



INVENTING & INNOVATING

INNOVATING

IN

TECHNOLOGY

FOR

Humanity

Annual Report 2021-22



భారతీయ సాంకేతిక విజ్ఞాన సంస్థ హైదరాబాద్
 भारतीय प्रौद्योगिकी संस्थान हैदराबाद
 Indian Institute of Technology Hyderabad



"Learning is not about earning, but a way of flowering".

**Nature@ IITH/
Lively Life@IITH**



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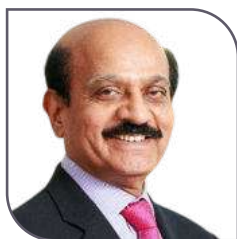
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Research is creating new Knowledge - Neil Armstrong

Board of Governors



Chairman
Dr B V R Mohan Reddy
Founder & Executive Chairman
of Cyient Limited



Ex-Officio Member
Shri Rakesh Ranjan
(IAS)
Additional Secretary (TE), Ministry
of Education, Government of
India



Ex-Officio Member
Prof B S Murty
Director
IIT Hyderabad



Ex-Officio Member
Shri Sandeep Kumar Sultania
(IAS)
Secretary to Government, Higher
Education, Government of
Telangana



Member
Prof Vinod Krishan
Senior Professor & Dean
Indian Institute of Astrophysics



Member, Senate Nominee
Prof Ch Subrahmanyam
Professor
IIT Hyderabad



Member
Dr Prema Ramachandran
Director
Nutrition Foundation of India



Member, Senate Nominee
Prof C Krishna Mohan
Professor
IIT Hyderabad



Member
Prof M Lakshmi Kantam
Professor
Institute of Chemical
Technology, Mumbai



Secretary
Commodore Manohar Nambiar
(Retd)
Registrar
IIT Hyderabad

“ View research as an opportunity to explore and discover new things - Faith Blum ”

Our Deans



Prof Saptarshi Majumdar
Dean (Academic)



Prof K V L Subramaniam
Dean (Planning)



Prof Raja Banerjee
Dean (Administration)



Prof C Krishna Mohan
Dean (Public & Corporate Relations)



Prof M Deepa
Dean (Faculty)



Prof Kiran Kumar Kuchi
Dean (Research and Development)



Prof Pinaki Prasad Bhattacharjee
Dean (International and Alumni Relations)



Prof P Rajalakshmi
Dean (Students)

“ Vulnerability is the birthplace of innovation, creativity and change - Brene Brown ”

Our Distinguished Professors



Prof Bayya Yegnanarayana
Professor and Microsoft Chair
IIIT Hyderabad
Profile Page:
<https://iith.ac.in/inst/yegna/>



Prof Chennupati Jagadish
Distinguished Professor
and Head of Semiconductor
Optoelectronics and
Nanotechnology Group,
The Australian National University
Profile Page:
<https://iith.ac.in/inst/chennupati-jagadish/>



Prof Jun Murai
Professor, Keio University
Profile Page:
<https://iith.ac.in/inst/junmurai/>



Prof Paresh Kumar Narayan
Professor & Consultant,
Monash Business School, Monash
University
Profile Page:
<https://iith.ac.in/inst/paresh-kumar-narayan/>



Prof Pulickel M Ajayan
Professor, Rice University
Profile Page:
<https://iith.ac.in/inst/ajayan/>



Prof Saraswat V K
Member, Niti Ayog
Profile Page:
<https://iith.ac.in/inst/vksaraswat1949/>



Prof Vidyasagar M, FRS
Fellow of The Royal Society
SERB National Science Chair
Hyderabad
Profile Page:
<https://iith.ac.in/inst/m.vidyasagar/>



Prof Vijay Singh
Distinguished Professor & Regents
Professor,
Caroline & William N. Lehrer
Distinguished Chair in Water
Engineering
Profile Page:
<https://iith.ac.in/inst/vsingh/>



Innovation survives only when people believe in their own ideas - Levo League



Director's Message



While making an attempt to portray the journey of IITH all along the year through the 2nd & 3rd wave of the pandemic and its after-effects, we realized that we excellently leveraged the digital prowess to overcome the hollowness created by the Pandemic. The transformation from live to online was well managed to be contactless yet even more connected. As said, every wave of life teaches a lesson. We have learned to nail the situation with Resilience, Solidarity, and Innovation.

Elated to share that 1,323 degrees were conferred during the 9th & 10th Joint Convocation, where 1,303 students graduated from the 2020 & 2021 batch in the august presence of Hon'ble Minister of Education Shri Dharmendra Pradhan with 8 Gold Medals & 47 Silver Medals.

Attainments:

There are some more reasons to share and cheer today; IIT Hyderabad enjoys its first year ever in the top 600 in QS World Rankings. For the 2nd consecutive year, IITH has maintained its position within the Top 10 ranks among the

technical institutes in the country and as the best among the second-generation IITs. Pleased to share that IIT Hyderabad has improved its overall NIRF Rankings from 17 in 2020 to 16 in 2021. For the 6th consecutive year, IITH has maintained its position within the Top 10 NIRF ranks among the engineering institutes in the country and as the best among the second-generation IITs. On the research & Innovation front, IITH has outperformed some 1st Gen IITs in the ARIIA-2021 ranking with 7th rank, a significant growth from last year's 19th rank.

Academics @IITH:

IITH is a cradle for inventions and innovations. It advances the knowledge and skill of the students in science, technology, and liberal arts. Following this vision, the institute has introduced seven online MTech programs and an online MDes program for Working Professionals. To boost entrepreneurship, our Entrepreneurship & Management Department and Business Design Lab & ITIC Incubator have launched Business Model Innovation Certificate Program & a Certificate Course on DeepTech Entrepreneurship, respectively. Continuing to be uniquely distinctive, we have started an MTech program in Techno-Entrepreneurship. In addition to the trend-setting PG Programs, IITH has come up yet again with first-of-its-kind UG programs like BTech in Biotechnology & Informatics, Biomedical Engineering, Industrial Chemistry & a multidisciplinary BTech in Computational Engineering.

Research, Innovations & Entrepreneurship @IITH:

Research is ongoing perseverance, and many steps have been taken to strengthen the research base at IITH with 7,200+ Publications & 92,500+ Citations, and Rs. 575 Cr of Research Funding. Many path-breaking innovations and inventions have taken place, like the development of a sustainable and low-cost Dual carbon battery, an alternative to conventional Lithium-ion batteries, innovative DuroKea fast-acting and long-lasting technologies to combat COVID-19 virus spread, Muscope, the world's smallest Microscope that will make medical devices low-cost, mobile and automated. Researchers made an Oral solution for 'black fungus' ready for technology transfer and also explored aspects of human language and cognition. I am delighted that Koala SoC, an NB-IoT 3GPP standards-compliant chipset, has been jointly developed by IITH and WiSig. I am glad to share a few pivotal outcomes, e.g., the COVID-19 Test Kit with CCMB certification, mPTX for enhanced sperm competence for IVF, 1st Bio Brick Building at IITH under BUILD project, followed by DCM Hydrogel for Cornea treatment. IITH and WiSig Networks jointly announced a maiden 5G data call using indigenously developed 5G ORAN technology, and IITH's Researchers worked on how antioxidants improve the inhibitory nature of Triclosan on Acetylcholinesterase enzyme to protect ourselves from the toxic effects of Triclosan.

I feel immensely glad to share with you that Cyient has instituted the first Chair at IITH, Cyient Chair in Future Communications, and Prof P Rajalakshmi, Department of Electrical Engineering, is the first appointee of the Chair.

Principal Scientific Adviser to the Govt of India, Prof Vijay Raghavan, soft launched (Beta-Version) of 'Swarajability,' India's 1st AI triggered Job Platform for Persons with Disabilities. I am happy to share that one of our Incubatee could successfully launch India's one of most affordable & reliable portable ventilators - Jeevan Lite, launched by the Honorable Governor of the State of Telangana & Puducherry Dr (Smt) Tamilisai Soundararajan and handed over ten free units to each state. This reflects our commitment to our motto, "Inventing and Innovating in Technology for Humanity (IITH). The institute has implemented an innovation policy to convert ideas into incubatees to foster the ingenious mindset on campus to fuel our spirit for inventing and innovating in technology.

Awards & Recognitions:

We have celebrated many moments of pride with the proud recognition of many colleagues, students & alums this year. I feel pleased to share with you that our faculty member, Prof K V L Subramaniam, has been elected as a Fellow of the Indian National Academy of Engineering. Prof Saket Asthana has been inducted as a Fellow of the Royal Society of Chemistry. Prof Suryanarayana was inducted as an Associate Fellow of the Telangana Academy of Sciences. Dr Jyotsnendu Giri received Abdul Kalam Technology Innovation National Fellowship from INAE. Prof C Krishna Mohan and Dr Arabinda Halder were elevated as Senior members of IEEE. Dr Raavi Sai Santosh Kumar was inducted as the Member of the INYAS. Dr Aravind Kumar Rengan was selected for the BRICS Young Scientist Forum 2021. Dr Mudrika Khandelwal received Women Excellence Award 2022. Shuhita Bhattacharjee received the Outstanding Woman Researcher Award in English Literature. Prof Kanchana received the "MRSI Medal" for the year 2021. Our Distinguished Professor, Prof Jagadish, has received Australia's highest civilian honor, the Companion of the Order of Australia (AC). Our students have received many Best Papers, PhD & Posters awards like INAE Innovative Student Projects Award 2021 awarded to Naik Sakshi Sushan, Sakshi Sushant Naik, Mr Sontam Govardhan Reddy.

Collaborations & Relations Building:

With this objective of working together and excelling together, several MoUs have been signed with institutes & organizations of International & National Repute, namely, PharmCADD, IISc, IAMRAI, IPE, RGKUT, Military College of Electronics & Mechanical Engineering, and Kepler Aerospace - Aidin. To accelerate the research in Advanced Automotive Technologies, IITH joined hands with Mobis India. IITH has also signed an MoU with Basavataarakam Indo American Cancer Hospital & Research Institute (BIACH&RI) for Academic & Research Collaboration, APUNA to promote UN objectives of the 2030 SDGs agenda, ECIL for Enhancing Academic & Intellectual Interaction to promote Mutual Intellectual Growth & Indigenous Technological Solutions and with Centre for Adivasi Research and Development Odisha (CARD) for Promotion, Awareness & Empowerment of Marginalized Communities.

Cheerful Moments @IITH:

KirIITH - The Crowning Glory, our quarterly magazine, was instrumental in reflecting the amazing work being done by researchers in the fields of 5G & Next Gen Communications, Energy, Computational Engineering, and Additive manufacturing.

Substantial progress has been made towards campus development with the inauguration of four State-of-the-art facilities by Hon'ble Minister of Education, Shri Dharmendra Pradhan, the establishment of a Resource Recovery Plant, and a 14-inch Telescope. We inaugurated new buildings for the departments of Materials Science & Metallurgical Engineering, Biotechnology & Biomedical Department Building and renovated the Institute Data Centre to aid the research & development activities on the campus. We had some in-person gatherings to celebrate the new entrants to our architecturally outstanding campus, including Primary Health Centre and DAV Campus School. As part of digital transformation, IITH has upgraded eight classrooms to Hybrid classrooms with a CSR initiative by Cyient foundation under the vision of Inventing & Innovating in Technology for Humanity. Cyient, a global engineering, manufacturing, and digital technology solutions company, has also launched its Private 5G Networks Center of Excellence (CoE) at IITH.

At IITH, we focus on the well-being of our fellow residents. We have conducted the third successful vaccination drive on the IITH campus to add an extra protection cover for the residents. However, COVID-19 was never a speed breaker in our last two years' journey.

We have not only set a new benchmark in academics & research but also elevated the campus's experience. IITH conducted Natfoe-2021 in association with INAE. We have also organized the Japan Day-2021 led virtually this September. We also had Alumni Meet. iTIC Incubator at IITH announced CLEAN A THON Winners and has undertaken many exciting and interactive activities like the Sensitization event for FICCI Flo members WIN Challenge to promote Innovation & Entrepreneurship culture at IITH. Amidst the pandemic, too, our students have kept their extra-curricular activities like the EBSB club at IITH has taken up an event, 'Jal hi Jeevan hai,' to reiterate the need to conserve water, whereas Culturals at IIT Hyderabad have organized CultCombat 21. I am happy to see the campus energized via the myriad enthusiasm of Students during the 13th edition of 3 Day 'ELAN & ηVision 2022 - Zora-e-Sukoon', E-Summit 2K22, a flagship entrepreneurship conclave by ECell, and what an end of the quarter with the Milan, Championship of Champion - A 5-day inter-hostel tournament.

We are happy to convey our initiatives to reduce our ecological impact. We adopted sustainable environment-friendly practices by seamlessly organizing Plantation Day (the first Saturday of every month), which resulted in planting 15000 plants. IITH is dynamically evolving to bring changes in people's everyday lives for the better through Technology and Innovation.

I would like to take this opportunity to thank our Board of Governors, and particularly our Chairman, Dr B V R Mohan Reddy, for their constant support and advice. Also, thank all the students, staff, and faculty for their outstanding work in keeping the flag of IITH high.

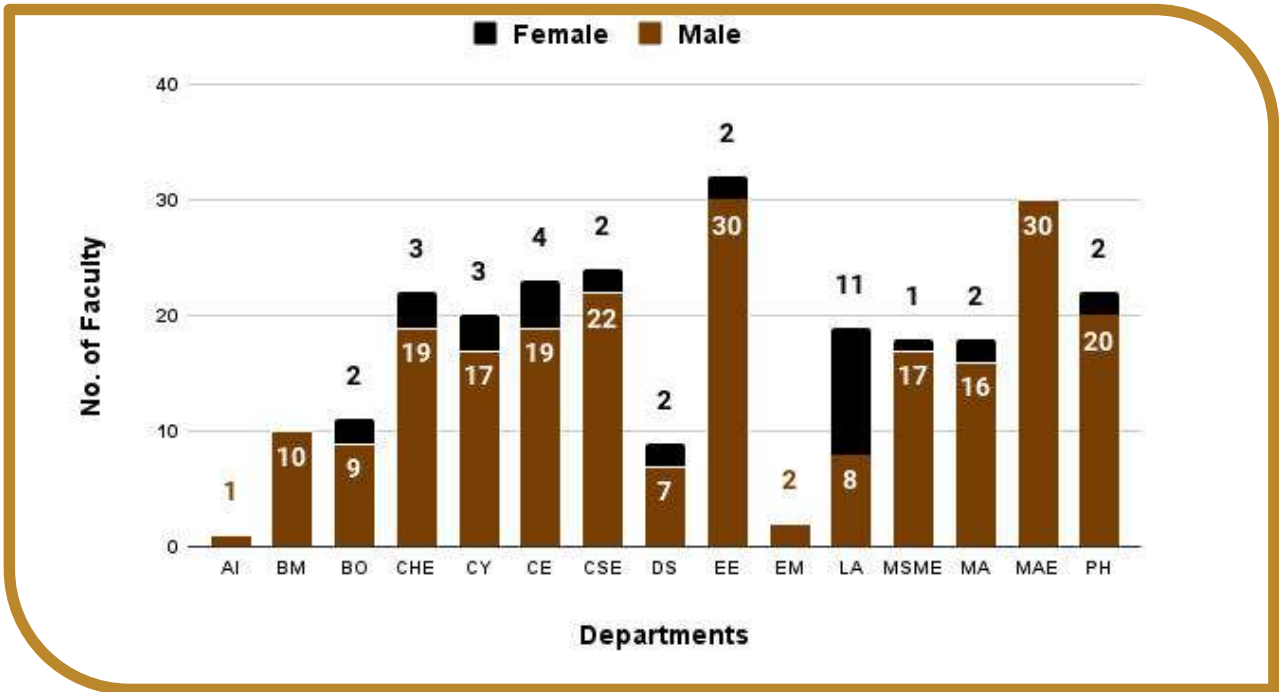
Jai Hind!

Best Regards
Prof B S Murty

Faculty Statistics

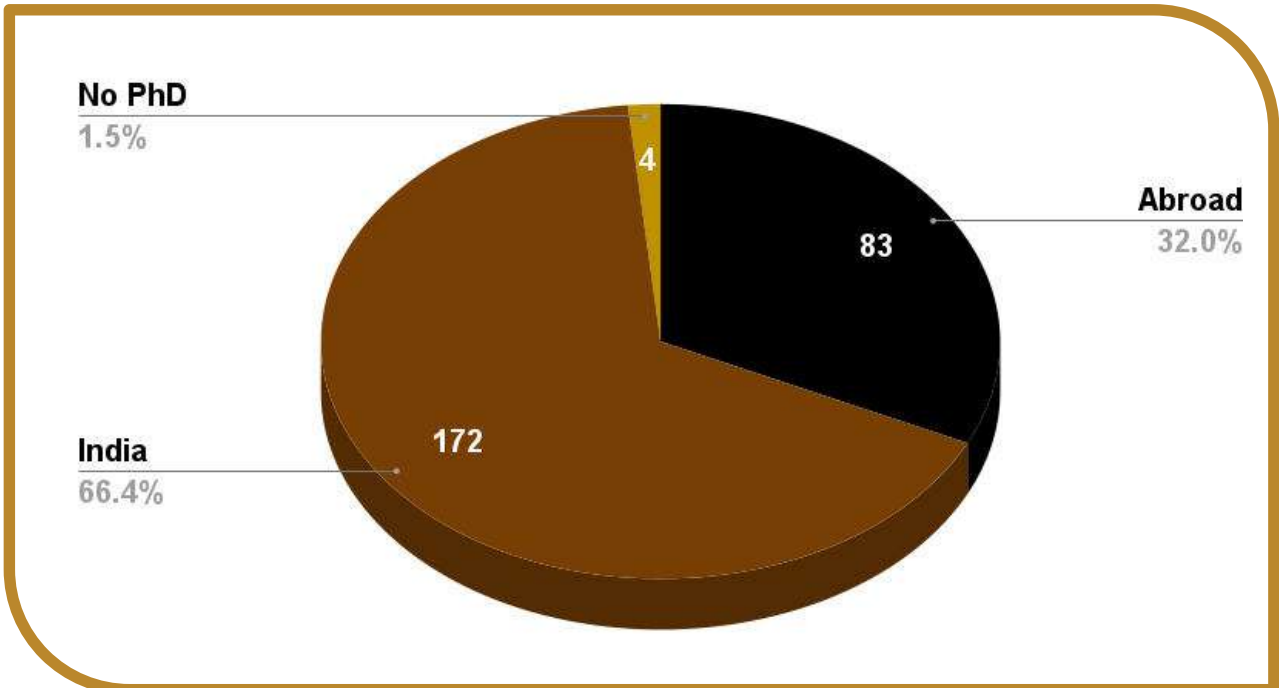
Department-wise

As on 31 March 2022, IITH is having 261 faculty members on-roll. ~15% of the total faculty are women.



Place of PhD

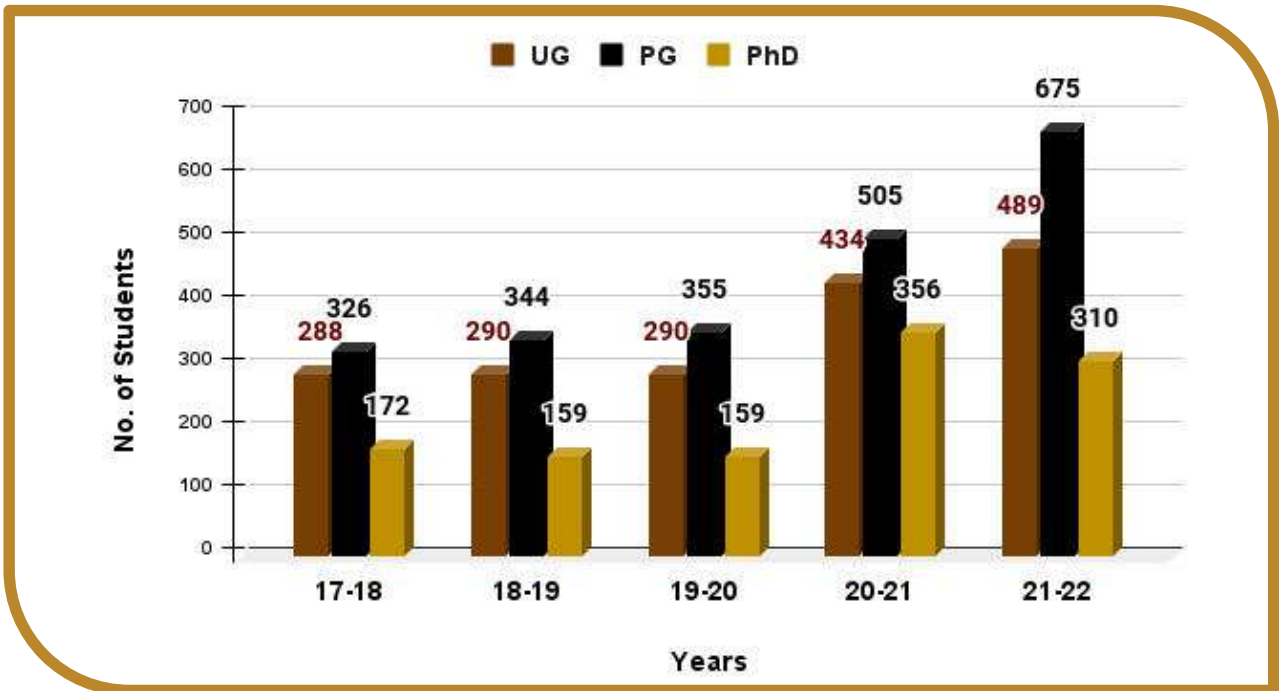
Place of PhD denotes the geographical location (India/ Abroad) of the Institute from where the concerned faculty has obtained PhD.



