

A GLIMPSE OF RESEARCH ACTIVITIES AT IIT PATNA



INDIAN INSTITUTE OF TECHNOLOGY PATNA

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About Us

Indian Institute of Technology (IIT) Patna is an Institution of National Importance. Since its inception in 2008, IIT Patna has pursued excellence with steadfast determination. IIT Patna is located in Patna, capital city of the state of Bihar.

Departments in IIT Patna



Engineering

Computer Science & Engineering (CSE)
Electrical Engineering (EE)
Mechanical Engineering (ME)
Civil & Environmental Engineering (CEE)
Chemical & Biochemical Engineering (CBE)
Metallurgical and Materials Engineering (MME)



Basic Sciences

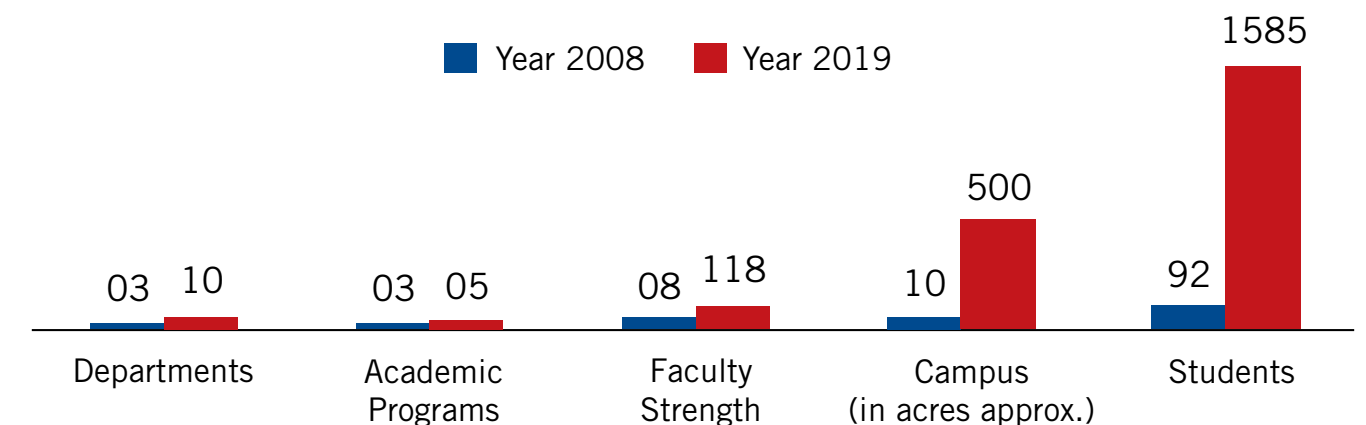
Physics (PHY)
Chemistry (CHEM)
Mathematics (MATHS)



Humanities and Social Sciences (HSS)

IIT PATNA, established in 2008 by the Institutes of Technology (Amendment) Act of Parliament

Growth of IIT Patna since inception in 2008



Awards & Recognition during last five years

IIT Patna ranked 22nd in Engineering Institute category according to NIRF, MHRD, Govt. of India

Sr. No.	Points of Pride
1	Two projects received consolation prizes at GRIDTECH 2019 held at Delhi. Congratulations to Mr. Surya Prakash (Ph.D.Scholar, EE) and Mr. Tarun Kumar (B.Tech, EE). The projects were mentored by Dr. Ranjan Kumar Behera (EE).
2	Mr. Kundan Kumar (Ph.D. scholar, MME) has been awarded with MRSI prize for the best poster in First Indian Materials Conclave (IndMaC) by MRSI (Materials Research Society of India) at IISc Bangalore February 12-15, 2019.
3	Biaxial Testing Device selected among the top six best business ideas in Business Plan Competition organized by Bihar Industries Association and Venture Park.
4	Dr. Ashish K Upadhyay (MATH) has been elected to the executive council of the prestigious Ramanujan Math Society.
5	Dr. Sushant Kumar (CBE) receives funding under Young Scientist Research Award (DAE, BRNS).
6	Dr. Pranay Ranjan (ex-Ph.D. scholar, PHY) won the Best Thesis Award at the 'International Conference on Nanomaterials for Clean Energy'.
7	Congratulations to Mr. Vatsal Singhal for being selected as Lead for Google's Developer Student Club program of IIT Patna campus.
8	Mr. Tirthankar Ghosal (Ph.D. scholar, CSE) has been awarded the AWSAR award 2018 in the popular science story category organized by DST.
9	Mr. Mithun Mandal (Ph.D. scholar, CEE) has received the "Best Paper Presenter Award" at the Indian Geotechnical Conference (IGC 2018).
10	Dept. of EE got two awards for best M.Tech. thesis ISTE-L&T National award in Electrical/Electronics Engineering.
11	Dr. Sudhan Majhi (EE) became the Editor of IEEE Communications Letters.
12	Dr. Manabendra Pathak (ME) was selected for "Academic Excellence" award under the subcategory "Head of the Department" at IEI-FCRIT Excellence Award 2019.
13	Dr. Sriparna Saha (CSE) Dr. Shovan Bhaumik (EE) Dr. Sanjoy Kumar Parida (EE) have been awarded the prestigious "Young Faculty Research Fellowship" under Visvesvaraya Ph.D.Scheme for Electronics & IT.
14	Mr. Kundan Kumar (MME) got the best poster award in the Interdisciplinary Symposium on Materials Chemistry, ISMC-2018, organized by DAE - BRNS at BARC.
15	Dr. Papia Raj (HSS) has been invited to deliver a keynote address at the ICSSR sponsored National Conference on "Understanding Women: The Gender Based Role Crisis" at Nitishwar Mahavidyalaya, Muzaffarpur, Bihar.
16	IIT Patna won the Third Prize in National Open Data hackathon. It includes a cash prize of Rs 50,000.00 and Citation. Congratulations to Binayak Krishna Swami and Rakesh Kumar Sanodiya.
17	Mr. Nemi Chandra Rathore and Dr. Somanath Tripathy (CSE), won the best poster award at the 6th International Conference on Advances in Computing, Communications and Informatics (ICACCI-2018) held in Bangalore.
18	Best paper award to Mr. Deba Prasad Dash and Dr. Maheshkumar H Kolekar (EE) at the 4th International Symposium on Signal Processing and Intelligent Recognition Systems held at Bangalore, India on September 19-22, 2018.
19	Dr. Aditya Raj (HSS) has been invited as the convener of the interdisciplinary Thematic Panel on 'Population, Poverty and Migration' of the 42nd of Indian Social Science Congress to be held in BHU, Varanasi.
20	Dr. Anup Kumar Keshri (MME) has been selected for the short research stay at the University of Kassel, Germany by Alexander von Humboldt Foundation.
21	Dr. Asif Ekbal (CSE) has been invited as the Area Chair (AC) in the area of Question Answering for The 2019 Conference of the North American Chapter of the Association for Computational Linguistics - Human Language Technologies in 2019.

Sr. No.	Points of Pride
22	Dr. Manoranjan Kar (PHY) has been selected for the IAPT-DSM Best Teacher Award for the year 2018, coordinated by Indian Association of Physics Teachers (IAPT).
23	Dr. Pratibhamoy Das (MATH) has been selected as DAAD Research Ambassador of Germany for the period 2018-22.
24	Dr. Sudhan Majhi (EE) has been selected in the Editorial Board of IEEE Transactions of Vehicular Technology.
25	Dr. Rishi Raj (ME) has been selected for prestigious INAE (Indian National Academy of Engineering) Young Engineer award 2018.
26	Dr. Sanjoy Kumar Parida (EE) has been selected for BHARAT VIKAS AWARD.
27	Dr. Sriparna Saha (CSE) has been selected for the "Indo-U.S. Fellowship for Women in STEMM (WISTEMM) Women Overseas Fellowship program 2018".
28	Dr. Rishi Raj (ME) has been selected as the Associate of the Indian Academy of Sciences, 2018.
29	Prof. Pushpak Bhattacharyya, Director, IIT Patna, has been selected for Distinguished Alumnus Award from his alma mater, IIT Kharagpur.
30	Prof. Pushpak Bhattacharyya, Director, IIT Patna, has been chosen as one of the top ten artificial intelligence and machine learning researchers in India.
31	Prof. Pushpak Bhattacharyya, Director, IIT Patna, was nominated by Hon'ble Minister of External Affairs to be a panelist in the panel 'Indian Diaspora's Role in Capacity Building of Artificial Intelligence in India'.
32	Dr. Sudhanshu Sekhar Panda (ME) was nominated as a member of the editorial board of "Journal of Clinical Orthopaedics and Trauma (JCOT)" published by Elsevier.
33	Dr. Sriparna Saha (CSE) won SERB Women in Excellence Award 2018.
34	Dr. Neeladri Das (CHEM) was selected for Research Stays funding(DAAD).
35	Work of Mr. Mahipal, Mr. Hasan Ahmed Faisal and Dr. T. Ray Choudhury (CEE) has been selected for Gandhian Young Technological Innovation (GYTI) Award/Appreciation 2018.
36	IIT Patna team won runners up position at ACM ICPC Kolkata-Kanpur Regionals. The team includes Mr. Bhavit Sharma, Mr. Shaurya Gupta and Mr. Prateek Karnal.
37	Dr. Saurabh Kumar Pandey (EE) won Marquis Who's Who Achievement Award 2018 for his contribution in the field of micro- optoelectronics devices.
38	Mr. Nilotpal Chakraborty (research scholar, CSE), was selected for Richard E. Merwin Student Scholarship.
39	Dr. Alpana Nayak (PHY) was conferred with the Bharat Vikas Award 2017 for her contribution in the field of nanoscience and technology.
40	Poster by Mr. Gour Mohan Das and Dr. Venkata Ramanaiah Dantham (PHY) was selected as one of the best posters in the 2nd International Conference on Condensed Matter and Applied Physics (ICC) held at Bikaner on 24-25th November 2017.
41	Mr. Sanjeet Nayak and Dr. Somanath Tripathy (CSE) got the 1st best technical poster award in Global Conference on Cyber Space (GCCS) held on 23 - 24th November 2017 at New Delhi.
42	Dr. Subrata Hait (CEE) has been conferred with the Bharat Vikas Award 2017.
43	Dr. Ranjan Kumar Behera (EE) has been conferred with the Bharat Vikas Award 2017.
44	Dr. Saurabh Kumar Pandey (EE) has been selected as an Associate Editorial Board member in "Research & Development in Material Science" (RDMS) Journal.
45	Mr. Anupam Das (B.Tech, CSE) was selected as the Google Android with CS facilitator.
46	Mr. G.P. Satish, working under Dr. Atul Thakur (ME) and Dr. Subrata Hait (CEE) won the Best Research Presentation Award Runner-up in RACI 2017 at ISI Kolkata.
47	Mr. Chirag Wadhwa (B.Tech., CSE) was selected as the Student Lead for the Developer Student Club program of Google for the 2017-18 academic year.
48	Dr. Sweta Sinha (HSS) was awarded the 'Certificate for Best Presentation' in the International Conference of Linguistics and Phonology (ICLP19) in Bangkok, Thailand.
49	Mr. Vinay Kumar Trivedi (Research Scholar, EE), was selected for the "Marquis Who's Who" 2018 Albert Nelson Marquis Lifetime Achievement Award.
50	Dr. Amarnath Hegde (CEE) was selected for the prestigious "IEI YOUNG ENGINEERS AWARD 2017-2018" in Civil Engineering discipline.

Sr. No.	Points of Pride
51	IIT Patna team 'Alacrity' has secured overall third position at ASME HPVC Asia Pacific 2017 held from 3rd-5th March at Jaipur.
52	Best paper award won by Mr. Deba Prasad Dash (EE) in Symhealth 2017.
53	IITP team "INVINCIBLES IITP (Baja)" awarded 2nd position.
54	Best poster award won by Mr. O. S. Asiq Rahman in "International Conference on Emerging Trends in Materials, Manufacturing Engineering, 2017".
55	Best paper award won by Mr. Siddharth Suman in ICEEEE2017.
56	Best Paper Award won by Mr. Rohan Kumar Choudhary in ETWREE'17.
57	Best E-poster award won by Ms. Sristhi and Dr. Papia Raj (HSS) at 61st Annual National Conference of IPHA.
58	Ms. Kriti Gupta won the best research paper award at CUSB-2017.
59	Dr. Maheshkumar H Kolekar (EE): elevated to the grade of IEEE Senior Member.
60	IIT Patna team 'Alacrity' is 2nd Runner Up in ASME HPVC Asia Pacific 2017.
61	Best Poster Presentation Award won by Mr. Kundan Kumar (research scholar, MME) in ICFM 2016.
62	Dr. Asif Ekbal (CSE) became an Associate Editor of Sadhana, an IAS Journal.
63	Eminent Engineer Award conferred by The Institution of Engineers to Prof. Pushpak Bhattacharyya at the 31st National Convention of Computer Engineers.
64	Dr. Rajiv Misra (CSE) was elevated to the grade of IEEE Senior Member.
65	Mr. Atul Kumar won the best poster award at ICRCs 2017.
66	Best poster award to Mr. Deepak Kumar Prajapati, a research scholar of Mechanical Engineering Department in National Tribology Conference (NTC 2016).
67	Best paper award to two final year B.Tech. students Mr. Vishal Nagarkoti (ME), and Mr. Omprakash Sahu (ME) in the 6th International and 43rd National Conference on Fluid Mechanics and Fluid Power(FMFP2016).
68	Ms. Pranjali Kokare (CSE) received an Adobe Research Women-In-Technology Scholarship award for year 2017.
69	Dr. Asif Ekbal (CSE) was awarded JSPS Fellowship.
70	Dr. Richa Chaudhary (HSS) won the best research paper award at IIM World Management Conference.
71	Dr. A. K. Thakur (PHY) became the Vice-President, Asian Society for Solid State Ionics (ASSSI).
72	Dr. Sriparna Saha (CSE) has been selected for Bioclues Innovation Research and Development (BIRD) awards 2016.
73	Dr. Preetam Kumar (EE) became the Editorial Board Member of International Journal of Wireless Personal Communications.
74	Mr. K.K. Yenumula of Electrical Engineering Department received Theme Award in 2016 IEEE Students' Technology Symposium, in "Advancing Technology for Humanity.
75	Mr. Angshuman Das (Ph.D. scholar, CEE) won First Prize for a paper in SHILP-2016.
76	Mr. Sumit Asthana (BTech, CSE), got the invitation to attend the Google Summer of Code Mentor Summit 2016 at Sunnyvale, California, USA from October 28 - 30, 2016.
77	Best Paper Award won by Mr. Vikas Kumar in the 12th IEEE International Colloquium on Signal Processing & Its Applications held in Kuala Lumpur, Malacca, Malaysia during March 4-5, 2016.
78	Ms. Pranjali Kokare (CSE) was selected to attend the 2016 Grace Hopper Celebration as a Google Intern Travel Grant Recipient.
79	Dr. Sriparna Saha (CSE) was awarded NASI-Young Scientist Platinum Jubilee Award.
80	Accenture and IIT Patna tied up in AI research.
81	Dr. Saurabh Kumar Pandey (EE) has been Selected of his biographical profile for inclusion in the "Marquis Who's Who in the World 2016 (33rd Edition).
82	Best Paper Award to Ms. Anshupriya in Recycle - 2016 at IIT Guwahati.
83	Dr. Sanjoy Kumar Parida (EE) has been elevated to the grade of IEEE Senior member.
84	Dr. Sudhan Majhi (EE) has been provided with the 'Associate Editor' role in the journal 'Circuits, Systems, and Signal Processing'.
85	IIT Patna being conferred Education Award instituted by CMAI Association of India. Prof. Pushpak Bhattacharyya Director IIT Patna received the award from the Hon'ble Governor of Bihar Shri Ram Nath Kovind on 8th March, 2016.

