tarun Gupta

**Co-Investigator(s)/Collaborators (if any):** NONE

**Project Initiated on:** 05/05/2017

### Project objectives

In the present scenario, any air sampler seeks attention after 6-8 h. The proposed sampler will be capable of running up to 15 days without any operator involvement. The pictorial and intuitive user manual will be scripted on the sampler body itself and thus will be useful to use. The sampler will have many user centric design features including ergonomic working place and rain sensor.

### Progress report

This present study depicts the development of an off-centric impaction based PM2.5 air sampler. This provides a qualitative solution to reduce particle bounce off problem which was well recognized but unsolved so far. This study identifies the root cause of the problem and uses an intuitive approach to finding its solution. It finds inspiration from 'Wheel' which symbolizes changes by rotation. The product maintains the assumptions of impaction theory. With engineering feasibility and user-centric design approach, the final product has been developed equipped with four sampling cylinders and capable of carrying out unattended PM2.5 sampling for 15 days.

One process Indian patent application (201611022179, June 28, 2016) has been filed and 3 design Indian patents (291998, 291999, 292000, March 23, 2017) have been granted so far on this sampler.

### Highlights

- Developed ampler is capable of running up to 15 days without any operator involvement.
- The pictorial and intuitive user manual is scripted on the sampler body itself and thus it is very easy to use.
- This sampler is equipped with ergonomic working bench and seat, wheels to move it around and it comes with a rain sensor.

**Project Title:** PMMMNMTT

**Sanction Letter Number and date:** F.No.3-13/2015-PN.II, Dated: September 30, 2015

**Consortium Partner:** IIT Kanpur- Prof. T.V. Prabhakar

### Activity during FY 2018-2019

We organized and conducted 12 Online MOOC Courses and 4 F2F Workshops. 2 courses were also conducted in flipped mode at IIT Kanpur.

In the technology part, mooKIT MOOC Management has been enhanced with Blockchain capability. Now certificates issued by mooKIT can be written on a public Blockchain (Bitcoin or Ethereum) and can be independently verified. We also rebuilt mooKIT platform with messaging backend. This will enable mooKIT to function in low- bandwidth situations as well.

### Software Developed

S. No	Software	Comments
1.	Progressive Web Apps for mooKIT, which are messaging based	Using these Apps the course content can be accessed even though the bandwidth is very low. Videos can be downloaded, and content can be cached locally. Both iOS and Android Apps are available.
2.	Enhanced mobi mooKIT using Cloud Services	A platform suitable for the developing world where data connections are not available for a large segment of the population. Content is accessible over a phone call, with IVR based navigation
3.	mooKIT offline app	To deal with network challenged environments. The videos are stored locally either on the mobile storage space or an SD Card. With this, the user does not need to spend bandwidth to watch the videos. This solves a major problem of poor connectivity.
4.	Enhanced mooKIT with Blockchain capability.	Now certificates issued by mooKIT can be written on a public Blockchain (Bitcoin or Ethereum) and can be independently verified by any third party.
5	Enhanced mooKIT as a self-paced learning platform	mooKIT can be used for offering self-paced courses where constant reminders will be sent to students regarding course activities. Students are also notified in case of inactivity. Certificates are released automatically once they complete the course.

### MOOCs

S. No	Name of MOOCs	Date	Participants
1	Life Skills MOOC Level 1 by CEMCA, University of Hyderabad and Osmania University	15 May-2Jul 2018	4216
2	Mobi MOOC in Kannada for Farmers by Prof. A. Prabhuraj, UAS Raichur	25 Jul-14 Nov 2018	4335
3	Mobi MOOC in Hindi for Farmers by IIT Kanpur	25 Jul-10 Aug 2018	94
4	Life Skills MOOC Level 2 by CEMCA, University of Hyderabad and Osmania University	6 Nov-20 Dec 2018	1446
5	Basics of Special theory of Relativity by Dr. H C Verma, IIT Kanpur	18 Dec-8 Mar 2019	18, 203
6	Fundamentals of Agricultural Extensions - Instructor In-charge: Prof. B. Jiri, BHU, Varanasi	20 Feb - 20 April 2018	4108
7	Integrated Disease Management - Instructor In-charge: Prof. B. K. Sharma, BHU, Varanasi	20 Feb - 5 April 2018	4066
8	Integrated Pest Management Instructor In-charge: Dr. Prabhuraj A., UAS Raichur	8 Oct - 8 Dec 2018	3753

9	Functional Foods: Concept, Technology and Health Benefits <i>Instructor In-charge: Dr. Amrita Poonia BHU, Varanasi</i>	8 Oct - 8 Nov 2018	4628
10	Basics of C Programming <i>Instructor Incharge: Dr. Kushal Shab, IISER Bhopal</i>	12 Jan.-12 Feb 2019	492
11	Resource Management in Rainfed Dry Lands <i>Instructor Incharge: Dr. G M Sujith, UAS, Bangalore</i>	25th March - 5 May 2019	3759
12	Fundamentals of Agricultural Extensions - <i>Instructor Incharge: Prof. B. Jirli, BHU, Varanasi</i>	25th March – 24 May 2019	3288
		<b>Total</b>	<b>52,388</b>

## F2F Workshops

S. No	Name of Workshop	Date	Number of Participants
1	Faculty Induction Program - TLC IIT Kanpur along with TEQIP IIT Kanpur	20 - 24 Jan. 2018 29 Jan. - 2 Feb. 2018, 9 - 13 Feb. 2018	253
2	Software Architecture <i>T.V.Prabbakar, IIT Kanpur</i>	15 - 16 Sept., 2018	19
3	Computer Networks <i>Dbeeraj Sanghi, IIT Kanpur</i>	15 - 16 Sept., 2018	19
4	Design Thinking <i>J. Ramkumar, IIT Kanpur</i>	25 - 27 Feb., 2019	13
		<b>Total</b>	<b>304</b>

**Project Number:** UAY IITK\_005

**Project Title:** Biodegradable polymers for packaging applications

**Project Investigator:** Vivek Verma

**Co-Investigator(s)/Collaborators (if any):** Hindustan Unilever Limited

**Project Initiated on:** 14/06/2018

### Project objectives

Biodegradable polymers are susceptible to moisture onslaught that results in deterioration of their properties during use. The main objective is to develop new/modified biodegradable materials with sufficient strength, permeability and tolerance to the processing needs so as to be suitable for replacing the current non-biodegradable packaging materials.

### Progress report

We have developed chemical cross linking processes that impart moisture resistance while maintaining biodegradability of the polymers. The modified polymers demonstrate better strength in presence of moisture. Addition of natural fillers like cellulose and clay to polymers have resulted in their better mechanical properties. We have demonstrated crosslinking the reinforcement with the polymer results in much better mechanical properties. We have also added fillers to resist microbial onslaught during service. We are furthering our work on a number of natural polymers (agar, carrageenan etcetera) for testing their applicability in packaging applications.

### Highlights

- Extracted agar from its natural source, seaweeds
- Reduced moisture sensitivity of agar and polyvinyl alcohol
- Increased strength of agar and polyvinyl alcohol

**Project Number:** IMPRINT 5223

**Project Title:** GaN HEMT based circuit design solutions and product demonstration for defense and space applications

**Project Investigator:** Yogesh Singh Chauhan  
Associate Professor, Department of Electrical Engineering, IIT Kanpur

**Co-Investigator(s)/Collaborators (if any):**

K. V. Srivastava, Professor,  
Dept. of Electrical Engineering, IIT Kanpur, U.P.-208016

Dr. Sandeep Anand, Assistant Professor

Dept. of Electrical Engineering, IIT Kanpur, U.P.-208016

**Project Initiated on:** 21-03-2017

### Project objectives

We aim to develop circuit design kit using ASM-GaN model and distribute this to the industry for RF and high-power product development. Moreover, this technology and end products will be used in defense and space applications. Our solution will be based on ASM-GaN model which is in the final phase of industry standardization at Compact Model Coalition.

### Progress report

This project is of prime importance to industry and organizations with immediate applications in RF circuit design for defense, satellite or base station applications. We are providing Indigenous computationally efficient compact models and implementing them in a Process Design Kit (PDK) to enable reliable circuit design such as power amplifiers and power electronic circuits like DC-to-DC converters etc. A Quality Assurance (QA) test-bench was developed for the ASM-HEMT Model and the model underwent rigorous benchmarking across various simulator platforms. A new PDK was developed (for 5 nodes) with the updated parameter set from the recently released standard ASM-HEMT model. The restructured PDK is being used to develop a prototype high efficiency class E/F3 power amplifier and a fly-back converter shown in the figure below. We are closely working with ISRO and DRDO on modeling and simulations of systems developed by the two organizations.

### Highlights

- Our ASM-HEMT for GaN transistors is now industry standard model.
- Indian agencies – ISRO and DRDO as well as global semiconductor companies are using the model and design kits.
- Our model is available in commercial Electronic Design Automation (EDA) softwares from Keysight, AMCAD, Silvaco etc.