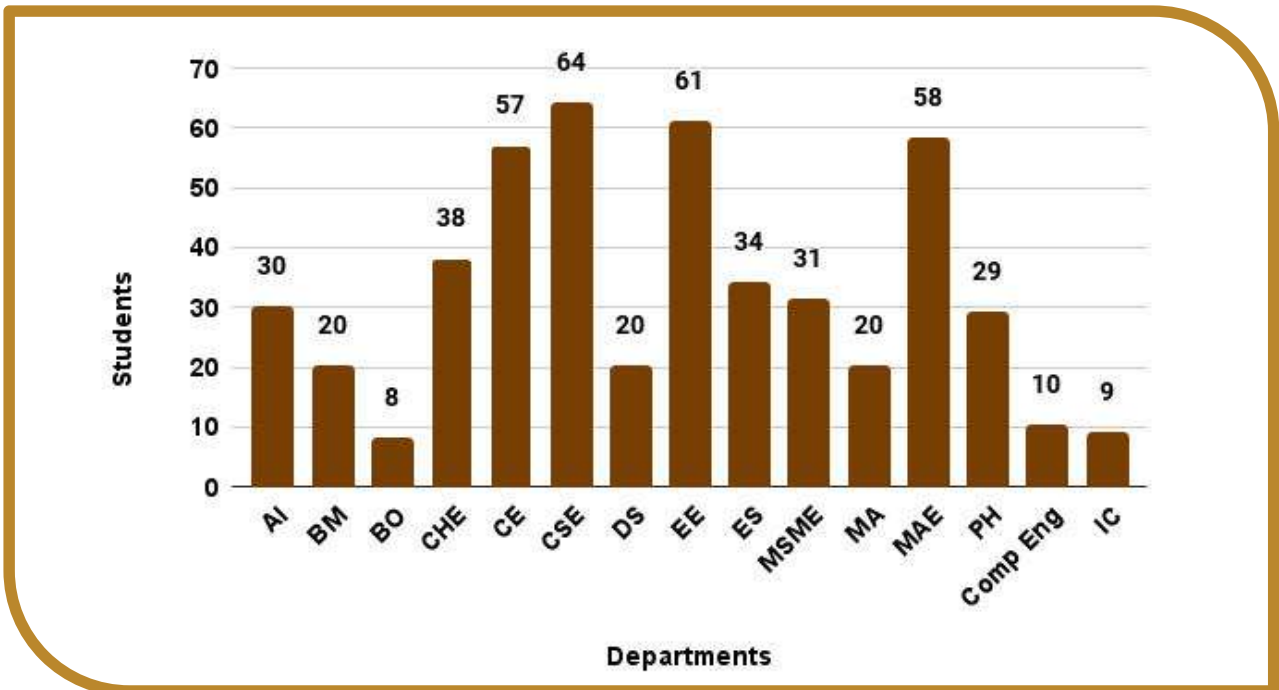
“ Art begins in imitation and ends in innovation - Mason Cooley ”

Student Statistics

IITH has seen an overall **~13.8%** of increase in Student intake for AY 2021-2022 with maximum intake in UG programs at **~33%**

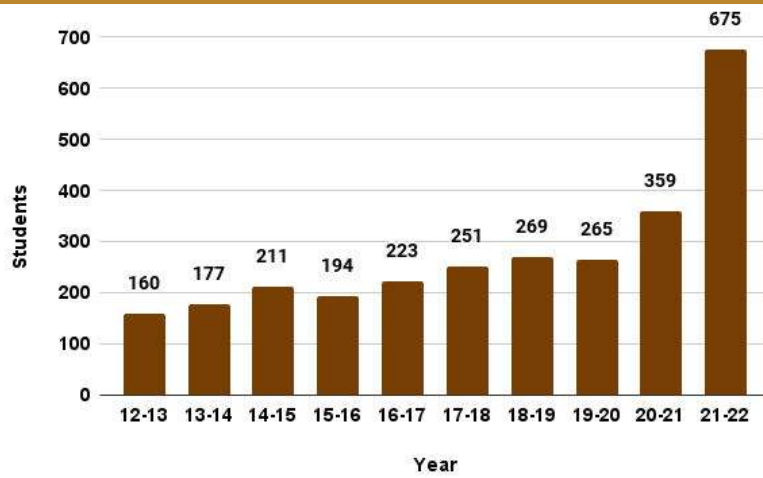


The summary of annual intake for various courses



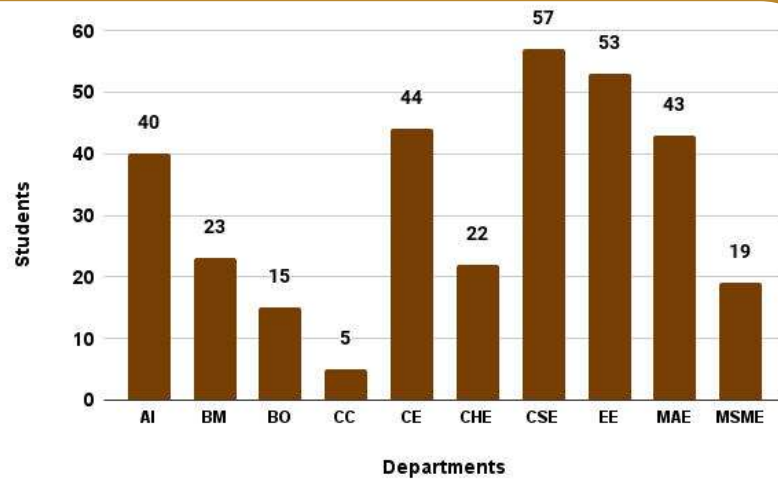
Department-wise Distribution of Undergraduate Students (BTech+BDes) for 2021-2022

“ Innovation is the ability to see change as an opportunity, not a threat - Steve Jobs ”

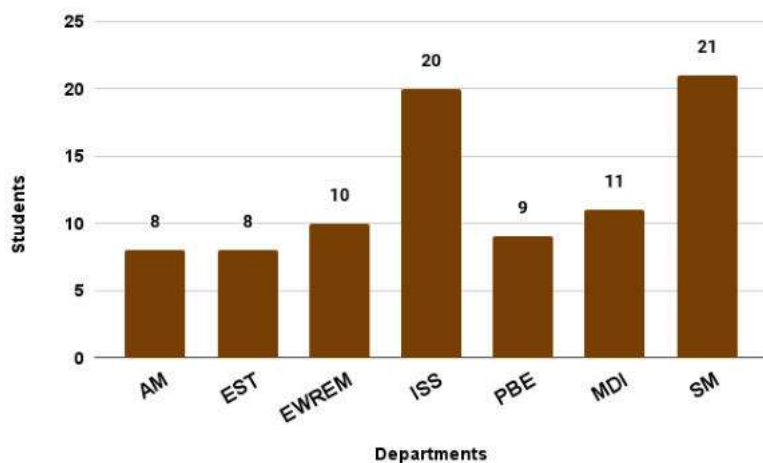


M.Tech (Yearly Intake of M.Tech Students)

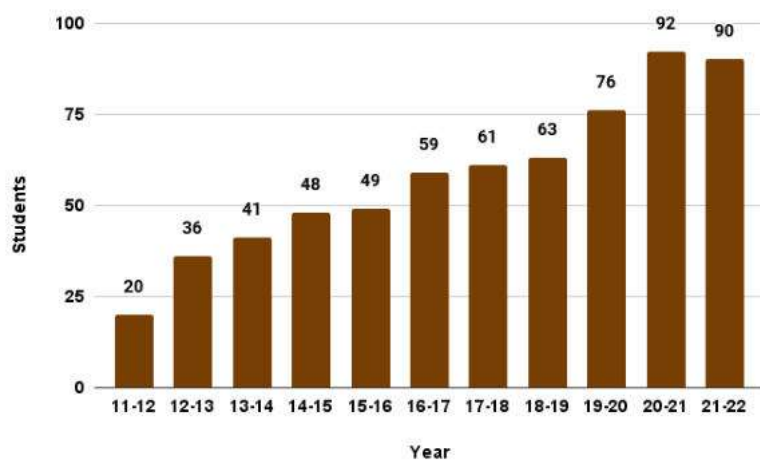
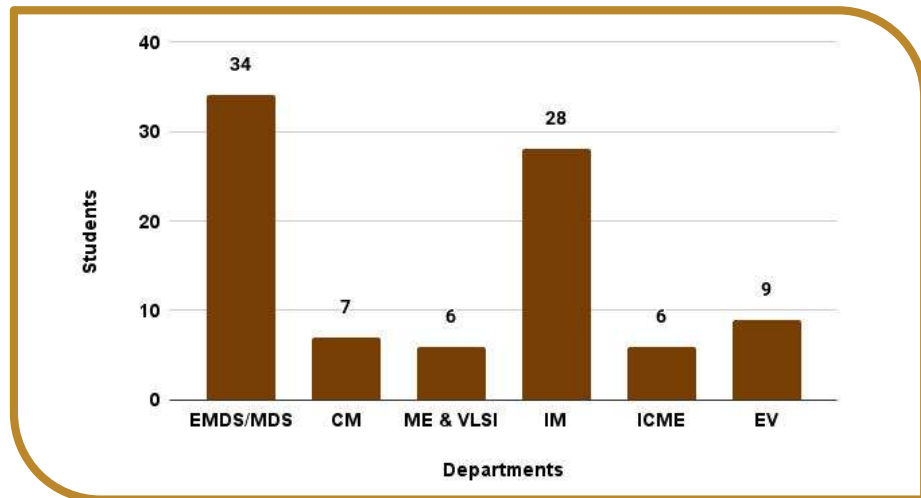
Department-wise Distribution of M.Tech Students for 2021-2022



Department-wise Distribution of M.Tech (Interdisciplinary) Students for 2021-22

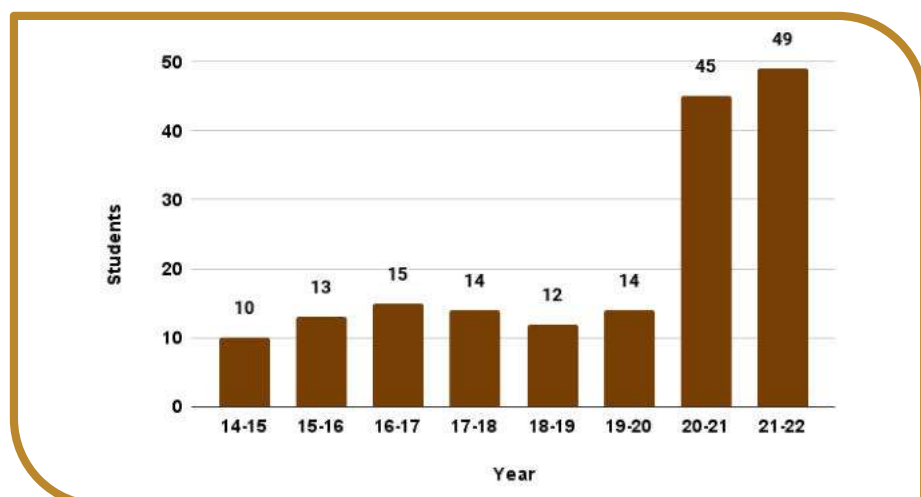


**Department-wise
Distribution of MTech
(Online) Students for
2021-22**

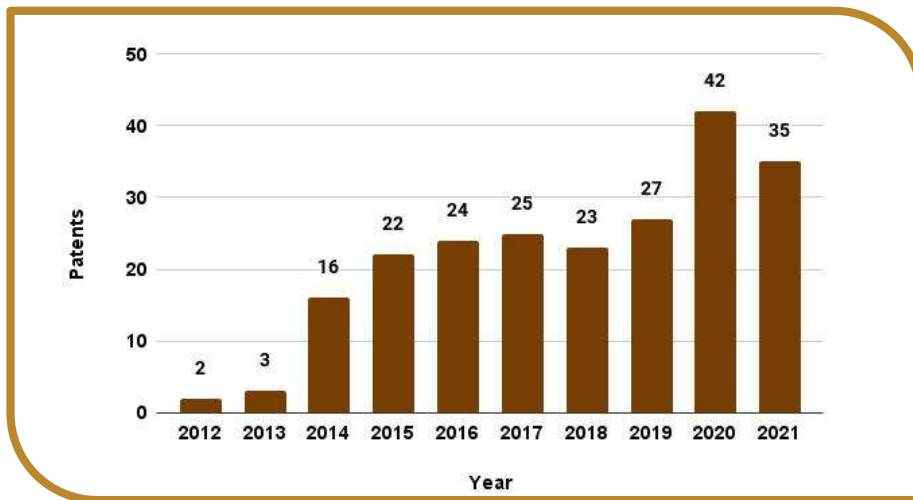


**Yearly Intake of
MSc Students**

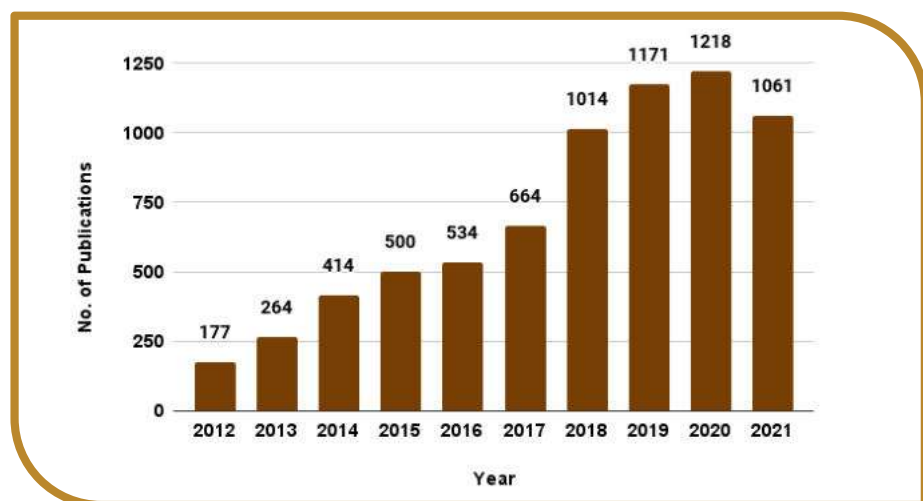
**Yearly Intake of
MDes Students**



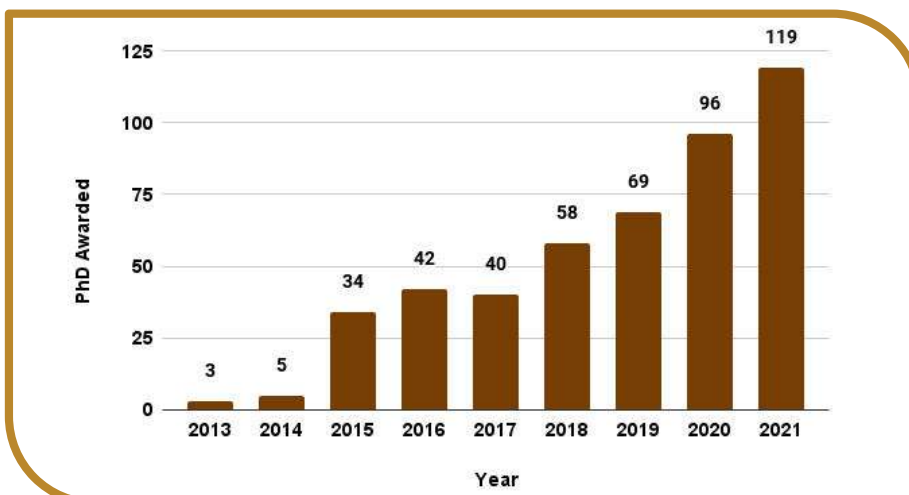
Patents, Publications & PhD



**Year-wise
Distribution of
Patents filed**

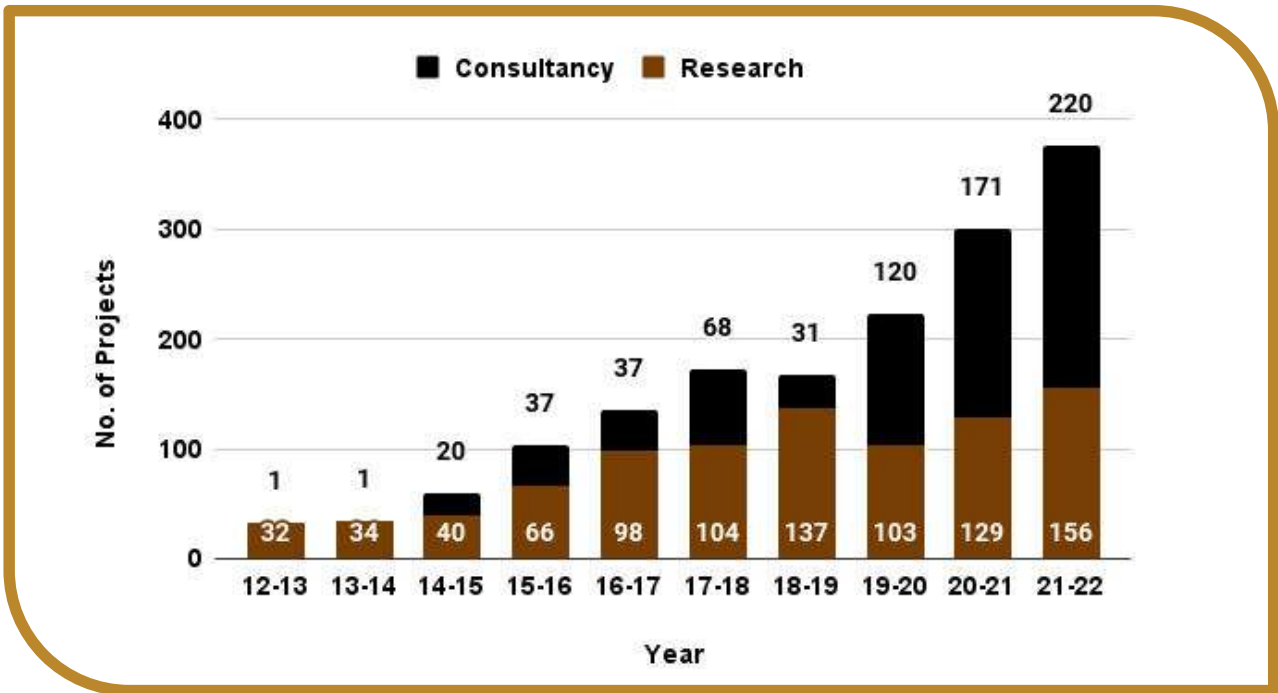


**Year-wise
Distribution of
Publications**

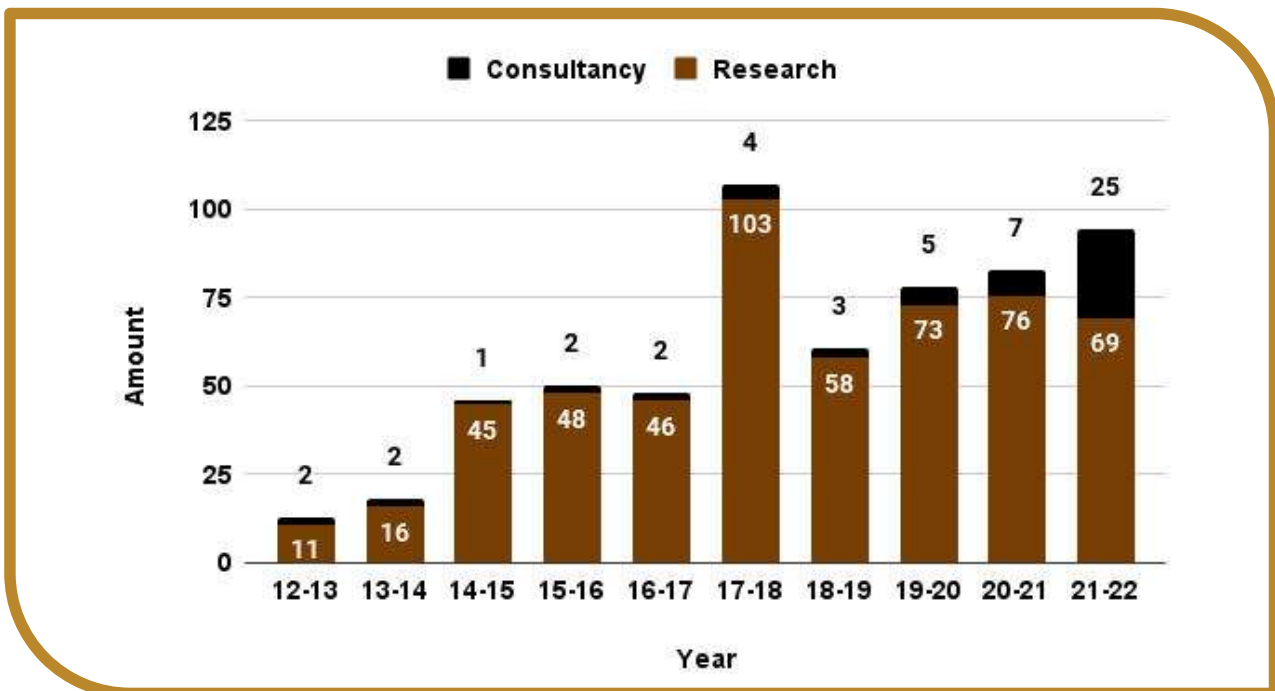


**Year-wise
Distribution of
PhD Awarded**

Research & Development



Year-wise distribution of No. of Projects



Year-wise distribution of Project Funds (Value in Cr {INR})

“ Changes call for innovation, and innovation leads to progress - Li Keqiang ”

Placement & Internship

Webpage: <https://ocs.iith.ac.in/>

Placements

Job Offers

Despite the Covid19 pandemic, current year placement figures are the highest compared to the previous years, notably the highest international offers. Placement trends at IIT Hyderabad witnessed the highest-ever placement this year. Further, several Indian start-ups made a good number of offers. Students are also preferring these start-ups as they offer faster growth and learning opportunities. Placements for this year highlight positive trends both in terms of the diversity of recruiters as well as the quality of profiles offered.

Key Highlights for the year 2021-2022

- Number of Companies Registered: **330**
- Total number of students: **781**
- Number of Students Registered for Placement: **666**
- Total offers Issued: **584**
- Number of Companies hired: **140**
- Highest Package: **₹ 65.46 Lakhs**
- Average Package: **₹ 20.49 Lakhs**
- Number of International offers: **46**

Top Paying Recruiters:



Higher Education

A good number of students from UG and PG opted for higher education in India and abroad. Mentioned below are the few universities opted by the students for higher education:

- California Institute of Technology
- Carnegie Mellon University
- Columbia University
- Georgetown University
- Georgia Institute of Technology
- Harvard Business School
- New York University
- University of Southern California
- Purdue University
- University of Illinois
- University of Pennsylvania
- University of Texas
- Karlsruhe Institute of Technology
- University of Minnesota Twin Cities
- University of Munster

Internships

IITH is continuously working towards industry engagement. Semester-long Internships for BTech & BDes, Interdisciplinary MTech, Industry lectures, industry-defined MTech projects are some of the key initiatives taken in this direction in recent years. IIT Hyderabad witnessed a significant increase in the number of National and International internship offers for the AY 2021-22. A total of 289 offers were received from 90 companies, out of which 23 are international from 10 Japanese Companies. The participated companies are from diversified sectors such as IT, Financial Services, E-Commerce, Manufacturing, Construction, Healthcare Services, Auto Retailers, R&D, etc.

Highlights for the year 2021-22:

- Number of companies registered: **172**
- Companies hired: **90**
- Total Internship Offers: **289**
- Summer Internship offers: **250**
- Semester-long Internship offers: **39**
- Highest monthly stipend: **₹ 2 Lakhs**
- Average monthly stipend: **₹ 52,000**
- Internship offers of 2020-21 converted to PPOs: **82**

Top Hirers for the year 2021-22:



Incubation Centres

CfHE - Centre for Healthcare Entrepreneurship

Webpage: <https://cfhe.iith.ac.in/>

A Healthcare Entrepreneurship Educator, Healthcare Solution Provider, & Technology Business Incubator (DST Approved) & BioNEST (DBT approved). The program was successfully completed by 10 of the 17 fellows in the first batch (September 2020). In the second batch (January 2021), 14 fellows joined, and 12 are now working on the Proof of Concept of the clinical unmet needs that have been identified. Selected fellows had previously attended Institutions like the All-India Institute of Medical Sciences, M. S. Ramaiah Medical College, Rajiv Gandhi University of Health Sciences, IIT Guwahati, NIT Raipur, NIT Calicut, IIM Ahmedabad, IIM Udaipur, University of London, CUSAT, to name a few. They were from different states of the country bringing cultural diversity to the program.

Grand pitch of 2021 batch

The "Grand Pitch" for the Foundation for Center for Healthcare Entrepreneurship's sixth batch of fellows was conducted on November 6, 2021.

- M/s Cortex N Grey, founded by Mr. Pramod S, Ms. Shani and Mr. Assini H, is introducing a Screening and Diagnosis of Autism Spectrum Disorder as early as 2 Years
- M/s MedBlue, founded by Mr. Jitesh Pande and Ms. Kavya, introduced the Non-invasive bilirubinometer to screen neonatal jaundice.
- M/s iOPS, founded by Mr. Satheesh, introduce the intelligent Anesthesia Management System.

MedTech Symposium

To bring together key leaders in the field of Academics, Business, Medical and Healthcare Technologies to discuss they challenges and Developments in the medical devices start-up Eco-System. The event took place on March 24 and 25, 2022. The topics in the discussions were associated with Funding (Challenges & Opportunities), Product Development and how to increase Product Valuation.

Product Launch

JeevanLite: Low cost, portable, IoT enabled ventilator



Smart IoT-based, indigenously-developed, ICU Ventilator "Jeevan Lite" inaugurated by Dr. (Smt.) Tamilisai Soundararajan, Hon'ble Governor, Telangana & Hon'ble Lt. Governor, Puducherry at IIT Hyderabad

1. Companies in the Process of Incubation

a. Through Fellowship Program

- i) SurgeGenie HealthTech Pvt. Ltd: Operation Theatre Armamentarium Management (Got Registered this month)
- ii) Cortex N Grey Pvt Ltd: Screening and diagnosis of Autism Spectrum Disorders as early as 2 years
- iii) MedBlue Pvt Ltd: Non-Invasive bilirubinometer to screen neonatal jaundice
- iv) iOPS: Intelligent Anaesthesia Management System

b. Through Lateral Incubation:

- i. Digimedtech Pvt. Ltd: A novel and efficient Colposcope
- ii. Ernaki Labs Pvt. Ltd: Highly focused Ultrasound for diagnosis & Therapy
- iii. Zy-Quest Global Pvt. Ltd: In vitro Fertilization Microscope
- iv. Matrix-Heal Pvt. Ltd: Tissue Bioprinting
- v. In5n8: Cervico-vaginal fluid retriever device for the screening of cervical cancer/CIN/vaginal infections
- vi. Sensate Interface Devices Pvt. Ltd: Vitals Monitoring
- vii. Vyuha MeddataPvt Ltd: Medical Data Analytics

HDFC Parivartan, HDFC bank's umbrella for its corporate social responsibility selects M/s Aerobiosys and M/s Vaccine on Wheels, the start-ups incubated at The Foundation for Center for Healthcare Entrepreneurship (CfHE), IIT Hyderabad under the fifth edition of its SmartUp grants.

i-TIC - Technology Incubation Centre

Webpage: <https://itic.iith.ac.in/>

Overview:

iTIC is a Technology Business Incubator (TBI) under the aegis of the Indian Institute of Technology Hyderabad (IITH) and supported by the Department of Science and Technology (DST), Government of India. iTIC is a Not-For-Profit Society that focuses on creating a supportive and nourishing environment for budding entrepreneurs in the field of technology. The focus areas of the iTIC incubator are deep tech sectors such as AI/ML, Quantum Computing, AR/VR, Cybersecurity, Robotics, IOT, Industry 4.0, Blockchain, Electronics, Advanced materials, Drones, Biotechnology, Healthcare, etc.

iTIC aims to help entrepreneurs leverage a premier quality research and startup ecosystem with the goal of building a comprehensive platform to practice innovation and entrepreneurship so that these entrepreneurial ideas can be turned into sustainable, scalable profit-making business ventures. iTIC provides support to startups such as Mentoring, Financial Aid, IP Support, Networking, and access to Dedicated office/ Coworking space, Software, IITH Technological Infrastructure, and Makerlab.