Sr. No.	Points of Pride
86	Dr. Sriparna Saha (CSE) was selected for IEI Young Engineers award 2015 in Computer Engineering discipline.
87	Dr. Debashree Guha Adhya (MATH) has been granted the National Scholarship SAIA-NSP given by Govt. of Slovak Republic.
88	Dr. Preetam Kumar (EE) has been elevated to the grade of IEEE Senior Member.
89	Dr. Sriparna Saha (CSE) has been elevated to the grade of IEEE Senior Member.
90	Best Paper Award in the International Conference on Condensed Matter & Applied Physics (ICC-2015).
91	Prof. Pushpak Bhattacharyya, Director, IIT Patna, was invited to be the chair for NLP in IJCAI 2016, a flagship conference in Artificial Intelligence.
92	Prof. Pushpak Bhattacharyya, Director, IIT Patna, was elected as Fellow of Indian National Academy of Engineering.
93	Book titled "Machine Translation" published by Prof. Pushpak Bhattacharyya.
94	Dr. Neeladri Das (CHEM) was awarded a Poster Prize by the Royal Society of Chemistry, UK.
95	Dr. Rajib Kumar Jha (EE) got 2015 Premium Award for Best Paper in IET Image Processing.
96	Doctoral research work of Dr. Vaibhav Singhal selected as Innovative Students Projects Awards 2015 of (INAE).
97	Dr. Sriparna Saha (CSE) has been granted the Junior Humboldt Research Fellowship.
98	Dr. Sudhan Majhi (ME) has been elevated to the grade of IEEE Senior member.
99	Book title "Fluid Mechanics & Machinery" by Dr. Mohd. Kaleem Khan (ME).
100	Dr. Sriparna Saha (CSE) has been chosen as Associate Editor of ACM transactions on Asian Low Resource Language Information Processing (ACM TALLIP), 2017.
101	Mr. Kuntal Das (CSE) and Mr. Ravi Sonam (CSE) were selected as Summer Research 2015 Intern at Arizona State University, USA.
102	Dr. Suman Kumar Maji (CSE) received SERB Early Career Research Award-2017.



Research & Development

IIT Patna has research laboratories equipped with the state-of-the-art facilities in Engineering and Natural Science dept. Faculty members of various departments are actively working with govt. agencies and other R&D organizations to enable the participation of IIT Patna in large number of cutting edge scientific research. Research & Development (R&D) Unit at IIT Patna is a special unit with dedicated staff members to manage the projects funded by external funding agencies.

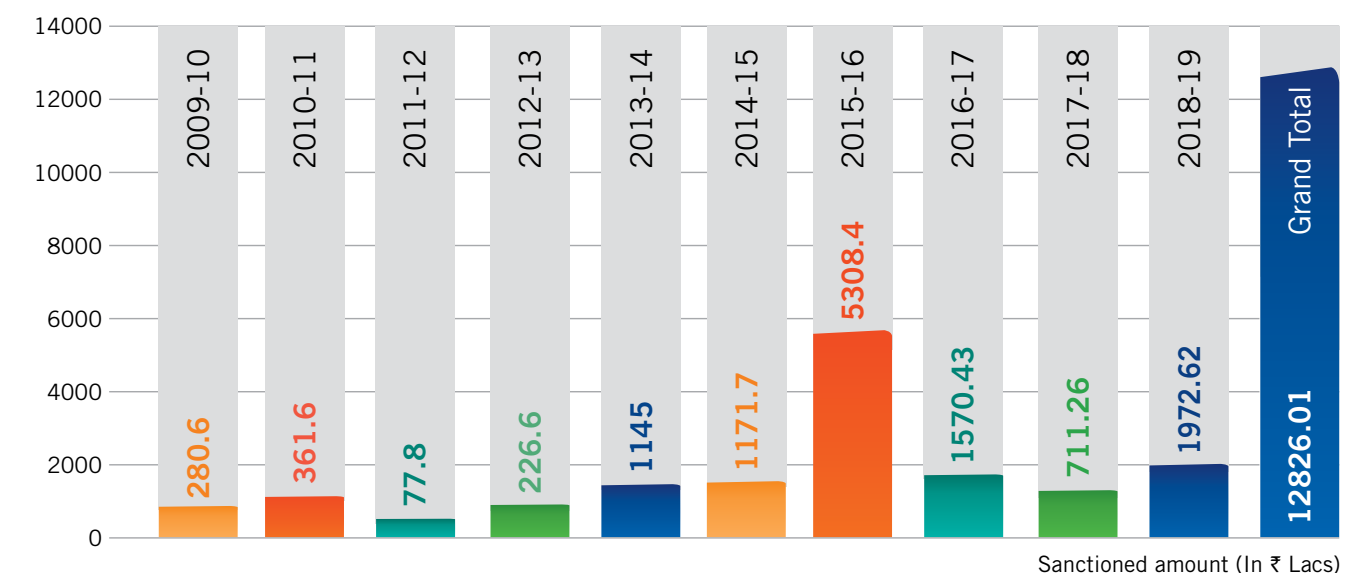
386

Total number of projects (since inception)

₹12826.01 Lacs

Total amount of grant received for projects

Growth in Value of Projects Sanctioned



Sanctioned amount (In ₹ Lacs)



Details of Patent, Design & Technology Transfer at IIT Patna

Department	Topic	Name of Inventor/s
*ME	Surfactant based boiling system for zero gravity	Md. Q. Raza and Dr. R. Raj
ME	A biaxial stretching device for simultaneously stretching of an elastomer sample	Dr. K. Patra
EE	Multi person viewable 3d display device and filter glasses based on frequency multiplexing of light	Mr. S. A. Reddy
ME	Determination of whirl direction of shaft using modified full spectrum analysis of motor current signature	Dr. S. Sarangi, Mr. A. K. Verma, Mr. G. Krishnan
CHEM	A process for the preparation of biopolymers	Dr. D. Chakraborty
MATH	Blind wireless receiver (BWR) testbed implementation for single carrier systems	Dr. S. Majhi, Mr. M. Kumar
EE	Automatic booklet scanning machine (ABSM)	Dr. K. C. Ray, Mr. P. Parmar
EE	An improved squirrel cage induction motor with enhanced efficiency and wide range of operating speed for application in electric vehicle	Dr. R. K. Behera, Mr. Md. J. Akhtar, Dr. S. K. Parida
ME	Dielectric elastomer annular diaphragm based micro hydroelectric generator.	Dr. K. Patra, Mr. S. K. Sahu, Mr. A. R. Jithin, Mr. V. J. G. Bharadwaj
ME	An improved valveless micropump with dome shaped dielectric elastomer diaphragm, pumping chamber and nozzle diffuser as flow control element.	Dr. K. Patra, Mr. A. Saini
ME	Vibro tactile feedback system using FSR	Dr. K. Patra & Mr. L. G. D'sa
ME	A Stretching apparatus and a method of stretching	Dr. K. Patra, Mr. A. Kr. Sinha

Note: *The patent has been granted.

Department	Topic	Name of Inventor/s
PHY	A method for the synthesis of pure phase multiferroic bismuth ferrite, bifeo3 (BFO) ceramics.	Dr. M. Kar & Mr. P. Kumar
MME	A phase and stoichiometrically pure ceramic powder and a process for the preparation thereof	Dr. A. Chowdhury
ME	An improved system of a passive exoskeleton to reduce manual effort in carrying load	Dr. M. Tiwari, Mr. R. Gupta, Mr. V. Pandey, Mr. P. Kumar, Mr. N. Kumar
ME	A system and method for controlling the buoyancy of an underwater submersible	Dr. R. Raj, Dr. A. D. Thakur, Mr. S. Banerjee, Mr. U. Pandey
MME	A process for obtaining shape and size controlled ceramic nanopowders	Dr. A. Choudhury, Mr. K. Kumar, Mr. K. Singh
CSE	System and method for detecting change in occupation status of a slot over a platform	Dr. J. Mathew, Mr. Z. Easa P, Mr. D. Gupta, Mr. A. Mathew
CSE	System and method for determining company performance	Dr. A. Maiti, Mr. S. Mandal
CSE	System and Method for activity based user authentication	Dr. S. Kr. Dandapat, Dr. A. Maiti
ME	Dielectric elastomer transducer based exoskeleton type knee motion harvester.	Dr. K. Patra, Mr. S. Kr. Sahu
ME	A method of joining polymers rod through deformation technique using a Y-shape die apparatus	Dr. S. S. Panda & Mr. P. Kumar
CSE	A hybrid multi bit random number generator	Mr. V. Kr. Rai, Dr. J. Mathew & Dr. S. Tripathy
ME	System and method for heat recovery in gasification process	Mr. Sunil, Dr. R. Raj, Dr. A. D. Thakur, Mr. B. Kr. Rajan, Mr. B. Chaitanya, Mr. A. Aggarwal, Mr. A. Aggarwal, Mr. R. Sinha
ME	An apparatus and a method for cryogenic machining of polymers materials	Mr. A.K. Sinha & Dr. K.Patra

Department	Topic	Name of Inventor/s
PHY	Method of coating a substrate	Dr. M. Kar & Mr. A. Saxena
ME	Biaxial planar tensile testing device for elastomeric materials	Dr. K. Patra, Mr. S. Kr. Sahu, Mr. A. Javed, Mr. D. Ahmad
EE	Lowpass to bandpass switchable and tunable filter	Mr. N.Kumar & Dr. Y. Kr. Singh
ME	Stepped microchannel heat sink	Mr. S. Raj, Mr. A. Shukla, Dr. M. Pathak, Dr. Mohd. K. Khan
ME	System and method for suppressing two phase flow instability, title changed to : an improved heat sink system for suppressing two-phase thermal and flow instabilities and a method thereof	Mr. A. Kumar, Mr. D. P. Ghosh, Mr. D. Sharma, Dr. R. Raj
EE	A blind modulation classification (BMC) method for linearly modulated signal over single carrier system	Dr. S. Majhi, Mr. R. Gupta, Mr. B. J. Prakash

Details of Design at IIT Patna

Department/Centre	Topic	Name of Inventor/s
ME	Manual Wheat Harvester	Mr. R. Gupta, Mr. H. P. Singh, Mr. A. Kumar, Mr. R. Gupta
ME	Hand operated garbage & soil Collector	Dr. M. Tiwari, Mr. R. Gupta & others
ME	Exoskeleton	Dr. M. Tiwari & some B. Tech. Students

Details of Technology Transfer at IIT Patna

Department/Centre	Topic	Name of Inventor/s
ME	Vibro Tactile feedback System using FSR	Dr. K. Patra & Mr. L. G. D'sa



Funding Agencies



Departments at a Glance

Computer Science and Engineering

Number of Faculty: 14

Courses offered: B.Tech, M.Tech, M.Tech by Research, Ph.D.

Electrical Engineering

Number of Faculty: 16

Courses offered: B.Tech, M.Tech, Ph.D.

Mechanical Engineering

Number of Faculty: 17

Courses offered: B.Tech, M.Tech, Ph.D.

Civil and Environmental Engineering

Number of Faculty: 13

Courses offered: B.Tech, M.Tech, Ph.D.

Chemical and Biochemical Engineering

Number of Faculty: 08

Courses offered: B.Tech., Ph.D, M.Tech by Research

Materials Science and Engineering

Number of Faculty: 05

Courses offered: B.Tech (w.e.f. July 2019), M.Tech., Ph.D.

Chemistry

Number of Faculty: 11

Courses offered: M.Sc., Ph.D., M.Tech

Mathematics

Number of Faculty: 10

Courses offered: M.Sc., M.Tech, Ph.D.

Physics

Number of Faculty: 16*

Courses offered: M.Sc., Ph.D., M.Tech

Humanities and Social Sciences

Number of Faculty: 09

Courses offered: Ph.D.

* With one Ramanujan Faculty

MoUs with Foreign Organizations



京都大学
KYOTO UNIVERSITY



Università
Ca' Foscari
Venezia



COMPUTER SCIENCE AND ENGINEERING

Research Vision of the Department

- To evolve into a powerhouse of excellence in CSE education to impart enduring CSE programs with rigour and relevance that help individuals acquire academic excellence, competencies, and, cutting-edge research skills and inculcating in them a social consciousness and human values
- Become a globally recognized centre for Computer Education with world class research output

Lab facility



Research Lab I: Elsevier Centre for Excellence of Natural Language Processing

Aim: To conduct research and development in some of the cutting edge areas of Artificial Intelligence, Natural Language Processing and Machine Learning

Important Publications:

- T. Ghosal, A. Raj, A. Ekbal, S. Saha and P. Bhattacharyya, "A Deep Multimodal Investigation To Determine the Appropriateness of Scholarly Submissions," 2019 ACM/IEEE Joint Conference on Digital Libraries (JCDL), Champaign, IL, USA, 2019, pp. 227-236.
- N. Saini, S. Saha, P. Bhattacharyya (2019). "Multi-objective Based Approach for Microblog Summarization". IEEE Transactions on Computational Social Systems.

- Dushyant S. Chauhan, Md S. Akhtar, A. Ekbal and P. Bhattacharyya (2019). Context-aware Interactive Attention for Multi-modal Sentiment and Emotion Analysis, In **EMNLP 2019 (accepted)**.
- T. Ghosal, R. Verma, A. Ekbal and P. Bhattacharyya (2019). DeepSentiPeer: Harnessing Sentiment in Review Texts To Recommend Peer Review Decisions. **ACL 2019**, pp 1120–1130.



Research Lab II: Shusrut: ezDI Research Lab on Health Informatics

Aim: To conduct research and development in some of the crucial issues having great impact on health care based on Natural Language Processing and Machine Learning

- S. Yadav, A. Ekbal, S. Saha, P. Bhattacharyya (2019). A Unified Multi-task Adversarial Learning Framework for Pharmacovigilance Mining. **ACL 2019**, pp 5234–5245.