## FINANCE

The Institute has a decentralized financial management structure, organized largely by the primary source(s) of funds. Unaudited FY 2018-19 accounts are prepared as per the guidelines of Ministry of Human Resource Development (MHRD), the administrative ministry of the Institute, conveyed vide their letter no. 29-4/2012-IFD dated 17 April 2015. The unaudited accounts were duly adopted by the Board of Governors (BOG) at its meeting of 27 June 2019, following endorsement at the Finance Committee meeting earlier in the day.

The accounts are available with the title '2018-2019 Consolidated (unaudited)' at the following link:

<http://www.iitk.ac.in/new/annual-accounts>

Following are the highlights of Institute's FY 2018-19 unaudited financials:

- ✧ Balance sheet size of over Rs.3,462 crore, without any valuation added for the IIT brand.
- ✧ Operating income and almost matching operating expenditure of about Rs.594 crore.
- ✧ MHRD released revenue and capital funds of Rs. 476 crore and Rs.119 crore respectively under different schemes like Support to IITs, Prime Minister Research Fellowship and National Initiative for Technology Transfer.
- ✧ Funds receivable from MHRD at Rs. 20.64crore as on 31 March 2019, was received on 2 April 2019.

Table below presents the summary financials:

<b>INDIAN INSTITUTE OF TECHNOLOGY KANPUR</b>			
<b>INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31 MARCH 2019</b>			
<b>(Amount in Rs)</b>			
<b>PARTICULARS</b>	<b>SCHEDULE</b>	<b>CURRENT YEAR 2018-19</b>	<b>PREVIOUS YEAR 2017-18</b>
<b>INCOME</b>			
Academic Receipts	9	57,90,61,483	47,81,86,455
<u>Grants/Subsidies</u>			
Grants against Salary	10	1,94,00,31,548	2,11,75,18,536
Grants against Pension	10	1,05,39,96,681	59,65,64,820
Grants against Others	10	66,30,40,556	25,69,34,650
Grants against Scholarships	10	53,69,70,324	50,38,91,524
Grants against HEFA Interest	10	5,82,86,356	--
Grants against P M Research	10	48,61,174	--
Income from Investments	11	17,28,27,884	21,94,84,892
Interest earned	12	1,62,35,589	3,24,88,277
Other Income	13	91,01,44,911	80,59,98,999
Prior Period Income	14	84,22,675	5,72,80,734
<b>TOTAL (A)</b>		<b>5,94,38,79,181</b>	<b>5,06,83,48,888</b>
<b>EXPENDITURE</b>			
<u>Staff Payments &amp; Benefits (Establishment Expenses)</u>			
MHRD Grant Salaries	15	1,89,36,45,574	1,98,87,96,490
MHRD Grant Retirement and Terminal Benefits	15	1,49,58,10,050	1,27,69,46,779
<u>Academic Expenses</u>			
MHRD Scholarships	16	53,69,70,324	50,38,91,524
Other Academic Expenses	16	24,82,18,831	20,40,42,275
Administration and General Expenses	17	70,11,80,867	42,96,80,942
Transportation Expenses	18	6,53,097	36,01,379
Repairs & Maintenance	19	52,13,50,676	39,17,30,357
Finance Costs	20	7,02,03,927	3,69,43,958
Depreciation	4B	19,33,578	1,15,86,052
Other Expenses	21	3,71,94,225	3,97,43,781
Prior Period Expenses	22	32,49,827	94,96,630
<b>TOTAL (B)</b>		<b>5,51,04,10,976</b>	<b>4,89,64,60,167</b>
<b>BALANCE BEING EXCESS OF INCOME OVER EXPENDITURE (A-B)</b>		<b>43,34,68,205</b>	<b>17,18,88,721</b>
Utilization Against HEFA Loan		<b>39,10,00,000</b>	<b>-</b>
<b>BALANCE BEING SURPLUS/(DEFICIT) CARRIED TO CAPITAL FUND</b>		<b>4,24,68,205</b>	<b>17,18,88,721</b>



The primary objective of our library is to improve the accessibility to the resources in all formats to meet the research and teaching needs of the institute. Library uses open source software KOHA for its automation, Joomla for website designing and DSpace for Institutional Repository. Our webcatalog enhances the way of searching and retrieval of resources, it gives a link to Google® cover images & contents, enables print options, support rating, comments, making of list and exports search results in different formats. Library is equipped with CCTV for better surveillance & security, and high speed (5G) Wi-Fi internet access. P. K. Kelkar library subscribed to only online digital subscriptions of all periodicals. The library vision document approved by the academic senate is also in its final stages of implementation to make the P.K. Kelkar library an efficient and modern knowledge Center. RFID implementation is also under process for better inventory and theft control.

#### **Achievements:**

IIT Kanpur was awarded and appreciated by American Chemical Society (ACS), USA, at an event jointly organized by ACS and Balani Infotech, New Delhi on September 21, 2018, for an outstanding usage in the year 2017 and continuous patronage to ACS publications to catalyze research and academic activities.

#### **Skill enhancement:**

During the period two library personnel (Mr. P.K. Behera and Mr. Ramakant) participated 4th Library Technology Conclave on the theme “From eBooks to eLearning: Libraries as Learning Hubs” at Cochin University of Science & Technology (CUSAT), Cochin, during 23rd - 25th January 2019.

Dr. SK Vijaianand participated in a seminar on “Changing Landscape of Science & Technology Libraries (CLSTL)” and 7th All IIT Librarian's meet at IIT Gandhinagar during 28 February – 03 March, 2019.

The library regularly conducts lectures for the apprentice trainees and staff for the upgradation of skill and recent development.

#### **Library budget:**

The library had spent Rs. 16.43 crores for the purchase of various print and online resources.

#### **Personnel changes:**

Two project staff Ms. Vandana Bajpai and Mr. Rinku Verma joined our team on 7th December 2018 and 10th December 2018 respectively.

During the period Mr. Ram Chandra superannuated on 31st December 2018 from his service after completing a successful service of more than 27 years. (30-08-1991 to

31-12-2018)

The work done by various units are summarized below:

#### **A. Library Automation:**

The library has its website (<http://pkklib.iitk.ac.in>) hosted and maintained by the library. The website provides navigation to the resources subscribed by the library. The online request of untraceable books, library resource usage statistics, resource manual, budget details, new arrival of books, highlighting research output, etc. are the other services provided through our website.



During the period 627 theses were archived in ETD repository with a total number reached to 16927. All these are now curated and given md5 and sha512 checksum numbers so that the files cannot be tampered with after deposition.

#### **B. Circulation and Maintenance Unit**

The unit not only holds the responsibility of circulation of resources but also resolve reference and referral queries. The unit also put all its efforts to maintain and restore the library building, furniture and fittings. Unwanted and unserviceable goods were also written off and disposed of to create more space in the library. During this period, painting and touching work of the top floor in the library was completed.

During April 2018 to March 2019 total number of 80727 books were checked out and renewed and 37385 were checked in. A total number of 118112 transactions were carried out (approximately 328 per day). Thirteen (13nos) books were reported as lost and a sum of Rs. 51457.00 was recovered as book cost with handling charges. The library has also bounded 1750 damaged/ mutilated books with a total amount of Rs.246870.00 during the financial year. More than 624 outside visitors/ students also visited the library during the period.

#### **Inter-Library Loan (ILL):**

The library is facilitating its users and other institutes for delivering the documents and books through resource sharing with other institutions. ILL unit also provides reference and Inter-Library Loan facility. During the period 77 documents requests were fulfilled to IITK users, whereas 148 documents were delivered to other

libraries.

### C. Acquisition Unit

#### C1: books:

Library procured 805 books by spending an amount of Rs.45.09 lakh. We appreciate faculty members for recommending the books that are likely to be used extensively.

A total of 380 books were received as donations and were also duly acknowledged.

The purchased books of different departments are listed in the below table.

Department/ Centers	No. of books purchased
• Aerospace Engineering	57
• Biological Science & Biological Engineering	54
• Civil Engineering	116
• Center for Lasers and Photonics	9
• Cognitive Science	16
• Chemical Engineering	48
• Chemistry	33
• Computer Science Engineering	13
• Library/Discretionary	0
• Design Programme	20
• Economics Science	34
• Electrical Engineering	36
• Environmental Engineering & Management	0
• Earth Sciences	44
• Generalia	0
• Humanities and Social Sciences	58
• Industrial & Management Engineering	22
• Mathematics and Statistics	43
• Mechanical Engineering	78
• Materials Science and Engineering	28
• Materials Science	3
• Nuclear Engineering and Technology	3
• Physics	90

News about the accessioned books is sent out every week as an e-mail link to all users.

#### C2: Online Resources

IIT Kanpur is a core member of INFLIBNET e-ShodhSindhu (eSS): a consortium for higher education electronic resources. The consortium provides access to e-resources to universities, colleges, and centrally funded technical institutions in India.