Since its inception in 2015, iTIC has supported 100+ startups through Pre-incubation, Incubation, Advanced Incubation, and Acceleration programs and has directly sanctioned more than INR 10 crores to startups. So far, iTIC startups have generated more than INR 800 crores of revenues and helped create 1000+ jobs.

- iTIC supports startups at different stages via its Pre-incubation, Incubation, Advanced Incubation, and Acceleration programs. Under the umbrella of iTIC, during 2021-22, various grants and programs supported entrepreneurs in areas like:
- iTIC Incubation Program
- iTIC Advance Incubation Program
- NICE for sector agnostic deep tech startups
- TiHAN for autonomous Navigation and UAVs
- IDEX DIO for Defense applications
- Nidhi PRAYAS for Hardware based ideas
- MeitY TIDE 2.0 for ITES related innovations

Impact by iTIC:

iTIC has been prioritizing support to startups in all possible ways. The team at iTIC understands the importance of timely interventions and customized support required for early-stage startups. Some of the handholding provided to startups are mentioned below:

- Access to IITH buildings as test bed for Manali Swing for conducting their dummy and human jump trials.
- Technical and business handholding to LiqSure for building their demo and industrial grade systems.
- iTIC team also got involved in B2B negotiations, brand building, connecting to right customers for paid pilots etc.
- Access to the right tools and equipments to Rovonize for building their first 1:1 scale VTOL prototype at iLAB.

- | | |
|--|-----------------|
| • Startups Onboarded in 2021-22 | : 14 |
| • Startups Graduated in 2021-22 | : 12 |
| • Active Startups in 2021-22 | : 34 |
| • Office Hours conducted in 2021-22 | : 131 |
| • Fund sanctioned in 2021-22 (direct and indirect) | : ₹ 7.8 Crores |
| • Prototypes made at iLAB in 2021-22 | : 3500+parts |
| • Total Jobs created by all startups | : 1000+ |
| • Total revenues by all startups | : ₹ 800+ Crores |
| • Mentors associated | : 150+ |

**Major
Milestones
achieved by
i-TIC
Incubator
in FY 2021-22**



Innovation requires an experimental mindset - Denise Morrison



TiHAN

DST NM-ICPS Technology Innovation Hub on Autonomous Navigation

Webpage: <https://tihan.iith.ac.in/>

Major Activities at TiHAN during FY 2021-22

TiHAN Testbed on Autonomous Navigations (Aerial/Terrestrial):

TiHAN at IITH has taken up a magnanimous effort in building an unified and first of its kind state-of-the-art Testbed for the development of autonomous navigation technology for ground and aerial vehicles. We envisage testbed as one of the collaborative platforms with Industry/ Academia/ R&D labs in our endeavours aiming at translational research & commercialization of technology development both national and international level. The Facilities includes Proving Grounds, Test tracks, Mechanical integration facilities like Hangers, Ground control stations, Anti-drone detection systems, State of the art Simulation tools (SIL, MIL, HIL, VIL), Test tracks/circuits, Road Infra - Smart Poles, Signalized & Unsignalized Intersections, Environment Emulators like Rainfall Simulators, V2X Communications, Drone Runways & Landing area, Control Test centres.



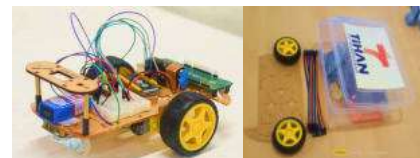
Technology Products:

TiHAN (Technology Innovation Hub on Autonomous Navigations) at IITH focuses on Unmanned Aerial Vehicles (UAVs) and Unmanned Ground Vehicles (UGVs) for a wide range of applications.

UAV: In Nano/Micro category drones, Bio-Inspired drones like Quad-wing UAV (Dragonfly based) and Flapping Wing Micro Aerial Vehicles (Aerial Birds based), Nano drone swarms are being developed at TiHAN. In Medium/Large category drones, TiHAN is focusing on developing solutions for next generation urban air mobility – air taxis, air metros, air ambulances etc as a means of solving traffic congestion in the downtown of large cities.

UGV: ADAS features are built into passenger vehicles, campus shuttles, and bicycles (for last-mile connectivity). ADAS features include pedestrian detection, emergency braking, LDWS, LKA. Used test scenario of ADAS function assessment in the SIL framework for an Indian setting. GPS-based autonomous navigation for DbW-enabled vehicles using waypoints. Algorithms for obstacle avoidance and path planning are being developed.

UAV and UGV training kits is developed inhouse by TiHAN skill development team. It is an easy to assemble DIY [Do It Yourself] kit that can be used by students and others interested in working with UGV and UAV. TiHAN has entered into royalty agreement with an MSME Optimus Logic systems to commercialize it in the market.



Human Resource & Skill development

TiHAN in collaboration with IIT Hyderabad has established a New Interdisciplinary 2-year M. Tech program on Smart mobility (SM) from Aug 2020. There are 39 students in SM2020 and SM2021 batch from different departments like Artificial Intelligence, Civil Engineering, Computer Science and Engineering, Design, Electrical Engineering, Mathematics, Mechanical and Aerospace Engineering in together.

TiHAN has initiated research collaborations with various industries both at national and international level like Suzuki Motor Corporation, Maruti, ANRA, ARAI, ALTRAN, Continental, Infineon Technologies, Invento Makerspace Pvt Ltd, Honeywell and many more. Through these collaborations, the parties intend to enhance consultation and discussions for exploring business opportunities in the area of Autonomous Navigation. R&D collaborators from reputed institutions like IITs, IIITs, Government labs like CDAC, in the area of Autonomous Navigation have been identified through call for proposals. With a synergistic industry and academic collaborations, the hub aims at realizing the utilization of autonomous navigation and data acquisition systems. All of these collaborators have signed their MOUs.

TiHAN is funding for 3 startups namely Aviac, UAVIO, ALOG in incubation stage and 3 startups namely Adiabatic (EIR), Qoptars (EiR), Rovonize (PRAYAS) in the preincubation stage as below.

iTIC Incubator at IIT Hyderabad in collaboration with TiHAN is organizing OTTONOMO'22, a grand challenge. The challenge offers a chance to work on real-world challenges and propose a solution that can be converted into a full-fledged business or can also be adapted by industry. To leverage the innovation capabilities of teams around the world who are passionate to solve problems of the Autonomous Navigation industry.

TiHAN and iTIC Incubator are collaborating to provide access to the platform, institutions, and resources which can be engaged in the process of solution identification based on the problems sourced from the industry. OTTONOMO'22 started on February 1, 2022 and it is still going on.

TRP - Technology Research Park

Webpage: <https://trp.iith.ac.in/>

"IITH Technology Research Park" is an independent Section 8 Company, founded, promoted, and hosted by IIT Hyderabad, governed by a Board of distinguished academicians, faculty of IIT Hyderabad, and industry professionals, to inculcate the idea of innovative entrepreneurship in synergy with research and development.

Funded by the Ministry of Human Resource Development (MHRD, Govt. of India) to the tune of Rs. 75 Crores towards capital expenses, the research park shall feature the latest facilities on par with world standards. It provides the infrastructure and facilities for industry partners to co-locate Research and Development centers at Research Park.

Key highlights @ IITH Technology Research Park

- Approximately 1.5 Lakhs Sqft floor area
- 250+ Faculty
- 17 Departments
- 570+ Acres of Campus
- Mentoring Support
- Showcasing & Networking events
- Training Programs and Seminars

About New Premises

The new premises of TRP was inaugurated on Feb 05, 2022, by Dr Srivari Chandrasekhar, Secretary, DST, GOI in the august presence of Dr B V R Mohan Reddy, Chairman, BoG, IITH, Mr SAITO Mitsunori, Chief Representative, JICA & Mr Shingo Miyamoto, Minister of Economic & Development, Embassy of Japan, Prof B S Murty, Director - IITH. Prof KVL Subramaniam, Dean (Planning) IITH and Prof Ch Subrahmanyam - FIC TRP.



The new premises has a total built-up area of 1.50 Lakh sq. ft. including 11 individual towers of re-configurable spaces and provisions for dry and wet labs. Additionally, 15 conference rooms (of various seating capacities) equipped with latest AV/VC functionality have been made available for the ready use of occupants. 5 Business Lounges have been made accessible for the occupants to host their guests/ visitors. Apart from these, 2 Seminar Rooms (equipped with AV) of different capacities are also made available for occupants to conduct Workshops, Training Sessions, and allied activities.

Research & Development Labs Established in TRP

Plianto Technologies, Qulabs, Vervesemi Microelectronics, WiSig Networks, Repine Signals & Midwest Energy had begun operations in earlier fiscals. Meanwhile, FY 2021-22 witnessed the setting up of R&D centers of Suzuki Motor Corporation, Dhruva Space & HC Robotics in IITH TRP. As on 31st March 2022, 6 companies had enrolled for setting up of their R&D labs in the new premises.

In totality, nearly 16250 sq. ft. has been allocated to the companies along with an operational food court to cater to their requirements. A few more industries have evinced their interest in setting up of their R&D outposts and are expected to take up space in few months.

Some of the
Occupants of
Technology
Research
Park

Plianto
Technologies

WiSig
Networks

QULABS

SUZUKI
INNOVATION
CENTRE

Exawizards

DHRUVA
SPACE

HC
ROBOTICS
Innovation and Research

MIDWEST
ENERGY

Centre of Excellence

Centre for Research and Innovation in AI, supported by Honeywell (क्रिया)

To support the research activities of the AI department, a Centre for Research and Innovation in AI (क्रिया) has been established with the support of JICA (Japan International Cooperation Agency) and Honeywell. This AI क्रिया Centre - in addition to seating areas, classrooms and conference rooms for researchers -- houses a mini-data centre with high-end computational facilities to meet the ever-increasing demand of researchers associated with the AI department at IIT Hyderabad. With various GPU servers and deep learning supercomputers, the data centre is actively contributing to focused as well as exploratory research across multiple research themes. This centre is in use by faculty, research staff and students at IIT Hyderabad to carry out state-of-the-art AI research in-house, as well as in partnership with its collaborators in government and the industry.

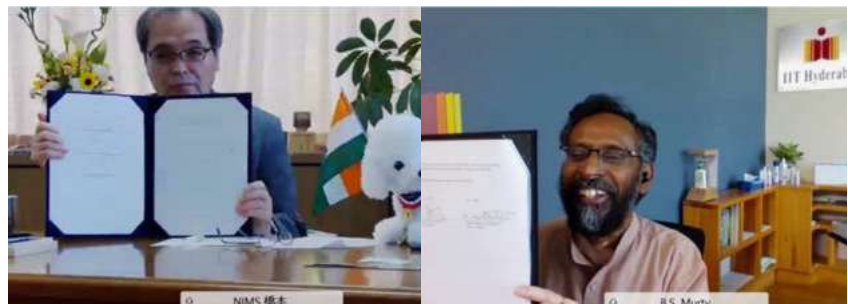


IITHNJCMS - IITH-NIMS Joint Center for Materials Science

National Institute for Materials Science (NIMS) and IIT Hyderabad (IITH) had their first collaborative agreement in November 2019 for exchanging human resources and scientific information. Subsequently, one more agreement was signed by the institutes in 2020 for International Corporate Graduate Program (ICGP) to opportune PhD students at IITH to visit NIMS and promote research effectively in both countries.

The two institutes of global importance have now decided to form a joint research structure named "IITH-NIMS Joint Center for Materials Science" (IITHNJCMS) at the campus of IITH in India and NIMS, Japan. The Centre is announced in a virtual event in April 2021 attended by officials of NIMS & IITH, followed an agreement signing ceremony between Prof. Kazuhito HASHIMOTO, President, NIMS, Japan, and Prof. B. S. Murty, Director, IITH in the kind presence of Dr. K. Hono, Director, Global Networking Division, NIMS, Prof. Pinaki Prasad Bhattacharjee, Dean International and Alumni Relations, IITH and Prof. M. Deepa, Dean, Faculty, IITH.

The centre will be jointly managed by Dr. K. Hono, Director, Global Networking Division, NIMS and Prof. M. Deepa, Dean, Faculty, IITH as co-directors. For FY 2021, 28 meetings were held, 25 proposals were submitted and after careful examination by the head of two institutes, two projects have been approved. These projects will be jointly carried out by a team comprises of a project leader from each institute.



NVIDIA Artificial Intelligence Technology Centre-NVAITC@IITH:

As the Department of Artificial Intelligence at IIT Hyderabad continues to grow by leaps and bounds, scaling up to state-of-the-art technology and infrastructure has become essential. The department has recently entered into close collaboration with NVIDIA to establish an NVIDIA Artificial Intelligence Technology Centre (NVAITC), the first of its kind in India. The NVAITC at IIT-Hyderabad has been established with an objective to jointly pursue research projects of importance to societal needs. The initial set of projects are underway and have led to jointly authored papers already, include AI for agriculture, intelligent transport, natural language understanding, etc

RDC - Rural Development Centre

Webpage: <https://rdc.iith.ac.in/>

Rural Development Centre (RDC) at IITH was established in July 2020 with a vision to support rural development initiatives of the Government through innovative technologies being developed at IIT Hyderabad. The main objectives of RDC are as follows:

- To identify the problems and needs of the rural people through direct interaction or with the help of reputed institutions/organizations/NGOs working for rural sectors.
- To strengthen the UBA activities conducted in the villages adopted by IITH.
- To help the NSS team to conduct activities in nearby villages.
- To facilitate the faculty/staff/students who are passionate to develop technologies to be used in the field such as agriculture, sanitation, drinking water, etc. in rural areas.
- To collaborate with institutions/industries interested to contribute meaningfully to the development of the rural sector.
- To organize training/workshops on skills development to educate the villagers.
- To spread awareness among rural people about the importance of hygiene and cleanliness.
- To develop an academic framework for working on societal problems, their solution, and delivery.
- To involve and motivate the students to work for the welfare of society.

Some of the activities conducted by RDC during April 2021 to March 2022:

- Signing of MoU with Centre for Adivasi Research and Development (CARD) Odisha for mutual cooperation in the area of joint activities for the betterment of Rural, Adivasi and Marginalized communities. As part of the MoU signing ceremony, an interactive session with the Director CARD was organized on 25th March 2022.
- Prof Chetan Singh Solanki popularly known as the Solar man of India visited IITH with the Energy Swaraj Yatra. He is a professor from IIT Bombay, a brand ambassador of Solar Energy for Govt. of MP, and a Founder of the Energy Swaraj Foundation, has pledged not to go home until 2030 and live & travel in the solar bus. Prof Solanki lives in the bus. It is his mobile home. The bus has the facilities to go through all daily activities. Energy Swaraj Yatra bus will be demonstrated after the talk. The bus is fitted with 3.2 kW solar panels and 6 kWh of battery storage. It has a 3 kVa inverter. Lights, cooler, cookstove, TV, AC, laptop charging inside the bus are all solar-powered. The engine of the bus runs on diesel.
- Prof Neelakantan and Prof Srikar, in collaboration with UBA, IITH, and coordinated by RDC IITH, conducted a Service Design workshop in Gongaluru Village in Sangareddy District from February 15th to 28th, 2022.
- Visit of Members of Suzuki Innovation Centre (SIC) at IIT Hyderabad to the villages adopted by IITH under UBA Program.
- Design department students developed the packaging design for Sarvodaya's Manjeera products like detergents and soaps.
- Director of IIT Hyderabad Prof B S Murty visited the UBA adopted villages and schools on 2nd and 3rd December 2021.
- National Farmer's day celebrations includes activities like: Introductory talk by Dr Prasad Onkar on farmers day, Interactive Session with the farmers, Presentation of Bio brick by Priyabrata Rautray, PhD scholar, Design Department, Awareness talk by Prof Prasad Onkar on different online platforms and Awareness talk by Prof Prasad Onkar on different online platforms



CCE - Center for Continued Education

Webpage: <https://cce.iith.ac.in/>

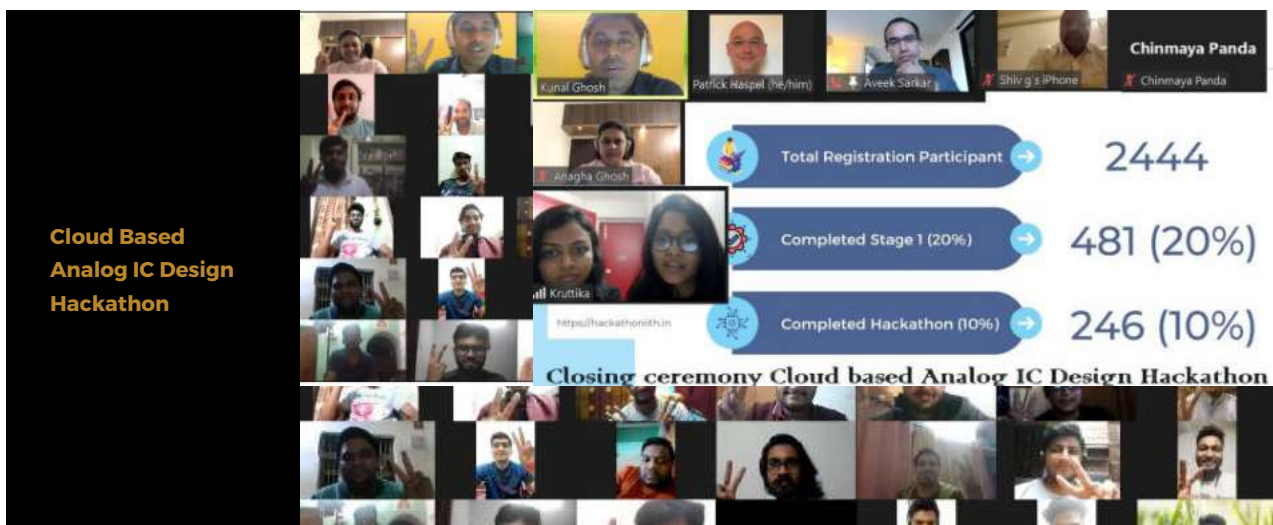
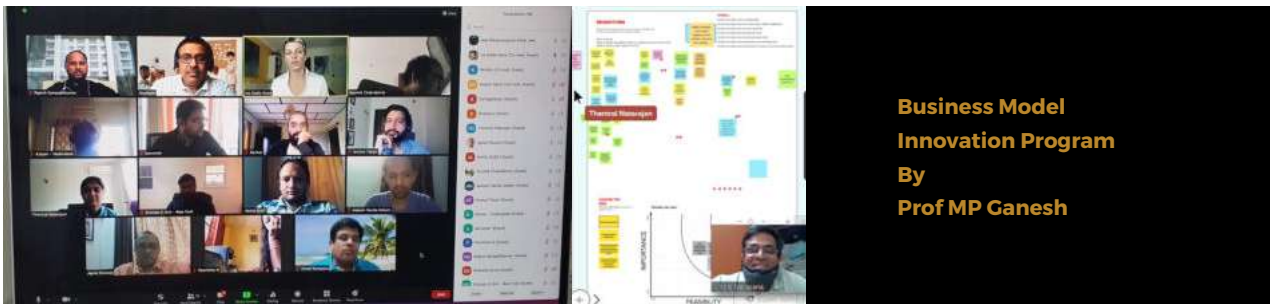
CCE ACTIVITIES - April 2021-March 2022 (TLC, TEQIP, and GIAN activities also come under CCE from October 2020)

- 1st Indo-Norway Workshop on unmanned Aerial Vehicles (IN-WAVE) by Prof Abhinav Kumar
- Professional Program on Artificial Intelligence - Cohort 3 by Prof Antony Franklin
- Cloud-Based Analog IC Design Hackathon by Dr Asudeb Dutta
- Essential Softskills for R&D by Prof Shourya Datta
- PG level Advanced certificate program in Digital design by Design Dept
- Symposium on Algebra and Number theory on National Mathematics Day by Prof Anantha Lakshmi Narayana P and Prof Mrinmoy Datta
- Business Model Innovation (BMI) program by Prof MP Ganesh
- Training on Concepts in Computational Acoustics- Carrier India Pvt Ltd by Prof Venkatesham
- Seminar in Understanding Structural Steel Design by Prof Mahendra Kumar Madhavan

- **ATAL FDP Workshops**
- Nonlinear Problems in Mechanical and Physical Systems by Prof Ashok Kumar Pandey
- Nano-materials & Nano-mechanics and their application in devices and sensors by Prof Viswanath Chintapenta
- Energy Conversion and Storage Devices(ECSD21) by Prof Sai Santosh Raavi

NPTEL Courses:

- Strategies for Sustainable Design by Prof Shiva Ji
- Computational Complexity by Prof Subrahmanyam Kalyanasundaram
- Deep Learning for Computer Vision by Prof Subrahmanyam Kalyanasundaram
- Basic Electrical Circuits by Prof Gajendranath Chowdary and Prof Nagendra Krishnapura
- Introduction to Semiconductor Devices by Prof Naresh Kumar Emani
- Organizational Behaviour by Prof M P Ganesh
- Introduction to Quantum Field Theory(Theory of Scalar Fields) by Prof Anurag Tripathi
- Introduction to Classical Mechanics by Prof Anurag Tripathi
- Strategies for Sustainable Design by Prof Shiva Ji



“ There is a way to do the thing, find it. - Li Keqiang ”

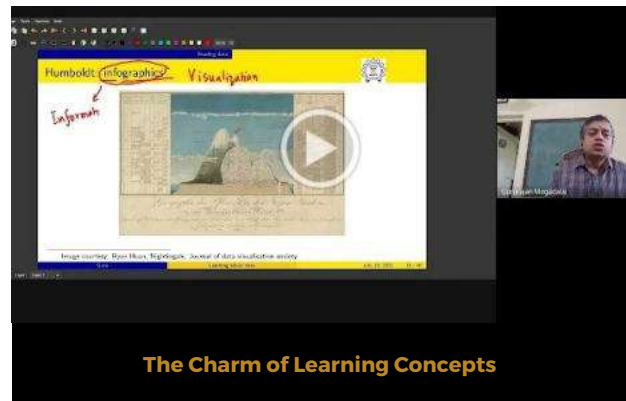
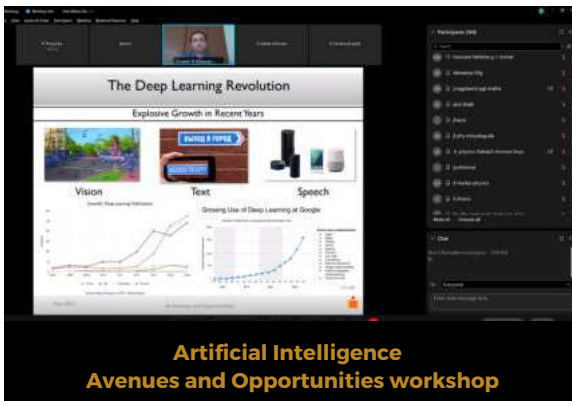
Teaching Learning Centre-TLC@IITH

Webpage: <http://tlc.iith.ac.in/>

TLC activities of IITH is mainly focused on faculty development programs (FDPs) aiming at advanced pedagogy and teaching effectiveness in the faculty and to instigate curiosity and art of questioning among the children in learning fundamentals of science and technology.