- P. Dutta, S. Saha, S. Chopra, and V. Miglani (2019): "Ensembling of Gene Clusters utilizing Deep Learning and Protein-protein Interaction Information", IEEE/ACM Transactions on Computational Biology and Bioinformatics (accepted).
- S. Yadav, A. Ekbal, S. Saha and P. Bhattacharyya, "Multi-task Learning Framework for Mining Crowd Intelligence towards Clinical Treatment", in NAACL-HLT 2018, pp 271–277

Research Lab III: Advanced Computing Lab

Aim: This proposed Advanced Computing lab will cater to the needs of computing resources for applications such as Large Scale Distributed Computing, Cloud Computing, High Performance Computing and Big Data Computing. Besides, setting up a private cloud, hybrid cluster and

- Accelerators for many cores/threads, the computing will

be extended for public cloud, grid. The researchers can develop prototypes and test on advanced computing facilities

Research Lab IV: Embedded Systems Integration Lab

Aim: To act as a key enabler and catalyst for Embedded System Education. To Innovate, enterprise and take leading role in R&D of Embedded System Engineering.

- Specifically, to promote design and development of hardware based system for Improving the quality of life. Intel has donated a number of Galileo boards and Grove starter kits. Embedded Systems, IoT and OS supporting tools from ARM university program is being acquired. Students from various departments will be using this facility for project/research work. Currently this lab is operated from Hardware lab of CSE dept.

Ongoing key projects

- A platform for Crosslingual and Multilingual Event Monitoring in Indian languages (MHRD under IMPRINT-I)
- A Software Tool for the Planning and Design of Smart Micro Power Grids (MHRD under IMPRINT-I)
- Center of Excellence for Natural Language Processing (Elsevier)
- Deep Learned Detection and Classification of Multiple Intrusions Using WDM Intensity and Phase-Sensitive OTDR in Underwater Environment (NRB, DRDO, New Delhi)
- Design, Development, and Characterization of Blue LED and Visible Laser Based Underwater Optical Wireless Communication System for Audio and Video Sig (Naval Research Board)
- Developing Systems for Sentiment, Emotion, Sarcasm and Hate Speech Detection (SESH) (CDOT)
- Development of Adaptive Algorithms for Solving Many-Objective Optimization Problems: Application in Machine Learning (DST, SERB)
- Development of CDAC Digital Forensic Centre with Artificial Intelligence based Knowledge Support Tools (Meity, Govt. of Bihar)
- Development of Lizard-like Robotic Spy Surveillance System (MHRD under IMPRINT-II)
- Development of Planning and Designing Tool for Smartly Adopting Electric Vehicles in Indian Cities (Science and Engineering Research Board (SERB))
- Dynamic Natural Language Generation (Samsung)
- Hindi to English Machine Translation System for Judicial domain (MeITY)
- Improving Regional Transportation Systems using GPS (SPARC)
- Information Retrieval Via Knowledge Graphs Developed for Aircraft Accidents Database and Aircraft Manuals (IMPRINT-2: MHRD, MEITY, Honeywell)
- LG-Soft Restaurant Recommendation (LG Soft)
- Low-cost Energy Efficient Cloud for Cyber Physical Disaster Management Systems (DST)
- Road extraction from satellite images (Sky Map Pvt. Ltd.)
- Sevak – An Intelligent Indian Language Chatbot (IMPRINT-2: MHRD MEITY Wipro)
- V2D: Video-to-Description Generation using Deep Learning (DST)
- A Computational Model for 3DFluorescence Microscopy Super Resolution, SERB, DST

Selected recent publications

- S. K. Maji and H. Yahia : A Feature based Reconstruction Model for Fluorescence Microscopy Image Denoising, Scientific Reports (Nature Publishing Group), 9: 7725, 2019.
- A. Jana, R. Halder, K. V. Abhishekh, S. D. Ganni, and A. Cortesi, Extending Abstract Interpretation to Dependency Analysis of Database Applications , IEEE Transactions on Software Engineering, (2018).
- S. Kr. Nayak, S. Tripathy , SEPDP: Secure and Efficient Privacy Preserving Provable Data Possession in Cloud Storage , IEEE Transactions in Service computing, (2018).
- Jos A. V. P., B. R. Jose, J. Mathew, B. A. Jose. , A Differential Quantizer-Based Error Feedback Modulator for Analog-to-Digital Converters. , IEEE Transactions on Circuits and Systems -II(1): 21-25, (1) (2018).
- S. Saha , S. Mitra, S. Kramer (2018): "Exploring Multi objective Optimization for Multi-view Clustering", ACM Transactions on Knowledge Discovery from Data, Vol. 12(4), Pages 44:1-44:30.
- S. Mishra, S. Saha, S. Mondal, and C. A. Coello, A Divide-and-Conquer based Efficient Non-dominated Sorting Approach , Swarm and Evolutionary Computation, 44, 748-773 (2019).
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- K. M. Pooja, S. Mondal and J. Chandra , A Graph Combination with Edge Pruning Based Approach for Author Name Disambiguation , Journal of the Association for Information Science and Technology, (2019).
- S. Sen, K. Kr. Gupta, A. Ekbal and P. Bhattacharyya, Multilingual Unsupervised NMT using Shared Encoder and Language-Specific Decoders, ACL 2019, Florence, Italy, 28 July- 2 August, 2019.
- R. N. Yadav, R. Misra , Approximating Common Control Channel Problem in Cognitive Radio Networks , IEEE Systems Journal (2019), 13(1): 301-312 (2019).
- S. Priya, R. Sequeira, J. Chandra and S. Kr. Dandapat , Where should one get news updates: Twitter or Reddit , Online Social Networks and Media, (2019).
- N. Chakraborty, A. Mondal and S. Mondal , Efficient Scheduling of Non-Preemptive Appliances for Peak Load Optimization in Smart Grid , IEEE Transactions on Industrial Informatics, vol 14(8), 3447-3458 (2018).
- S. Yadav, A. Ekbal, S. Saha, A. Kumar, P. Bhattacharyya, Feature Assisted bi-directional LSTM Model for Protein-Protein Interaction Identification from Biomedical Texts , Knowledge Based Systems, Volume 166, 18-29 (2019).
- S. Behera, A. Choubey, C. S. Kanani, Y. Singh Patel, R. Misra, and A. Sillitti, Ensemble trees learning based improved predictive maintenance using IIoT for turbofan engines. Proceedings of the 34th ACM/SIGAPP Symposium on Applied Computing (2019): 842-850.
- S. Acharya, S. Saha, P. Pradhan , Multi-factored gene-gene proximity measures exploiting biological knowledge extracted from Gene Ontology : application in gene clustering , IEEE Transactions on Computational Biology and Bioinformatics, (2018).
- R. Chakraborty, M. Bhavsar, S. Kr. Dandapat and J. Chandra, Tweet Summarization of News Articles: An objective Ordering Based Perspective, IEEE Transactions on Computational Social Science (2019).
- N. Saini, S. Saha, P. Bhattacharyya, H. Tuteja (2019), "Textual Entailment based Figure Summarization for Biomedical Articles". ACM Transactions on Multimedia Computing Communications and Applications (2019)

Books Published

- A. Mishra and P. Bhattacharyya: Cognitively Inspired Natural Language Processing- An Investigation Based on Eye Tracking published by Springer (2018)
- A. Joshi, P. Bhattacharyya and M. J. Carman: Investigations in Computational Sarcasm published by Springer (2018)
- R. S. Chakraborty, J. Mathew, Athanasios V. Vasilakos : Security and Fault Tolerance in Internet of Things published by Springer (2019)

CSE Develops "DIGIMONITOR" tool

Computer Science and Engg. Department, IIT Patna is developing an automated cyberspace monitoring tool named "DIGIMONITOR" that monitors real time social media Tweet feeds for early detection of radical and violence provoking feeds. The existing monitoring solutions like ASMA, X1 Social Discovery, Media Sonar and Geofeedia analyses tweets collected using a set of pre-identified keywords. However, prior identification of keywords is difficult due to the large and dynamic vocabulary sets used over the social media. In contrast DIGIMONITOR uses advanced deep learning techniques for identifying feeds that may be potentially threatening. Further, it also uses novel techniques to measure the potential virality of the feeds and thus provides relevant information to the law enforcement agencies, without burdening them with irrelevant information overload.

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ELECTRICAL ENGINEERING

Research Vision of the Department

"To engage in the frontiers of the field and channelize the state-of-the-art knowledge to train personnel who can solve problems of relevance to the society at large. While imparting high quality education, emphasis is being imparted on taking up innovative ideas from concept stage to final product development stage via the route of basic technology research, feasibility studies, technology improvement, demonstration and product development."

Lab facilities



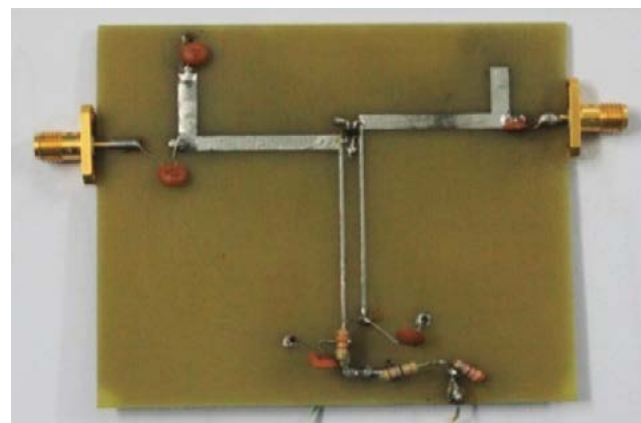
Power System & Protection Lab :- Numerical Relay Development Environment (NRDC) for Research on Power System Protection ,ETAP-Software



Instrumentation and Control:- Various Sensors: Thermocouple, Strain gage, LVDT, Programmable Logic Controller, Inverted Pendulum Control



Optical Communication Lab:- WDM DFB laser sources, Optical spectrum analyzer, Digital Sampling Scope with Precision Time Base Module for signals up to 12.5Gbps, 0.5Gbps-12.5Gbps PRBS generator and Bit Error Detector, Optical Network Simulator: OPNET, Device



RF and Microwave Lab:- Softwares:	Hardwares:
Agilent ADS Software	3 GHz Signal Generator
Ansys – HFSS Software	4 GHz Vector Network Analyzer
Coventorware MEMS analysis software	

Ongoing key projects

- Teaching Learning Centre for Internet-of-things, Smart Grid and Smart Building - Department of Higher Education, Ministry of Human Resource, Development, Govt. of India.
- A software tool for planning and design of smart micro power grids - Ministry of Human Resource, Development and Ministry of Power, Govt. of India.
- National Resource Centre on Internet of Things, Department of Higher Education - Ministry of Human Resource Development, Government of India.
- “Development and Implementation of AI Driven Adaptive Microgrid Control and Protection Schemes” under SPARC, Ministry of Human Recourses and Development (MHRD), Govt. of India.
- Multi-Node Wide Area Distributed Control to Improve Power System Stability in Indian Context, Science and Engineering Research Board (SERB), DST, Govt. of India.
- Cyber-Physical Systems for M-Health, Early Career Research (ECR) award scheme under Science and Engineering Research Board (SERB), Govt. of India.

Selected recent publications

- A. K. Panda and K. C. Ray, “Modified Dual-CLCG Method and its VLSI Architecture for Pseudorandom Bit Generation”, IEEE Transactions on Circuits and Systems-I: Regular Papers, Vol. 66, Issue 3, pp. 989-1002, Mar. 2019.
- A. Agarwal and P. Kumar, “Analysis of Variable Bit Rate SOFDM Transmission Scheme over Multi-relay Hybrid Satellite-Terrestrial System in presence of CFO and Phase Noise”, IEEE Transactions on Vehicular Technology, 2019.
- A. Agarwal and P. Kumar, “Analysis of Variable Bit Rate WH/CI-Spread OFDM based Integrated Satellite-Terrestrial Broadcast System”, IET Communications, 2019.
- V. K. Trivedi, K. Ramadan, P. Kumar, M. I. Dessouky and F. E. Abd El.Samie, “Enhanced OFDM-NOMA for Next Generation Wireless Communication: A Study of PAPR Reduction and Sensitivity to CFO and Estimation Errors,” Elsevier AEU - International Journal of Electronics and Communications, 2019.
- P. Pattanayak and P. Kumar, “An Efficient Scheduling Scheme for MIMO-OFDM Broadcast Networks,” Elsevier AEU - International Journal of Electronics and Communications, 2019.
- J. Akhtar and R. K. Behera, “Optimal design of stator and rotor slot of induction motor for electric vehicle applications,” IET Electrical Systems in

Transportation, Volume 9, Issue 1, March 2019, p. 35 – 43.

- D. Punetha and S. Kr. Pandey, “CO Gas Sensor Based on E-Beam Evaporated ZnO, MgZnO, and CdZnO Thin Films: A Comparative Study” IEEE Sensor Journal (Early Access) 2019.
- H. Dixit, D. Punetha and S. Kr. Pandey, “Improvement in performance of lead free inverted perovskite solar cell by optimization of solar parameters” Optik - International Journal for Light and Electron Optics 179 (2019) 969–976.
- D. Punetha, H. Dixit and S. Kr. Pandey, “Modeling and analysis of an Ni:ZnO-based Schottky pattern for NO₂ detection” Journal of Computational Electronics, vol.18, 2019.
- S. Kumar, S. Majhi, “Blind Symbol Timing Offset Estimation for Offset-QPSK Modulated Signals,” Accepted ETRI, Wiley, 2019.
- A. R. Adhikary and S. Majhi, “New Construction of

Optimal Aperiodic Complementary Sequence Sets of Odd-lengths,” Accepted at IET Electronics Letters, 2019.

- A. R. Adhikary and S. Majhi, “New Constructions of Complementary Sets of Sequences of Lengths Non-Power-of-Two,” accepted at IEEE Communications Letters, 2019.
- S. Kumar, “Performance Analysis of RSS-based Localization in Wireless Sensor Networks,” Springer Wireless Personal Communications, DOI: 10.1007/s11277-019-06428-5, 2019 (IF: 1.200, h5 index: 39)
- B. Lokeshgupta, S. Sivasubramani, “Multi-objective home energy management with battery energy storage systems”, Sustainable Cities and Society, vol. 47, 2019, 101458.
- Md. S. Ahmad and S. Sivasubramani, “Optimal Number of Electric Vehicles for Existing Networks Considering Economic and Emission Dispatch”, IEEE Transactions on Industrial Informatics, vol. 15, no. 4, pp. 1926-1935, April 2019.