The library has subscribed and provided campus-wide access to more than 12000 peer-reviewed journals, which include 7000+ e-journals supported by eSS and 18 bibliographic, citation and factual databases among them 3 databases supported by eSS, in different disciplines,

from various publishers/aggregators, for the year 2019. The expenditure for subscribing to various resources was Rs.15.98 crores.

The major subscribed e-resources from various publishers are listed below.

Library Subscribed	eSS supported
1. American Chemical Society	1. ACM Digital Library
2. Cambridge University Press	2. American Institute of Physics
3. Cell Press	3. American Physical Society
4. CMIE database (selected datasets)	4. Annual Reviews
5. EBSCO(selected datasets)	5. ASCE Journals Online
6. Elsevier (ScienceDirect)	6. ASME Journals Online
7. Emerald Group Publishing	7. Economic & Political Weekly
8. Grammarly	8. ISID Database
9. IEEE/IET	9. J Gate Plus (JCCC)
10. Indiastat	10. JSTOR
11. Institute of Physics	11. MathSciNet
12. Optical Society of America	12. Nature
13. Royal Society of Chemistry	13. Oxford University Press
14. SciFinder	14. Project Muse
15. Scopus	15. Springer
16. SIAM	16. Web of Science
17. Springer-Nature	**
18. Taylor and Francis	**
19. Thomas Telford / ICE	**
20. Wiley	**

### D. Archives Unit

The unit digitizes preserve requisite documents of superannuated faculty/staff members as received from the office of DOFA/Registrar. As per the decision of the Archives Committee, the unit had archived information about (i) initial bio-data (ii) appointment letter (iii) subsequent promotions (iv) major awards. During the period 1096 personal files were digitized and archived. Archived data are made searchable and retrievable using "Joomla" open source content management software.

I finally would like to place on record my thanks to all SLC members, library staff, institute administration, and all users for their help in the smooth functioning of the library. Special mention must be made of here of the continued support from the Director and Deputy Director without whose support and encouragement this activity would have lost its rigors and enthusiasm.

## COMPUTER CENTRE

Computer Centre (CC) caters to the computational and IT related needs of the academic as well as residential community at IIT Kanpur. The main facilities provided by CC are: High Performance Computing, Institute Local Area Network covering academic area, residential area and students' hostels, Email facility to over 13000 users, Computer Labs, Various software for specialized research and general use by the campus.

The centre functions round the clock on a state of art data centre divided into various zones that host compute and other servers, parallel clusters for different projects, office automation services and soft switch based telephony services. All the CC facilities are backed up by a UPS system and diesel generator for 24 hours uninterrupted supply.

The institute Computer Centre has two High Performance Computing setups, which have ranked 369 and 130 in top 500 lists ([www.top500.org](http://www.top500.org)), in the November 2010 and June 2013 lists respectively. The

second cluster became ranked 118 in the top 500 lists in June 2014 with the addition of extra nodes. Together these setups have 1373 nodes.

The Institute has a fully managed Local Area Network of more than 20000 nodes, connecting all the hostel rooms, offices and residences over wired as well as wireless network. It has 4 Gbps connectivity to the Internet via different internet service providers. CC provides Single-sign on facility for seamless wifi connectivity within campus and eduroam for seamless wifi connectivity for members travelling to participating institutes worldwide. CC maintain labs with over 400 computers. The labs and the computational infrastructure hosts a wide variety of general as well as specialized application software in areas like simulation, modelling, data management & processing, CAD/CAM, computer graphics, word processing. Several software are also hosted on central servers for use by students and faculty on their own computers.

## CENTRE FOR CONTINUING EDUCATION

The Centre for Continuing Education was established for the purposes of coordinating the various activities connected with development of curricula, preparation of resources, administering the continuing education programme and providing in-service training to the teachers of engineering colleges. This Office is located in the Academic Affairs Building Room No. 303.

The activities are organized under two different cells, namely

1. Quality Improvement Programme (QIP)
2. Continuing Education Cell (CEC)

This write-up describes the various activities of the above two cells:

### 1. QUALITY IMPROVEMENT PROGRAMME

Since its inception, in 1971, the Quality Improvement Programme of the Ministry of Human Resource Development, Department of Education, Government of India, has strived for development of technical education in the country, primarily by upgrading the teaching curricula and enhancing qualifications of teachers of engineering colleges/institutions recognized by All India Council for Technical Education (AICTE). The main facets of QIP include.

#### (A) Degree awarding programme

##### Master's Degree Programme (M.Tech.)

Under M.Tech. programme (4 semester) the teachers are

sponsored by the engineering colleges/institutions recognized by the AICTE. After the selection of the teachers by the Central Committee of the QIP Coordinator, the admission letters to the selected candidates are issued by the respective Head of the Department of the Institute. The State Governments /Institutions sponsoring the teacher are required to treat them as on deputation and bear their normal salaries and other allowances during the period of their sponsorship. In addition to the above the Government of India provides each candidate a scholarship and a contingency grant. The present rates of scholarship and contingency grant are as follows:

Scholarship	:	Rs.4,000 per month (24 months)
Contingency grant	:	Rs.3,000 per annum

##### Doctoral Programme (Ph.D.)

Under this programme the serving teachers who already possess Master's degree and are sponsored by the State Government/Engineering Institutions recognized by AICTE are eligible for selection. The Doctoral Programme under QIP is for three years duration.

The present rates of fellowship and contingency grants are as follows:

Fellowship	:	Rs.15,000/- per month for three years
Contingency Grant	:	Rs.15,000/-per annum



## **(B) Short Term in-Service Training Courses (AICTE Sponsored)**

The short-term in-service training courses sanctioned under Quality Improvement Programme are specifically designed for improving the competence of serving teachers of engineering colleges in specific areas according to their requirements. The different short term courses which will be conducted during the year are announced once in a year. Short term courses for various durations are as follows:

### **One-week Course**

### **Two-week Course**

The faculty members of various disciplines are requested to submit proposals for the conduct of short term courses under QIP in the month of December every year. These proposals are put up to QIP Coordinator for approval. About 20 course proposals are approved under this scheme every year.

## **2. CONTINUING EDUCATION CELL (CEC)**

### **(A) Self-Financed Short-Term Courses**

Faculty members are also encouraged to run short-term continuing education courses for industry on a self-financing basis. An overhead of 20% of the gross receipts of the course is chargeable by CCE on all such courses whether run at IIT Kanpur or elsewhere, and also on industry-sponsored courses whether run at IIT Kanpur campus or elsewhere. Proposals for all such course must be submitted to CCE for approval by the Deputy Director.

Besides these programmes CCE will also approved the activities of Courses/ Workshop /Seminar/Conferences /Symposium/Training programme throughout the year.

Summary of various activities during the year 2018-2019

1. QIP Students
  - (a) M. Tech. Candidates admitted - Nil
  - (b) Ph.D. Candidates admitted - Nil
2. Short term courses conducted under QIP – 19
3. Short term self-financed courses conducted - 20
4. Workshops/ Conferences/ Seminars conducted - 27

## **CENTRE FOR CREATING WRITING AND PUBLICATION**

The Centre for Creative Writing and Publishing (CCWP) organized four events in the past year. The centre had two faculty members of the HSS Department, Drs. Mini Chandran and Ritwij Bhowmik, to organize and coordinate the activities.

An hour-long "devised solo performance" titled RIP by Ms. Savita Rani was the first of the events. It was held on Monday, December 3rd 2018 at 6:00pm in the Outreach Building Auditorium. Ms. Savita Rani who is a graduate of the National School of Drama (NSD), is an eminent theatre personality who is associated with the Jatan Natya Manch of Haryana. She has worked with people like Vivian Sundaram and Adil Hussain, and given performances all over India and abroad. The programme was an enquiry into an individual's possibilities of living, where the focus is not on any final product or goal but rather on the person living, in that process. The performance was well received by students who formed a major part of the audience.

A talk by Mr. Kamesh Aiyer on "Re-imagining the Mahabharata" was organized on January 11, 2019 at 9:30 am in FB 620. Kamesh Aiyer (writing as Kamesh Ramakrishna) is an alumnus of IIT Kanpur and went on to obtain a Ph.D. in Computer Science from Carnegie-Mellon University. He has since worked as a Professor and Software Engineer. In his talk he highlighted some assumptions he has made in his book "The Making of Bhishma" about the unusual society of the Sarasvati-Sindhu Culture and its transformation to the patriarchal form of the Iron Age, well into modern India. People were fascinated by the blend of myth and science that was

offered by Mr. Aiyer.

The noted Kannada author Vivek Shanbhag was invited for a talk on February 7, 2019. It was held at 6:30 pm in L 8. An engineer by training, Vivek Shanbhag has published five short story collections, three novels and two plays. His critically-acclaimed novel "Ghachar Ghochar" was published in English translation and is translated into 17 other languages worldwide. Ghachar Ghochar was a finalist for The LA Times Fiction Award 2017 and The American National Translation Award 2017. In an interactive talk, he discussed the issues of creative writing in a regional language like Kannada, and the problems of translation. This gave the audience a good opportunity to hear firsthand about creative writing from a practicing author himself.