Activities:

- The Charm of Learning Concepts-1 by Prof Ranjith Ramadurai
- The Charm of Learning Concepts-2 by Prof Ranjith Ramadurai
- Artificial Intelligence - Avenues and Opportunities workshop by Prof Ranjith Ramadurai
- Thoughts on Teaching by Prof Ranjith Ramadurai

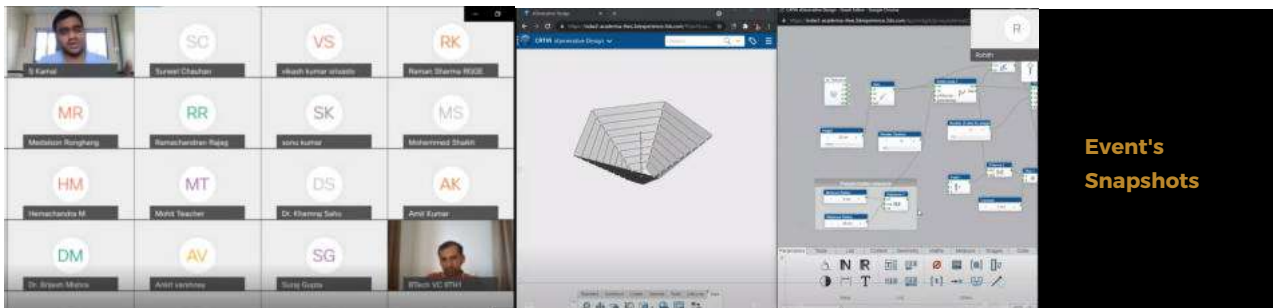


Technical Education Quality Improvement Programme TEQIP-KITE Center

Webpage: <https://www.iith.ac.in/teqip/>

The Technical Education Quality Improvement Programme (TEQIP) was conceptualized in 2003 by the Government of India and the World Bank jointly. The Knowledge Incubation in Technical Education (KITE) Center was created at IIT Hyderabad in 2013 and since then IIT Hyderabad is actively participating in all TEQIP activities. The major objectives of TEQIP-III are to increase in student participation in technical examinations, to increase enrolment of students from traditionally disadvantaged groups like SC/ST and Women, to increase the number of Trained Faculty, to increase in percentage of NBA accredited UG&PG programs and to gain UGC autonomous status. TEQIP-III through IITs, pledged for a combined Students, Staffs, Faculty, and Institutes development in Engineering Education through various activities like Workshops, Joint Research Projects, Internships, GATE sensitization for the Engineering Students and Lab development through staff trainings, minor civil works and purchase of equipment, furniture, books, and software. Handholding of these Institutes needing support is performed through mentoring them by IITs.

A course on "Future Skill Technologies in 3D Printing & Design" has been held by Prof Prasad Onkar from 19-06-2021 to 26-06-2021



“ Innovation distinguish between a Leader and a follower. - Steve Jobs ”

CIP - Center for Interdisciplinary Program

Webpage: <https://cip.iith.ac.in/>

Center for Interdisciplinary Programs (CIP) has been created with a vision of fostering interdisciplinary studies across various disciplines at IIT Hyderabad. CIP @ IITH envision to create new paradigms in education, integrating techniques, tools and science from multi and cross-disciplinary expertise on the IITH campus. The CIP would be a cradle for 'SEEDING' new interdisciplinary Programs bringing together experts with common interests from various branches to address the ever-evolving needs of Science, Industry and humanity, thus shaping up new courses and unique Programs that never existed before and training human resources for tomorrow. These teams of interdisciplinary nature would act as epicentres for brainstorming and writing new grants that would emerge into new Centers of Excellence of National Importance. **IITH has formalized 9 interdisciplinary MTech, One BTech program in Computational Engineering, One MSc Program in Medical Physics and Joint PhDs..**

New Programs from CIP

BTech in Computational Engineering:

Usage of high-end computational techniques for the design of new products or processes, troubleshooting and management of its overall life-cycle is ubiquitous in modern industry. Though traditional engineering BTech curriculums introduce important computational techniques related to the specific branch of engineering, however, they do not cover the wide array of computational methods used in industry. Therefore, the graduates from the traditional engineering streams have limited exposure to these methods & therefore the industry has to spend valuable time and resources to train these graduates on various computational methods that are used in their respective fields. To address this vital gap area of engineering education, a new interdisciplinary BTech program is introduced in Computational Engineering that aims to produce graduate engineers to have expertise in using modern computational methods for a variety of industrial applications.

Medical Device Innovation MTech (MDI):

This is a unique Master's Degree Program to foster the development of world-class affordable medical devices to address the existing gap in the country. This program, M Tech in Medical Device Innovation, shall be offered in association with a clinical partner, the Asian Institute of Gastroenterology (AIG) Hyderabad, and an Incubator partner, the CfHE, IITH. It shall add impetus for scaling up Med Tech innovations by translating Academic Research and Clinical Needs Finding into downstream commercial design and development of medical devices.

MSc in Medical Physics:

IIT Hyderabad in partnership with Basavatarakam Indo American Cancer Hospital And Research Institute, launches an MSc in Medical Physics with approval from AERB. This is quite a unique program among all IITs where the students work closely with a cancer hospital in acquiring experience and knowledge on Radiation therapy, dosimetry, radiation safety and regulations in clinical practice. Medical Physics is a branch of Applied Physics, that uses physics principles, methods and techniques in practice and research for the prevention, diagnosis and treatment of human diseases with a specific goal of improving human health and well-being.

Interdisciplinary PhD:

The Center offers a unique interdisciplinary doctoral program where each enrolled student will be guided by two faculties from different disciplines in a project that needs multidisciplinary expertise. The CIP also hosts an interdisciplinary joint doctoral program with Deakin University, Australia where the doctoral student receives a joint degree with IITH and Deakin University & will be guided by one supervisor from each Institute.



Innovation comes from the people who takes joy in their work. - W Edwards Deming



Innovation Cells

DRDO Cell

An MOU was signed between the Chairman, DRDO, and the Director, IITH, on 3 July 2020 for the establishment of the DRDO-IIT Hyderabad research cell at the IIT Hyderabad campus. This Cell is an extension wing of the Research and Innovation Centre Chennai. This cell will work as an enabler to tap the knowledge of the collaborative directed basic research and multi-institute collaborative research in the basic and applied areas of engaging faculty and researchers at the academic institutions and technology centers and other renowned institutes in India through defined research programs and activities. Currently, the thrust areas of this cell are the following - Advanced materials and processing, sensors, Hardware and Softwares of Artificial Intelligence-based missile applications, Technology for space applications, Adaptive optics and Image processing, UAVs, and Quantum Computing to name a few. In the last financial year (FY 20-21), a total of 13 projects in these related areas were approved with a budget of 19 Crores INR in collaboration with various DRDO Laboratories in India and the research work in these projects is in progress. A Centre of Excellence in Additive Manufacturing has been in principle approved under the cell.

Key Projects at DRDO Cell::



Adaptive Optics & Image Processing



Advanced Materials & Processing



Artificial Intelligence



Biomedical Products Development



Quantum Technologies



Technologies for Space Applications

IPFC - Intellectual Property Facilitation Centre

- Number of patent applications filed: **158**
- Number of patent applications published: **142**
- Number of patent applications granted: **20**

IPFC Statistics till March 31, 2022

FY 2021-22: Activities

- Number of patent applications filed: **31**
- Number of patent applications published: **35**
- Number of patent applications granted: **6**
- Conducted **10** awareness programs on IPR to all the researchers
- Trained the researchers to file the patent applications on their own
- Supporting the filing of patent applications and other patent office actions
- Conducted the prior art search for various inventions



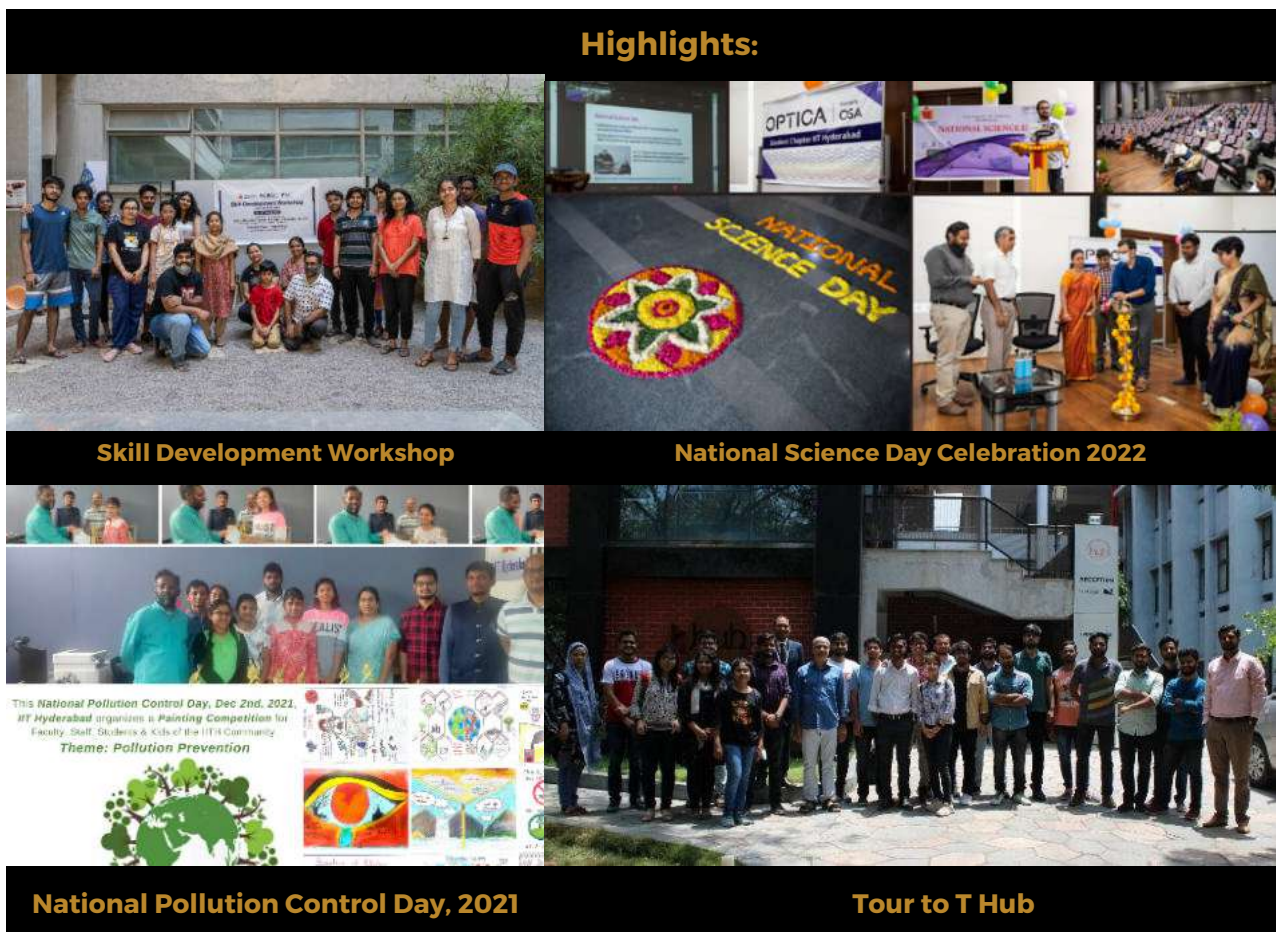
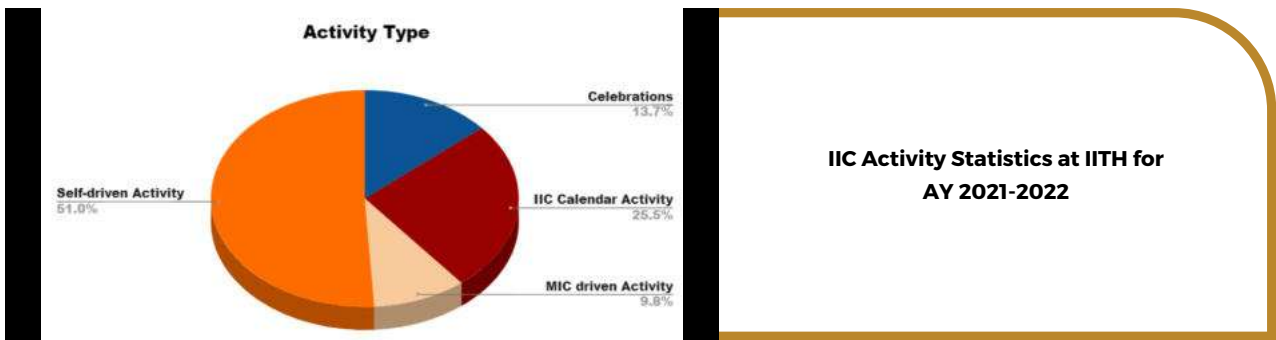
Logic will get you from A to B. Imagination will take you everywhere. - Albert Einstein



IIC - Institution's Innovation Council

Webpage: <https://innovationcouncil.iith.ac.in/>

Institute Innovation Council at IIT Hyderabad was initially established in February 2018 with Innovation, IPR, and Entrepreneurship as its 3 pillars. Later in February 2021, the council was reconstituted with 22 Representatives, as per the IIC norms with an appropriate framework designed for its Objectives, Functions, Roles, and Responsibilities. Since then, all the innovation and entrepreneurship-related activities of IIC are strictly implemented by the Council. The IIC meetings were conducted timely with all the representatives of the Council. At IIC at IIT Hyderabad has 29 active members to inculcate the culture of Innovation & Entrepreneurship on campus.



“ Diversity is Innovation. - Duncan Wardle ”

Hindi Cell

In pursuance of the Official Language Policy of the Government of India, the Hindi Cell of the Institute promotes the progressive use of Hindi at IIT Hyderabad. Before June 2021, the work of the Hindi cell was looked after by the faculty in charge of the cell. Presently Hindi Cell has a sanctioned post of Junior Hindi Translator, for which the translator was recruited in June 2021. The registration of the institute for sending quarterly progress reports and annual assessment reports online to the Department of Official Language, Government of India, by Hindi Cell was also done in this financial year for the first time in the history of the institute. Every effort is made by the Hindi Cell to get the rules and regulations related to the official language of Hindi in the institute to be followed.

Highlights of official language activities are as follows:

Ongoing Activities of the Cell

The Hindi Cell provides the translation of the Institute Annual Report, Annual Accounts, Audit Report, and various other documents, which comes under section 3(3) of the Official Language Act, 1963. In addition, different other letters and correspondences, replies, etc., are either translated or prepared in Hindi. The Hindi Cell also tries to ensure the effective implementation of the "Official Language" policy of the Govt. of India at the Institute. The Cell ensures the bilingual board display and use of different nameplates, notice boards, rubber stamps, and routine type forms and also helps in preparing bilingual Degree certificates as well as PhD thesis titles awarded by the Institute during Convocation.

Hindi Training and Workshop

The Hindi cell emphasized the need to provide Hindi training to all the employees of the institute who do not have a working knowledge of Hindi. In order to solve the problem of the employees in the use of the official language, the Hindi cell apprised the director and other higher officials about the need to organize Hindi workshops for the employees of the institute.

Hindi Week Celebrations

On the occasion of Hindi Diwas on 14 September 2021, Hindi Cell organized "Hindi Week Celebrations" from 14 to 20th September 2021 in the Institute. In the opening ceremony of this program, Shri Uday Pratap Singh ji was invited as the chief guest through virtual mode, who has also been a well-known poet, litterateur, and former Rajya Sabha MP and working president of Uttar Pradesh Hindi Sansthan. He has also been a member of the Parliamentary Committee on Official Language many times. During this Hindi week in the institute, the Hindi cell organized many competitions for the faculty, staff, and students, like essay writing, official terminology competition, and handwriting competition. Students' essay writing competition was conducted in online mode due to corona guidelines. Smt Bela, Assistant Director, Central Hindi Training Institute, Secunderabad, was invited as the chief guest in virtual mode on the occasion of the closing ceremony of Hindi week celebrations on 20-09-2021. Certificates and mementoes were given to all the winners of the competitions organized during the Hindi week celebrations. In the end, the vote of thanks was given by Dr Anupam Gupta, Faculty In-charge, Hindi Cell & Member Secretary, OLIC, and after the national anthem, the Hindi Week celebrations were successfully completed.

Bilingual Website

According to the Official Language Policy of the Government of India, the higher officials of the Institute were apprised of the need to make the Institute's website bilingual by the Hindi Cell.

Unicode

Hindi Cell has put on Intranet a detailed description of "How to Install Unicode Font" with the help of Computer Center to enable Unicode in the computers of all the departments of the Institute, which helps the employees to work in Hindi.

Official Language Implementation Committee

According to the guidelines of the Department of Official Language, for the first time in the history of the Institute, on the recommendation of the Hindi Cell, the Official Language Implementation Committee(OLIC) was constituted on 06-09-2021. The Director of the institute was made the Chairman of this committee and the Registrar was made its Vice-president. As per the official language policy, preference was also given to non-Hindi-speaking members in the selection as committee members. The faculty in charge of the Hindi cell was made member secretary of the committee. The purpose of this committee is to promote the implementation of the official language policies of the government and to review the progressive use of Hindi in the institute. The first meeting of the Official Language Implementation Committee was held on 10-12-2021 under the chairmanship of the Director of the Institute. In this meeting, all possible steps were discussed to expedite the implementation of Official Language in the Institute.

RAJBHASHA SAMMELAN

Government of India, Ministry of Home Affairs, Department of Official Language. organized Joint Regional Official Language Conference (South and South-West Zone) in Hyderabad on December 4, 2021. In this conference, Indian Institute of Technology Hyderabad was represented by Naveen Srivastava of Hindi cell.



What is now proved was once only imagined. - William Blake



Celebrations

Dr. Tejaswini Manogna

- India's Best Cadet.
- Miss India Earth 2019.
- Prime Minister Medal Awardee.
- Yoga Practitioner and International Trainer.
- Bharatnatyam Artist.



IITH observed 7th International Day of Yoga 2021 with the theme "Stretch, smile and relax. Revive your spirit. Find your inner peace and tap into your soul and rediscover yourself", with Dr Tejaswini Manogna (Celebrated Yoga practitioner) as the Chief Guest.

IITH celebrated 75th Independence Day on 15 August 2021 with great joy and pomp. The sense of happiness and pride could be clearly seen on the faces of all the people as the Director B S Murty hoisted the Flag



Vigilance Awareness Week, Acts of Acuity @IIT Hyderabad



Vigilance Awareness Week 2021, at IITH, is a week full of Act of Acuity with Expert's Talk, Elocution Competition, Essay Writing, and Painting by School Kids.

IITH celebrated Constitution Day 2021 to commemorate the adoption of the Constitution of India. The Hon'ble President led the reading of the Preamble on the day. The faculty, staff and the students took part in this event virtually and celebrated the day with the mass-reading of the Preamble.

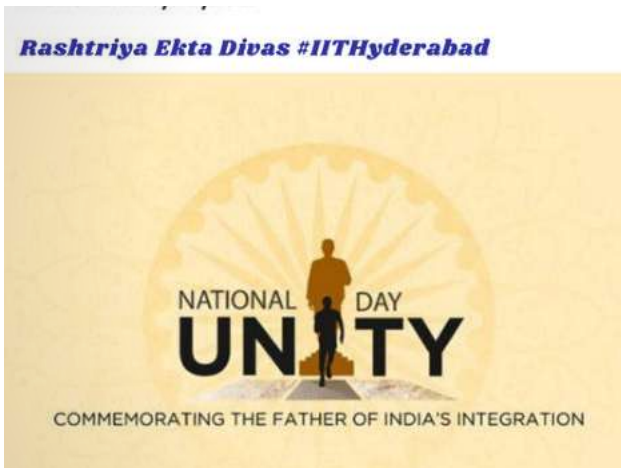
IIT Hyderabad celebrated Constitution Day 2021 in full spirit





IITH campus reverberated with patriotic favor and enthusiasm on the 73rd Republic Day. A Glimpse: <https://youtu.be/MZYdjmSE4lw>.

IITH took pride in glorifying and celebrating the spirit of unity on Rashtriya Ekta Divas by taking the pledge.



IITH Celebrated "International Mother Language Day" on February 21, 2022, with the theme "Using technology for multilingual learning: Challenges and opportunities". View Video Abstract: <https://youtu.be/FLICq-4JMyg>.

Dept. of Physics & IIC, celebrated National Science Day in full spirit. The OPTICA Student Chapter was inaugurated by the Science Veterans of IITH. A glimpse: <https://www.youtube.com/watch?v=EQntFlyCPLM>





భారతీయ సాంకేతిక విద్యార్థి సంస్థ హైదరాబాద్
भारतीय प्रौद्योगिकी संस्थान हैदराबाद
Indian Institute of Technology Hyderabad

Celebrating WoWomen @IIT Hyderabad

Both Men & Women of IITH



International Women's Day 2022 has been marked with an event packed with Recognition for Women Excellence, Singing, Music, Knowledge Sharing Session, Motivational Talks & Speak Your Heart Out Memories. A Climpse: <https://youtu.be/qISRSKVExuQ>

Iconic Week - Azadi Ka Amrit Mahotsav is celebrated at IITH to commemorate 75 years of independence and the glorious history of it's people, culture and achievements.



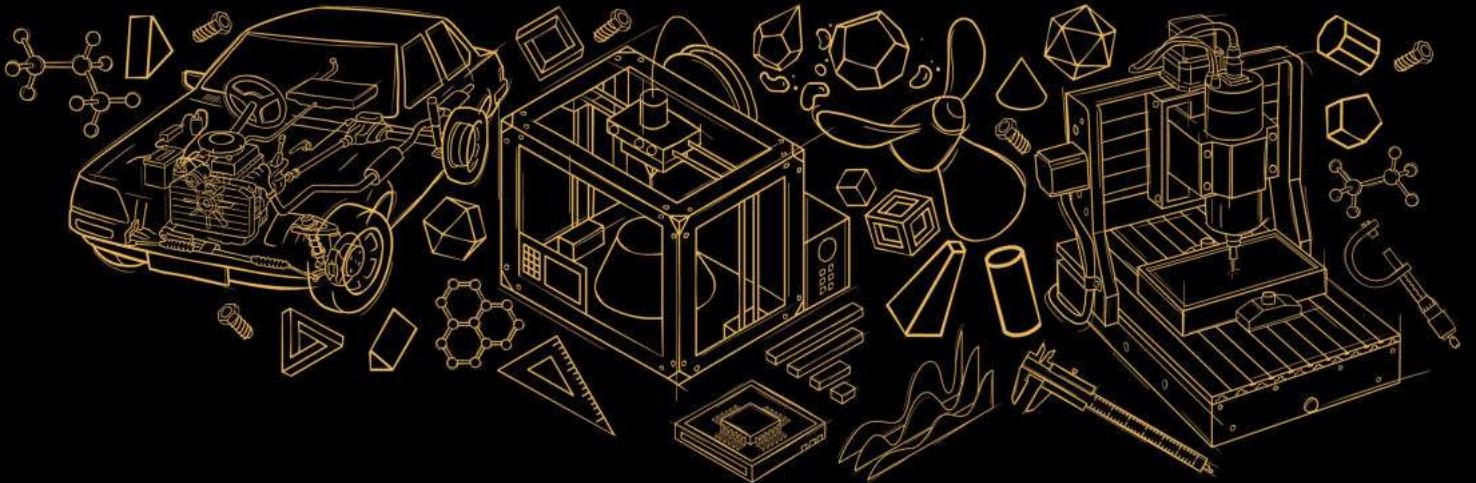
IITH has arranged an Exhibition match of Hockey to observe the National Sports Day. The monumental victory in Tokyo Olympics 2020 makes it more important for us to celebrate National Sports Day with vigor & enthuse by remembering Major Dhyan Chand Singh.



IITH organized Fit India Freedom Run 2.0 on the august occasion of Celebrations of India's 75 years of Independence- Azadi Ka Amrut Mahotsav with the theme, Fitness ki Dose - Adha Gantha Roz



DEPARTMENTS



Department of Artificial Intelligence

Established in 2019, the Department of Artificial Intelligence (AI) at IITH is the first such in India offering BTech, MTech, and PhD programs in AI with an objective to mold students with a holistic understanding of the theory and practice of AI, as well as to create an ecosystem for pedagogy and research in AI, encompassing foundational, applied, and interdisciplinary perspectives. Its mission is to enable students to become leaders in the AI industry and academia nationally and internationally; as well as to meet the pressing demands of the country in various sub-areas and applications of AI. After functioning as a virtual department comprised of affiliated faculty for nearly three years, the department began recruiting its own faculty in 2022. The department offers BTech, MTech, and PhD programs. The department currently has approximately 100 BTech, 40 MTech, and 40 PhD students.