Head, Electrical Engineering

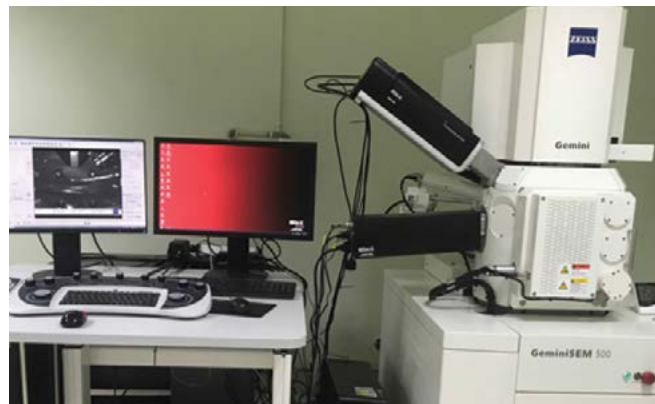
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MECHANICAL ENGINEERING

Research Vision of the Department

The Department of Mechanical Engineering (ME) at IIT Patna aims to engage in the frontiers of the field and channelize the state-of-the-art knowledge to solve problems of relevance to the country and society at large. While imparting high quality education, emphasis is laid on taking up innovative ideas from concept stage to final product development stage via the route of fundamental research, feasibility studies, technology improvement, demonstration, and product development.

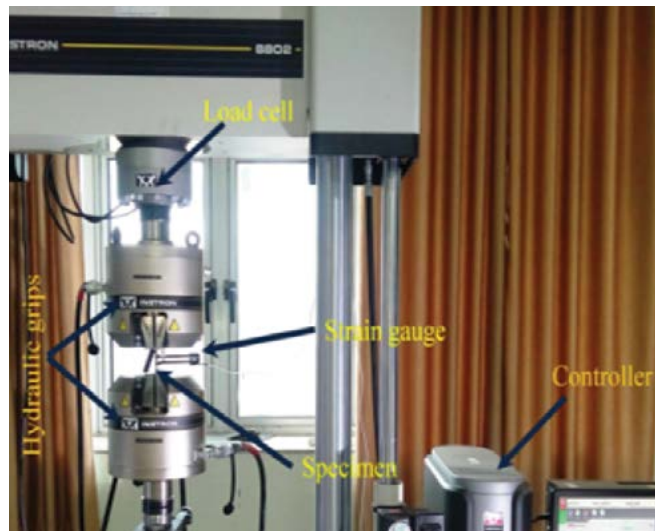
Lab facilities



Field Emission Scanning Electron Microscopy



Micromachining



Fracture Fatigue Machine



Biomass Gasification powered Adsorption Refrigeration System

Brief Outline of the Department

The Department of Mechanical Engineering at present has 17 faculty members, all with Ph.D. degree, 13 staff members, 75 Ph.D. students, 49M.Tech. students, and 208 B.Tech. students. The faculty members in the department work in four broad areas, namely Manufacturing, Energy, Mechatronics, and Machine Design. The Department has two ASME, three ISTAM, one ISES, one ASHRAE, and three ISHMT members. We also have one Indian National Academy of Engineering (INAE) Young Engineer/Associate, and one Indian Academy of Science (IAS) Associate.

Research Areas

Currently, the personnel in the Department venture in diverse multidisciplinary fields including tribology, soft-tissue mechanics, non-traditional manufacturing, laser material processing, condition monitoring, biomedical robotics, biomedical bone drilling, computational mechanics, fracture, finite element modelling, composites, micro- and nano-scale heat transfer, boiling, condensation, two-phase flows, refrigeration and air-conditioning, computational fluid dynamics, interfacial flows, fluid-structure interaction, soft computing, microgravity, among others.

Advance Manufacturing Laboratory, Deformation and Damage

Ongoing key projects

- Acoustic Detection of Leidenfrost Dynamics on Scalable Micro-/Nanostructured Surfaces – Department of Science and Technology (DST), Nanomission
- A Self-Adaptive Electronic Cooling System by Enhanced Pool Boiling – Science and Engineering Research Board (SERB)
- Controlling the Vibrational Dynamics of Fluid-Carrying Flexible Tubes via Acoustic Irradiation - Early Career Research Award, SERB
- Design of An Integral SFD – Aeronautics Research and Development Board (ARDB)
- Design of Asperity for Textured Metal Surfaces to Improve Tribological Characteristics in Sliding: An In-situ Approach - SERB
- Development of An Agricultural Waste Based Off-The-Grid Climate Control Unit for Storage and Processing of Agricultural Produce – Impacting Research Innovation and Technology (IMRPINT), DST, SERB
- Development of Cryogenic Micromachining for Fabrication of Soft and Stretchable Polymer Based Artificial Skin with Multi-Modal Sensing Capability – Advanced Manufacturing Technology (AMT) - DST
- Development of Lizard-like Robotic Spy Surveillance System – IMPRINT, DST, SERB
- Development of Low Cost, Efficient, Mechanism for
- Collection of Garbage and Dirt for Municipal Corporations, Panchayats - Swachhta Action Plan (SAP), MHRD
- Development of Multi-layered Microstructure Gradient Functionally Graded Composite Material using Friction stir Additive Manufacturing - Early Career Research Award - SERB
- Development of Novel SMA Bearing Supports and Retrofit for Enhanced Performance and Durability of Rotating Machinery – Uchhatar Avishkar Yojana, SERB-DST
- Establish Correlation between Specimen Level Fatigue and Cornering Fatigue Test - Tata Steel Limited
- Influence of Secondary Heat in Friction Stir Welding: Mechanical Properties and Metallurgical Observations - SERB
- Improvement of Fatigue and Ductile Fracture Behavior of Steel and Aluminium Alloy Specimens by Application of Pulsed Electric Current –SERB, DST
- Mechanical and Micro-structural Characterization of Additive Friction Stirred (AFS) 3D Structures Made of Al6061 T6 Aluminium Powder - SERB
- Modeling and Experimental Research Wall Bounded Flow of Magneto-Rheological Grease – SERB-DST
- Modeling and Analysis of High-Speed Hybrid Micromachining - DST

Laboratory, Flow Physics Laboratory, Machine Dynamics Laboratory, Material Testing Laboratory, Measurement and Process Analysis Laboratory, Mechatronics Instrumentation and Controls Lab, Metrology Laboratory, Processing and Fabrication of Advanced Materials Research Lab, Robotics Laboratory, Smart Machine and Material Laboratory, Surface Engineering and Manufacturing Laboratory, Sustainable Energy Research Laboratory, Thermal and Fluid Transport Laboratory, Tribology Laboratory.

Key Figures: Since the inception of the department in 2008, 243 B. Tech., 63 M. Tech, and 14 Ph.D. degrees have been awarded. The research excellence of the department is reflected in more than 140 SCI journal and more than 250 conference publications, 1 text book, and, 14 book chapters published by the faculty during last 5 years. Sponsored and consultancy projects exceeding Rs. 13 Crores have been awarded to ME IITP Faculty members by various external funding agencies during the last 5 years. Research efforts in the department have resulted in one technology transfer and more than ten patent applications have been filed. Two STARTUPS in the area of medical electronics have also originated from the PG students of the department. The Doctoral Degree students from the Department have secured Faculty and Post-Doc Positions at National and International Universities of repute.

- Passive Two-Phase Heat Spreader for Hotspot Mitigation in Microgravity of Space – Indian Space Research Organization (ISRO)
- Soft Active Dielectric Elastomers for Human Motion Based

Energy Harvesting - DST

- Strengthening Interfacial Characterization Facilities: Funds for Improvement of S&T Infrastructure (FIST) – DST

Selected recent publications

- K.N.R. Sinha, D. Ranjan, M.Q. Raza, N. Kumar, S. Kaner, A. Thakur, and R. Raj, 2019. "In-situ acoustic detection of critical heat flux for controlling thermal runaway in boiling systems". International Journal of Heat and Mass Transfer, 138, pp.135-143.
- A. Raj, and A. Thakur, , 2019. "Dynamically feasible trajectory planning for anguilliform-inspired robots in the presence of steady ambient flow". Robotics and Autonomous Systems.
- D. Kumar, and S. Sarangi, , 2019. "Electro-magnetostriction under large deformation: modeling with experimental validation". Mechanics of Materials, 128, pp.1-10.
- M. Raturi, A. Garg, and A. Bhattacharya, 2019. "Joint strength and failure studies of dissimilar AA6061-AA7075 friction stir welds: Effects of tool pin, process parameters and preheating". Engineering Failure Analysis, 96, pp.570-588.
- P. Deepu, 2018. "Modeling the production of belly button lint". Scientific reports, 8(1), p.14472.
- S. Ahmed, and P. Saha, , 2018. "Development and testing of fixtures for friction stir welding of thin aluminium sheets". Journal of Materials Processing Technology, 252, pp.242-248.
- D.S. Reddy, M.K. Khan, M.Z. Alam, and H. Rashid, 2018. "Design charts for Scheffler reflector". Solar Energy, 163, pp.104-112.
- R.K. Gouda, M. Pathak, and M.K. Khan, 2018. "Pool boiling heat transfer enhancement with segmented finned microchannels structured surface". International Journal of Heat and Mass Transfer, 127, pp.39-50.
- B. Chaitanya, V. Bahadur, A.D. Thakur, and R. Raj, 2018. "Biomass-gasification-based atmospheric water harvesting in India". Energy, 165, pp.610-621.
- N.K. Sundaram, A. Mahato, Y. Guo, K. Viswanathan, and S. Chandrasekar, 2017. "Folding in metal polycrystals: Microstructural origins and mechanics". Acta Materialia, 140, pp.67-78.
- P. Kumar, and A. Singh, 2018. "Investigation of fracture behaviour and low cycle fatigue properties of cryorolled Al-Mg alloy". Theoretical and Applied Fracture Mechanics, 98, pp.78-94.
- T. Pratap, and K. Patra, 2018. "Fabrication of micro-textured surfaces using ball-end micromilling for wettability enhancement of Ti-6Al-4V". Journal of Materials Processing Technology, 262, pp.168-181.

Head, Mechanical Engineering

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CIVIL & ENVIRONMENTAL ENGINEERING

Research Vision of the Department

- Providing innovating sustainable solutions and technology catering to the general infrastructural needs of the country
- Developing advanced technologies to fight against climate change, global warming and natural disaster

Lab facilities

Structural Engineering

Structural engineering and concrete technology lab serves a wide spectrum of activities relating to teaching, research and development. The primary activities include experimental study and testing of the construction materials to understand the behavior and performance on diverse conditions. It is equipped with state-of-art load/displacement controlled equipment for load application and precise instrumentation. The lab is provided with the advanced analysis and designing tools for the experimental study on model/prototype of structural elements and



Bending moment determination



Suspension bridge



Base shaker

assemblies under various static and dynamic conditions. Seismic accelerometer and data logger are available for large and full scale investigation of load-deformation of structure including their post-peak strength and deformability up to the failure. Some of the research facilities are as shown

Geotechnical Engineering

Geotechnical engineering lab works towards developing the cost-effective and sustainable Geotechnical solutions to meet the country's infrastructure needs on the firm basis of classical soil mechanics concepts. The lab is equipped with the advanced tools used for cost effective ground improvement and foundation techniques. Equipment are

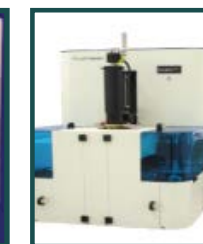
available for determining soil properties as well as advanced research on dynamic properties of the soil, soil liquefaction, ground improvement, behavior of expansive and unsaturated soil amplification studies. The lab is fully equipped with software tools like GeoStudio and PIAXIS to aid in its research objectives. Some of the research facilities are as shown below:



Water potential measurement



Fredlund SWCC



Mercury porosimeter



Cyclic plate load test



Transportation Engineering

Transportation engineering specialization is equipped with pavement material characterization such as bitumen and aggregates. It is also equipped with advanced research



Railway track testing facility

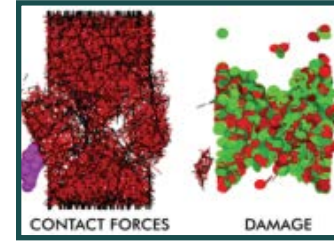


Large scale Direct shear apparatus

equipment's for studying the stability of the rail tracks, design of pavement in adverse conditions and analysis of traffic behaviour. Some of the research facilities are as shown below:



Large scale Pullout apparatus



Particle Flow Code (PFC) Version 5

based solutions through robust computational platforms for optimal management of groundwater resources as well as experimental investigation. The lab is equipped with Groundwater Modelling System (GMS). For high performance computing an advanced server is procured. Some of the research facilities are as shown below:

Water Resources Engineering

Water resources engineering section workshop develop cutting edge technology and provide optimal solutions to real world problems encompassing water resources management, with thrust area on simulation-optimization



Hydrographs



Seepage flow



Losses in pipe system



Measurement of jet forces

Environmental Engineering

The Environmental Engineering Laboratory tests and assesses water, hazardous materials, and biological samples. Its purpose is to be an innovative research-driven organization that provides the highest value and highest

quality environmental testing, monitoring, assessment, and information services to benefit both citizens and the natural environment. To this end, the Lab operates in a flexible, innovative, manner that is responsive to the needs and expectations of individuals and of government programs. The lab is equipped with the following advanced equipments:



Atomic Absorption Spectrometer



Microwave Digestion System



TOC Analyzer



Ion Chromatography

Thrust Research Area:

- Seismic performance of structures | Fluid-structure interaction | Structural health monitoring
- Ground improvement | Radioactive waste disposal | Geotechnical earthquake engineering | Geo-energy

- Pavement characterisation | Traffic Engineering | Performance of railway ballast using geosynthetic
- Groundwater Pollution Sources Identification | Sedimentation analysis
- Waste treatment and resource recovery | Biological production of nano-silica from agro-industrial waste | management and recycle of e-waste

Ongoing key projects

- Seismic response, damage and vulnerability of structures in Patna for future earthquakes SERB, DST, GoI
- Development of Structural Health Monitoring Technique for Existing Bridge in Bihar: A Pilot Study- Road Construction Department, Bihar
- Evaluate the fate and transport and implication of engineered nanoparticle retention in porous media- DST, Go
- Arsenic immobilization by in-situ synthesis of iron-based adsorbent under reducing environment within porous media- DST-WTI (Water Technology Initiative)
- Varied profiling of bio-macromolecules for energy and byproduct assessment employing electrochemical tools- SERB, DST
- Development of Ganga Grams under Namami Gange Programme with Support of Technical Institutions MHRD & National (NMCG), Ministry of Water
- Development of Gravity-based Household Filter for Simultaneous Removal of Arsenic and Iron Contamination of Groundwater in Patna District, Bihar, India. Shastri Indo-Canadian Institute
- Occurrence, Fate and Removal of Emerging Contaminants in Surface Water- Shastri Indo-Canadian Institute
- Microzonation of Jaipur City Based on Shear Wave Velocity DST, GoI,