The fourth event was a talk by the Indian English novelist Samhita Arni titled "Retelling the epics today" on February 25th at 6:30 pm in L 8. Samhita Arni, who had become famous as a child-writer through her first work, "The Mahabharata: A Child's View", has also authored the graphic novel "Sita's Ramayana". It went on to become a New York Times bestselling graphic novel. Her other novel is "The Missing Queen" and the latest, "The Prince", all based on the epics. Samhita Arni talked about the different ways she has chosen to feature and adapt the epics for a contemporary audience. Her talk was a wonderful example of how the epics could be read today and the audience enjoyed the experience.

**The Media Technology Centre**, IIT Kanpur is committed to ensure a smooth transition to Digital India encompassing all walks of life. Hence it provides a learning platform for faculty and students alike, exposing them to a whole world of extensive knowledge.

### **Facilities available at The Media Technology Centre:**

Engaged in creating video based course content for outreach education.

Creative platform for the students, where they can explore their hidden talent and attain greater heights. Student of the Communication Design in the Design Program have an academic relevance to the resources of the centre. Students continue to exhibit their ample creative talents by producing social ad campaigns, documentary films, radio jingles and various web applications exploiting the varied domains of media arts.

Besides, there are undergraduate students of HSS Level 1 and 2 courses who utilize the resources to work on video assignments.

Audio Video recording of seminars, workshops, conferences etc for different departments is available with a very nominal charge.

### **National Program for Technology Enhanced Learning (NPTEL)**

NPTEL is a joint initiative of the MHRD and the seven IITs and IISc Bangalore. There are 117 video and 126 web based courses from phase I and about 600 courses were proposed to be developed by the end of phase II&III. Of these 600 courses, 121 courses have been developed by the faculty members at IIT Kanpur and have been posted live on the NPTEL Portal.

### **Central Sector Scheme For MOOCs-Complaint e-content creation (NPTEL Phase IV)**

The broad aim of the project CSS-MOOCs is to facilitate the competitiveness of Indian Industry in the global markets by improving the quality and reach of education. The operational objective of CSS-MOOCs is to make high quality learning material available to students of different institutions across the country. The target group for this project consists of students and faculty members of institutions offering Undergraduate/Postgraduate education in India.

Since 2014 IIT Kanpur has offered 262 MOOCs based on the needs of the engineering colleges. As part of the NPTEL Phase IV initiative we have developed the concept of NPTEL Local Chapters across the country in the different universities and engineering colleges. There are close to 2557+ local chapters today with identified expert faculty members of these institutions serving as local mentors for the students enrolled in NPTEL

courses. Since September, 2017 we have conducted 11 workshops in the institutes in Uttar Pradesh, Uttaranchal, Madhya Pradesh, Punjab, Jammu, Rajasthan and Mizoram. These workshops aim at generating awareness about the NPTEL platforms, explaining difficult concepts from the course content by the subject matter experts and inviting more and more institutions with a dearth of good teaching staff to become local chapters and meaningfully utilize this platform initiated jointly by the IITs and supported by MHRD.

In the upcoming July run IIT Kanpur is developing 53 courses of which 17 are new and 36 are reruns.

### **Some highlights & new initiatives of the Project:**

Largest online repository in the world of courses in engineering, basic sciences and selected humanities and social sciences subjects

Online web portal <http://swayam.gov.in> – more than 471 million+ views

Youtube channel for NPTEL – most subscribed educational channel, 1.5 million+ channel subscribers, 404 million+ views

More than 56000 hours of video content

Most accessed library of peer-reviewed educational content in the world

52000+ hours of transcribed content; 51000+ hours of subtitled videos

AICTE & UGC have approved credit transfer for students in different subjects that they can enroll for free on the Swayam portal. About 20% of the courses each semester is permissible for credit transfer as per the norms.

All India Council for Technical Education (AICTE) the statutory body and a national-level council for technical education, under Department of Higher Education, Ministry of Human Resource Development and NPTEL have signed an MOU on July 24, 2018 whereby advanced NPTEL online certification courses are approved for Faculty Development Programme (FDP) by AICTE.

The MOOCs content is used for GATE examination preparation. Apart from this the students taking the courses are getting an opportunity to work as an intern with the faculty members. To improve the skills and employability of students and to prepare them for taking up jobs in the industry.

We are now entering into a new phase where we are expanding our efforts in providing the course contents in different Indian regional languages.

Right now, we are engaged in translating the English text transcripts of NPTEL video contents into 8 different languages - Bengali, Gujarati, Hindi, Kannada,



Malayalam, Marathi, Tamil and Telugu. This endeavour ensures better and effective knowledge transfer, breaking the language boundaries.

### **DTH (Swayam Prabha) Project**

Swayam Prabha, DTH is a group of 32 DTH channels devoted to telecasting of high-quality educational programs on 24X7 basis using the GSAT-15 satellite. The project is sponsored by the Ministry of Human Resource & Development, Government of India. Channels would do a live telecast of classroom lectures from top institutions, including six IITs, as part of Swayam Prabha initiative.

Out of the 32 Swayam Prabha DTH channels, 8 channels are being managed by the NPTEL Core Team. The two channels (16 & 17) are currently being managed by IIT Kanpur.

Swayam Prabha, DTH Channel 16 and 17, of IIT Kanpur has been started with an aim to initiate new ways of learning by educating students with better and improved methods of curriculum. It offers education through virtual class room and students can access digital repositories from Swayam Prabha portal which is managed by Infibnet Center Gandhinagar. Channel 16 is an exclusive channel for Humanities and Social Sciences related courses and Channel 17 is an exclusively dedicated channel for Mechanical Engineering and related courses. These MHRD Funded channels are focused to expand the reach of high quality education and helping it to percolate across the social strata.

Both of the Swayam Prabha channels have introduced new educational areas and acquainted students with advanced learning methods. The channels are producing courses for both undergraduate and graduate students. Besides the existing NPTEL Courses, 30 more courses are being developed this year in the field of Humanities and Social Sciences, Economic Sciences, and Management and Mechanical Engineering. The channels are available for free on Doordarshan's Free Dish DTH platform and the students will only need a Set Top Box to access them.

Lectures recorded at other institutes are also being sourced from here (Channel 16 and 17). We have also made call for proposals with other institutions and partner IITs for the addition of new courses in related areas. This online learning portal is not only beneficial for students, it is also useful for the faculties and instructors.

### **FM 90.4 Community Radio Station**

IITK Community Radio has been serving the local community in and around the campus since 2010. Our main aim is to broadcast popular and relevant content for our listeners. Programs encouraging local culture, student talent, local art forms or handicrafts, music, agriculture, health & hygiene etc are aired to provide a variety of content to our community.

In the year 2018-2019 we have majorly focused on Health

awareness programs which are a major requirement of our society. Our radio team successfully worked in collaboration with the Health Ministry of India and UNICEF to create awareness oriented radio programs on measles and rubella.

Our contribution in the POSHAN ABHIYAN-2018, conducted by the Ministry of Women and Child development, Govt. of India has been appreciated. Interviews with doctors and people associated with this effort were aired to create maximum awareness regarding malnutrition among women and children. Information about various health centers, schemes and benefits provided by the government to the citizens of our country were also shared with our listeners.

Along with this we constantly share inspiring experiences and thoughts of our community members with our listeners through radio programs, to motivate ourselves and our community to do better. IIT students, faculty and our radio team work together to produce such programs. Our aim is to create interest in the mind and hearts of our listeners and raise awareness about the real aim of a community radio.

### **Conducting online examination for recruiting engineers and officers for different departments of the State Government of UP.**

#### **UPPCL (Uttar Pradesh Power Corporation Limited)**

The Media Technology Centre conducted online examination and interview for the recruitment of Assistant Engineers (Trainee) in UPPCL. Total number of candidates who appeared for the examination were 15690 of which 623 were short listed for the Interview. The total number of selected candidates in the disciplines of Electrical, Electronics & Communication, Computer Science and Civil Engineering were 299.

The online examination was conducted in collaboration with TCS ION across the state of Uttar Pradesh in 45 centres. This was in line with our commitment to the State Government of UP to extend our support to the various functional departments of the state. The whole exercise has been successfully completed.

#### **UPHDB (Uttar Pradesh Housing Development Board)**

The Media Technology Centre is in the process of conducting the online examination and interview for recruiting Assistant Engineers in the discipline of Civil & Electrical Engineering for the UPHDB.

The process is expected to be completed by November, 2019.

The co-operation and synchronized team work by the members of our team is helping us put a steady foot forward in achieving our targets and giving education a new dimension.