The department currently consists of around 30 faculty working in various areas of AI including machine learning, computer vision, speech understanding, natural language processing, social media analysis, robotics, signal processing, high-dimensional data analysis, distributed AI, compilers for AI, and embedded AI. It also includes faculty at the intersection of AI and other disciplines such as AI and IoT, AI and blockchains, AI and wireless networks, as well as computational neuroscience. Faculty associated with the AI department have been involved in projects conducting research and development of AI solutions for healthcare, smart transport, security and surveillance, agriculture, disaster management, fraud analytics, e-commerce, astronomy, and aerospace applications. Faculty in the AI department at IITH consistently publish in high-impact, high-visibility conferences, and journals in various areas of AI, including ICML, NeurIPS, CVPR, ICCV, ACL, AAAI, IJCAI, ICASSP, InterSpeech, etc.

The AI department at IITH has strong collaborations with various government, academic, and industry organizations such as DRDO, ICRISAT, Microsoft, Honeywell, Intel, Adobe, NVIDIA, Tredence Analytics, etc. In particular, the AI department hosts India's first NVIDIA AI Technology Centre (NVAITC), as well as works closely with the Telangana AI Mission on its initiatives. With growing interest in the domains of prospective students, society, industries as well as the government, the department is expected to scale greater heights in years to come.

For more information, please visit: <https://ai.iith.ac.in/>

Faculty

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“
You can't use up creativity. The more you use, the more you have - Maya Angelou
”

Internal Adjunct Professor



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Publications:

1. A paper titled "Achieving Fairness in the Stochastic Multi-Armed Bandit Problem", Journal for Machine learning research (JMLR) 2021.
<https://doi.org/10.1609/aaai.v34i04.5986>.
2. A paper titled "Ballooning Multi-armed Bandits", published in AI Journal in 2021.
<https://doi.org/10.1016/j.artint.2021.103485>.

Research Highlights

1. Centre for Research and Innovation in AI

To support the research activities of the AI department, a Centre for Research and Innovation in AI (क्रिया) has now been established with the support of JICA (Japan International Cooperation Agency) and Honeywell. This AI क्रिया Centre in addition to seating areas, classrooms and conference rooms for researchers, houses a mini-data centre with high-end computational facilities to meet the ever-increasing demand of researchers associated with the AI department at IITH. With various GPU servers and the deep learning supercomputers NVIDIA DGX1 and DGX2, the data centre supports upto 250 TFlops of GPU computing power. This centre will be used by faculty, research staff and students at IITH to carry out state-of-the art AI research in-house, as well as in partnership with its collaborators in government and the industry.



2. Professional Certificate Program in AI and Emerging Technologies

A residential (converted to remote under the current circumstances) Professional Program in Artificial Intelligence and Emerging Technologies, was jointly offered by IITH and TalentSprint from Jun-Dec 2021. The program is intended for young professionals and college graduates seeking to build world-class expertise in AI and emerging technologies, and obtain professional certification from IITH.

3. AI Research Scholars Day

The AI department celebrated its first Research Scholar's Day, which various professors from different departments attended. The first PhD batch of the AI department, started in 2019, consisting of 3 students: Bhattacharyulu V V R Dittakavi, Tejasri Nampally, and Suresh N, who presented their research as a part of the proceedings. The event witnessed keynotes from Professor M Vidyasagar, Distinguished Professor, IITH, and Prof S P Arun, IISc.

“

No idea is so outlandish that it should not be considered - Winston Churchill

”

Department of Biomedical Engineering

As part of Phase-II infrastructure development of IITH with the support of JICA and MoE, a spacious new building has been inaugurated in the presence of Professor Dr Balram Bhargava, Director General, Indian Council of Medical Research (ICMR), and Secretary, Department of Health Research, Ministry of Health and Family Welfare, Government of India as the chief guest. Dr Nagarajan Ganapathy, a new faculty has been appointed as Assistant Professor. His area of research interest is in the fields of Clinical Artificial Intelligence (AI) for Healthcare, Affective Computing, Big data analysis, medical bioinformatics, signal and Image analytics, Internet of things, Edge AI, wearable systems, and clinical decision models. Two faculty members Dr Mohan Raghavan and Dr Aravind Kumar Rengan have been promoted to Associate Professor. Dr Subha Narayan Rath, Dr Falguni Pati, Dr Aravind Kumar Rengan were the Invited Speakers at BPI Mini-Symposium Series, biomaterials, and tissue engineering, on November 27, 2021, & delivered talks on "Effective Immunoisolation Devices for Allogeneic Islet Cell Transplantation", "Biomimetic Hydrogel for Corneal Scar Treatment". The creation of a new virtual Department of Heritage Science and Technology (HST) was initiated at IIT Hyderabad with financial support from DST, the Govt of India, and Dr Mohan Raghavan as Head of the department. Dr Falguni Pati, Associate Professor was appointed as FIC Hospital, IITH.

On the occasion of the new BTBM building inauguration, co-circular activities like Poster Presentation, Rangoli, Treasure Hunt, and Cultural events were organized for BTech, MTech & PhD students. Department staff participated in various activities organized by IITH during several events. Saransh Khandelwal, Sairam M, and Chaitanya Gajbhiye participated and secured First & Third prize in the Face mask painting competition and Saransh Khandelwal won First Prize in Poster Making Competition on the occasion of International Mental Health Day, organized by the Sunshine team of IITH.

During Hindi week celebrations, Saransh Khandelwal secured Second Prize in Technical Terminology Hindi & Chaitanya Gajbhiye secured Third Prize in Hindi Handwriting Competition, organized by IITH Hindi cell. Saransh Khandelwal (TS) participated in the Elocution competition on the theme Independent India @ 75: Self Reliance with Integrity on the occasion of Vigilance Awareness Week, organized by the IITH vigilance cell, and won third prize amongst the Faculty/Staff category. Abhay Kumar & Ameya Chatur of BTech I & II, Ivan Isaac & Anindita Tarafdar of MTech I & II years has received an academic excellence award during the 14th foundation day of IITH. Rajalakshmi PS, PhD Scholar, and Abhishek Dash, MTech II-year student received a research excellence award during the 14th foundation day of IITH. Dr Jyotsnendu Giri, Associate Professor received the faculty research excellence award 2022 during the 14th foundation day of IITH.

For more information, please visit: <https://bme.iith.ac.in/>



Faculty

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“

An investment in knowledge pays the best interest - Benjamin Franklin

”

Professor



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Associate Professor



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“ Education's purpose is to replace an empty mind with an open one - Malcolm Forbes ”

Adjunct Faculty



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Patents:

Filed:

1. Subha Narayan Rath; Microfluidic Platform for Three-Dimensional Cell Culture and Multi-Drug Testing and Methods of Fabrication Thereof (Provisional Patent); 202141030041.
2. Falguni Pati; Silk Fibroin Microfiber Reinforced Polycaprolactone Composites; 202141055556.
3. Subha Narayan Rath; Electrospun macroencapsulation devices for islet cell transplantation in the treatment of diabetes mellitus; 202141039638.

Published:

1. Aravind Kumar Rengan; Hybrid Polymeric Nanoformulations for the Treatment of Retinoblastoma by Chemo/Photothermal Therapy; 202041001986.
2. Aravind Kumar Rengan; Plant Derived Fluorescent Nanoparticles for Treatment of Cancer; 201941030649.
3. Aravind Kumar Rengan; Thermosensitive Hydrogel for Cancer Therapeutics and Methods of Preparation Thereof; 202041021283.
4. Falguni Pati; Decellularized Corneal Matrix Based Hydrogel, Bioink Formulation and Methods Thereof; US16/981,957.

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36. V S S, Panigrahy N, & Rath S N. (2021). Recent approaches in clinical applications of 3D printing in neonates and pediatrics. *European Journal of Pediatrics*, 180(2), 323–332. <https://doi.org/10.1007/s00431-020-03819-w>.

Funded Research Projects:

1. Aravind Kumar Rengan; Dual Target Starvation Therapy Mediated Cancer Nano Theranostics; 9.90 L. [ICMR/BME/F163/2021-22/G395].
2. Aravind Kumar Rengan; Flavanoid Encapsulated Liposomes as Inhibitors of Big Four Snake Venom; 2.00 L. [KIPMR/BME/F163/2021-22/G376].
3. Avinash Eranki; Portable Ultrasound Device for Non-Invasive Therapy of Solid Tumors; 49.88 L. [BIRAC/IKP01459/BIG-18/21].
4. Avinash Eranki; Dual Mode Ultrasound for Soft Tissue Sarcoma Therapy; 30.91 L. [SERB/BME/F239/2021-22/G411].
5. Falguni Pati; Development of advanced healthy and diseased in vitro 3D glomerulus model for drug testing and understanding kidney disease mechanisms; 17.41 L. [G457].
6. Falguni Pati; Biomimetic hydrogel for the treatment of blinding corneal diseases; 83.47 L. [S214].
7. Jyotsnendu Giri; Abdul Kalam Technology Innovation National Fellowship (Autologous Platelet-Rich Plasma (PRP) Loaded Personalized Wound Care Patch at Patient Bedside for Effective Burn Wound Care); 57.00 L. [INAE/BME/F122/2021-22/G401].
8. Kousik Sarathy Sridharan; Takshashila center for Heritage Science & Technology; 540.00 L. [DST].
9. Mohan Raghavan; Takshashila Centre for Multidisciplinary Heritage Science & Technology; A Digital Takshashila of Our Times; 528.74 L. [DST/BME/F143/2021-22/G447].
10. Mohd Suhail Rizvi; Computational Biomechanics of Circulating Tumor Cells and Blood Vessel Interactions; 30.06 L. [SERB/BME/F236/2021-22/G434].
11. Renu John; ICMR-DHR-CoE, IIT Hyderabad; 1519.64 L. [ICMR/BME/F055/2021-22/G402].
12. Renu John; ICMR, MDMS CLIMB Fellowship Program; 300.00 L. [ICMR/CfHE/CLIMB;].
13. Subha Narayan Rath; Bio-Inspired Nano-Hierarchical Architecture of Fabrication and Maturation of Spheroid-based Tendon-Ligament Tissues by Bio-3D Printer; 12.24 L. [Indo-JSPS CFP-2020].

Awards and Recognitions:

1. Aravind Kumar Rengan has been selected for the BRICS Young Scientist forum 2021.
2. Avinash Eranki won the Best Start-Up Presentation at the 2022 MedTech Symposium.

3. Jyotsnendu Giri has received the Abdul Kalam Technology Innovation National Fellowship by INAE.
4. Subha Narayan Rath has been selected as a Member of the Expert working group for "alternatives to animal methods" in Indian Pharmacopoeia, IPC, Ministry of Health and family welfare, Govt. of India.

Research Highlights:

Dr Falguni Pati & his Team worked on "A strategy to save vision using Decellularized Cornea Matrix (DCM) Hydrogel". This technology offers a minimally invasive procedure to prevent scarring following corneal injury and a new treatment strategy to cure the existing blinding scar for which the currently available option is corneal transplantation. Also, a human-sized cornea has been fabricated by Bioprinting technology for the development of artificial cornea for transplantation.

Read more at: <https://bit.ly/3xpYSeN>

Video Abstract: <https://youtu.be/SrK6UvSpfyk>

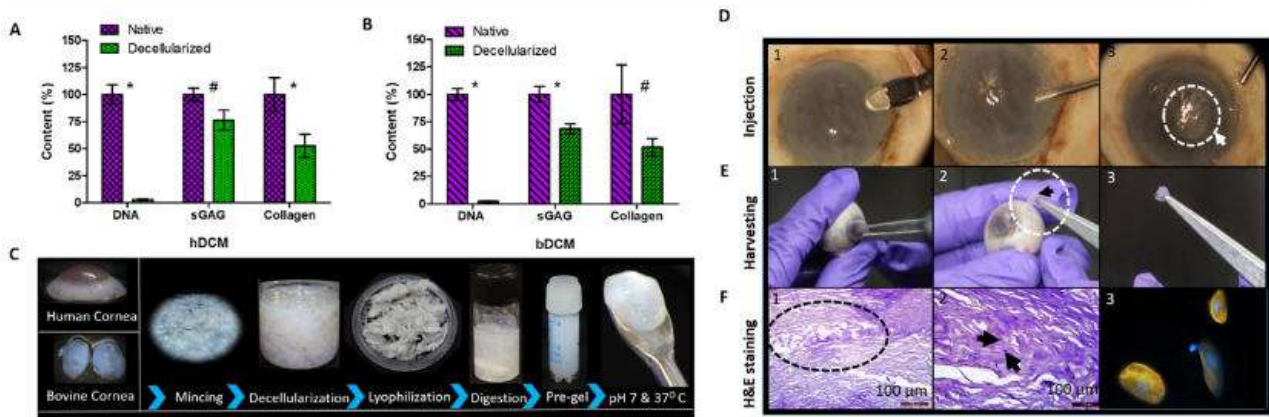


Figure 1. Preparation and characterization of dCMHs. (A) Retained ECM components and DNA after tissue normalization of hDCMH and bDCMH. (B) Retained ECM components and DNA after tissue normalization of hDCMH and bDCMH. (C) Stepwise procedure for the preparation of dCMHs. (D) *Ex vivo* study procedure for creating an intralamellar pocket and injection of bDCMH. (E) Images depicting the harvesting of injected bDCMH after 14 days of incubation. (F) H&E-stained sections show (F1) the injected hydrogel in the corneal stroma and (F2) migrated cells (black arrowheads), and (F3) confocal image shows the migrated cells stained with F-actin (yellow) and DAPI (blue).

Preparation, decellularization, and biochemical characterization of dCMH

“ Develop passion for learning then you will never cease to grow -Anthony J D'Angelo ”

Department of Biotechnology

The Department of Biotechnology at IITH has two major thrust areas, Biotechnology, and Bioinformatics. The Department offers three academic programs: BTech (Biotechnology and Bioinformatics), MTech (Medical Biotechnology), and PhD. The Department has 11 faculty members, 8 BTech, 23 MTech, and 47 PhD, students. The four-year BTech (Biotechnology and Bioinformatics) program, which started in 2021, has a unique curriculum that emphasizes both Biotechnology and Bioinformatics. The two-year MTech program in Medical Biotechnology provides a robust theoretical foundation and develops research skills in multiple research areas. Our PhD program aims to produce highly skilled and knowledgeable scientists to pursue careers in academia, industry, and government. The Department is also part of the IITH joint PhD program with the Swinburne University of Technology (SUT), Melbourne, Australia. The Department has eleven research laboratories, one UG & PG research laboratory, three classrooms, and an auditorium.

The Department's research is focused on both applied and basic research, aiming to provide solutions for immediate use and generation of future ideas. The ongoing research areas include Molecular Biophysics, Protein misfolding, Cell signaling, Structural Biology, DNA repair, DNA-protein interaction, RNA biology, Genomics and Transcriptomics, Chromosome dynamics, Circadian Rhythms, and Disease Biology. During 2021-22, the Department has started research in Computational Genomics & Transcriptomics and Nanobiotechnology. The Department has state-of-the-art infrastructure and research facilities to support both computational and experimental research. The newly constructed department building has three common equipment facilities shared by all the labs, one Sophisticated Instrumentation Facility funded by JICA, and a Departmental computer facility. During 2021-22, the department faculty received several extramural research funding and awards. Since its inception, Biotechnology Department has maintained close interaction with the Biotech and Pharma industry and reputed national R & D laboratories and without exception this year also Biotechnology Department initiated several new industry and international academic collaborations.

For more information, please visit: <https://biotech.iith.ac.in/>

Biotechnology and Biomedical Engineering Departments Building



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“ It is impossible for a man to learn what he thinks he already knows - Epictetus ”

Publications:

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2. Pullaguri N, Grover P, Abhishek S, Rajakumara E, Bhargava Y, & Bhargava A. (2021). Triclosan affects motor function in zebrafish larva by inhibiting *ache* and *syn2a* genes. *Chemosphere*, 266, 128930. <https://doi.org/10.1016/j.chemosphere.2020.128930>.
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5. Mohan M, Hussain M A, Khan F A, & Anindya R. (2021). Symmetrical and un-symmetrical curcumin analogues as selective COX-1 and COX-2 inhibitors. *European Journal of Pharmaceutical Sciences*, 160, 105743. <https://doi.org/10.1016/j.ejps.2021.105743>.
6. Nigam R, Raveendra Babu K, Ghosh T, Kumari B, Das P, Anindya R, & Ahmed Khan F. (2021). Synthesis of 2-Chloro-3-amino indenone derivatives and their evaluation as inhibitors of DNA dealkylation repair. *Chemical Biology & Drug Design*, 97(6), 1170-1184. <https://doi.org/10.1111/cbdd.13839>.
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9. Bharathi V, Girdhar A, & Patel B K. (2021). Role of CNCL1 gene in TDP-43 aggregation-induced oxidative stress-mediated cell death in *S cerevisiae* model of ALS. *Biochimica et Biophysica Acta (BBA) - Molecular Cell Research*, 1868(6), 118993. <https://doi.org/10.1016/j.bbamcr.2021.118993>.
10. Bharathi V, Manglunia R R, Sharma N, Nirwal S, & Patel B K. (2021). Pharmaceutical acetylation can modulate the amyloidogenicity of human serum albumin. *Indian Journal of Biochemistry and Biophysics*, 58(4), 344-351. Retrieved from www.scopus.com. <http://op.niscair.res.in/index.php/IJBB/article/view/51473>.
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16. Fangazio M, Ladewig E, Gomez K, Garcia-Ibanez L, Kumar R, Teruya-Feldstein J, Rossi D, Filip I, Pan-Hammarström Q, Inghirami G, Boldorini R, Ott G, Staiger A M, Chapuy B, Gaidano G, Bhagat G, Basso K, Rabadan R, Pasqualucci L, & Dalla-Favera R. (2021). Genetic mechanisms of HLA-I loss and immune escape in diffuse large B cell lymphoma. *Proceedings of the National Academy of Sciences*, 118(22), e2104504118. <https://doi.org/10.1073/pnas.2104504118>.
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20. Abhishek S, Deeksha W, & Rajakumara E. (2021). Helical and β -Turn Conformations in the Peptide Recognition Regions of the VIM1 PHD Finger Abrogate H3K4 Peptide Recognition. *Biochemistry*, 60(35), 2652-2662. <https://doi.org/10.1021/acs.biochem.1c00191>.
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 25. Puppala, A, Rankawat, S, & Ray, S. (2021). Circadian Timekeeping in Anticancer Therapeutics: An Emerging Vista of Chronopharmacology Research. *Current Drug Metabolism*, 22(13), 998-1008. <https://doi.org/10.2174/138920022266621119103422>.
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 27. Rando H M, MacLean A L, Lee A J, Lordan R, Ray, S, Bansal V, Skelly A N, Sell E, Dziak J J, Shinholster L, D'Agostino McGowan L, Ben Guebila M, Wellhausen N, Knyazev S, Boca S M, Capone S, Qi Y, Park Y, Mai D, Greene C S. (2021). Pathogenesis, Symptomatology, and Transmission of SARS-CoV-2 through Analysis of Viral Genomics and Structure. *mSystems*, 6(5), e00095-21. <https://doi.org/10.1128/msystems.00095-21>.
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 29. Ajjugal Y, & Rathinavelan T. (2021a). Conformational distortions induced by periodically recurring A...A in d(CAG). D(CAG) provides stereochemical rationale for the trapping of MSH2.MSH3 in polyQ disorders. *Computational and Structural Biotechnology Journal*, 19, 4447-4455. <https://doi.org/10.1016/j.csbj.2021.07.018>.
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 34. Sathyaseelan C, Vijayakumar V, & Rathinavelan, T. (2021). CD-NuSS: A Web Server for the Automated Secondary Structural Characterization of the Nucleic Acids from Circular Dichroism Spectra Using Extreme Gradient Boosting Decision-Tree, Neural Network, and Kohonen Algorithms. *Journal of Molecular Biology*, 433(11), 166629. <https://doi.org/10.1016/j.jmb.2020.08.014>.
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Funded Research Projects

1. Anamika Bhargava; As Co-PI: ICMR-DHR Center of excellence under Prof Renu John, Dr Anamika Bhargava as Co-PI along with other Co-PIs; 414.66 L. [G402].

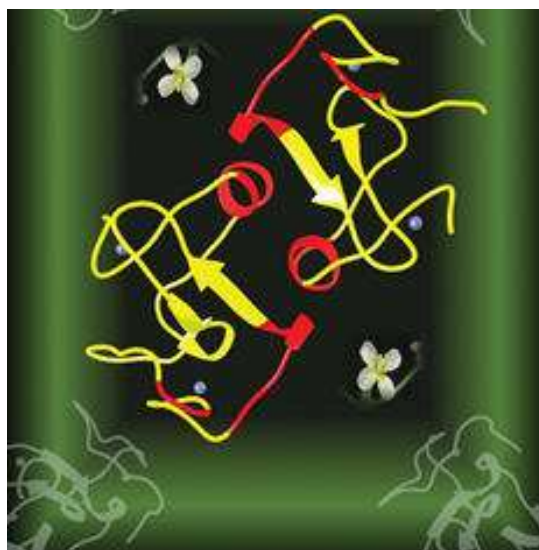
2. Anamika Bhargava; As Co-PI: investigation of the dependence of cytotoxicity of caspase-cleaved TDP-25, TDP-35, and alternate spliced TDP-43-S1 and TDP-43-S-2 fragments of TDP-43 on the IRE1 pathway of the ER stress response mechanism in the TDP-43 proteinopathy models of amyotrophic lateral sclerosis disease. 26.46 L. [G422].
3. Basant Kumar Patel; Investigation of Dependence of Cytotoxicity of Caspase-Cleaved Tdp-25, Tdp-35 and Alternate Spliced Tdp-43-S1 and Tdp-43-S-2 Fragments of Tdp-43 On the Ire1 Pathway of The Er Stress Response Mechanism in The Tdp-43 Proteinopathy Models of Amyotrophic Lateral Sclerosis Disease; 54.60 L. [SERB/BT/F039/2021-22/G422].
4. Gunjan Mehta; Elucidating the Role of Chromatin Remodelers in Yeast Meiosis, Especially in Meiotic Recombination, Chromosome Segregation and Transcription of Meiosis-Specific Genes; 61.62 L. [DBT/BT/F256/2021-22/G389].
5. Gunjan Mehta; Exploring the Cohesin Ring independent Functions of Rec8 During Yeast Meiosis; 42.50 L. [RCB/BT/F256/2021-22/G398].
6. Raghavendra Nidhanapati Karanam; Characterization of Human E2 Enzyme Ube2N Response to DNA; 35.14 L. [DBT/BT/F076/2021-22/G396].
7. Rajakumara Eerappa; Structure-based design and evaluation of inhibitors against phosphodiesterases for enhancing sperm motility and early embryo development and reducing gamete and embryotoxicity; 4.00 L. [G363].
8. Sandipan Ray; Comprehensive Characterization of The Circadian Regulations of Kinases and Diverse Signalling Pathways; 28.71 L. [SERB/BT/F255/2021-22/G414].

Awards and Recognitions:

1. Gunjan Mehta received Har-Govind Khorana innovative Young Biotechnologist Award from the Department of Biotechnology, Govt. of India.
2. Nitesh Kumar Podh, PhD scholar, guided by Gunjan Mehta, has been selected for the PMRF (Prime Minister's Research Fellowship) scheme in Dec 2021 cycle.
3. Gunjan Mehta received Ramalinga swami Fellowship from the Department of Biotechnology, Govt. of India.
4. Shwetha S, MTech Student, working under the guidance of Anamika Bhargava, received Excellence in Academic award 2022.

Research Highlights

Structure of the protein molecule from the model plant Arabidopsis. This protein controls gene activity. Structure was solved by the X-ray crystallography technique by **Dr Rajkumara Erappa's group**.