Selected recent publications

- S. Sharma, H. Venkateswarlu, and A. Hegde, (2019). Application of Machine Learning Techniques for Predicting the Dynamic Response of Geogrid Reinforced Foundation Beds. *Geotechnical and Geological Engineering*, in press.
- K.N. Ujjawal, H. Venkateswarlu, and A. Hegde, (2019). Vibration Isolation using 3D Cellular Confinement System: A Numerical Investigation. *Soil Dynamics and Earthquake Engineering*.
- K. Kumar, A. Priya, A. Arun, S. Hait, A. Chowdhury, (2019) Antibacterial and natural room-light driven photocatalytic activities of CuO nanorods, *Materials Chemistry and Physics*, 226, pp. 106-112
- A. Verma, S. Hait, (2019) Chelating extraction of metals from e-waste using diethylene triamine pentaacetic acid, *Process Safety and Environmental Protection* 121, pp. 1-11
- D. Tripathy, and V. Singhal, (2019). "Estimation of In-Plane Shear Capacity of Confined Masonry Walls With and Without Openings using Strut-and-Tie Analysis," *Engineering Structures*, 188(1), 290-304.
- S. L. Sagar, V. Singhal, and D. C. Rai, (2019). "In-Plane and Out-of-Plane Behavior of Masonry-Infilled RC Frames Strengthened with Fabric-Reinforced Cementitious Matrix," *ASCE Journal of Composites for Construction*, 23(1), 04018073-1-14.
- K. Sweta, S. K. K. Hussaini (2019). "Behavior evaluation of geogrid-reinforced ballast-subballast interface under shear condition", *Geotextiles and Geomembranes*, 47(1), 23-31.
- K. Sweta, S. K. K. Hussaini (2019). "Performance of Geogrid-Reinforced Railroad Ballast in Direct Shear Mode", *Ground Improvement*, in press.
- Dibyanshu and Raychoudhury, T (2019) Co-transport behavior of nano-ZnO particles in the presence of metal-nanoparticles through saturated porous media *Journal of Environmental Chemical Engineering*, In press.
- M. Inanya, H. A. Faisal, A. Kar, T. Raychoudhury, (2019), Fluoride removal by novel composite material and its performance in the fixed bed column filter, *Current Science*, In press.
- M.Y. M. Tadza, M.A.M.Tadza, R. Bag, N.S.H.Harith, (2018), Potential impact of Andrassy bentonite microbial diversity in the long-term performance of a deep nuclear waste repository, *IOP Conf. Series: Materials Science and Engineering* 298, 012009, pp 1-6
- A. Samanta, and Y.N. Huang, (2017). Ground-motion scaling for seismic performance assessment of high-rise moment-resisting frame building. *Soil Dynamics and Earthquake Engineering*, 94, pp.125-135.
- K. Roy, (2017). Structural Damage Identification Using Mode Shape Slope and Curvature. *Journal of Engineering Mechanics*, 143(9), pp.04017110.
- V. Puri, P. Chakraborty, S. Anand, S. Majumdar, 2017. Bamboo reinforced prefabricated wall panels for low cost housing, *Journal of Building Engineering*, 9, pp. 52-59.
- V. Deshpande, B. Kumar, (2017) Effect of downward seepage on the shape of an alluvial channel, *Proceedings of the Institution of Civil Engineers:Water Management* 170(1), pp. 3-14.

Head, Civil & Environmental Engineering

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CHEMICAL & BIOCHEMICAL ENGINEERING

Research Vision of the Department

To achieve national and international recognition through the educational and research achievements and the professional service of our faculty, staff and students. Our mission is to provide students and scholars with a wholesome educational experience that prepares them to become successful professional capable of undertaking national and global challenges

Lab facilities



LC-MS/MS



In Situ-Fourier-transform infrared spectroscopy (FTIR)



Fluorescence Microscope



Simulation Lab

Ongoing key projects

- Design and optimization of systems containing micro-encapsulated phase change materials (MPCMs) for efficient thermal energy storage and heat transfer - DST.
- Wetting behavior of Ionic Liquids on different surfaces: Insight from Molecular Dynamic Simulation - SERB
- Low pressure ammonia synthesis using nitrides as catalysts - SERB-DST
- Continuous Polymorphic Crystallisation of Active Pharmaceutical Ingredients in a Slug-Flow-Cooling-Crystalliser - DST
- Planning of process industries production to minimize carbon emissions and energy consumption - SERB.

Selected recent publications

- N.D. Chaturvedi, "Targeting Intermediate Fluid Flow in Batch Heat Exchanger Networks." *Process Integration and Optimization for Sustainability* (2019): 1-10.
- R.Kr. Sinha, and N.D. Chaturvedi "Pinch Analysis Approach to Determine In-Between Carbon Emission Caps in Production Planning." *Chemical Engineering Transactions* 70 (2018): 1081-1086.
- N.D. Chaturvedi "A Linear Mathematical Formulation to Minimize Intermediate Fluid Flow in Batch Heat Exchanger Networks." *Chemical Engineering Transactions* 70 (2018): 1087-1092
- A. K. Gupta, S.B. Chen, L. E. Yu, A. Prhashanna, D. Katoshevski, "CFD study on particle grouping under an oscillatory flow in a wavy duct". *Separation and Purification Technology* 213 (2019) 303-313.
- C. Sasmal, A. K. Gupta, R.P. Chhabra, "Natural convection heat transfer in a power-law fluid from a heated rotating cylinder in a square duct". *International Journal of Heat and Mass Transfer* 129 (2019) 975-996.
- J. V. Parambil, S. K. Poornachary, J.Y.Y. Heng, and R. B.H. Tan. "Template-induced nucleation for controlling crystal polymorphism: from molecular mechanisms to applications in pharmaceuticals processing." *CrystEngComm* (2019)21, 4122-4135.
- J. K. Shah, E.M. Rimoldi, R.G. Mullen, B.P. Keene, S. Khan, A. S. Paluch, N. Rai, L.L. Romanielo, T.W. Rosch, B. Yoo, E. J. Maginn, " Cassandra: An open source Monte Carlo package for molecular simulation", *Journal of computational chemistry*, 2017
- S. Bhushan, K. Ashwin, H. Simsek, S. Swati, S.K. Prajapati*. *Remediation of domestic wastewater using algal-bacterial biotechnology: Application of Microalgae in Wastewater Treatment* (In-press, Springer Nature, 2019)
- A. Dubey, V. Mishra, S. K. Prajapati, S. U. Ahmed, M. Goswami, *Nanotoxicity on human and plant pathogenic microbes and aquatic organisms. Environmental Toxicity of Nanomaterials*, CRC Press (In-press, 2018).
- S. K. Murthy, A. K. Sharma, C. Choo, E. Birgersson, *Analysis of Concentration Over potential in an All-Vanadium Redox Flow Battery*, *Journal of The Electrochemical Society* 165 (9), A1746-A1752.
- S. Kumar, T. Pavloudis, V. Singh, H. Nguyen, S. Steinhauer, C. Pursell, B. Clemens, P. Grammatikopoulos, M. Sowwan, "Hydrogen flux through size selected Pd nanoparticles into underlying Mg nanofilms", *Advanced Energy Materials*, 2017, 1701326 DOI: 10.1002/aenm.201701326 (Impact factor: 16.721).
- P. Ranjan, P. Verma, S. Agrawal, T. R. Rao, S. Kr. Samanta, A.D. Thakur, "Inducing Dye-Selectivity in Graphene Oxide for Cationic Dye Separation Applications", *Materials Chemistry and Physics*, 226, 350-355 (2019).
- P. Verma and S. Kr. Samanta, "A direct method to determine the adsorbed dyes on adsorbent via processing of diffuse reflectance spectroscopy data", *Materials Research Express*, 6(1), 015505 (2019).
- P. Verma and S. Kr. Samanta, "Microwave-enhanced advanced oxidation processes for the degradation of dyes in water", *Environmental Chemistry Letters*, 16(3), 969-1007 (2018).
- P. Verma and S. Kr. Samanta, "Facile synthesis of TiO₂-PC composites for enhanced photocatalytic abatement of multiple pollutant dye mixtures: A comprehensive study on the kinetics, mechanism and effects of environmental factors", *Research on Chemical Intermediates*, 44(3), 1963-1988 (2018).

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METALLURGICAL & MATERIALS ENGINEERING

Research Vision of the Department

The vision of the Department of Metallurgical & Materials Engineering at IIT Patna is to become pioneers in teaching and research. Our department is still very new. To achieve our goal we are in the process of establishing state of the art laboratories and recruiting faculty members with strong backgrounds in the fundamentals of metallurgical & materials engineering and exposure to foreign universities, labs and industries. Our focus is on industry-relevant research. We are deeply involved in working with the materials industries and actively seeking more industrial partners for collaboration. Another aspect of our research focus is socially relevant work which will provide benefit to the people of this country. To the students of this department, we want to impart knowledge that is cutting edge and relevant to industries at large to make them suitable for employment and also for higher studies.

Lab facilities



Powder XRD



Micro Indentation - Scratch Tester



Plasma Spray – Inside View



TG - DSC Unit

Currently, research is undergoing in different facets of metallurgical & materials engineering. Thrust research areas are thin film and coatings, nano materials, novel polymer blends & composites, synthesis of advanced ceramics, carbon nanotube reinforced materials, flash sintering, ultra high temperature ceramics & computational material science. We have developed state of the art laboratories for research in those areas. Presently, there are five (05) research laboratories along with couple of sub-units associated with them.

Metallurgical and Materials Engineering Lab

Plasma Spray Lab, b. Metallographic & Corrosion Lab, c. Mechanical Testing Lab, d. Nanoindentation Lab)- Metallurgical and materials engineering lab has world-class plasma spray coating facility (Oerlikon Metco, USA), which can fabricate industrial scale metal and ceramic coating for the tribological applications. For characterization, we have sophisticated micro indentation with the scratch tester (Microtest, Spain), Pin/Ball On Disc Tester, Quantachrome Instruments – Pycnometer, Electrical Conductivity Two-Probe Setup, Adhesion Tester Positest AT, Hall Flow Meter LPW. To study the corrosion behavior of coating/substrate, corrosion lab has potentiostat/galvanostat (GAMRY, USA). Apart from these, basic sample preparation lab has the low speed diamond saw (Buehler, USA), grinder and polisher (Allied Hi-Tech, USA).

Ceramics & Nanomaterials lab

Nanomaterials Lab, b. Materials chemistry lab, c. Ceramics lab)- Ceramic and nanomaterials lab focuses on the area of synthesis (via materials chemistry routes) and characterization of advanced functional ceramics. Facilities

available are Thermal Analysis (TG- DSC) unit, XRD (Rigaku, Miniflex), Temperature Programmed Reduction (TPR) and UV-Vis spectrophotometer, Millipore Unit, Hydraulic Press Unit, Grinder & Polisher and Spin Coater.

Polymer science and technology lab

Polymer characterization lab, b. Polymer processing lab, c. Polymer synthesis lab)- Polymer science and technology lab has world-class polymer synthesis, processing and testing lab. Polymer processing lab facilities: Haake internal mixer (Thermo Fisher Scientific), micro injection molding machine (Thermo Fisher Scientific), compression molding machine, two roll mixing mill and moving die rheometer. Polymer testing and characterization lab facilities:- Universal testing machine (Zwick-Roell), dynamic mechanical analysis (TA instruments), modular compact rheometer (Anton-Paar) and thermo-gravimetric analyzer (TA instruments), Fourier transform infrared spectroscopy (FTIR). Polymer synthesis lab: Fume hoods, laboratory island tables and basic facilities for polymer synthesis.

Processing and Modeling Lab:

Processing and modeling lab is working on processing and characterization of advanced and ultra high temperature ceramics. Additionally, computational modelling of sintering and micro-structural evolution in materials is undertaken in this lab. Facilities include high temperature furnace, density measurement setup and workstations.

Flash sintering lab:

Flash sintering lab is focusing on flash sintering a recent novel method to produce advanced ceramics at very low temperature. Facilities include custom flash sintering setup.

Ongoing key projects

Research projects supported both by government (funding agencies include, SERB-DST, NRB, ISRO) and industry (e.g., Tata Steel Limited, MRF Tyres, Carborundum Universal Limited) are currently going on.

- Synthesis & characterisation of faceted nanocrystalline powders of Ceria-Zirconia and related systems, SERB-DST.
- Improvement of low temperature flexibility and room temperature physical properties of chloroprene rubber (CR), DENKA, Tokyo, Japan.
- Fabrication of Robust Plasma Sprayed Rare Earth Oxide Hydrophobic Coating for the High Temperature and Wear Resistance Applications, SERB-DST
- Surface modified metallic orthopedic implant for sustained drug release, DST/TSG/AMT
- Plasma Sprayed Carbon Nanotube reinforced Molybdenum Disulfide Anti-friction Nano Composite Coating with enhanced Mechanical and Wear Properties,

Naval Research Board (NRB), India

- Plasma Sprayed Carbon Nanotube and Graphene Reinforced Alumina Hybrid Nanocomposite Coating with Enhanced Electrical Conductivity, Corrosion and Mechanical Properties for Light Metal Alloys, (ISRO),
- Development and optimization of cost effective and scalable near net shape plasma sprayed membrane with graded porosity for microfiltration application. IMPRINT II.
- High Temperature Materials for Thermal Protection Systems, IMPRINT II
- Study on the densification and fracture properties of piezoelectric ceramics produced by novel flash sintering technique: DST-INSPIRE.
- Factors influencing the tack behaviour of rubbers used in tyres, MRF Tyres, Chennai, Tamil Nadu, India.
- Analysis of material compositions of investment casting powders, Maharashtra Jewellery Tools.

Selected recent publications

- M. K. P. Kumar, D. Yadav, J. M. Lebrun, R. Raj : Flash sintering with current-rate: A different approach, In press, in Journal of the American Ceramic Society, 2019.
- X. Vendrell, D. Yadav, R. Raj, A. R. West: Influence of flash sintering on the ionic conductivity of 8 mol% yttria stabilized zirconia, Journal of the European Ceramic Society, 39 (2019) 1352-1358.
- A. K. Srivastav, N. Chawake, D. Yadav, N. S. Karthiselva, B. S. Murty: Localized pore evolution assisted densification during spark plasma sintering of W-5wt.%Mo alloy, Scripta Materialia, 159 (2019) 41-45.
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- K. Kumar, H. Dutta, S. K. Pradhan, A. Chowdhury: Stabilization of ZrO₂ matrix: Revisiting the 'archaic' issue with a peculiar example, Scripta Materialia, 157, 138-141, 2018
- K. Kumar, S. Srivastava, A. Chowdhury: La³⁺-doped CeO₂ system: Negating the myths with a tailor-made ceramic, Scripta Materialia, 162, 408-411, 2019
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- P. R. Sreenath, S. Singh, M. S. Satyanarayana, P. Das, K. D. Kumar: "Carbon dot - Unique reinforcing filler for polymer with special reference to physico - mechanical properties", Polymer, 112 (2017) 189.
- M. S. Satyanarayana ,P. R. Sreenath, A. K. Bhowmick, K. D. Kumar: "Catalyst driven preferential growth of in-situ generated nanosilica particles in the phases of incompatible polymer blend and its effect on physico-mechanical properties", Polymer 156 (2018) 186.
- R. Sreenath, S. Mandal, S. Singh, P. Das, A. K. Bhowmick, K. D. Kumar: "Remarkable synergetic effect by in-situ covalent hybridization of carbon dots with graphene oxide and carboxylated acrylonitrile butadiene rubber", Polymer, 175 (2019) 283.