SIDBI Innovation and Incubation Centre has observed an unprecedented growth in 2018-19, translational part of research was promoted through the Innovation and Incubation activities at SIIC, 34 new startups have been incubated in the last financial year from varied domains.

"4 new projects namely, (i) NIDHI SS Seed Fund, (ii) Engineers India Ltd EIL Innovation Support, (iii) Bill & Melinda Gates Foundation and Tata Trust supported first Agritech Incubator of India & (iv) HDFC CSR grant funded Social Innovation support were started to promote the conversion of Idea into prototype for prospective Entrepreneurs, Some fresh sanctions have been received under the existing PRISM Program as well".

A total of 61 Companies are currently under-going incubation at SIIC.



Some of the accolades received by Incubate Companies during FY 2018-19 are listed below

Company	Achievement
Urinalytics Health	Founder Nikky Jha is selected for Young Social Entrepreneurs 2019 Workshop by Singapore International Foundation Singapore
Ficting	Founder Abhay Gupta is Selected for Draper University's Pre-Accelerator Program 2019 in Silicon Valley with scholarship
Ignis Career	USD 150,000 fund raise from Grey Matter Capital
BioScan Research	Winner of Social Alpha Quest for Healthcare Innovation 2018
Aquafront Infrastructure	NRDC National Meritous Innovation Awards 2018
EmpowerU (Promorph Solutions Pvt Ltd)	Top 100 Finalists in Maharashtra Startup Week 2019
Delmos Research Pvt Ltd	Eat Right Startup Awards from FSSAI
Kritsnam Technologies	Best Startup Award (Social Impact) in MeltingPot2020
KrishiHub (JB Infolabs Pvt Ltd)	NASSCOM Emerge 50 Awards
OxenFarm Solutions	Awaaz Entrepreneur Viewer's Choice Award from CNBC AWAAZ
HelpUsGreen	National Bio Entrepreneurship Competition organized at C-CAMP Bangalore
HelpUsGreen	2018 GSG Millennial Honors
KrishiHub (JB Infolabs Pvt Ltd)	Top 20 finalists at the Food Loss Challenge Asia
HelpUsGreen	UN Young Global Leader Awards 2018

### Patents & Technology Transfer

During the Financial year, 47 patents including 2 design patents were filed, and 29 previously filed patents were granted, besides two technologies were also licensed.

1. Design Patent titled "School Bag Convertible to Study Table" having design no- 287945 licensed to PROSOC Innovators Private Limited in consideration of INR 7.54 Lakhs.
2. Technical Know-how "Intelligent Tutor System" licensed to Robust Result Private Limited, at a Royalty percentage of 25% from the annual profits earned.

Till date, 557 Indian patents have been filed, out of which 152 patents have been granted so far along with 56 technologies licensed for commercialization.

**List of Patents filed in 2018-19**

S. No	Inventors	Title	IPA	Date	Grant	Date
1.	Mr. Santosh Pramanik (JTS, 4iLab), Mr. Kaniska Biswas (Student, DP), Dr. Pratik Sen, Chem	Designing Improvement and Implementing New Features to Conventional Ro(reverse Osmosis) Water Purifier Sytems	304338	03.04.2018	Design	05.03.2019
2.	Dr. Ashok Kumar (BSBE), Mr. Arun Kumar Teotia (PhD Student, BSBE)	Nano-hydroxyapatite Based Porous Polymer Composite Scaffolds for Bioactive Molecule Delivery in Musculoskeletal Regeneration	20181101 5012	20.04.2018		
3.	Dr. B. Mazhari (EE), Mr. Syed M. H. Rizvi (Student, DP)	An Organic Thermistor	20181101 5509	24.04.2018		
4.	Mr. Dhananjay Dubey (Student, MSP), Dr. J. Ramkumar (ME), Dr. V. K. Jain (Retired Prof., ME), Mr. Sanjeev Verma (Tech. Supt.)	Apparatus for Finishing of Ball using Abrasive Flow Finishing	20181101 6131	28.04.2018		
5.	Dr. J. Ramkumar (ME), Mr. AmalSudheendran Kumar (Student, DP), Dr. Mohan Gurjar (SGPGIMS, LKO)	Automated Subglottic Aspiration Device	20181101 6906	04.05.2018		
6.	Dr. Sri Sivakumar (ChE), Dr. Raj Ganesh S. Pala (ChE), Ms. ShilpiSaxena (ChE)	A Method for Synthesis of Metal Nanoparticle encapsulated with a Plurality of Shells of Zeolite	201811020842	04.06.2018		
7.	Dr. TanmoyMaiti (MSE), Ms. Megha Acharya (M.Tech. Student, MSE)	A Method for Synthesis of N-type Oxide-based Nanocomposite with Graphite for Thermoelectric Applicat	201811021100	06.06.2018		
8.	Dr. Manas Ghorai (Chem), Dr. Chandan Kumar Shahi (Post Doc, SCDT), Mr. Sajjan Pradhan (Student, Chem), Dr. Aditya Bhattacharyya (Post Doc, Chem)	Process for the Synthesis of 3-spiropiperidino Indolenines	201811022519	15.06.2018		
9.	Mr. Nishant Agarwal (Student, ME), Dr. Niraj Sinha (ME), Dr. PankajWahi (ME)	Bionikli: Affordable Bionic Prosthetic Hand for Transradial Amputee	201811024019	27.06.2018		
10.	Dr. Aswani Kumar Thakur (BSBE), Mr. Abhayraj S. Joshi (PhD Student, BSBE)	Peptide Encapsulated Biodegradable Nanoparticles for Treatment of Neurodegenerative Diseases and Preparation Method Thereof	201811024748	03.07.2018		
11.	Mr. ParvrajPachore (Student), Ms. Akansha Jain (Student), Dr. Sandeep Anand (EE), Dr. SaikatChakrabarti (EE), Mr. Ajay Kumar Verma (NTPC), Mr. Shish Pal Singh Pundir (NTPC), Mr. Subrata Sarkar (NTPC)	Control Device	201811024706	03.07.2018		

12.	Ms. Gagandeep Kaur (PhD Student, Chem.), Ms. Savita Kumari (ESNPL), Ms. Piyali Saha (Student, BSBE), Mr. Sandip Patil (ESNPL), Dr. Subramaniam Ganesh (BSBE), Dr. Sandeep Verma (Chem.)	Electrospun Fibrous Nanomat Composition and a Method of Synthesizing the Same for Cancer Cell Detection	201811025128	05.07.2018		
13.	Mr. Himanshu Kumar (Student, EE), Mr. Saumik Bhattacharya (Student, EE), Dr. Sumana Gupta (EE), Dr. K. S. Venkatesh (EE)	Method and System for Dehazing Videos and Images in Real-time	201811027075	19.07.2018		
14.	Dr. Sandeep Anand (EE), Mr. Pratik Deshmukh (Student, EE), Mr. Abhinav Arya (PhD Student, EE)	A Voltage Measurement Circuit and Method Thereof	201811028927	01.08.2018		
15.	Mr. Santosh Pramanik (JTS, 4i Lab), Mr. Afraz Khan (Alumni, AE), Mr. Ravi Pandey (REO, IPR Cell)	A Flow Cell and Method Thereof for Optical Measurement of Micro/nano Structure	201811029094	02.08.2018		
16.	Dr. A.K. Chaturvedi (EE), Mr. Abhay Kumar Sah (Student, EE)	A Neighborhood Search Based Large Multiple Input Multiple Output Detector and a Method Thereof	201811029143	02.08.2018		
17.	Dr. A.K. Chaturvedi (EE), Mr. Abhay Kumar Sah (Student, EE)	Low Complexity Detection in Multiple Input Multiple Output Systems and A detector Thereof	201811029113	02.08.2018		
18.	Mr. Santosh Pramanik (JTS, 4i Lab), Mr. Ravi Pandey (REO, IPR Cell)	Antibacterial Nano Breathing Nasal Filter	201811032893	01.09.2018		
19.	Dr. Jayandharan Giridhara Rao (BSBE), Mr. Shubham Maurya (BSBE)	Process for Modifying Neddylation Site of an AAV Vector and Product Thereof	201811035192	18.09.2018		
20.	Dr. Siddhartha Panda (ChE), Ms. Kusumita Dutta (PhD Student, CHE/SCDT)	A Process of Synthesizing a Composite of Aniline, Nphenylglycine and Graphene Oxide and Product Thereof for Sensing of Metal Ions	201811036105	25.09.2018		
21.	Dr. Jayandharan Giridhara Rao (BSBE), Mr. Bertin Mary (PhD Student, BSBE)	Glycoengineered Adeno-associated Virus Vectors for Hepatic and Ocular Gene Therapy	201811037384	03.10.2018		
22.	Mr. Gaganpreet Singh (R Scholar, ME), Dr. S. A. Ramakrishna (Phy), Dr. J. Ramkumar (ME), Mr. Kumar Vaibhav Srivastava (EE)	Controlled Micro-texturing of Transparent Conducting Oxide Thin Films for Uniform Transparency	201811038031	08.10.2018		
23.	Mr. Gaganpreet Singh (Student, ME), Ms. Kajal Chaudhary (PhD Student, MSP), Dr. Kumar Vaibhav Srivastava (EE), Dr. J. Ramkumar (ME), Dr. S. Anantha Ramakrishnan (Physics)	A Microwave Absorbing Metamaterial Based Wearable and a Preparation Method Thereof	201811038763	12.10.018		