Graphical Representation of Structure of the protein molecule from the model plant Arabidopsis

Department of Chemical Engineering

With IITH consistently flying high in the NIRF ranking, ChE@IITH is committed to setting new heights for excellence in Chemical Engineering Education, Research, and Expert consulting support to the process industries. With 22 committed faculty members, the department targets to execute this ambitious plan by adopting a holistic approach of (i) fractal and hands-on / project-based practical teaching, (ii) connecting interdisciplinary research approaches to socially relevant problems, (iii) inculcating the start-up culture and making high-quality education accessible for all. Broadly, teaching covers various aspects of chemical, biochemical, minerals, materials, and process systems engineering. Our electives provide exposure to state-of-the-art developments in the fields of energy, new materials, nanoscience, machine learning, and biochemical engineering. ChE@IITH encompasses both BTech and MTech programs featuring a curriculum that is both comprehensive and as flexible as having the option of exploring internship opportunities. Hosting nearly 56 PhD and 27 MTech students, the department's strong commitment to research is evidenced by ~INR 38 crores in extramural funding (through DST, DBT, DRDO, National Supercomputing Mission, National Textile Mission, etc., and several corporate organizations) that faculties have obtained so far, many of which have been translated into high TRL level inventions. Faculty bestowed with the highly prestigious DST Swarna Jayanti award, Vasvik award, and several department faculties appearing among the top 2% scientists in the world (Stanford University list 2021) bearing the testimonies of quality and research environment in the department. A large number of faculty from the department are actively involved in hosting /participating in conference and outreach workshops (TEQIP, ATAL-FDP) delivering invited / keynote lectures benefitting the students and faculties across several institutes in India. The department also houses state-of-the-art research and teaching laboratories. The faculty members in the department conduct research in a wide variety of exciting areas such as catalysis, fluid flow, nanotechnology, materials for energy and biological applications, bioengineering, atomistic simulations, efficient energy harvesting and storage, process control and optimization, machine learning, techno-economic analysis, supply chain management, mineral processing, and climate change. With such aims, the department aligns itself with the nation's several missions and dedicates itself to the dream of nation-building.

For more information, please visit: <https://che.iith.ac.in/>



Chemical Engineering Departments Building/ Academic Block - A

“Education is the key to unlock the golden door of freedom.” – George Washington Ca

Faculty

Head of the Department



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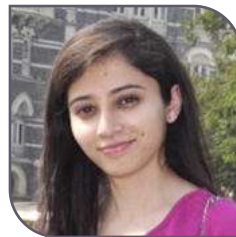
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“ Imagination plus innovation equals realization. - Denis Waitley ”

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Filed:

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Published:

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 8. Kishalay Mitra; Development of AI-Based Model for Coke Quality Prediction and Coal Blend Optimization; 33.23 L. [TATA/CHE/F089/2021-22/S167].
 9. Narasimha Mangadoddy; Recovery of Galena, Sphalerite from Lead Zinc Tailings by Integrated Energy Efficient Ultrafine Comminution and Novel Shear Flocc-Flotation and Its Impact On Downstream Paste Fill; 25.00 L. [MINES(GOI)/CHE/F046/2021-22/G406].
 10. Saptarshi Majumdar; Experimental & Simulation Studies for Multiscale Design of Non-Crosslinked Polymeric Drug Delivery Vehicle for Controlled Drug Release Application: In Search of Ideal Low-Cost Biomaterials; 41.29 L. [SERB/CHE/F040/2021-22/G418].
 11. Suhanya Duraiswamy; Microfluidics Enabled Programmable and Controllable Assembly of Plasmonic Nanomaterials - Development of a Nano biosensor; 31.71 L. [SERB/CHE/F222/2021-22/G408].
 12. Vikrant; Cfd-Dem Modelling of Gas-Solid Fluidized Beds with Elongated Rods Particles; 30.90 L. [SERB/CHE/F243/2021-22/G424].
 13. Vikrant; Towards the large-scale modelling of dense gas-solid fluidized beds with non-spherical particles; 42.40 L. [SERB/CHE/F243/2021-22/G456].
 14. Vinod M Janardhanan; Development and Characterization of Unitized Regenerative Fuel Cells for High Temperature Operation; 38.64 L. [SERB/CHE/F031/2021-22/G415].
 15. Kirti Chandra Sahu; Modelling of active membrane micro pumps; 3.35 L. [PDF-52].

Funded Research Projects:

1. Alan Ranjit Jacob; Colloidal Water Remediation; 32.81 L. [SERB/CHE/F254/2021-22/G420].
2. Balaji Iyer Vaidyanathan Shantha; Multi-Scale Simulations for Design of Particle-Polymer Hybrid Materials; 22.26 L. [G360].
3. Chandrasekhar Sharma; Activated and Patterned Carbon Nanofibers Based Advance Design Configuration for High-Performance Lithium-Ion Batteries and Supercapacitors; 93.09 L. [TEXTILES/CHE/F065/2021-22/G385].
4. Chandrasekhar Sharma; Scaling Up of Electro-Spinning Process for Nanofibers; 124.00 L. [TEXTILES/CHE/F065/2021-22/G386].
5. Debaprasad Shee; A Combined Experimental and Theoretical Approach towards Rational Design of Supported Metal Catalysts for the Reductive Depolymerization of Corncob Lignin to Produce Bulk Aromatic Chemicals; 40.19 L. [SERB/CHE/F069/2021-22/G416].
6. Kishalay Mitra; A combined experimental and theoretical approach towards the rational design of supported metal catalysts for the reductive depolymerization of corn cob lignin to produce bulk aromatic chemicals; 40.18 L. [G416].
7. Kishalay Mitra; Development of an on-board spray controller model for UAVs using AI for precision agricultural application; 40.18 L. [G436].

Awards and Recognitions:

1. Anand Mohan has been selected as an Editorial Board member of the *Journal Systems Biology and Physiology Reports*.
2. Chandrasekhar Sharma was Featured among 75 scientists under 50 years shaping Today's India in a coffee table book published by Vigyan Prasar, Department of Science & Technology, Govt. of India.
3. Chandrasekhar Sharma has been selected as Guest Editor-in-chief of the 4th Special issue of *Proceedings of Indian National Science Academy (PINSA) Journal* edited by INYAS, Springer Nature, 2022.
4. Chandrasekhar Sharma has been selected as the PAC Member of SERB Early Career Research Award and NPDF Committee (Engineering Sciences) (2021-24).
5. Chandrasekhar Sharma has been selected as the Expert Member of SERB SUPRA Screening Committee, 2021-22.
6. Chandrasekhar Sharma has been selected as the PAC Member of the Technology Development Programme under the Technology Development & Transfer Division, DST (2021-22).

7. Chandrasekhar Sharma has been selected as the Member of the Committee on Circular Economy on Used Oil Waste, formed by Niti Aayog under the Chairmanship of Secretary, Ministry of Petroleum & Natural Gas, Govt. of India (2021).
8. Chandrasekhar Sharma received First Prize in HPCL New Generation Ideation Contest 2020 at the Undergraduate level (jointly with student).
9. Shalakha Saha, working under the guidance of Chandrasekhar Sharma, received 1st and 2nd Prize in the International Sci-Art Image Competition organized by INYAS in association with the National Young Academies of Bangladesh and Thailand (July 2021).
10. Shalakha Saha, working under the guidance of Chandrasekhar Sharma won the 2nd prize in an International Science Image Competition, NanoArtography organized by Drexel University, USA.
11. Chandrasekhar Sharma and Team's work on 3D Carbon-Metal oxide composite electrodes on graphite coated substrate for high rate and high-performance anode in Li-ion batteries is highlighted on the cover page of the latest edition (Vol. 2, Issue 12; Dec. 2021) of Wiley journal, Advanced Energy & Sustainability Research.
12. Kishalay Mitra has been chosen twice as an Expert Member of the PMRF Review Committee (Interdisciplinary areas in Science and Engineering).
13. Kishalay Mitra has been inducted into the Editorial Board of IJMMP (Taylor & Francis Journal with Impact Factor 4.62).
14. Kishalay Mitra has been selected as a National Program Committee member for PSE ASIA 2022, a biennial international event, being held in IIT Madras, Dec 11 - 14, 2022.
15. Kishalay Mitra is named among World's Top 2% Scientists, according to the latest profile review conducted by a group from Stanford University released recently at <https://lnkd.in/ecV9y9Tv>.
16. Sakshi Naik, Kishalay Mitra's BTech project student won the Best Project Award, 2021 (BTech category) awarded by the Indian National Academy of Engineering (INAE).
17. Kapil Gumte, PhD student of Kishalay Mitra was appointed as Assistant Professor, IIM, Jammu.
18. Kishalay Mitra was selected by the Indian National Academy of Engineering (INAE) to lead the AI track on Surrogate Modeling, Uncertainty optimization, Data Science and ANN, showing the national capability while preparing the ICME Materials Research roadmap for INDIA (INAE plans to submit recommendations to Govt of India).
19. The Paper titled Characterization of Bubble Column Using Electrical Resistance Tomography and Image Processing, authored by Balraju Vadlakonda, Chaitanya Vudikala, Suharika Diddi and Narasimha Mangadoddy was selected as the best paper of the session on the 48th National Conference on Fluid Mechanics and Fluid Power (FMFP 2021) held at BITS Pilani virtually 27-29th Dec 2021.
20. Narasimha Mangadoddy has appeared in the top 2% of Scientists in the world, according to the latest profile review conducted by a group from Stanford University, that has released in August 2021 <https://elsevier.digitalcommonsdata.com/datasets/btc-hxktzyw/3>.
21. Mayank Kumar, PhD scholar, working under the guidance of Narasimha Mangadoddy, won the excellent research award at IITH for 2021-22 research contributions.
22. Shelaka Gupta has been selected as one of the 75 Women in STEAM to be featured in the second edition of She Is.
23. Suhanya Duraiswamy Certificate: Innovation Ambassador.
24. Kirti Chandra Sahu has been selected for VASVIK Industrial Research Award.
25. Kirti Chandra Sahu has been Elected as a Fellow of the Institute of Physics.
26. Kirti Chandra Sahu received UK STAIR Outstanding Researcher Award 2021.
27. Dr Shelaka Gupta name was mentioned among 75 Women in STEAM in the announcement by Office of Principal Scientific Advisor to Govt. of India



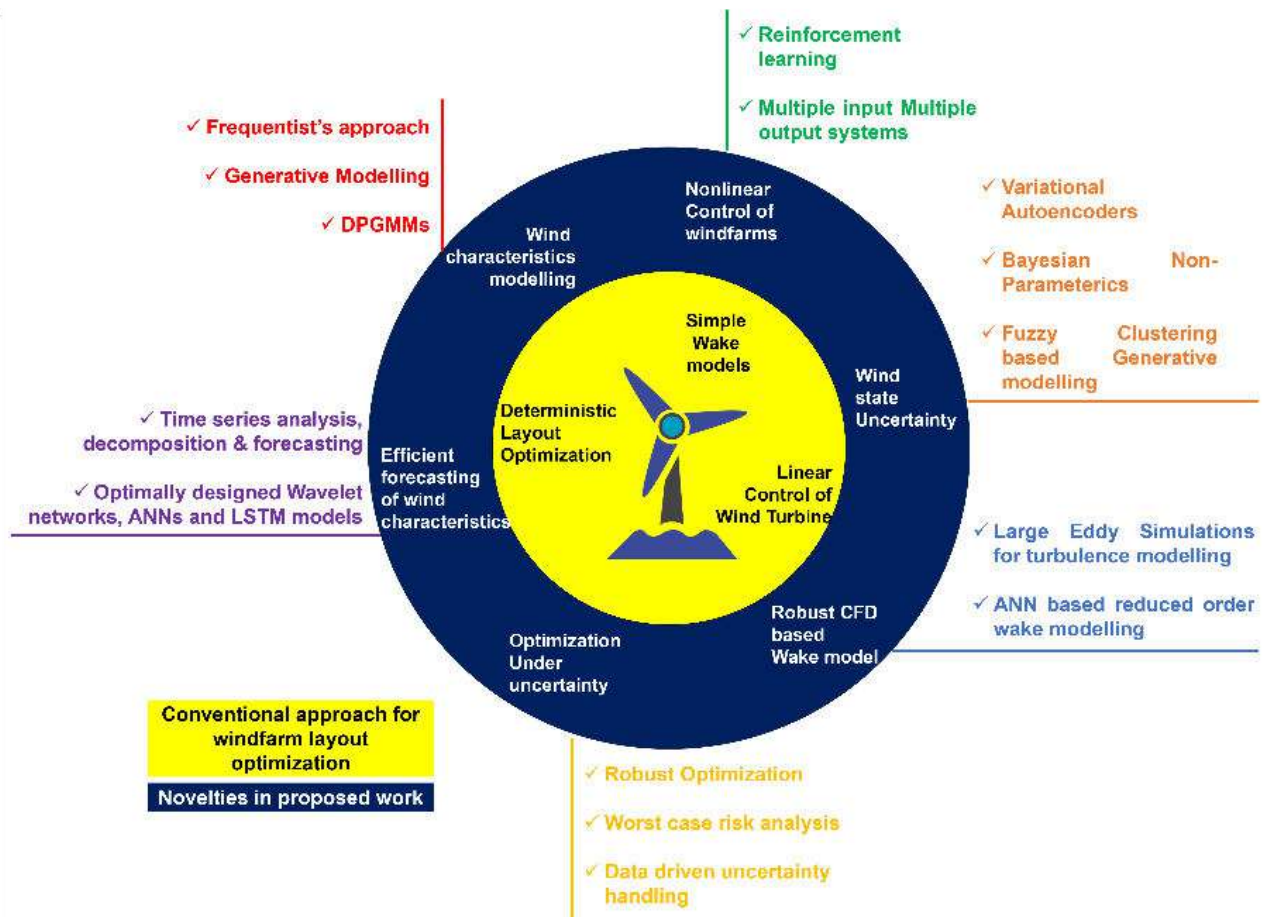
View research as an opportunity to explore and discover new things - Faith Blum



Research Highlights:

1. AI / ML @GOKUL (Global Optimization and Knowledge Unearthing Lab) by Kishalay Mitra

Our aim @ GOKUL is to develop state-of-the-art data tools that can cater to the special needs of vast amounts of highly complex data generated by the PSE community. We target potential areas in PSE and investigate how the applications of deep supervised/unsupervised learning methods based on artificial neural networks (ANN) can be made useful there. Exploiting the novel multi-objective evolutionary Neural Architectural Search technique developed @GOKUL, TRANSFORM, we could successfully show how (i) optimization of computationally expensive models can be improved multiple folds using surrogate models (ANN), (ii) accurate system identification and data-based model predictive control of extremely nonlinear industrial processes can be performed (RNN, LSTM), (iii) image-based sensing can be improved for better optimization of the process (CNN, AE, VAE), (iv) the uncertainty quantifications for nonlinear models using analytical derivations can be obtained through Sobol indices and global sensitivity analysis (PUNNs), (v) the ideas of approximation of control vector using ANNs can be utilized to solve complex single and multi-objective optimal control problems efficiently, (vi) fuzzy clustering performance can be improved by neural networks based reformulation for identification of global optimum and (vii) generative modelling can be utilized to accurately solve the industrial nonlinear multi-objective optimization problems in uncertain framework (GAN, VAE). Our targeted applications include wind farm layout optimization, new alloy discovery by enhanced computational materials science calculations, monitoring environmental parameters due to climate change, smart sensing of particulate matter, fast charging protocols in Li+ battery management, bio-fuel supply chain optimization, systems biology (cell classification based on Ca⁺ oscillations in neurons), chemical engineering (polymerization reactors), metallurgical engineering (steel making processes etc.), mineral processing (grinding and flotation) and mechanical engineering (uncertainty analysis in supersonic flow of tactical missiles, surrogate optimization using CFD models) applications.



Machine Learning driven Novel work at GOKUL

2. Isolation and Screening of L-Asparaginase free of Glutaminase and Urease by Devarai Santhosh Kumar

L-asparaginase is an enzyme that is used for the treatment of Acute Lymphoblastic Leukemia and Lymphoma. Solid state production was carried out using fungal species obtained from various sources, including Antarctica, agricultural wastes and soil samples from different locations in India. The production was tested for efficiency using the various species and the best out of these was selected to obtain the desired results. Laboratory scale studies were done to analyze the effectivity of the species for different factors and the optimized parameters were later studied on the Laboratory scale using a submerged fermenter and an in-house designed solid-state fermenter.

3. Production and Purification of Extracellular Lipase and Its Application in Biodiesel Synthesis by Devarai Santhosh Kumar

Production of lipase using agro-industrial wastes as solid substrates in solid-state fermentation on both flask scale and large scale has been studied. *Prosopis juliflora* was used as a novel solid substrate in the tri-substrate mixture containing red gram husk and cottonseed cake. The maximum lipase activity was achieved using sequential optimization techniques such as simplex centroid mixture design, followed by a central composite face-centered design to optimize substrate ratio and physical parameters, respectively. The lipase purification was achieved to homogeneity using different purification techniques such as ammonium sulphate precipitation followed by dialysis and gel filtration chromatography. The enzyme molecular weight was determined using SDS-PAGE. The purity of the lipase was determined using HPLC. The purified lipase was characterized under different conditions and enzyme kinetics studies were performed.

The purified enzyme was immobilized in calcium alginate beads by entrapment. The beads were used as a biocatalyst in biodiesel synthesis by transesterification and esterification reactions using waste cooking oil and methanol

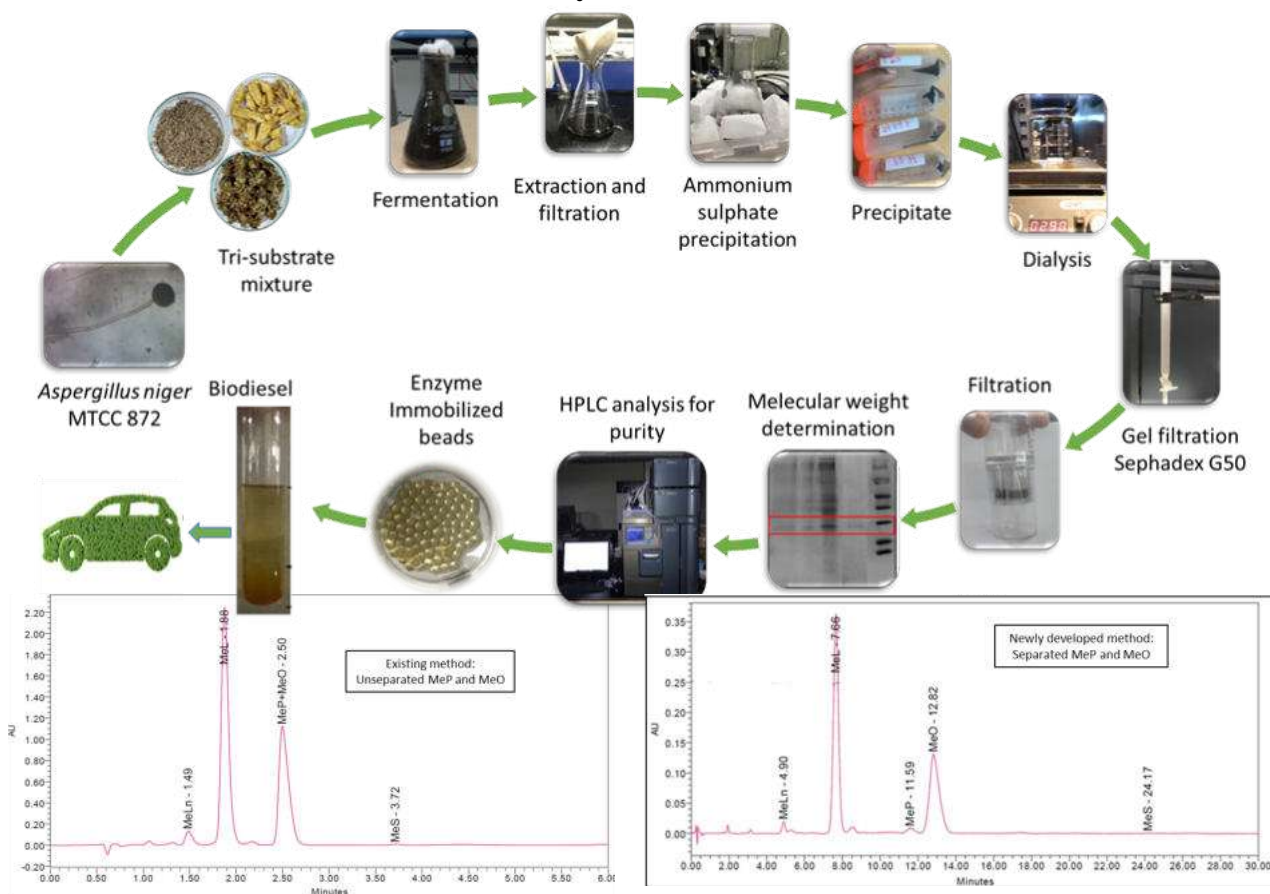
A new HPLC method has been developed to separate and efficiently quantify the fatty acid methyl esters Methyl Oleate and Methyl Palmitate in biodiesel mixture using reverse-phase HPLC

Production of High Cell Density Powdered form of Edible Mushrooms

The mushroom biomass has been produced from submerged fermentation in the flask scale in two stages i) seed culture medium and ii) fermentation medium. The optimization of carbon sources in the seed culture and fermentation medium for various factors was carried out. The final biomass and exopolysaccharides (EPS) were obtained as 5.266 g/L and 1.39 g/L, respectively. One factor at a time statistical approach was performed to enhance biomass and Exo-Polysaccharide, respectively.

Studies to Convert Batch to Continuous Manufacturing of Methyl Formimidate as an Intermediate for Tenofovir

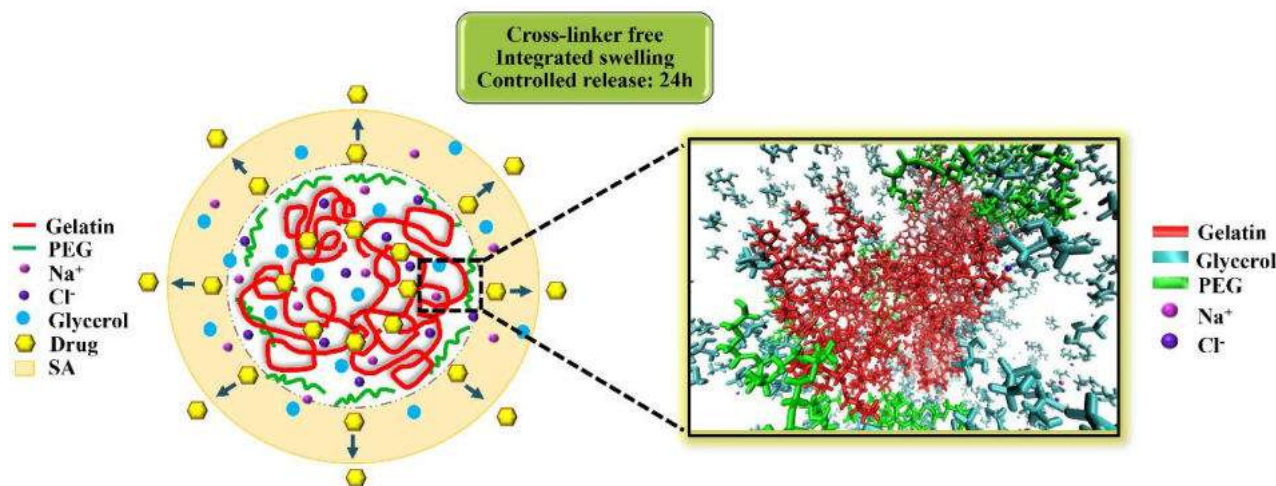
We have synthesized an intermediate methyl formimidate as an intermediate to tenofovir (An Active Pharmaceutical Ingredient for HIV Treatment). Batch and continuous reactor parameters were optimized to improve the yield. The qualitative analysis was done by using various characterization techniques for product formation like Thin Layer Chromatography and NMR Spectroscopy. This work has been done with the collaboration of Aurobindo Pharmaceuticals, Hyderabad.



Studies to Convert Batch to Continuous Manufacturing of Methyl Formimidate as an Intermediate for Tenofovir

4. **Behaviour of charged polymers to design cross-linker free biomaterials by Saptarshi Majumdar**

Charged macromolecules such as Polyelectrolytes and Polyampholytes have gained prominence in various fields such as Biotechnology, Bio-medical engineering and drug delivery systems. The properties of such polymers can be tuned based on their stimuli to the external environment such as temperature, pH etc. The domain of such systems is governed by electrostatic forces, hydrogen bonding and Van der Waals interactions, which are non-linearly coupled. Hence more attention needs to be given to the interactions present among the polymer chains. The research in our lab focuses on this aspect with emphasis on understanding the interactions in such systems both at the Macroscopic as well as at the molecular level by carrying out experimental studies and molecular simulation techniques. The primary aim is to understand the behaviour of charged polymers to design cross-linker free biomaterials. Studies have been conducted using nature inspired biomaterials like soyabean and cardamom which have been transformed into bio-materials. Current research revolves around developing hydrogel-based biomaterials employing FDA-approved biopolymers like Gelatin and Sodium Alginate.