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PHYSICS

Research Vision of the Department

- **Vision:** To become a globally recognized physics learning centre with world class research output
- **Mission:** To impart quality education and research training so as to make students ready for R & D and academia
- To offer attractive and flexible course curricula with multidisciplinary electives
- To create research facilities sufficient for applications of fundamental learning into real life problems

Lab facilities



X-ray Diffractometer



Scanning Electron Microscope



Scanning Probe Microscope



Raman Spectrometer

Ongoing key projects

- Development of an agricultural waste based off-the-grid climate control unit for storage and processing of agricultural produce (SERB, IMPRINT II)
- Design and Development of an Agricultural Waste Based Gasifier Heating System for GreenCHILLTM (DST under Ucchatar Avishkar Yojna)
- Investigations on Thin Films of Discotic Liquid Crystal Molecules for Applications in Organic Electronics (SERB)
- Setting up of an advanced multimode scanning probe microscopy facility for device applications (DST under FIST program)
- Development of Indigenous Technology for High Energy Density LiPo Battery for Low Temperature Applications (RCI, DRDO)
- Photoionization and Electron Scattering Dynamics of Free and Confined Atomic Systems (SERB, DST)
- Fluctuations in DNA for molecular recognition (SERB, DST, India,)
- Study of Optical Image Fusion Techniques for Securing Multispectral Data (CSIR New Delhi)
- Valleytronics in gapped Dirac Materials (ECRA, DST-SERB)
- Electromagnetically Induced Transparency and Slow Light in a Two dimensional Magneto Optical Trap (2D MOT) (SERB, DST)
- Superconducting Spintronics using hybrid Superconducting-Ferromagnetic Metamaterial (DST - INSPIRE Scheme)
- Novel Spin-triplet Superconductivity using ferromagnetic-superconducting heterostructures (UGC-DAE)
- Generation, Imaging and Control of Novel Coherent Electronic States in Artificial Ferromagnetic-Superconducting Hybrid Structures and Devices (DST-SERB)
- Coherent Control & Interferometry using Bose-Einstein Condensate (SERB, DST, GoI)
- Enhancement of Raman scattering signal of single molecules using photonic nanojet mediated surface enhanced Raman scattering (SERS) technique (CSIR) (SERB , Extra Mural Research Funding,)
- Real time detection and sizing of single protein molecule using a nanoplasmonic-photonic hybrid microresonator - SERB-DST
- Design and Implementation of Orbital Angular Momentum (OAM) Assisted Spectrally Efficient Wavelength Division Multiplexed Communication System Using Conventional Optical Fibers (IMPRINT – II)

Selected recent publications

- A Low-Cost Non-explosive Synthesis of Graphene Oxide for Scalable Applications, P. Ranjan, S. Agarwal, A. Sinha, T. R. Rao, J. Balakrishnan, A. D. Thakur, Scientific Reports 8, 12007 (2018); DOI: 10.1038/s41598-018-30613-4.
- Influence of Coulombic Interaction on the Interfacial Self-Assembly of Discotic Liquid Crystal Amphiphiles: A Combined Experimental and Computer Simulation Study P. Verma, S. Erimban, N. Kumar, S. Das Chakraborty, A. Nayak, and J. S. Kumar Phys. Chem. C 2019, 123, 27, 16681-16689. (<https://doi.org/10.1021/acs.jpcc.9b02713>)
- A. K. Mukherjee and N. Kumari, Current Voltage Perspective of an Organic Electronic Device, Physics Letters A, 382, 1413-1418 (2018)
- A theoretical investigation of elastic scattering of H Atom by C60 and Kr@C60 , Km Akanksha Dubey, Shweta Agrawal, T. Rajagopala Rao, and Jobin Jose, J. Phys. B: At. Mol. Opt. Phys, 52 035203 (2019)
- S. Supriya, S. Kumar and M. Kar, Enhancement of dielectric constant in polymer-ceramic nanocomposite for flexible electronics and energy storage applications, Composites Science and Technology 157, 48 (2018).
- I. Mehra and N. K. Nishchal, "Image fusion using wavelet transform and its application to asymmetric cryptosystem and hiding," Optics Express 22 (2014) 5474-5482.
- S. Bhushan, V. S. Chauhan and R. K. Easwaran, Ultracold Rydberg atoms for efficient storage of terahertz frequency signals using electromagnetically induced transparency, Physics Letters A, Volume 382, Issue 48, 3500-3504 (2018).
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Hybrids, Advanced Materials, 31, 1900353 (2019)

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- The Proton- Ω correlation function in Au+Au collisions at $\sqrt{s} \text{NN} = 200 \text{ GeV}$, The STAR Collaboration, Physics Letters B, 790, 490 (2019)
- M. Kr. Sarangi, V. Zvoda, M. N. Holte, N. A. Becker, J. P.

Peters, L. J. Maher, III, A. Ansari, Evidence for a bind-then-bend mechanism for architectural DNA binding protein yNhp6A, Nucleic acid research, 47, 2871 (2019)

- Scope of strongly self-interacting thermal WIMPs in a minimal U(1)D extension and its future prospects" R. Kr. Barman, B. Bhattacharjee, A. Chatterjee, A. Choudhury, A. Gupta, Journal of High Energy Physics, 05, 177 (2019)

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CHEMISTRY

Research Vision of the Department

The main vision of the Department of Chemistry at IIT Patna is to promote research to achieve the goal of "Discovery with delivery". We want to create advanced molecular sciences facilities for doing research in the chemical sciences. Dedicated researchers are sure to reap the harvest of such an effort and consequently chemical innovation and discovery is foreseen. We should not restrict ourselves to discoveries only, the mission is to create deliverables that are of utmost social requirement through this discoveries. The department also strives to develop globally competent skilled manpower to undertake the challenge of performing cutting edge research and innovation. Preeminence in core areas of Chemistry will enable to strengthen the foundation upon which chemistry faculty can contribute to interdisciplinary and multidisciplinary research that addresses societal problems through innovation. The department will distinguish itself by its inventive and successful research initiative, and by its strong cross-disciplinary, interdisciplinary, and multi-disciplinary collaborations both within and beyond the Institute.

Lab facilities



AFM



Picosecond Time-Resolved Confocal Microscope with Single Molecule Sensitivity



Atomic Force Microscope NMR



Fourier-transform infrared spectroscopy FTIR

The Department of Chemistry has developed laboratories for advancement of research in several areas of Chemistry. Currently, there are eight (11) research laboratories and few more are in pipeline.

- Supramolecular Synthesis Lab: Research in Inorganic Chemistry with emphasis on Self-assembled macrocycles, metal-organic frameworks, and coordination polymers. Additionally, synthesis of Covalent organic frameworks (COFs), porous organic polymers (POPs), and microporous polymers and their applications.
- Glycochemistry Lab. for research in carbohydrate chemistry including development of new reaction methodologies.
- Green Synthesis Lab. specializes in multicomponent and Domino reactions using green chemistry approach to discover novel organic molecules and reaction methodologies.
- Gas Phase & Computational Lab. for dedicated research in gas phase spectroscopy with both experimental and computational approach.
- Catalysis and Nanochemistry Lab. for research in the development of nanocatalyst for organic reactions and nanomaterials for dye degradation.
- Biochemistry Lab. Specializes in research pertaining to DNA based novel Nanostructures for Biomedical applications including Biosensing and Drug Delivery.
- Ultrafast spectroscopy lab. is devoted to unearth the photophysical properties of fluorophores in different

confined media using steady-state and time-resolved spectroscopic techniques.

- Quantum Chemistry Lab. for research in theoretical chemistry in the area of reaction dynamics.
- Molecular Simulation Lab. for research in structure and dynamics of soft condensed matter using molecular dynamics simulation and theory based on statistical mechanics.
- Solid State and Inorganic Chemistry Group. for research in metal organic frameworks, metallogels, coordination polymers, oxides, chalcogenides, energy conversion and catalysis.
- Macromolecular chemistry and engineering lab. for research in synthesis of macromolecules, recyclable and dynamic materials, stimuli-responsive smart materials and polymer nanomaterials.

Important Resources

To cater the research community, the department has procured several state of the art equipments including, steady state fluorescence spectrophotometer, time resolved fluorescence spectrophotometer, UV-Vis spectrophotometer, NMR, FTIR, TGA, Circular Dichroism spectrometer, HPLC, GPC, Pore size analyzer, glove box, GC-MS, photochemical reactor and many others. Research facility equipped with modern furniture and accessories in the area of Physical, Organic, Inorganic, Biological chemistry have been created for providing a conducive environment for innovative research. The department also subscribe to a huge number of globally renowned journals.

Ongoing key projects

- Quantum dynamical studies on bimolecular reactions of practical and fundamental interest - DST.
- Graphene/conducting polymer nanocomposite based enzymatic biosensors for the detection of biomolecules - SERB.
- Exploration of Multicomponent Reactions (MCRs) Towards Green Synthesis of Novel Functionalized & Sequence Regulated Macromolecules - SERB.
- Theoretical investigation of intermolecular forces and optical properties of atmospheric aerosols - CSIR.
- Mechanism of hydroxide ion transfer through anion exchange membrane in anion exchange membrane fuel cell investigation using molecular dynamics simulation - SERB.
- Development of carbon-Dot and DNA aptamer based nanobiosensors for concurrent visual detection of food toxins in solution phase and micro fluid chip format. DBT Research Associateship program in biotechnology and life sciences IISc Bangalore.
- Rational Design and Synthesis of functionalized metal-organic frameworks/gels for biomimetic Heterogeneous Catalysis - SERB.
- Dynamics of water near Biomolecules - DST.
- IITP, Capturing Volatile organic compounds by room temperature ionic liquids a molecular perspective - DST.

Selected recent publications

- A. Jana, S. Mandal, K. Singh, P. Das, N. Das, Heterobimetallic (Fe II /Pt II)-Based Supramolecular Coordination Complexes Using 1,1'-Ferrocene Dicarboxylate: Self-Assembly and Interaction with Carbon Dots (2019) Inorganic Chemistry, 58 (3), pp. 2042-2053.
- R.K. Gautam, A. Chatterjee, D. Seth, Photophysics, rotational dynamics and fluorescence lifetime imaging study of coumarin dyes in deep eutectic solvent (2019) Journal of Molecular Liquids, 280, pp. 399-409.
- A. Chowdhury, A.A. Khan, S. Kumari, S. Hussain, Superadsorbent Ni-Co-S/SDS Nanocomposites for Ultrahigh Removal of Cationic, Anionic Organic Dyes and Toxic Metal Ions: Kinetics, Isotherm and Adsorption Mechanism (2019) ACS Sustainable Chemistry and Engineering, 7 (4), pp. 4165-4176.
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- J. Pal, R. Subramanian, Theoretical studies of hydrogen abstraction from H₂X and CH₃XH (X = O, S) by trichloromethyl radicals (2019) Physical Chemistry Chemical Physics, 21 (12), pp. 6525-6534.
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- M. Avais, S. Chattopadhyay, Waterborne pH responsive hydrogels: Synthesis, characterization and selective pH responsive behavior around physiological pH, Polymer 2019, Accepted Article (<https://doi.org/10.1016/j.polymer.2019.121701>)
- BSA amplified ROS generation from Anthracycline derived Carbon dot and concomitant Nanoassembly for combination antibiotic-photodynamic Therapy application, S. Mandall, S.R. Prasad, D. Mandal, P. Das*, ACS Applied Materials and Interfaces, 2019, DOI 10.1021/acsami.9b12455.
- M. Shaw, A. Kumar Visible-Light-Mediated β -C(sp³)-H Amination of Glycosylimidates: En Route to Oxazoline-Fused/Spiro Nonclassical Bicyclic Sugars Org. Lett. 2019, 21 (9) 3108-3113.
- S. Chakraborty, K.J. Endres, R. Bera, L. Wojtas, C.N. Moorefield, M.J. Saunders, N. Das, C. Wesdemiotis, G.R. Newkome, Concentration dependent supramolecular interconversions of triptycene-based cubic, prismatic, and tetrahedral structures (2018) Dalton Transactions, 47 (40), pp. 14189-14194.
- A.K. Panday, R. Mishra, A. Jana, T. Parvin, L.H. Choudhury, Synthesis of pyrimidine fused quinolines by ligand-free copper-catalyzed domino reactions (2018) Journal of Organic Chemistry, 83 (7), pp. 3624-3632.
- S.A. Ahmed, S. S. Duley, R.K. Gautam, D. Seth, Inclusion of a coumarin derivative inside the macrocyclic hosts: A spectroscopic, thermodynamic and theoretical investigation (2018) Journal of Molecular Liquids, 264, pp. 550-562.
- V. Dubey, N. Kumar, S. Daschakraborty, Importance of Solvents' Translational-Rotational Coupling for Translational Jump of a Small Hydrophobic Solute in Supercooled Water (2018) Journal of Physical Chemistry B, 122 (30), pp. 7569-7583.

Head, Chemistry

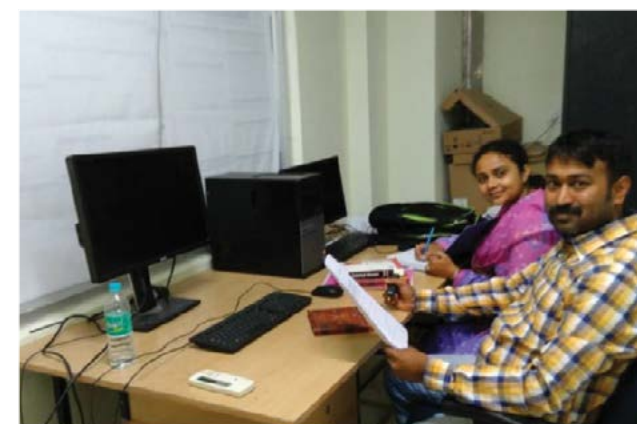
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MATHEMATICS

Research Vision of the Department

- The department will enhance its computational facilities to support and encourage research in complex computations including big data problems which is quite challenging.
- Our objectives include pursuing high quality cutting edge research, imparting the knowledge at different levels to train the human resource, interacting with potential users and offering to collaborative or consultancy solutions.