24.	DORA	Alumni Association, IIT Kanpur	3975358	16.10.2018	Trademark	
25.	DORA	Social Entrepreneurs & enterprises, an Alumni Association IITK Initiative	3976709	17.10.2018	Trademark	
26.	DORA	Startup Master Class, Alumni Association, IIT Kanpur	3980554	23.10.2018	Trademark	
27.	DORA	SMC Logo	3980574	23.10.2018	Trademark	17.04.2019
28.	Dr. Srisivakumar (ChE), Dr. Raj Ganesh Pala (ChE), Ms. ShilpiSaxena (ChE)	Process of Preparing Metal Nanoparticle Clicked Zeolite	201811041047	30.10.2018		
29.	Dr. Animansgu Ghatak, ChE, Mr. Nitish Singh (PhD Student, ChE), Mr. Anuj Tiwari (Ex-Dual Degree Student, ChE)	A Process for Dispersing Metallic Nanoparticles on a Template Surface	201811042159	08.11.2018		
30.	Mr. Aman Garg (Sr. Proj. Associate, ME), Mr. Chinthulal V. S. (Proj. Engineer, ME), Dr. Bishakh Bhattacharya (ME), Dr. Devender Gupta (SGPGI)	A Wireless Pressure Sensor Node for an Inflatable Structure	201811042160	08.11.2018		
31.	Dr. Jayandharan Giridhara Rao (BSBE), Mr. ShubhamMaurya (PhD Student, BSBE)	Sumoylation Target-site Modified AAV Vector, Methods and Sequence for Gene Therapy	201841042550	13.11.2018		
32.	Mr. Bharat Bhushan (PhD Student, MSE), Mr. Prvan Kumar Katiyar (PhD Student, MSE), Dr. KallolMondal (MSE), Dr. B.S. Murty (MME, IIT Madras)	Nickel-vanadium Nitride Hydrophobic Alloy Powder	201811045364	30.11.2018		
33.	Dr. Manas K. Ghorai (CHM), Mr. Gaurav Goswami (PhD Student, CHM)	The Synthesis of Tolterodine from Activated Azetidine	201811046497	08.12.2018		
34.	Mr. Aman Garg (Sr. Proj. Associate, ME), Dr. Bishakh Bhattacharya (ME), Dr. Anil Agarwal (SGPGI), Dr. Sujeet Gautam (SGPGI)	A Sensing-Based Guidance Device for Endotracheal Intubation and a Method for Operating the Same	201811046913	12.12.2018		
35.	Dr. J. G. Rao (BSBE), Mr. SathyanthithanArumugam, (Student, BSBE), Ms. Bertin Mary (PhD Student, BSBE), Mr. Mohit Kumar (Student, BSBE)	Identification of Micro-RNA and Methods to Improve Gene Expression from AAV Vector	201811047263	13.12.2018		
36.	Dr. S.S.K. Iyer (EE), Mr. Anirban Bagui (PhD Student, Physics)	A Method of Manufacturing an Organic Semiconductor Film having Improved Conductivity	201811047532	15.12.2018		
37.	Ms. Surekha Yadav (PhD Student, MSE), Dr. Krishanu Biswas (MSE), Dr. Arvind Kumar (ME)	A Multicomponent High-entropy Alloy Composite, a Preparation Method and Characterization Thereof	201811047924	18.12.2018		
38.	Dr. Kamal Krishna Kar (ME & MSP), Dr. J. Ramkumar (ME & MSP), Mr. Yaswanth Kumar Penke (Student, MSP), Mr. Amit Kumar Yadav (PhD Student, MSP), Ms. Iram Malik (PhD Student, MSP), Ms. Alekha Tyagi (PhD Student, MSP)	Mn-Al-Fe Impregnated RGO Hybrid Composite for Arsenic Adsorption and its Sludge as Super-capacitor	201911002684	22.01.2019		

39.	Ms. Madhu Rawat (NCFE), Mr. EswaranJayaraman (NCFE), Dr. S.S.K. Iyer (EE)	A Method for Coating on Lignocellulosic Fibrous Material Substrate to Facilitate Building Electronics	201911004465	05.02.2019		
40.	Dr. Baquer Mazhari (EE), Mr. Biswanath Panda (REO, Samtel), Mr. Suraj Malik (Samtel)	A Sensor System and Method Thereof	201911004819	07.02.2019		
41.	Dr. Siddhartha Panda (ChE), Mr. Narendra Kumar (PhD Student, MSP)	Development of A-IGZO Based Dual Gate ISFET using Al <sub>2</sub> O <sub>3</sub> as Top Gate/sensing Dielectric	201911005381	11.02.2019		
42.	Mr. Pankaj Singh (PhD Student, Physics), Dr. Asima Pradhan (Physics), Dr. NarenNaik (EE)	A Spatially Resolved Reflectance Based Bevelled Optical Fibre Probe for Epithelium Layer Diagnostics	201911006646	20.02.2019		
43.	Dr. Joydeep Bhowmik (AE), Dr. Debopam Das (AE)	Novel Spring Induced Ornithopter Wing Design with a Bent Bar	314953-001	19.02.2019	Design	
44.	Dr. D. S. Katti (BSBE), Mr. BinapaniMahaling (PhD Student, BSBE), Mr. Dadi A Srinivasrao (PhD Student, BSBE)	A Non-invasive Nanoparticle Based Sustained Release Ocular Drug Delivery System for the Treatment of Anterior and/or Posterior Eye Diseases	201911008173	01.03.2019		
45.	Mr. Auhin Kumar Maparu (Student, ChE), Dr. Sri Sivakumar (ChE), Ms. BeenaRai (TCS)	Process for Synthesis of Polydimethylsiloxane (PDMS) Nanoparticles	201911009242	09.03.2019		
46.	Dr. AbhijitKushari (AE), Mr. M.C. Keerthi (PhD Student, AE)	A Traverse System and Method Thereof	201911009661	13.03.2019		
47.	Mr. EswaranJayaraman (NCFE), Dr. S.S.K. Iyer (EE)	A Mechanical Scriber to Isolate Solar Cells During Monolithic Fabrication of Organic Solar Cell Modules on Substrates	201911012276	28.03.2019		

## INTERNAL COMPLAINT COMMITTEE

The Internal Complaints Committee (ICC), IIT Kanpur, first constituted under the Office Order No. DIR/IITK/2016/OO-04, dated March 9, 2016, has been undertaking its investigations under the Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013 and IIT Kanpur (Prevention, Prohibition and Redressal of Sexual Harassment of Students) Rules, 2017.

During the period from 1 April 2018 to 31 March 2019, the ICC received 5 complaints. In 01 case, the person who

committed the wrongdoing could not be identified and hence the investigation had to be closed. In the second case no evidence was found for the complicity of the respondent hence the case had to be closed. Recommendations were made in 2 cases. The recommendations of the ICC comprising of community service for 6 hours per week for four months and deferring the award of degree by three months were implemented by the Institute. One case was still under investigation at this time.

## WOMEN CELL

The Women's Cell was constituted by the Institute in October 2016, in accordance with the Sexual Harassment

of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013 (referred to as “the Act” below). In particular, the Cell was set up to promote gender-sensitivity among the Campus community, and to offer advice on available courses of action to women on campus who may be in distress. The Cell provides specialized counseling in cases of sexual harassment, to both complainants and respondents, whenever required. The Cell has designed posters in Hindi and English, listing, in brief, welcome acts that legally constitute sexual harassment, and giving help lines. These are displayed at conspicuous places across the Institute, as mandated by the Act, under “Duties of Employer.”

Following are the activities of the Cell during April 2018-March 2019, listed chronologically:

- April, 2018: *Survey of* students (male, female, PG and UG) on the prevalence of sexual harassment and gender discrimination in campus was conducted.
- June 2018: To sensitization sessions were held with girl students visiting the Institute under the Vigyan Jyoti Scheme.
- July 2018: Two orientation sessions on the Act were held for new UG and PG students.
- August 2018: A special awareness session was held with new girl students on the issues of sexual harassment and gender discrimination.
- September 2018: Sensitization session on the Act for male staff of PK Kelkar Library.