Portraying cross-linker free hydrogel for zero-order drug release and the polymeric interactions obtained from molecular dynamic simulation

The goal is to increase the dissolution resistance by maximizing the potential of physical forces (hydrogen bonding interactions). Interaction studies are also being carried out to investigate the physicochemical effects on gelatin by altering physical parameters like salt ions, pH, temperature and polymer concentration. Salt alters the electrostatic interactions in the gelatin chains. The solute-solvent interactions are monitored by investigating the hydrodynamic radius of the polymer chains, FTIR studies. The findings from such interaction studies can be incorporated into the multiscale design of biomaterials and polymer-based drugs. The need of the hour is to produce non-toxic, biocompatible, and biodegradable drugs to induce a therapeutic effect. Another ongoing research of our lab is in collaboration with LVPE Institute. The aim is to formulate a dual-drug delivery system for the treatment of Glaucoma (one of the leading diseases causing blindness). It is quite common to prescribe two eye drops to patients undergoing treatment for Glaucoma. The marketed eye drops have a high drug dosage and side effects. There are some dual drug marketed formulations in which the effect of one of the drugs gets over and hence, a second dose of the same is prescribed. The research focuses on preparing a polymer-based extended-release dual drug formulation for glaucoma treatment.

5. **Production of aromatics from biomass by Debaprasad Shee**

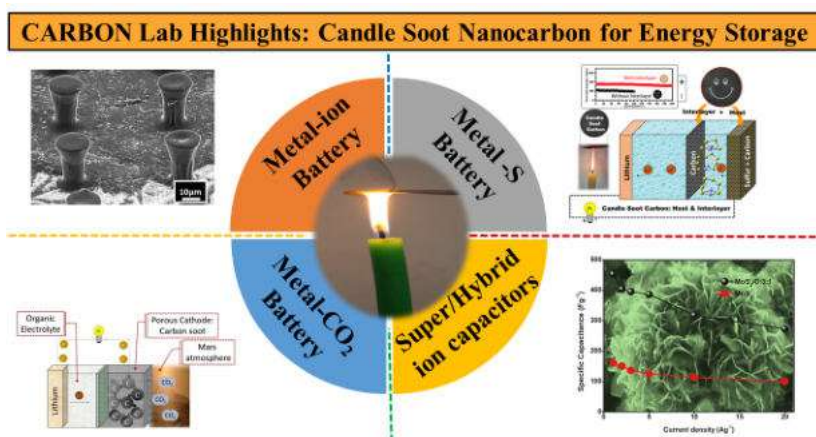
The production of aromatics from biomass is very much essential to address the sustainability issue of human civilization. A novel process for butylene's and building block aromatics production with high selectivity from n-butanol using various supported heteropoly acids and metals (Ga and Zn) incorporated zeolites in a fixed bed reactor has been developed. Ga and Zn deposition enhanced the selectivities of total aromatics and BTEX. The presence of Zn and Ga species suppressed the hydride transfer reaction and promoted the dehydrogenation reaction resulting in higher selectivities of aromatics and BTEX. The selectivity to different aromatics was also affected by the variation of different process parameters. The total aromatics selectivity was raised with increasing temperature and decreasing WHSV. However, the aromatics production was reduced at high operating pressure. The high operating pressure led to the production of higher aromatics and deposition of these aromatics caused the deactivation of the catalyst. The coke analysis revealed the formation of polynuclear aromatic coke at high pressure. The maximum selectivity of total aromatics (~75%) and BTEX (~69%) were achieved at 723 K, 1 bar pressure and 0.75 h⁻¹ of WHSV over Zn/HZSM5 catalysts. However, similar range of aromatics and BTEX selectivity were achieved at 823 K over Ga/HZSM5. The dehydration of n-butanol over supported heteropoly acids produces butylenes with high selectivity. The nature of heteropoly acids (addenda and hetero atom) and loading are important factors for the dehydration of n-butanol and selectivity towards butylenes. The 20PTA (phosphotungstic acid)/SiO₂ catalyst afforded 99.8% selectivity towards butylenes at quantitative conversion of n-butanol, whereas the 20STA (silicotungstic acid)/SiO₂ catalyst gave nearly 97.0% conversion of n-butanol and 99.9% butylenes selectivity at 673 K, 37.4 h⁻¹ of WHSV.



Production of aromatics from n-butanol

6. Uncovering the Potential of Candle Soot Nanocarbon for Energy Storage Applications by Chandrashekhar Sharma

There has been tremendous focus on carbon nanomaterials, primarily on carbon nanotubes, nanofibers and graphene in the last 2-3 decades for a variety of applications including energy storage. Our CARBON Lab however introduced for the first time in 2015 the use of one of the most facile and inexpensive carbon nanomaterial in the form of candle soot nanocarbon as an electrode for Lithium ion batteries, especially for electric vehicles. Since then, we have explored a number of ways to modify the physiochemical properties of soot derived nanocarbon and extended its application from Metal-ion to Metal-S batteries and supercapacitors. With graphitization, candle soot nanocarbon which is otherwise amorphous at the time of collection may be structurally tuned into polyhedral carbon onion rings. Hetero atom doping, adding candle soot carbon into electrospun carbon nanofibers to prepare flexible electrodes are some other approaches explored in our group to fabricate next generation energy storage devices. Very recently, we also started exploring a new battery chemistry based on Metal-CO₂ redox reaction in order to find the solutions to overcome the challenges of increased CO₂ emissions on earth. Soot derived nanocarbon is found to play an important role in this case as well. Last but not the least, we are also working these days on candle soot carbon based dual carbon battery and hybrid-ion capacitors. There is still so much to explore further even at fundamental level while uncovering the potential of this new form of nanocarbon beyond energy storage applications.



Candle soot nanocarbon for Energy Storage

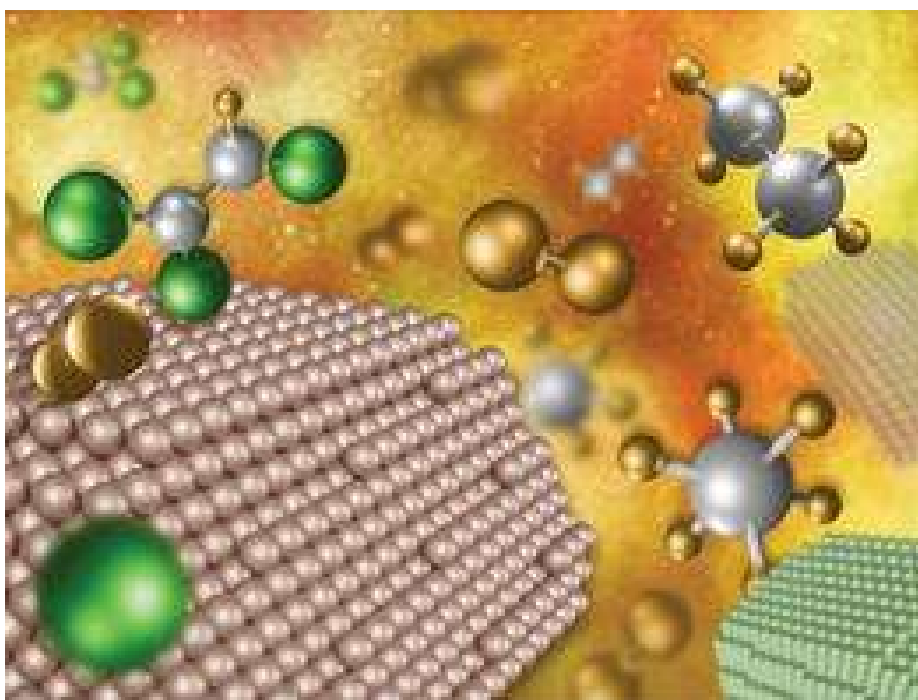
7. मेदुरी प्रवीण द्वारा Photoelectrochemical water splitting (oxygen evolution reaction)

- Development of metal sulfides such as indium sulfide (In₂S₃) and overcoming their inherent challenges by the way of identifying the apt material phases along with cobalt doping for improved current densities.
- Ternary material design in the form of tin sulfide (SnS₂)/reduced graphene oxide/graphitic carbon nitride with layered architecture to complement the properties of each material for improving high current densities.
- Understanding the doping insights of molybdenum and tungsten in copper vanadate (Cu₃V₂O₈) to enhance its performance for prolonged stability.
- Understanding the interaction between the carbons and indium sulfide (In₂S₃) to better design the materials for good performance.
- Evaluation of heterogeneous interface induced electrocatalytic efficiency boosting of bimetallic Cu/Zn selenides, Sn/W selenides and Mo/Zn tellurides for improved stability.

- **Photoelectrochemical water splitting (hydrogen evolution reaction):** Overcoming the challenges of dissolution of copper oxide (CuO) by the way of creating a heterojunction with copper bismuth oxide (CuBi₂O₄) leading to significantly improved stability. Design of heterogeneous interfaces of tin and tungsten selenides for enhanced electron transfer leading to better performance.
- **Water purification by the way of reduction of chromium (VI) to chromium (III), nickel (II) to nickel (0) and oxidation of rhodamine (RhB):** Design and development of heterostructures consisting of tungsten disulfide (WS₂) and cadmium sulfide (CdS) with significant enhancement in light absorption across the entire visible spectrum which translates to higher number of charge carriers and hence, is a superior photocatalyst. Improved interaction between the carbons and indium sulfide leads to improved charge mobility for good performance.
- **Lithium-ion batteries:** Cell development comprising of silicon-based anodes and lithium iron phosphate cathodes for field deployment.
- **Lithium-sulfur batteries:** Understanding the impact of high surface area carbons in binding with sulfur and polysulfides to overcome the capacity degradation challenges. Design of metal sulfide materials such as molybdenum sulfide, tungsten sulfide as sulfur source for high energy density.

8. **Facet Dependent Selectivity Control in Hydrodechlorination of Trichloroethylene on Pd Catalyst by Shelaka Gupta**

Periodic density functional theory (DFT) calculations were used to understand the origin of structure sensitivity in hydrodechlorination (HDC) of trichloroethylene (TCE) over different facets of a palladium catalyst. The HDC reaction was simulated on the terrace (Pd (111) and Pd (100)) and undercoordinated (Pd (211) and Pd (110)) sites of the Pd catalyst. The most stable binding configuration of TCE on the Pd surfaces was observed to be through the di- σ mode of binding, wherein each carbon atom of the TCE molecule was adsorbed atop of the Pd atom. Maximum binding energy of -178 kJ mol⁻¹ was calculated over the Pd (110) surface. Upon adsorption on Pd catalyst TCE underwent dechlorination followed by hydrogenation of the hydrocarbon intermediates. The activation energies for C-Cl bond dissociation steps were significantly low when compared to the hydrogenation steps. The chlorine released from dechlorination tends to block the active sites, thereby poisoning the surface with high binding energies (B.E > -160 kJ mol⁻¹) on all the surfaces. The trend in chlorine binding energies on Pd facets follows: Pd (110) > Pd (211) > Pd (100) > Pd (111). The structure sensitivity in the TCE HDC reaction could possibly arise due to the differences in the energetics of Cl removal on different Pd facets. This mechanistic understanding could provide a rationale for designing suitable catalysts for the HDC of TCE.



Pd Nanoparticles taking part in HDC reaction of Trichloroethylene. (React. Chem. Eng., 2021,6, 2270-2279, in collaboration with IIT Delhi, CSIR-IIP Dehradun and University of Akron).

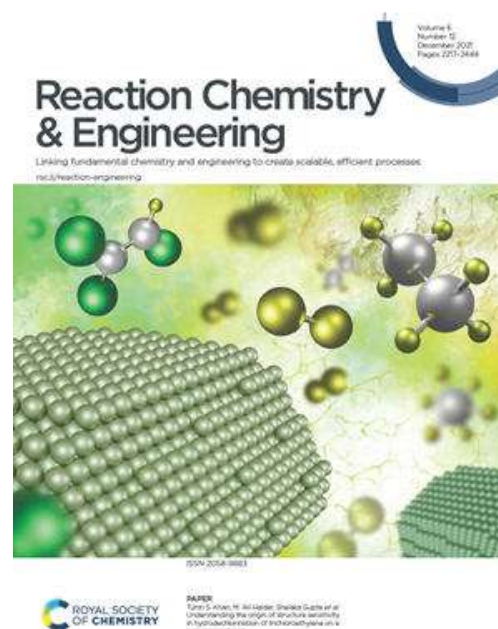
9. **Prof Saptarshi Majumdar & Dr Chandra Shekhar Sharma** made a proven study about oral nanofibrous AMB to be effective for Kala Azar.



10. Dr. Chandra Shekhar Sharma's work on 3D Carbon-Metal oxide composite electrodes on graphite coated substrate for high rate and high-performance anode in Li-ion batteries is highlighted on Cover page of the of Wiley journal, *Advanced Energy & Sustainability Research* (Vol. 2, Issue 12; Dec. 2021).



11. Dr. Shelaka Gupta's work on Understanding the origin of structure sensitivity in hydrodechlorination of trichloroethylene on a palladium catalyst is highlighted on Cover page of the of Royal Society of Chemistry journal, *Reaction Chemistry and Engineering* (Vol. 6, Issue 12; Dec. 2021).



12. A popular science coffee table book, *Demystifying the Nature* coauthored by Dr Chandra Shekhar Sharma and Dr Mudrika Khandelwal as published by Vigyan Prasara was released by Hon'ble Vice President of India, Shri M. Venkaiah Naidu in the presence of Prof. K. Vijay Raghavan, Principal Scientific Adviser, GoI and Dr. S. Chandrasekhar, Secretary, DST, GoI in a grand ceremony at Vigyan Bhawan to celebrate the National Ramanujan Day in Dec. 2021. This book is written to unravel the science behind Nature's perfection with easy explanation & depiction of fundamental Science, facts & applications with beautiful illustrations.

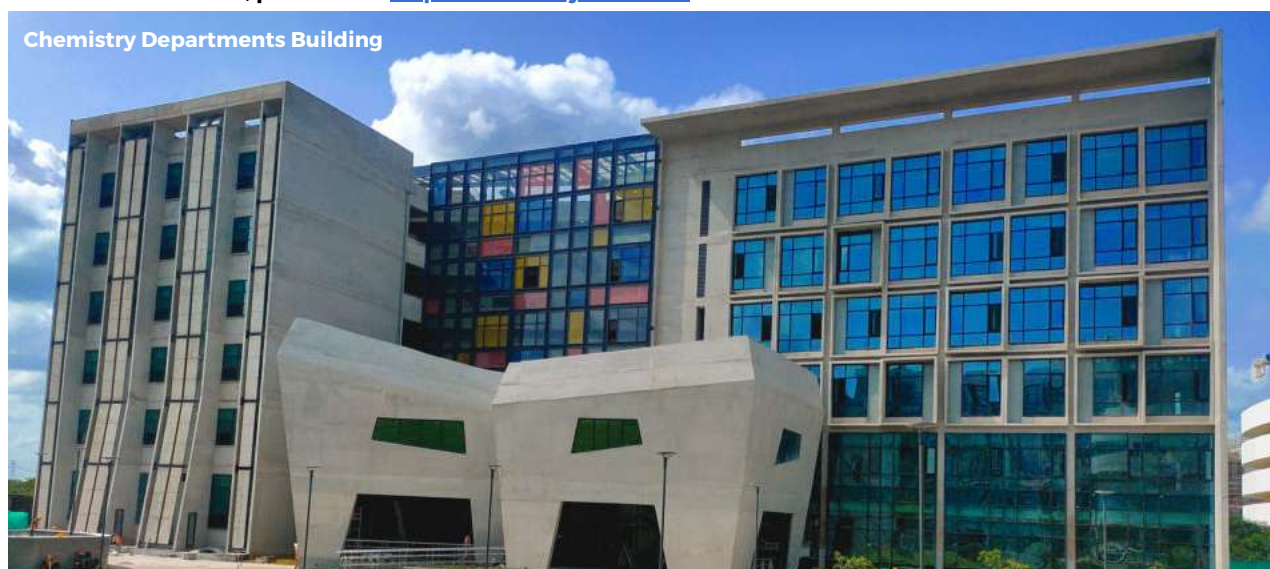


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The Department of Chemistry stands at the forefront of academic and research excellence at the Indian Institute of Technology Hyderabad, a premier educational institute in the country. The Department started functioning from the inception of IITH and was the first Department to offer the PG program (Two-year MSc Chemistry) in 2010. Over the years, it has grown from strength to strength in every aspect of academic and research setup. The Department has 21 faculty members, 95 PhD scholars, 94 MSc students, and 09 students in BTech. The Industrial chemistry BTech is a new program offered since the previous academic year. The joint effort by the enthused students and the committed staff members under the impeccable guidance of the faculty members has propelled the momentum forward in every aspect with excellence in both the teaching and research field. The Department of Chemistry at IITH is devotedly pursuing research in fundamentals and applied research. The Department is engaged in a diverse and wide range of challenging research problems. The ongoing research areas comprise Battery Materials, Bio-inorganic/-organic Chemistry, Biophysical and Microscopy, Computational chemistry, Development of next-generation solar cells and conducting polymers, Environmental remediation, Functional Organic Materials, and Supramolecular Chemistry, Heterogeneous Catalysis, Homogenous catalysis, Laser spectroscopy, Medicinal, and Bio-inspired Synthesis, Metal catalyzed Water Splitting/CO₂ Reduction/Hydrogen Generation, Molecular Magnetism, Heavy Element Chemistry, Natural Product Synthesis, Organometallic Chemistry, Synthetic Methodologies, and Superconducting and thermoelectric materials. The Department has state-of-the-art infrastructure and research facilities covering experimental and theoretical aspects of all core research areas.

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Patents:

Filed:

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Book Chapters

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5. Deepa M; Development of Organic Electrochromic Molecules; 5.42 L. [S137].
6. G Prabu Sankar; Self-Assembled Organo-Gold(I) Molecules and Their Aggregation- Controlled uminescence in Nano Materials; 7.78 L. [DST/INT/JSPS/P-332/2021].
7. G Prabu Sankar; Organo Gold(I) Molecules to Materials; 8.00 L. [JICA Friendship 2.0].
8. Jai Prakash; Syntheses of New Layered 3D-Transition Metal Based Chalcogenides for Superconducting and Magnetic Applications; 39.36 L. [SERB/CHY/F180/2021-22/G413].
9. Krishna Gavvala; Exploring Novel Nucleoside Analogues to Probe the Key Protein-DNA Interactions using Spectroscopic Tools; 19.86 L. [G319].
10. Narendra Kurra; Design of Functional Layered Structures, Architectures, and Interfaces for Electrochemical Storage of Calcium Ions; 41.36 L. [SERB/CHY/F273/2021-22/G407].
11. Satyanarayana G; Structure based design and evaluation of inhibitors against phosphodiesterases for enhancing sperm motility and early embryo development, and to reduce gamete and embryo toxicity; 23.00 L. [G-363].
12. Surajit Maity; Excited State Hydrogen Transfer in Microsolvated N-H Bearing Molecules: Determination of The Hydrogen Bonded Structures, Properties, and Tautomerization Reaction Products; 10.00 L. [G269].
13. Surendra Kumar Martha; Centre for Electrochemical Energy Storage: Design, Development, Fabrication, and Evaluation of Utility-Scale High-Performance Batteries; 61.55 L. [SERB/CHY/F112/2021-22/G449].
14. Tarun Kanti Panda; Atom Economic Hydroboration of C-X Unsaturated Bonds as Green Method for Organic Synthesis; 8.00 L. [AC2022-2].
15. Subrahmanyam Challapalli; Study of Storage Aging Conditions. (I.E. Shelf-Life and Out -Life) On Physical, Thermal And Mechanical Properties Of Epoxy Based Prepreg Systems (I.E. Tow & Fabric Prepreg)" To IITH; 32.03 L. [DRDO/CHY/F019/2020-21/G350].
16. Subrahmanyam Challapalli; An Integrated Approach Comprising Nano Biosensor Platform and Non-Thermal Plasma Irradiation for Continuous Monitoring and Elimination; 66.87 L. [DST/CHY/F019/2021-22/G435].
17. Subrahmanyam Challapalli; Plasma Initiated Catalytic Conversion of Co₂ to Value Added Products; 17.23 L. [TATA/CHY/F019/2021-22/S190].

Funded Research Projects:

1. Ashutosh Kumar Mishra; Probing the Significance of Peptide Sequence Identity in Synthetic FlavopeptideS Conjugates Toward Catalytic and Luminescent Behavior; 11.00 L. [G227].
2. Deepa M; Liquid Junction Solar Cells with Silicon Nanowires Photoanodes Modified with Hole Conducting Materials; 3.30 L. [G292].
3. Deepa M; DST-Materials MAP; 53.20 L. [G462].
4. Deepa M; India-UK Centre for Education and Research in Clean Energy (IUCERCE); 28.54 L. [G69].

Awards and Recognitions

1. Aratri Biswas, a Research Scholar working under the guidance of Bhabani Shankar Malik won the Best poster award at the National Conference on Molecular Modeling and Simulations (NCMMS 2022).
2. Deepa M has been selected as the PAC Member of the Expert Committee for the IPHRA-SERB Scheme for the SERB Centre for Energy Transformation and Storage (2021).
3. Deepa M has been selected as the Member of the Selection Committee for DST Inspire Faculty in Material Sciences. (For the term: 20.01.2022 - 19.01.2025).
4. Deepa M has been selected as the External Expert of the Screening Committee for Associate Professor at the School of Chemistry, University of Hyderabad.
5. Deepa M was Featured in the Top 2% Scientists in the World as per Stanford University Rankings in 2021.
6. G Prabu Sankar has been selected as the Fellow of Royal Society of Chemistry.
7. Jai Prakash received the Teaching Excellence Award - 2022.
8. Tarun Kanti Panda received Faculty Research Excellence Award for research at IIT Hyderabad, 2022.
9. Tarun Kanti Panda was Highlighted in Reviewer Spotlight in Chemical Science, RSC, Dec 2021. <https://blogs.rsc.org/sc/category/reviewer-spotlight>.
10. Tarun Kanti Panda received Teaching Excellence Award for teaching, at IIT Hyderabad, 2021.
11. Subrahmanyam Challapalli received Suzuko Research Fellowship.

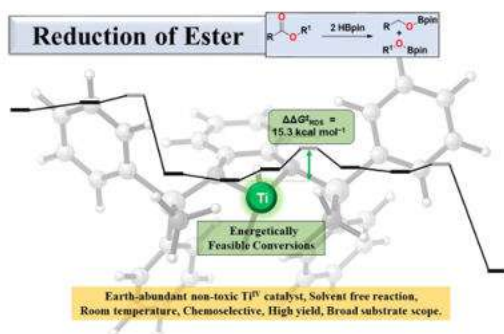
Research Highlights:

1. **Highly efficient Ti-catalyst for deoxygenative reduction of esters at ambient conditions: experimental and mechanistic insights from DFT Study by Prof Tarun K Panda**

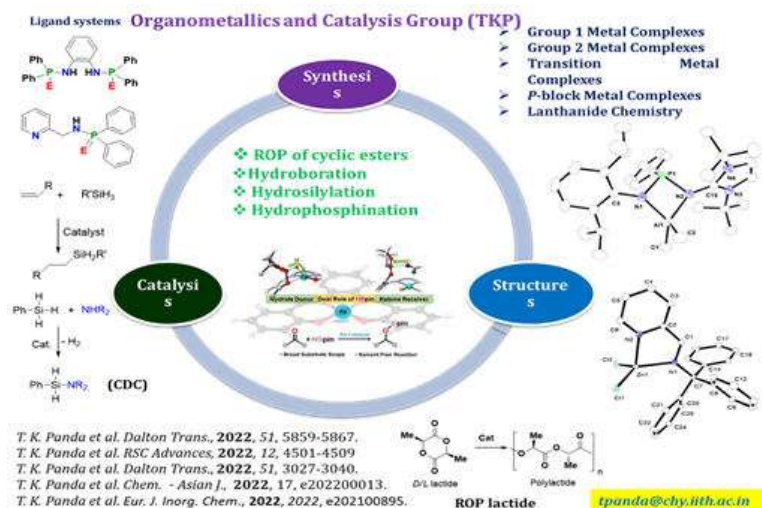
Team has developed a highly efficient Ti-catalyst for deoxygenative reduction of esters at ambient conditions with experimental and mechanistic insights from the DFT Study. Additionally, catalytic hydroboration and reductive amination of carbonyl compounds by HBpin were reported by using earth-abundant zinc promoter.

Graphical Abstract:

A combined experimental and DFT study of catalytic deoxygenative reduction of aromatic esters with pinacolborane (HBpin) using a TiIV alkyl complex as competent catalyst to afford corresponding boryl ether at room temperature under a solvent-free condition is reported.



Earth-abundant non-toxic Ti-IV catalyst, solvent free reaction, Room temperature, Chemoselective, High yield, Broad substrate scope.