Lab facilities



- Research Lab I: Statistical Lab**
- Research Lab II: High Performance Computing Lab**

Ongoing key projects

- Parameter uniform numerical analysis for singularly perturbed differential equations based on mesh adaptivity. Early Career Research Award, Science & Engineering Research Board (SERB), Govt. of India
- Impact of information of disease prevalence on the dynamics of diseases: A mathematical study. Mathematical Research Impact-Centric Support (MATRICS)

- Towards new Platform on Generalized Vector Variational Inequalities: Scope in Optimization and Bilevel Programming, Science and Engineering Research Board' (SERB)
- "Nonlinear Singular Differential Equations Arising in Real Life" for a period of three years. SERB (DST, New Delhi)

Selected recent publications

- Algorithmic aspects of b-disjunctive domination in graphs, B. S. Panda, A. Pandey, and S. Paul, Journal of combinatorial optimization, 36(2), 572--590, 2018.
- A. K. Verma and Sheerin Kayenat, On the Convergence of Mickens' type Nonstandard Finite Difference Schemes on Lane-Emden Type Equations, Journal of Mathematical Chemistry, J. Math. Chem. 56 (2018), no. 6, 1667–1706.
- P. Das and J. Vigo-Aguiar, Parameter uniform optimal order numerical approximation of a class of singularly perturbed system of reaction diffusion problem involving a small perturbation parameter, Journal of Computational and Applied Mathematics, 354, 533-544, Elsevier, 2019, ISSN No:0377-0427.
- P. Das, An a posteriori based convergence analysis for a nonlinear singularly perturbed system of delay

HUMANITIES AND SOCIAL SCIENCES

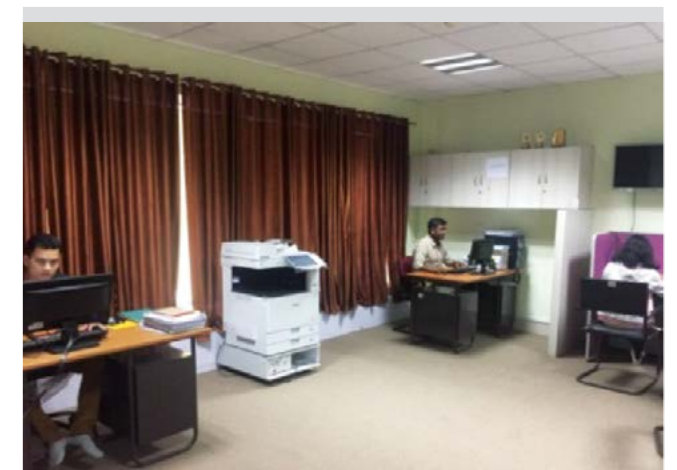
Research Vision of the Department

- The Department of Humanities and Social Sciences at IIT Patna is currently offering research programme in the diversified disciplines of Humanities and Social Sciences. The vision of the department is to incorporate human values and look for solutions to social issues.
- Economics, English language and literature, Linguistics, Management, Psychology, Public Health and Sociology are the major thrust zone of the department. Around 10 doctoral candidates were awarded Doctor of Philosophy in the above mentioned areas of research in last few years.

Lab facilities



Anechoic Chamber



Lab

There are many labs in the department of HSS to improve research and learning eminence.



Knowledge Centre on Women and Children

With support from UNICEF office of Bihar, the Department of Humanities and Social Science has developed a Knowledge Centre on Women and Children in the year 2011. It has reference materials related to condition of Child and Women in Bihar.

differential equations on an adaptive mesh, Numerical Algorithms, doi:10.1007/s11075-018-0557-4, Springer, 2018, ISSN No: 1017-1398.

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- A. Kumar, P. K. Srivastava, and R.P. Gupta, Nonlinear dynamics of infectious diseases via information-induced vaccination and saturated treatment, Mathematics and Computers in Simulation, 157 (2019), 77-99.
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- R. K. Mistri, R. K. Pandey and O. Prakash, A generalization of sumset and its applications, Proc. Indian Acad. Sci. (Math. Sci.) (2018) 128:55 (1-8), <https://doi.org/10.1007/s12044-018-0437-9>. (Springer)
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- H. Islam, T. Bag and O. Prakash, A class of constacyclic codes over $Z_4[u]/\langle u^k \rangle$, J. Appl. Math. Comput. 60(1-2) (2019), 237-251.
- T. Bag, H. Islam, O. Prakash and A. K. Upadhyay, A study of constacyclic codes over $Z_4[u]/\langle u^2-3 \rangle$, Discrete Math. Algorithms Appl. 10(4) (2018), 1850056 (1-10) DOI: 10.1142/S1793830918500568.
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- M.K. Gupta, N.K. Tomar, and M. Darouach, Unknown inputs observer design for descriptor systems with monotone nonlinearities, International Journal of Robust and Nonlinear Control, vol. 28, 2018, pp. 5481-5494.
- B.B. Upadhyay and R.N. Mohapatra Sufficient optimality conditions and duality for mathematical programming problems with equilibrium constraints, Communications on Applied Nonlinear Analysis, 25(4) 68-84, 2018
- T. Antczak, S.K. Mishra and B.B. Upadhyay: Optimality conditions and duality for generalized fractional minimax program involving locally Lipschitz (ϕ, ρ) -invexity, Control and Cybernetics, 47(1), 1-28 (2018)
- T. Sen, B. Pradhan, Y. M. Tripathi and R. Bhattacharya (2018). Fisher information in generalized progressive hybrid censored data. Statistics, Vol. 52 (5), 1025-1039. IF o. 606
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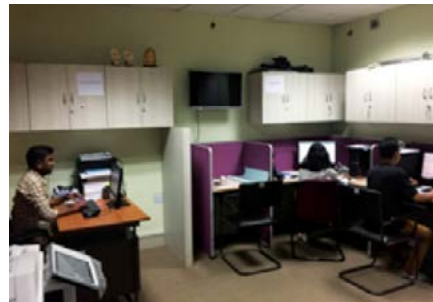
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Language Laboratory

The Language Lab of HSS Dept has the soft wares that are essential for effective and enjoyable teaching and learning, such as screen transfer features, audio and text communication tools, web browser and program launch capabilities, and classroom management and control features. It helps student to learn pronunciation, accent, stress and all other aspects of the phonetics of a language.



Linguistic Laboratory

The Linguistics Laboratory is well furnished with state of the art technology to carry out research in major areas of Linguistics especially Speech Acoustics and Speech Forensics. The Lab has computer systems, laptops, digital voice recorders, microphones and headphones. The anechoic chamber has been specially built to record human speech sounds with minimum noise intervention.



Public Health Research and Documentation Laboratory

Public Health lab is equipped with latest softwares and data sets to analyze various concurrent public health issues. Researchers in this lab are engaged in analysing wide spectrum of health issues, such as, perception of health, environmental health, health informatics, and so on. Apart from research we also take up documentation of vital health data and design specific research methods for empirical surveys.



Sociological Research and Community Outreach Laboratory

It has working space for cutting edge research and is rooted in rigorous theoretically informed way of knowing social reality. This laboratory is computer equipped and encourages group interactions. The Unnat Bharat Abhiyan (UBA) was coordinated from this laboratory. We also guided several public engineering projects of the B.Tech. students here, including Aaadhyan.



Human Resource & Management Laboratory

Set up in the corner of the left corridor of Humanities and Social Sciences department is a well-equipped lab with latest infrastructural facilities to support research in Human Resources and organizational behavior area. To impart practical exposure and in depth understanding, the systems provided to students are fully loaded with latest softwares, simulations, and cases. The lab provides access to many excellent journals and magazines. The air-conditioned lab caters to the need of each and every student by providing peaceful and professional environment to ignite young minds.

Ongoing key projects

- India-Japan Trade and Investment: What new after CEPA jointly with Professor T. Sato, Professor, Research Institute for Economics and Business Administration (RIEB) Kobe University, Japan funded by ICSSR (ongoing 2018),
- “Green Human Resource Management in Indian Automobile Industry located in Tamil Nadu state of India” – Major Research Project Sponsored by Indian Council of Social Science Research (ICSSR).
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- R. Chaudhary, (2018). Corporate Social Responsibility and Employee Performance: A study amongst Indian Business Executives. The International Journal of Human Resource Management, https://doi.org/10.1080/09585192.2018.1469159 (Taylor & Francis, Scopus listed and an ‘A’ Category journal rated by ABDC, SSCI listed, Impact Factor=2.425).
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Sophisticated Analytical Instrument Facility (SAIF)

Research Vision of the SAIF

- To provide the facility of data acquisition on SC-XRD and HR-LCMS for samples received from academic institutes, R & D laboratories and industries for Research work.
- Train technicians/students in maintenance and operation of the equipments.
- To organize workshops on the use and application of above analytical instruments/techniques for students, teachers and personnel from other Laboratories, Universities and Industries.

Sophisticated Analytical Instrument Facility (SAIF) at IIT Patna is a Science and Engineering Research Board (SERB), DST & Govt. of India sponsored facility for data collection/characterization of research samples/materials by paying nominal charges. This facility is open for internal (IIT Patna users) as well as external researchers from academia, research laboratories as well as industries. Presently, SAIF IIT Patna is equipped with two major analytical instruments (i) Single Crystal X-Ray Diffractometer (SC-XRD) and High Resolution - Liquid Chromatography Mass Spectrometry (HR-LCMS) having HPLC & UHR-TOF mass spectrometer. The other sanctioned instrument is a 500 MHz NMR, which is under purchase process.

SAIF website- It is available with the following link: <https://www.iitp.ac.in/saifiitp/>

Lab facilities

Detail of Instruments:

1. High Resolution Liquid chromatography-mass spectrometry (HR-LCMS)

Make: Bruker Germany

Model: Impact HD UHR-TOF mass spectrometer



HR-LCMS, SAIF IIT Patna



Sample preparation for HR-LCMS, SAIF IIT Patna

Applications: HR-LCMS is a powerful technique that has very high sensitivity and selectivity and so is useful in many applications. Its application is oriented towards the separation, general detection and potential identification of chemicals of particular masses in the presence of other chemicals.

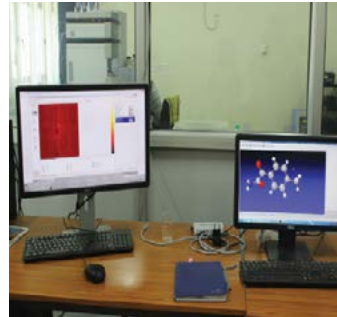
2. Single Crystal X-Ray Diffractometer(SC-XRD)

Make: Bruker Germany

Model: AXS D8 QUEST



SC-XRD, SAIF IIT Patna



Data /structure on SC-XRD
SAIF IIT Patna



Microscope, SAIF IIT Patna

Applications: Single-crystal X-ray Diffraction is a non-destructive analytical technique, which provides detailed information about the internal lattice of crystalline substances, including unit cell dimensions, bond-lengths, bond-angles, details of site-ordering and crystal structure.

- 500 MHz NMR: Procurement of NMR is under process. Purchase order has been released.

Ongoing key projects

- SR/RS/PAT-1/2013 Dated- 23.09.13 machine from the institute and 33 from the external institutes.
- Technical Progress of both equipment (From 01.04.18 to 31.03.2019)
- We have received a number of 489 samples for HRMS
- Similarly we have received 116 samples for SC-XRD, used by the Internal users and 03 from others institutes.

Highlights of key activities

Analytical Service

- HRMS- Total No. of samples run during 2018-19 is 522.
- SC-XRD- Total No. of samples run during 2018-19 is 119.
- No of publications: 40 (from 2017 to 2019) where SAIF, IIT Patna have been acknowledged.

Workshops organized:

- Training on SC-XRD data Analysis: During 11-12 August 2017. Total number of the participants =15.
- National Workshop On “Theory and Applications of Single Crystal X-Ray Diffraction: During 21st -23rd March, 2018. Total number of the participants = 25. Procurement of 500 MHz NMR is under process

Topics covered:

- Practical demonstration on data reduction, structure solution and refinement
- National Workshop On “Theory And Applications Of Single Crystal X-Ray
- Diffraction” 21st -23rd March, 2018

Topics Covered:

- Introduction to X-ray Crystallography
- Basics of the X-ray Diffraction

- Practical demonstration on data reduction, structure solution and refinement
- Demonstration on instrument (Lab Session)

(Total number of the participants in workshop = 25 (Internal and External)

- Development of the SAIF is going on (lab maintenance, procurement of Consumables and non-consumables etc.



National Workshop On “Theory And Applications Of Single Crystal X-Ray Diffraction” 21st -23rd March, 2018

Incubation Centre (IC)

Research Vision

- Incubation Centre IIT Patna aims to be the leading DST approved technology business incubator in the country for the development of products and intellectual property in the area of Electronic System Design and Manufacturing (ESDM), and Medical Electronics.
- This IC is a collaboration of IIT Patna, Ministry of Electronics and IT(MeitY) and Government of Bihar. The primary objective of IC is to promote innovation and entrepreneurship with the aim to identify, nurture and translate technological ideas and innovation in the broad area of Electronic System Design and Manufacturing sector and Medical Electronics i.e. Micro Electro Mechanical Systems (MEMS: Lab on Chip), Low Cost Medical Diagnostic System, Low Cost Ultrasound, Electronic Device Reliability and Medical/Industrial X-ray Tubes, Medical Telemedicine related Electronic products along with other industrial and consumer electronic products.
- The overall project outlay for setting up the IC is Rs 47.10 crore. The project is being implemented through joint funding from MeitY (Rs 22.10 crore) and Government of Bihar (Rs.25 crore) as matching Grant. This IC is being set up in area of 3000 square meters constructed space with state of the art facilities designated for ESDM incubation.
- IC is expected to give an impetus to entrepreneurship amongst interested students, faculty and external innovators. The total project duration to set up the Incubation Centre is 5 years; the IC aims to incubate 10 ideas each years with a clear focus to build commercial ventures out of these ideas.

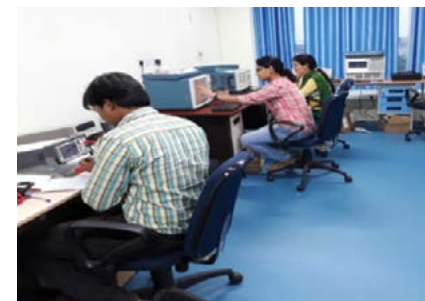
Lab facilities

Incubation Centre has state of the art laboratories, suitable for electronic product development, for the use of Incubated companies.



Electronics System Design and Prototype Lab

Electronics system design and prototype lab is equipped with high end workstations, software for electronic system design such as Eagle and Matlab, electronic work benches, microcontroller boards and similar facilities required to design and prototype electronic system



PCB Design and Manufacturing Lab

PCB design and manufacturing lab (Fig 1)is an advanced state of the art lab providing equipment for end to end implementation of PCB from a design file. The equipment includes machines for milling, drilling, cutting and rubout of PCBs, through hole plating, lithography, legend printing, pick and place, baking and multi-press to create upto 8 layer PCBs.



Testing and Calibration Lab

Testing and calibration lab (Fig 2) has an array of equipment required to test and calibrate PCBs such as pattern generators, real time spectrum analyzers, mixed signal oscilloscopes, source meters, logic analyzers etc.



Mechanical Packaging and Product

Prototyping Lab Mechanical Packaging and Product Prototyping lab (Fig 3) allows incubated companies to create product prototypes and has equipment such as 3D printers and 3D modelling softwares.

RF DC Sputtering Unit

The unit (Fig 4) is installed as part of micro nano fabrication facility and helps the companies to work on sensors and mems level fabrication.