- November 2018: Session with tutorial on “*Gender Sensitivity at the Workplace*” in Leadership for Academicians Program (LEAP)
- November 2018: 3-day workshop on “*Legal Rights of Women*”, including sensitization session for employees of the Institute on the Act, conducted by eminent legal scholar Ms. Flavia Agnes and her associate.
- November 2018: Legal orientation session for the ICC on the Act.
- January 2019: Orientation session on the Act for new PG students.
- February 2019: Competition of IITK students on “*Law related to Women*”.
- February 2019: Sensitization and interaction session on gender discrimination and sexual harassment with class 9 and 11 girl students of Kendriya Vidyalaya IITK.
- March 2019: Orientation session about the Act was held with new faculty of the Institute.
- March 2019: The Cell co-hosted talks by eminent Scientists Dr. Archana Bhattacharya and Dr. Rohini Godbole, in the event “*Women in Research*” (WiRE); sensitization talk in the event by the Cell chairperson on “*Women in Research Issues*”.
- March 2019: 2nd edition of awareness event for all IITK Community – 5 km run and 5 km Walk with theme “*Don't be a Bystander, Stand against Sexual Harassment.*”

## SC/ST/OBC/PWD CELL

The Institute is committed to maintain a work environment wherein faculty, staff and student members from different community can work in a coherent environment. It is the Institutes endeavor to ensure that no discrimination takes place at workplace. The Institute has appointed a Liaison Officer who can be contacted in the event of any incident of caste based discrimination. Particulars of Liaison Officer are as under:

**Name:** Dr. R K Sachan  
**Designation:** Joint Registrar  
**Department:** Dean, Research and Development  
**Email Id:** [sachan@iitk.ac.in](mailto:sachan@iitk.ac.in)  
**Contact No.:** 0512 259 7385

An online complaint register portal is being created for the SC/ST/OBC/PwD community to register their complaint officially. The url of the portal is given below:

<http://www.iitk.ac.in/new/complains-of-caste-discrimination>

**Implementation of reservation orders**

The effective date of implementation of reservation for SCs and STs in the direct recruitment is 5th September 1974 in this Institute and the implementation of reservation for OBCs and PwDs are w.e.f. the year 1995 and 1996, respectively.

### **Maintenance of rosters/ Percentage of reservation**

The Board of Governors had approved, in its meeting held on July 27, 1995, maintenance of 120 points vacancy-based roster for Group A [other than exempted posts (Points reserved in favour of SCs-20, STs-9, OBCs-31)] & B posts; and 100 points roster for Group C & D posts (Points reserved in favour of SCs-21, STs-1, OBCs-27) for direct recruitment at the Institute. On the basis of Judgment passed by the Constitution bench of Supreme Court, the Government of India, Deptt. Of Per. & Trg., issued O.M. 36012/2/96- Estt. (Res.) dated July 02, 1997 vide which the above vacancy-based rosters have been revised into post-based rosters for the different category of employees in direct recruitment. The Board after due consideration accorded its approval, in its 1997/5th meeting held on December 05, 1997 for maintenance of post-based rosters. Further, the Board of Governors of the Institute (in its meeting held in May



2004, vide item no. 2004.2.13) has considered and approved the proposal for grouping of staff for the purpose of reservation and separate grouping of technical and non-technical posts. The proposal was as follows – the posts under Group-A, B, C & D would be grouped separately for technical and nontechnical posts. However, there would be a single group under Group-D. Under this dispensation, there would be seven groups in all and as far as possible efforts would be made to provide adequate representation of SCs/STs/OBCs/PwDs to each post under the group.

The proposal was approved in the context that grouping of posts would provide greater leverage for purpose of securing adequate representation for SCs/STs/OBCs/PwDs in the Institute

The Modified Assured Career Progression Scheme (MACPS) is in operation at present.

#### **Infrastructural facilities provided to PwD candidates:**

Ramps are been constructed in lecture hall complex, tutorial block, P K Kelkar Library, Faculty Building, IME building, CSE Building from ground level to floor level. Barrier free accessible toilets are constructed in lecture hall complex, DOAA, IME, new lecture hall complex, towards DOSA office.

#### **Concessions/ Relaxations**

- (a) For Regular employees of IITs who are educationally qualified and otherwise eligible, can be considered for direct recruitment across the whole IIT system up to a maximum of 50 years of age. The due relaxation in upper age is made available for SC/ST/OBC/ PwD and Ex-servicemen candidates as per Central Govt.

Rules;

- (b) SC/ST and PwD candidates are fully exempted from payment of application and registration fees;
- (c) To and fro TA is being paid to the candidates of all categories out of Kanpur to attend the interview [for Group-A –AC-II rail fare (Rajdhani Exp. also)/Chair car in Shatabdi Exp. And for Group-B (Grade Pay of Rs.4600/-) – AC-III rail fare (Rajdhani Exp. also) / Chaircar in Shatabdi Exp. rail fare];
- (d) Experience requirement is relaxable at the discretion of competent authority.
- (e) For Regular employees of IITs who are educationally qualified and otherwise eligible, can be considered for direct recruitment across the whole IIT system up to a maximum of 50 years of age. The due relaxation in upper age is made available for SC/ST/OBC/ PwD and Ex-servicemen candidates as per Central Govt. Rules;
- (f) SC/ST and PwD candidates are fully exempted from payment of application and registration fees;
- (g) To and fro TA is being paid to the candidates of all categories out of Kanpur to attend the interview [for Group-A –AC-II rail fare (Rajdhani Exp. also) / Chair car in Shatabdi Exp. and for Group-B (Grade Pay of Rs.4600/-) – AC-III rail fare (Rajdhani Exp. also) / Chair car in Shatabdi Exp. rail fare];
- (h) Experience requirement is relaxable at the discretion of competent authority.

## STUDENTS' PLACEMENT

The Indian Institute of Technology Kanpur is known for its academic excellence and is often the 'first stop' for top ranked industries and research organizations to meet their hiring requirements. Students' Placement Office (SPO) functions as a facilitator for placement activities and provides assistance to recruiters and students in all placement related processes. The services rendered by SPO include recruiter selection, student training, resume short listing, conducting screening tests, infrastructure arrangements, scheduling and conducting job interviews, hospitality, etc. for both internship and recruitment processes. Our hiring partners range from consulting firms to FMCGs to core industries, software giants, e-commerce and engineering companies. SPO is actively engaged in building and maintaining long term relationships with corporate sector and constantly working towards building illustrious and rewarding careers options for IIT Kanpur students.

Activities of Students' Placement Office is coordinated by “Student Placement Committee (SPC)” which is an advisory body headed by the Chairman SPO. SPC committee is constituted with faculty representatives from individual departments and inters disciplinary programs. SPC is assisted by SPO office staff and a student team comprising of Overall Placement Coordinators, Internship coordinators and student volunteers who coordinates all placement activities organized by Placement office and Career Development Cell. Representatives from student body also participate in SPC meetings as invited guests and contribute to the decision making process. In addition to taking care of UG and PG placements, SPO also assists job pursuits of PhD scholars in reputed academic institutions, research and development centres and in consultancy firms across the globe. SPO/IIT Kanpur also encourages innovations and entrepreneurship ventures.

## Placement Office Activities

SPO activities in 2018-19 can broadly be divided into three sectors (1) facilitate hiring of current students for internships (academic and industry) (2) organize professional training towards interview preparations and (3) coordinate recruitment process for graduating students through Campus Recruitment Drive. In the first quarter of 2018-19, the focus of SPO team was on attracting potential employers for participation in placement and internship processes. Potential recruiters were identified based on input from SPO team, departmental recommendations and student feedback from previous placement seasons. Short listing of potential employers were carried out based on pre-defined screening criteria (in accordance with SPO guidelines) and the recruiters were invited to campus for student – employer interactions through Pre-placement Talks (PPTs). Efforts of SPO team was instrumental in bringing in a total of 48 new recruiters for internship and full time hiring during the year 2018-19.

### Internships for Current Students

SPO strongly encourages pre-final year students to participate in summer internship programs. IIT Kanpur boasts of a well-structured internship programme that carries the reputation of earning post internship/pre-placement offers (PPO's) for a large percentage of students. A total of 349 students were offered industry internships in year 2018-19 which is approximately 21 percent more than the number of offers received in the previous year. Out of all students who secured internships through SPO, a total of 132 students received pre-placement offers after their internship program. This is approximately 7.5 percent higher than PPO offers received in year 2017-18. Some of the prominent recruiters who participated in 2018-19 internship program include Adobe Systems, Citicorp Services, Credit Suisse, General Electric, Goldman Sachs, Jindal, KPIT Technologies, Reliance Industries Limited, Samsung, Schlumberger, Texas Instruments, JP Morgan Chase, EXL Services etc. In addition to regular clients, 14 new firms visited campus for internship hiring which include MNC's like Graviton, Jumio Japan, Quad eye Securities etc.

Apart from industry oriented internships, SPO also facilitated academic internship for students interested in pursuing a career in academia and R&D sectors through programs run by IIT Kanpur. Approximately 90 students were offered academic internships during the year 2018-19. This includes academic internships facilitated by SPO office, institute body like Office of International Relations and through individual departments. Selected few examples of these internships are TAMU-IITK intern program, Mitac Global link research internships, IIT-DAAD internships etc. Selected institutions where IITK students have received academic internships include University of Texas at Austin, Texas A&M University, Max-Planck institute, University of California Berkeley, U-T Arlington, Imperial College London, Cornell, University of Illinois etc.