Incubation centre lab facilities are primarily for the use of incubated companies. However, as the facilities are unique and rare, incubation centre is now allowing the use of these

labs by researchers or other users in need of such facilities on a pay per use basis.

Ongoing key projects

The Incubation Centre supported 17 companies in its regular incubation program as on Mar 2019.

- Bionic Hope Pvt Ltd, Active Prosthesis
- Electro CurieTech Pvt Ltd, Cataract Screening Device
- 4Mirrortech Innovative, Facility Management and Smart washroom solutions
- Atlamedico Tech Solutions, Critical patient monitoring system
- Wityliti Automation, Home Automation Solutions
- Rishabh Kishore & Team, High efficiency LiS battery
- Wellth Solutions, Preventive healthcare devices
- Sujith Sahu & Team, Knee Energy Harvester
- Amrenjeet Surenjeet Consultancy Pvt Ltd, Magnetic Engine
- TechproLabz, Robotics Training Kits, Labs
- Avronica Solutions, FonOclock based timers
- Ganesh Engineering Works, Biofules / renewable energy solutions
- Sybilline Technologies, Automated cleaning solutions
- Techgait Innovation, Smart Irrigation Systems
- Earn By Share, Smart equipment sharing solutions
- Urinalytics, Smart urine analysis device for early screening of diseases
- Sanju Raju and Justus Raju, Posture detection device with hand gesture inputs (under on-boarding process)

Programs in the IC

Two Year Incubation Program

The one year (extendable up to 2 years) regular incubation program at the IC IITP is designed to support aspiring entrepreneurs and start-ups for idea validation, product development, building and testing prototypes and early stage

scaling of innovations. IC IITP will enable the start-ups with:

- Fully furnished office space, conference rooms, internet and communication facilities
- State of the art laboratories for Electronic System

Design, Development and Prototyping, PCB Prototyping and Assembly, Testing and Measurement, Mechanical packaging and Product Prototyping

- Guidance by mentors from Industry, IIT Patna faculty, Bio Design Centre of AIIMS Delhi, Investors and IC management on business, technology, IPR and other aspects
- A seed funding of up to Rs10 lakhs
- Connects to investors and support services (CA, legal etc)

Three Months Pre-incubation Program

The three months pre-incubation program at the IC IITP is designed to support aspiring entrepreneurs for evaluating the commercial viability of their idea, develop a technology approach to implementing their idea, develop a business plan and to prepare for a regular two year incubation program.

Admission Process to Incubation and Pre Incubation Programs

Eligibility

Admission to the programs is open to students, faculty members, innovators and startup companies from across the nation. Only Indian nationals are eligible to apply.

Application Submission

Aspiring entrepreneurs or startup companies are required to submit a technical and business plan detailing the idea, the approach to implement the product and to make it commercially viable. A template of the business plan is available in IC website www.iciitp.com. Technical and business plans can be submitted through the year.

Internships

Summer and Winter internships:

Incubation centre offers internships in the fields of electronic design, PCB fabrication, 3D printing and mechanical packaging, RF DC sputtering, networking, accounting and

Completed business plans are to be submitted to the e-mail id manager_ic@iitp.com or iciitp@iitp.ac.in

Evaluation and selection

The proposals are put through a preliminary scrutiny. Shortlisted proposals are evaluated by Project Evaluation Team comprising of experts from medical, technology, entrepreneurship and investment areas and admission is offered to the selected companies/teams.

Training Programs

Winter and Summer Schools on Health Technology Innovation :

This is a one week paid training program offered to start-ups, students of technology/medicine and faculty of technology/medicine who aspire to enter into entrepreneurship in health technology. The participants are given a holistic picture of what it takes to identify, evaluate, define, design, implement and commercialize a concept in health technology. This training is offered during summer/winter breaks.

Pre-incubation Training for applicants from Bihar Startup Portal :

This 50 Hr training program is offered to start-ups who have applied for incubation support in Bihar Startup Portal under Bihar Startup Policy. The participants are given a holistic picture of entrepreneurship and business plans. After the training, the participants will be evaluated and quality startups will be offered incubation. Other startups/aspiring entrepreneurs also can attend this training by paying a fee.

marketing. The internship varies from 1 month to 3 months in duration and interns are guided by experienced IC staff or incubated companies. Certificates are provided upon successful completion of internships.

Other significant achievements

- 4Mirrortech Innovatives, an incubated company, entered the market with its smart washroom and facility management suite of products and secured orders from various airports and enterprises for its products. They also won Rs1 Lakh award in the Buzzwings competition by NSRCEL of IIM Bangalore
- Bionic Hope Private Ltd received BIRAC grant of 43.40 lacs under IIPME scheme. The company was in top 40 in National Bio Entrepreneurship Competition by BIRAC. Priyanka Kumari, a co-founder in Bionic Hope won Top 15 Women in Entrepreneurial Research by Tie Delhi & BIRAC with a cash award of Rs. 5 lakhs.
- AtlamedicoTechsolutionsPvt Ltd was selected as the best technology startup in Bihar in the Y4BIZ event held at Patna and was among the top 10 in Y4BIZ finals.
- Techprolabz entered the market with their robotics education kits and has secured many orders.
- In addition, the companies have filed two patents and are in the process of filing more patents.

Centre for Endangered Language Studies (CELS)

CELS is committed to work towards the documentation and revitalization of endangered and indigenous languages of Bihar and adjoining areas. Numerous linguistic field works are regularly conducted with the same purpose. The Centre is currently working in a virtual mode. Very soon a dedicated building will come up in IIT Patna campus; architectural designing of the same has already been finalized. The infrastructural facilities are being funded through MPLADS. Recently, the centre has been granted research fund from ICSSR to carry out research on designing disaster preparedness modules using indigenous knowledge. The centre has also been instrumental in the publication of a dedicated volume focusing on various linguistic aspects of the languages of Bihar. The Centre along with other collaborating universities and institutes organized a three day conference on Indigenous language which witnessed the participation of researchers from all across the country.



Inauguration of the first conference on indigenous languages organized by CELS and HSS, IIT Patna along with NNM, Nalanda and CIIL, Mysore.



Media coverage of research being carried out at CELS

Centre for Earthquake Engineering Research (CEER)

The vision of the CEER is to reduce earthquake hazard by improving understanding of the impact of earthquakes on the physical, social, economical, and cultural environment. The state of Bihar has a history of moderate to severe earthquake occurrences and its major area comes under seismic zones IV and V. Therefore, a center on earthquake engineering in IIT Patna is very apposite to support the state in mitigating the seismic risk through various research, teaching and training activities. The proposed centre is devoted in fostering a sense of shared commitment among the diverse communities dedicated to earthquake risk management, promoting research, facilitating the exchange of information among members. A plethora of research activities in this direction has been carefully planned with clear vision and mission as has already been clearly outlined in the framework of the Centre. Following are the academic activities CEER has conducted since May 2018.

CEER organised a Earthquake resistant building competition for Engineering students during the annual technical fest 'Samnivesha'

Richter 9.0, organised by Centre of Earthquake Engineering Research (CEER), was the main event of the maiden edition of Samnivesha, the annual technical fest of the Department of Civil and Environmental Engineering, IIT Patna conducted from 9th-10th February, 2019. Richter 9.0 was an event made to bring out the engineer within each of the participant. The goal of the event was to construct a realistic model of a building which will be tested to its limits on a shaking table. This event was designed to give everyone an idea on the impact of earthquakes on the buildings and the importance of 'earthquake – resistance' in a structure.

Participants were required to make an 8-storeyed structure of about 4 m height using plywood strips of different cross-sectional areas appropriately, with the help of nails and some

pre-specified adhesives. It was a 2-day event, in which, one and a half day was provided to participating teams to prep their structure and the last half day was reserved for testing their structure. For testing, gravity loads were placed on each floor of structure and then it was tested against ground motions, generated by the shaker table.

The structures were marked based on how realistic, innovative and mainly on its efficiency. Richter 9.0 proved to be a huge success as the maiden edition saw participation of around 50 people from various colleges of Bihar, besides IIT Patna. The event received a lot of appraisal by the participants. Winner of Richter 9.0 in Samnivesha'19 was a team from Nalanda College of Engineering, Bihar.



Testing of reduced-scale models under dynamic loads (Richter 9.0)

CEER participate in the workshop on “Major Bridges in Bihar-Innovations and Challenges” 26th and 27th July 2019 at Patna

The Indian National Group of the International Association for Bridge and Structural Engineering (ING-IABSE) in association with Bihar Rajya Pul Nirman Nigam Ltd. organized a two-day Workshop on “Major Bridges in Bihar- Innovations and Challenges” on 26th and 27th July 2019 at Patna. This Workshop was on the possible areas of innovation in the conceptualization, planning, design, construction, and supervision of such major bridges, with a specific focus on Bihar.

Dr. V. Singhal, Dr. K. Roy and their research team on behalf of CEER, Department of Civil and Environmental Engineering, IIT Patna organized two-day technical stall in the workshop. In the technical stall, the principles of Structural Health Monitoring and their recent advances were imparted to the delegates

coming from various field of the society. The principal aim of the presentation is on damage localization in the bridge-type structures. All three aspects from mathematical formulation followed by numerical modelling and finally, the on-site field investigation of a real Bridge (Arwal-Sahar Bridge) were addressed in the presentation. The topic of three posters presented was:

- Damage Localization in Beam-Type Structures/Girder: Analytical and Experimental Exposition.
- Mode Shape-Based Damage detection in Bridges: Simulation Approach
- Pilot Study on Arwal-Sahar Bridge: An Experimental Investigation



CEER participation in the workshop on Major Bridges in Bihar-Innovations and Challenges

International Conference on Quantum & Atom Optics (ICQAO-2018)

December 16-18, 2018, IIT Patna



Convener: Dr. U. Roy, Dept PHY, IIT Patna

The “International Conference on Quantum & Atom Optics (ICQAO-2018)” was arranged during December 16-18, 2018 in the main campus of IIT Patna, Bihar, India.

Please see the conference website for details: <https://www.icqao18.com/>

This international event was the largest event of its kind at IIT Patna as well as in Bihar.

There were eminent speakers from 16 different countries in the world and 24 reputed Institutes/universities in India.

A main unique vision of the conference was to make our state Bihar a major player in Quantum Technologies in national & international level.

The event was a grand SUCCESS and we were able to achieve the initial projected goal for this technological mission for the development of the state Bihar.

Objectives

Quantum Technology using quantum optics and atom optics is globally a high priority theme for the next generation

The main theme of this international gathering was to bring together leading scientists, engineers, researchers, technocrats, industry partners from all around the world to exchange and share their experiences and research outcomes

The main reason to make it an international conference is to bring together eminent speakers from around the world to Patna to create/enhance motivation of our students/researchers/faculty members etc.

The topics of the conference, starting from quantum information, atom optics, atom-interferometry, nanophotonics, fiber optics, quantum metrology etc have a large number of applications towards practical implementation of Quantum Technology.

Outcomes

The speakers of ICQAO-18 were world eminent personalities in their respective subject areas.

Technical sessions were of great quality as per the feedback from the conference delegates in the valedictory session.

This was the largest conference of its kind in this region of the state

Conference delegates (foreign and inland) became familiar about the place, Institute and research activities which imparted a spontaneous attention of scientists and technocrats towards relevant activities at IIT Patna and Bihar.

An initiative to establish a “Center for Quantum Technology” at IIT Patna is proposed by the conference delegates to be taken up by the organizers as the future goal to nurture Quantum Technology, for the first time in this part of the country.

Funding opportunities to establish such state-of-the-art Center will be explored.

**(International Conference on Quantum & Atom Optics-2018, IIT Patna, Bihta:
Convenor: Dr. Utpal Roy, Deptt. of Physics)**

Organizers @ ICQAO-18



Conference Patron
Prof. Pushpak Bhattacharyya
Director, IIT Patna



Conference Convener
Prof. Utpal Roy
HoD-Physics, IIT Patna



Conference Secretary
Prof. Raghavan K Easwaran
Deptt. of Physics, IIT Patna



Conference Secretary
Prof. Jobin Jose
Deptt. of Physics, IIT Patna



Conference Secretary
Prof. Suranjana Ghosh
ASET, Amity Univ. Patna



Conference Treasurer
Prof. Soumya J Ray
Deptt. of Physics, IIT Patna

Main Organizers @ ICQAO-18



Main Organizers @ ICQAO-18

5th IEEE International Conference on Data Science and Engineering (ICDSE 2019)



The Department of Computer Science & Engineering organized Fifth IEEE international conference on Data Science and Engineering (ICDSE2019) from 26th -28th October 2019. The rapid development of computer science and information technology in the last couple of decades has generated massive amount of data and fundamentally changed every field in

science and engineering. Many disciplines are now rich in data and tend to adopt data science or data-intensive engineering methodologies to do research and development. Scientific approach to process data involving the engineering aspects as well, would lead to major strides in the domains of data, information and knowledge which contribute to the evolving



knowledge society. This conference is intended to take stock of the trends and developments in the globally competitive environment as well as to provide indicators for future directions to researchers and practitioners. The conference the symposium enabled fruitful discussions between experts and other delegates leading to concrete contributions towards advancing the state of the art. It was a forum for leading experts from the Data Science, embedded systems programming and high-performance computing community to present their latest research, exchange ideas, and conduct brainstorming applications. ICDSE-2019 had a special theme this year, that is "Data, Devices, Decisions for a Digital World". This is particularly relevant considering the fact that it is being held in IIT Patna, India.

Technical Program Committee selected 31 papers for this year's technical program from a pool of 130 submissions. Highlighted topics this year are Data Science and Engineering, Cyber Security and Monitoring, Artificial Intelligence and Knowledge Computing, Domain Specific Data Management, Ubiquitous Intelligence and Cyber-Physical Computing and

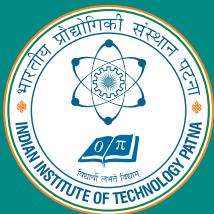
Machine Learning & Natural Language Computing. The keynote speakers were Prof. Sanghamitra Bandyopadhyay, Director ISI, Kolkata, Professor R.K. Shyamasundar, JC Bose National Fellow & Distinguished V. Professor, IIT Bombay, Mitra Bhanu Rath, Senior Solutions Architect – Deep Learning, NVIDIA, Dr Teresa Galvão Dias, University of Porto, Portugal, Dr Mohamed Rawidean, Mohd Kassim, MIMOS, Malaysia and Prof Zhou Liu, Alborg University, Denmark.

DRDO (Defense Research and Development Organisation), SERB (Science and Engineering Research Board), Department of Science and Technology, Bihar and CSIR India (Council of Scientific & Industrial Research), were the sponsors for the 5th IEEE international conference on Data Science and Engineering(ICDSE2019).All paper accepted by ICDSE 2019 will be submitted for inclusion into IEEE Xplore. Selected papers from the 5th International Conference on Data Science and Engineering (ICDSE 2019) will be published in Journal of the Indian Academy of Sciences, SADHANA Springer and Journal of Information Science and Engineering (JISE)

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