### Placement Preparations.

Student Placement Office has revamped its placement preparation programs which now provide 360 degree career solution for students. Placement preparation programs are organized in coordination with Career Development Cell along with support from IIT-K Student Gymkhana. Through these training sessions, SPO provides guidance and support to students in their job pursuits through career counseling sessions, resume preparation workshops, soft skill development programs, providing learning materials for placement preparations, organizing professional training services, providing assistance in offer finalization, documentation etc. Training and career orientation programs were intended towards developing professional ethics among students and guiding them in making educated career decisions. Students were also encouraged to pursue their careers in respective sectors of interest which often vary from core engineering sector to IT, Financial, Banking, Analytics, Consulting jobs, Research and Development, Academia etc.

Student Placement Office in association with Career Development Cell organized three professional training sessions during academic year 2018-19 for students participating in placement and internship processes. Training sessions were conducted by M/s. Prep leaf Private Limited and two sessions by M/s FACE (Focus academy for career enhancement) at different time periods during the academic year. SPO team also organized training sessions intended towards improving resume writing skills, conducted multiple practice/guidance sessions for aptitude tests, group discussions and personal interviews at the beginning of placement season. SPO team along with volunteers from Student Gymkhana also conducted personal guidance and soft skill enhancement sessions for selected student groups in improving personality and interpersonal skills required for job interviews. Discussions/ career awareness workshops/talks by invited alumni members working in various sectors were also organized as part of placement preparations. The following preparation activities were conducted for placement season (2018-19).

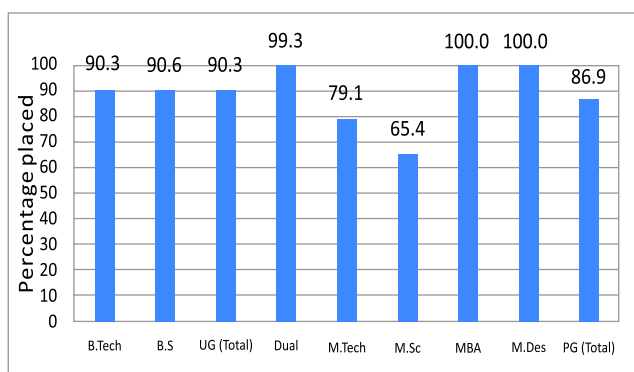
- Career counseling by professional agencies/experts towards soft skills development, professional communication and personality development
- Resume writing workshops for assistance on preparation of professional resumes
- Collecting corporate feedback on employee expectations for different job sectors
- Feedback on companies and interview experiences from students who participated in last year placement for use as orientation/information material for current students
- Resume preparation/verification of applicants.
- Student sessions on internship experiences at various industry sectors
- Sessions on group discussions and personal interviews as part of placement preparations by

invited alumni members (last 3 years). Relevant study materials (video, links, PPT etc.) were uploaded on preparation portal for future references

- Career awareness talks by invited Alumni and sharing their corporate working experience
- Aptitude tests for students through professional organization like Pariksha
- Development of further interaction pattern Campus Recruitment Drive

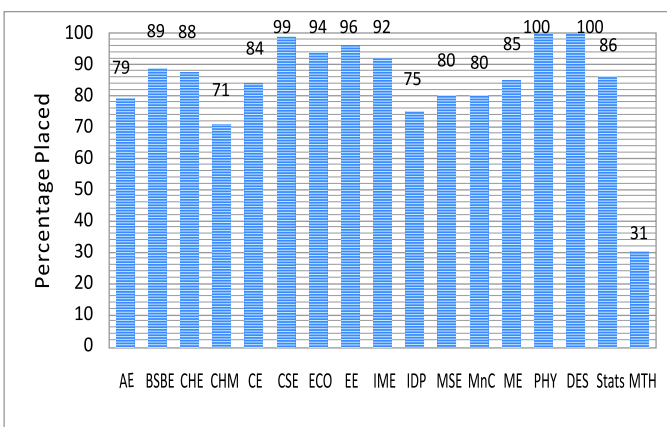
1041 students registered with Students' Placement Office for Campus Recruitment Drive 2018-19. As with previous years, recruitment drive for the academic year 2018-19 was held in two phases. Phase 1 of recruitments officially started on December 1st and extended till 15th of December, 2018. Approximately 294 recruiters visited campus during Phase 1 to hire students for full time employment. 44 top tier firms from various sectors visited campus for interviews on day 1 where an unprecedented 284 job offers were extended to IITK students. Based on hiring numbers, the top recruiter for placement season was Intel Corporation who visited campus on day one and hired 34 students. Other top recruiters for the season were HSBC, EXL Services, OYO and Reliance Jio Infocomm Ltd. As with previous years, "one student one job" policy (single offer acceptance policy) was continued to ensure equal opportunity to all students registered with SPO. Phase 2 of recruitments started in January and extended till May, 2019. More than 324 companies visited IITK campus for student hiring during the two phases of placements.

Approximately 88.5 % of the graduating batch (921 out of the 1041 registered students) were placed through Student Placement Office during the academic year 2018-19. This includes students in both under graduate and post graduate levels. 437 out of 484 registered students in B. Tech and B.S. degree programs (approx. 90.28%) were placed during the season. UG placement count also includes 95 accepted Pre-Placement Offers (PPO's) extended to them as part of academic internship provided through Student Placement Office. A summary of program wise placement record for the current season is included in figure below.



Approximately 86.9% of registered PG students (484 out of 557) were also placed through SPO during campus recruitment drive. Amongst the various post graduate programs, MBA and Master of Design (MDes.) recorded

100% placements followed by dual degree program were 99.4% of the students got placed during the current placement season. A summary of department level placement record for the current season is included in figure below.



Among the various departments, Computer Science and Engineering, Economics, Electrical Engineering, IME recorded 90 percent and above in terms of students placed. Percentage students placed in other departments are given in figure above. The percentage calculations given above are derived based on the number of graduating students whom have registered with the placement office. A good number of graduating students do not register for placements as they are interested in pursuing higher studies or entrepreneurship options. In addition, an appreciable number of IIT Kanpur students pursue Civil Services jobs or take-up career options in public sector companies and therefore abstain from participating in the recruitment process

Students of IIT Kanpur continued to demonstrate a strong commitment to their core educational background in their choice of employment. Placement season 2018-19 also saw an increase in the number of recruiters in "core" engineering sectors where close to 30 percent of students received job offers. Some of the top recruiting firms that visited IIT Kanpur for hiring students in core engineering sector include Intel, Cisco System, Schlumberger, Eaton, L&T Constructions, Tata Steel, Tata Motors, Jindal Stainless Limited, Indian Oil Corporation Limited etc. As with previous years, IIT Kanpur continued to draw recruiters in the field of data analytics where close to 100 companies visited campus for student recruitment. More than 250 offers extended to our students were accepted making it one of the biggest recruiters after engineering and information technology. This trend seen in the last few years seems to have taken strong roots at IIT Kanpur. More than 15 firms in consulting sector, including several global leaders, visited IIT Kanpur for recruitment this year. More than 32 offers extended in consulting sector including management consulting were accepted by students. Finance sector also saw a rush of top and mid-level companies visiting campus with a variety of profiles that are open for students in diverse disciplines. More than 47 offers in financial service firms were accepted by our students this year.



Some of the prominent recruiters who participated in Campus Recruitment Drive 2018-19 include Master card, Deutsche CIB Centre, Adobe Systems, Citicorp Services, Credit Suisse, Goldman Sachs, KPIT Technologies, Samsung, Quantiphi, Schlumberger, Texas Instruments, JP Morgan Chase, HSBC, EXL Services, Exxon Mobil, Blackrock, Rubrik Inc., Microsoft, Bank of America, American Express, Taiwan Semiconductor Manufacturing Company etc.

support needed for successfully conducting various placement activities. We also thank the members of various institute bodies namely Lecture Hall Complex, DOAA, DOSA, Visitors Hostel and Allied Facilities and various sections of Institute Works Department for their help and support in organizing these events. We also thank Career Development Centre and Student Gymkhana for the technical inputs and unparalleled support in coordinating and managing various SPO events.

### **Acknowledgements**

We wish to express our sincere gratitude to the institute administration for providing financial and infrastructure

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For full details visit following URL:

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कुलसचिव  
भारतीय प्रौद्योगिकी संस्थान कानपुर  
दूरभाष: 0512-259-2010  
वेब पेज: www.iitk.ac.in

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### Design

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### Publisher

Registrar  
Indian Institute of Technology Kanpur  
Tele: 0512-259-2010  
Web Page: www.iitk.ac.in

### Photographs

Shri Girish Pant



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