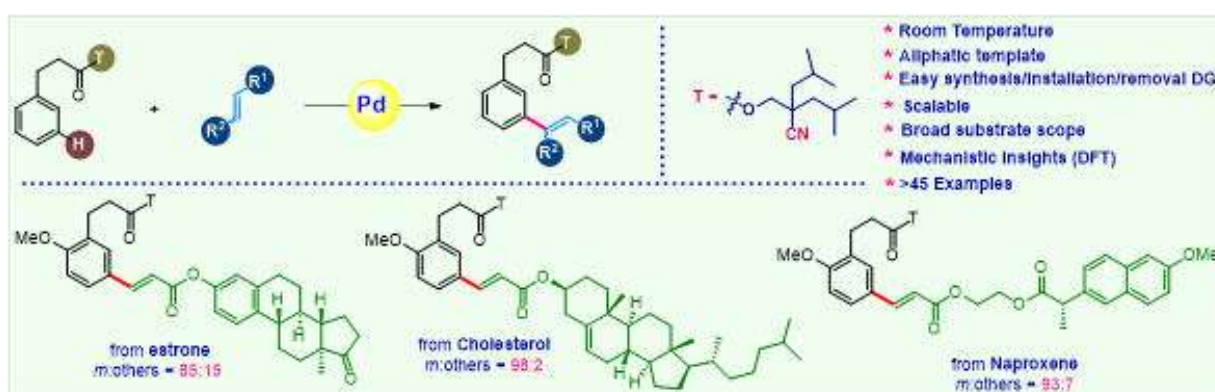
Organometallics and catalysis Group (TKP)

2. Recyclable aliphatic nitrile-template enabled remote meta-C-H functionalization at room temperature By Prof G Satyanarayana

The team has designed and developed a new aliphatic nitrile-template-directed remote meta-selective C-H olefin functionalization reaction of arenes. Remarkably, unlike the previous reports, this process is feasible at room temperature and enabled the formation of products with excellent regio-selectivity. The present protocol encompasses a broad spectrum of substituted dihydrocinnamic acids and olefines, producing meta-C-H olefinated products (up to 96% yield). In addition, the efficacy of the present method has been showcased by the synthesis of various drug analogs (e.g., cholesterol, estrone, ibuprofen, & naproxen). Significantly, the robustness of meta-olefination was also demonstrated by gram-scale synthesis. The new nitrile-based meta-directing template, in particular, could be easily synthesized in two steps and recycled under mild conditions. In addition, Prof G Satyanarayana et al. have published the three "The Journal of Organic Chemistry" publications (ACS Journals) with continuous page numbers from 2178 to 2240 [J. Org. Chem., 2022, 87, 5, 2178-2203; J. Org. Chem., 2022, 87, 5, 2204-2221; J. Org. Chem., 2022, 87, 5, 2222-2240]. Perla Ramesh, Chinnabattigalla Sreenivasulu, Dakoju Ravi Kishore, Dasari Srinivas, Koteswara Rao Corantla, Bhabani S Mallik, Gedu Satyanarayana.

Keywords: Aliphatic Nitrile-Template, meta-C-H activation, room temperature, C-H olefination, dihydrocinnamic acids.

Abstract:



Recyclable aliphatic nitrile-template enabled remote meta-C-H functionalization at room temperature

“ View research as an opportunity to explore and discover new things - Faith Blum ”

Department of Civil Engineering

The Department of Civil Engineering is always at the forefront of research, teaching, and engineering consultancy at IITH. The department has been created during the inception of IITH in 2008. Currently, the CE department has a total of 388 students which include 151 BTech students, 127 MTech students, and 110 PhD students. The CE department has 30 faculties which include 25 full-time faculties, 2 adjunct professors, and 3 distinguished professors. Currently, the department offers a 4-year full-time BTech program, a 2-year MTech program, a 3-year research project-based MTech program, and a self-sponsored MTech program. The MTech programs are offered in five different specializations of Civil Engineering: Environmental Engineering, Geotechnical Engineering, Hydraulics & Water Resource Engineering, Structural Engineering, and Transportation Engineering. The CE department provides the researchers a scope to fulfill their dream with the PhD program. The faculties of the CE department offer fundamental research in all the Civil Engineering subjects. At the same time, industry collaborative research works are also carried out extensively. A lot of inter-disciplinary research works are conducted in IITH and with the institutes abroad. The CE department has state-of-the-art high-performance experimental facilities and a computational laboratory. Alumni from the CE department are working in reputed organizations across the world in academia and industry.

The CE department has grown a lot in the past 1 year. The CE department is starting the MTech program in Transportation Engineering in 2022. The CE department has received 7 sponsored research projects, 163 consultancy projects, and 1 outreach in the past year. The department has conducted several GIAN/TEQIP programs in the last year. The CE department of IITH has organized the 1st International Conference on Structural Steel in India. The conference has attracted 380 researchers from 120 institutions across the world. Several workshops, international symposiums, and short courses have been conducted by the CE department in the last year. A center of excellence has been created in collaboration with the NHAI for transportation research in India. The main objective of the center is to create a state-of-the-art research and innovation hub for transportation infrastructure, which will be achieved by engaging the bright minds of the country in the research and development of innovative solutions for transportation infrastructure. The CE department is working towards developing several centers of excellence for solving different civil engineering problems.

For more information, please visit: <https://civil.iith.ac.in/>



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“ View research as an opportunity to explore and discover new things - Faith Blum ”

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Patents:

Filed:

1. Debraj Bhattacharya, A Novel Algal-Bacterial Photo-Bio Tower for Wastewater Treatment; 202141059299.

Book Chapters

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152. Reddy K C & Subramaniam K V L. (2021). X-ray diffraction-based quantification of amorphous phase in alkali-activated blast furnace slag. *Advances in Civil Engineering Materials*, 10(1), 333-349. Scopus. <https://doi.org/10.1520/ACEM20200167>.

Funded Research Projects:

1. Ambika S; Application and LCA of Biochar for pollution removal; Amount: 8.00 L. [JICA Friendship Phase-2].
2. Amirtham Rajagopal; Thermo Structural Analysis for Predicting Damage/Fracture in Functionally Graded thermal Barrier Ceramic Coatings using a Peridynamic Approach; Amount: 51.07 L. [DRDO/CE/F050/2020-21/G349].
3. Amirtham Rajagopal; Detailed Fe Simulation of RC Buildings for Seismic Damage Prediction using a Non-Local Plasticity Based Damage Models for Concrete; Amount: 9.70 L. [DST/CE/F050/2021-22/G382].
4. Anil Agarwal; Development of Textile Reinforced Mortar Based Strengthening Technique for Elevated Temperature Conditions; Amount: 27.19 L. [SERB/CE/F142/2021-22/G409].
5. Asif Qureshi; Sectoral Data Collection for 2 Na Cities in Telangana Namely-Nalgonda and Sangareddy; Amount: 5.84 L. [CFSOSTP/CE/F116/2021-22/S197].
6. Asif Qureshi; TSWB-QWBTS-GIS/GPS Mapping of Waqf Properties of Telangana; Amount: 181.72 L. [TSWB/CE/F116/2021-22/S205].
7. Debraj Bhattacharyya; Dynamic Evaluation of Pharmaceutical Contamination and Antibiotic Bacteria in Indian River; Amount: 4.70 L. [DST/CE/F095/2021-22/G375].
8. Debraj Bhattacharyya; Comprehensive Resource Recovery from Waste, Wastewater, and Emissions of Sugar/Distillery Plants: Proof-of-Concept Study; Amount: 35.00 L. [NSL/CE/F095/2021-22/S200].
9. Mahendra Kumar Madhavan; Sustainable Light Weight Composite Slabs; Amount: 21.24 L. [GODREJ&BOYCE /CE/F094/2021-22/S161].
10. Mahendra Kumar Madhavan; Development of innovative Cold-formed Steel Built-Up Sections; Amount: 35.37 L. [TATASTEEL/CE/F094/2021-22/S162].
11. Munwar Basha B; Development of Design Guidelines for Narrow Backfill Width Mechanically Stabilized Earth Walls built near Rock Faces; Amount: 49.00 L. [Tri-Hub].
12. Ramya Mullapudi; Self-Healing Characteristics of Warm Mix asphalt Mixtures; Amount: 32.79 L. [SERB/CE/F249/2021-22/G417].
13. Seetha N; Financial Sanction of the Vajra Faculty Scheme - Collaborative Research visit of S Majid Hassanizadeh from Utrecht University, the Netherlands to Indian Institute of Technology Hyderabad; Amount: 93.00 L. [SERB/CE/F194/2021-22/G405].
14. Surendra Nadh Somala; Origamisat for Structural Health Monitoring; Amount: 21.70 L. [DST/CE/F155/2021-22/G399].
15. Suriya Prakash S; influence of Size and Shape on the Effectiveness of Hybrid FRP Strengthening on Behaviour of RC Columns Under Concentric and Eccentric Compression; Amount: 61.95 L. [SERB/CE/F092/2021-22/G429].
16. Suriya Prakash S; Teacher's associateship for Research Excellence (Tare); Amount: 10.05 L. [SERB/CE/F092/2021-22/G440].
17. Suriya Prakash S; FRP Based Strengthening System; Amount: 1.18 L. [BHOR/CE/F092/2021-22/S201].
18. Suriya Prakash S; Assessment of New Reinforcement Systems for Concrete Constructions.; Amount: 10.62 L. [SOMANI /CE/F092/2021-22/S194].
19. Suriya Prakash S; Assessment of New Strengthening Schemes for Columns; Amount: 14.16 L. [SRMPL/CE/F092/2021-22/S170].
20. Suriya Prakash S; UHPC Column System; Amount: 1.48 L. [UHPC/CE/F092/2021-22/S202].
21. Umashankar Balunaini; Teacher's associateship for Research Excellence (Tare); Amount: 10.05 L. [SERB/CE/F017/2021-22/G437].
22. Subramaniam K V L; Evaluation of Cement Concrete Admixtures for Asian Paints; Amount: 23.00 L. [ASIANPAINTS/CE/F051/2021-22/S187].

Awards and Recognitions:

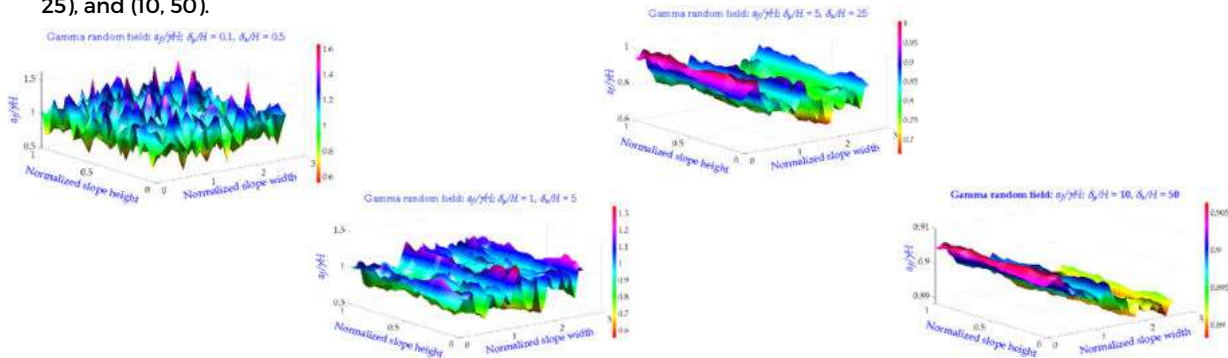
1. Anil Agarwal and Hemanth Chinthapalli received the Best Paper award in international Conferences on Advances in Structural Mechanics and Applications (ASMA 2021) for paper titled "Post earthquake fire performance of RC members".
2. Anil Agarwal and Priya Natesh won the Best Paper award in international Conferences on Advances in Structural Mechanics and Applications (ASMA 2021) for paper titled "the effect of stiffness of supporting system on the behavior of steel-concrete composite beams at elevated temperature".
3. Mahendra Kumar Madhavan has been Elected as Fellow of ASCE's Structural Engineering institute (SEI). First Indian to become a Fellow of SEI, Dec 2021.
4. Mahendra Kumar Madhavan won HUDCO DESIGN AWARD 2021-2022 under the Category of Cost-Effective Rural / Urban Housing Deploying innovative / Emerging & Disaster Resistant Technology from the Ministry of Housing and Urban Affairs, Government of India.
5. Munwar Basha B and Soujanya Dabbiru won the Springer Best Paper Award for the paper presented in Indian Geotechnical Conference 2021 at NIT Trichy, Tamil Nādu, India held on December 16-18, 2021.
6. Seetha N has been selected as a Review Editor of Environmental Water Quality, Frontiers in Water, 2021.
7. Shashidhar T has been selected as a NGT member for Polavarm Project EIA CFE/CFO member TSPCB.

8. Suriya Prakash S received Teaching Excellence Award, IIT Hyderabad, 2021.
9. Suriya Prakash S has been selected as the Member of Various BIS and Indian Road Congress committees to develop design guidelines.
10. Paper titled "influence of Geogrid Properties on Rutting and Stress Distribution in Reinforced Flexible Pavements under Repetitive Wheel Loading Journal of Materials in Civil Engineering" Authored by Ramu Baadiga; Sireesh Saride, and Madhira R Madhav selected as Top December papers by Indian Authors among all ASCE publications.
11. Umashankar Balunaini won the Springer Best paper award for "Modelling and Analysis of Back-to-back Walls with combined Wrap around and Full - Height Rigid Facing for High-Speed Rail Applications by Vamsi Krishna Kadagana, Sasanka Mouli Sravanam and Umashankar Balunaini" under the theme, "Geosynthetics Applications" presented in the "Indian Geotechnical Conference 2021" during December 16 - 18, 2021 by IGS Trichy Chapter and NIT Tiruchirappalli.
12. Best Paper Award (GEOMATE, 2021 conference) for the paper authored by Umashankar B; Ramu B; and Sireesh S. Only 8 papers were finalized out of 400 papers for the Geomate 2021 conference.
13. Subramaniam K V L has been selected as Fellow of Indian National Academy of Engineering.

Research Highlights:

1. Reliability Analysis of Unsaturated and Rainfall Induced Slope Failures by Munwar B Basha

The horizontal and vertical autocorrelation distance on the reliability index is discussed. The unsaturated soil slopes with small autocorrelation distance (ACD) tend to take deeper failure paths. On the contrary, the unsaturated soil slopes with large autocorrelation distance take shallow failure paths. Following figures demonstrate the surface plots with Gamma random field for the SWCC fitting parameter for related to air entry value with various autocorrelation distances. The surface plots are presented for the horizontal and vertical ACDs = (0.1, 0.5), (1, 5), (5, 25), and (10, 50).

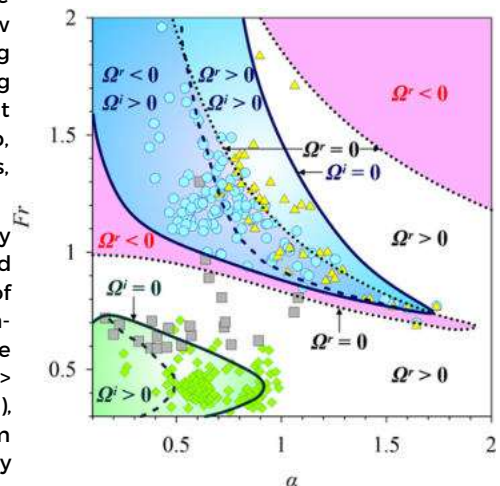


Demonstration of the surface plots with Gamma random field for the SWCC fitting parameter for related to air entry value with various autocorrelation distances.

2. Stability of dunes and antidunes by Sk Zeeshan Ali

Dunes and antidunes on sand and gravel streambeds propagate with a finite speed, with dunes propagating downstream and antidunes propagating both upstream and downstream. Existing linear stability theories predict the dune propagation reasonably well. However, in light of the experimental data, they fail to accurately predict the directional preference of antidunes. We revisit the problem by employing a one-equation rotational-flow model. We find a clear signature of the non-propagating perturbation within the unstable region of antidunes, separating the upstream and downstream propagating antidunes. The present model offers a unique reconstruction of the linear stability map, capturing satisfactorily the experimental data of dunes, antidunes, and the transition from dunes to antidunes.

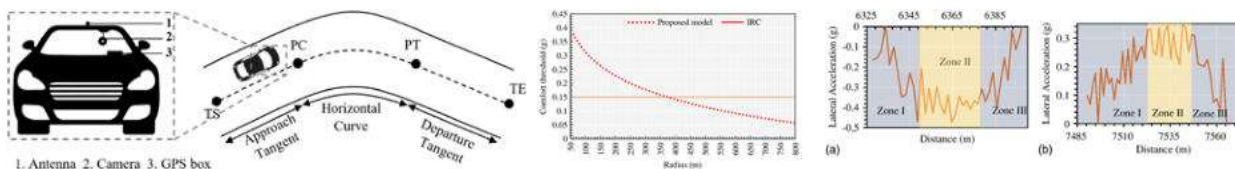
The solid lines (green and blue) represent the marginal stability curves ($\Omega_i = 0$), embracing the unstable regions ($\Omega_i > 0$) of dunes and antidunes, respectively. The broken lines denote the loci of maximum amplification. The dotted lines correspond to the non-propagating perturbation ($\Omega_r = 0$), which differentiates between the upstream ($\Omega_r < 0$) and downstream propagating perturbations ($\Omega_r > 0$). The experimental data of dunes (diamonds), plane bed (squares), upstream propagating antidunes (circles), and downstream propagating antidunes (triangles) are overlapped on the stability map.



Stability map (Froude number versus dimensionless wavenumber).

3. Comfort Thresholds for Horizontal Curves on Two-Lane Rural Highways by Digvijay S. Pawar

The comfort threshold is one of the basic controls in designing horizontal alignment. The current recommended comfort thresholds are conservative in nature as they were determined using the traditional approach for vehicle design and corresponding driver behavior during the 1930s and 1940s. Drivers exceed the recommended comfort thresholds (because they are conservative) when traversing horizontal curves, which results in overturning and lateral skidding of the vehicle, increasing the chances of crashes on the horizontal curves. Therefore, the design guidelines need to consider comfort thresholds determined using recent approaches in data collection for modern vehicle design and corresponding driver behavior. This study attempted to estimate the comfort thresholds for horizontal curves using an advanced data logger, instrumented in passenger cars for data collection on two-lane rural highways in India. Among the various geometric design features of curves, the curve radius significantly influenced the variation in the comfort threshold. The estimated comfort thresholds were higher than the side-friction demand recommended in an Indian design guideline.

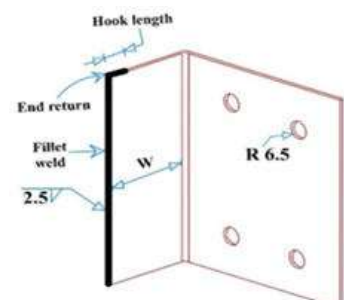
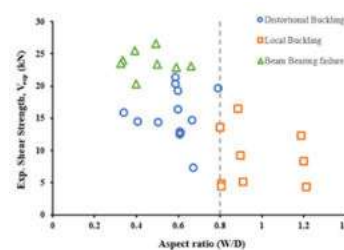


Comfort Thresholds for Horizontal Curves on Two-Lane Rural Highways.

4. Analysis and Design of CFS connections by Mahendrakumar M

The steel industry demands for higher aspect ratio (light-weight members) of steel members for economic and transportation reasons, which is feasible only with CFS sections. The stability of a structure mainly depends on its integrity in the load transfer mechanism. The connections play a vital role in load transfer and distribution thus achieving stability in a structure. Thin-wall behavior of the CFS sections makes its design complex and needs more attention towards its behavioral study thus demanding novel design methods for CFS sections design.

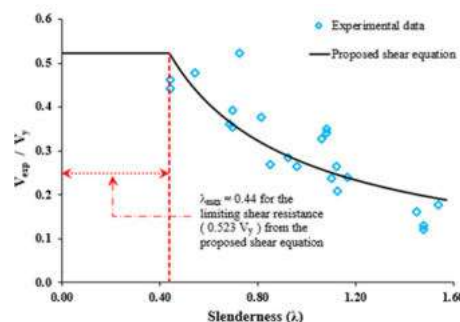
An L-shaped connector known as clip-angle is used to make the connection between the CFS members. Welded connections possess high stiffness and ease of fabrication. Relatively limited or no studies were conducted on the welded clip-angle connections in the CFS members. Most recently, through extensive laboratory tests the actual behavior of welded clip-angle connections between CFS beam and column was studied by our SSRG team. Reliable behavioral and design models had been proposed to aid in efficient design. Design stipulations were deduced from the experimental records to classify the failure modes of welded clip-angle connection and to preclude the failure of connected members (refer to Fig.2).



Welded clip-angle connector; (b) Classification of failure modes of clip-angle.



Beam bearing failure.



Design curve for welded clip-angle.

Along with the ultimate strength design, service limit state design and reliability analysis were performed to provide global design guidelines for the welded clip-angle connections in CFS structures.

“ View research as an opportunity to explore and discover new things - Faith Blum ”

Department of Computer Science and Engineering

The Computer Science and Engineering (CSE) department has grown leaps and bounds since its inception in 2008. The department faculty comprises 25 faculty members with a good representation in the areas of theoretical computer science, artificial intelligence/machine learning, and computer systems. The CSE department has already graduated around 40 PhDs, with many of the PhD graduates taking positions in top R&D labs and academic institutes - including other IITs. The department faculty and students consistently publish in top-tier conferences and journals. The undergraduate program has been always preferred by the top-ranked JEE performers - as evidenced by the improving opening and closing ranks. Our industry engagement has also been very strong, with the MDS program providing an opportunity for industry professionals to stay up-to-date with the latest R&D developments in the area of data science. The CSE department also collaborates with various other industry and R&D labs, including Samsung, Intel, Microsoft, Google, AMD, DRDO, Honeywell, KLA, IBM, Adobe, Suzuki Motors, Fujitsu AI, and Weather News Inc., to name a few.

For more information, please visit: <https://cse.iith.ac.in/>

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“ View research as an opportunity to explore and discover new things - Faith Blum ”



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Patents:

Filed:

1. Bheemarjuna Reddy Tamma, Antony Franklin; System and Method for Performing Efficient Scheduling in Cloud Radio Access Network; 202141020062.

Granted:

1. Bheemarjuna Reddy Tamma, Antony Franklin; Method for scheduling data by network node aggregated with LTE and wi-fi protocol stacks; US15/661,428.

Publications

1. Baswade A M, Reddy M A, A F, Tamma B R, Sathya V, Performance analysis of spatially distributed LTE-U/NR-U and Wi-Fi networks: An analytical model for coexistence study. *Journal of Network and Computer Applications*, 2021, 191, 103157. <https://doi.org/10.1016/j.jnca.2021.103157>.
2. Baswade A M, Reddy M A, A F, Tamma B R, & Sathya V. (2021). Performance analysis of spatially distributed LTE-U/NR-U and Wi-Fi networks: An analytical model for coexistence study. *Journal of Network and Computer Applications*, 191, 103157. <https://doi.org/10.1016/j.jnca.2021.103157>.
3. Sathya V, Kala S M, Bhupeshraj S, & Tamma B R. (2021). RAPTAP: A socio-inspired approach to resource allocation and interference management in dense small cells. *Wireless Networks*, 27(1), 441-464. <https://doi.org/10.1007/s11276-020-02460-7>.
4. Agrawal A, Panolan F, Saurabh S, & Zehavi M. (2021). Simultaneous Feedback Edge Set: A Parameterized Perspective. *Algorithmica*, 83(2), 753-774. <https://doi.org/10.1007/s00453-020-00773-9>.
5. Fomin F V, Golovach P A, Lokshantov D, Panolan F, Saurabh S, & Zehavi M. (2021). Multiplicative Parameterization Above a Guarantee. *ACM Transactions on Computation Theory*, 13(3), 18:1-18:16.

<https://doi.org/10.1145/3460956>.

6. Lokshantov D, Misra P, Mukherjee J, Panolan F, Philip G, & Saurabh S. (2021). 2-Approximating Feedback Vertex Set in Tournaments. *ACM Transactions on Algorithms*, 17(2), 11:1-11:14. <https://doi.org/10.1145/3446969>.
7. Biswas R, Kakwani D, Vedurada J, Enea C, & Lal A. (2021). MonkeyDB: Effectively testing correctness under weak isolation levels. *Proceedings of the ACM on Programming Languages*, 5(OOPSLA), 132:1-132:27. <https://doi.org/10.1145/3485546>.
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9. Prashanth Podili and Kotaro Kataoka, "TRAQR: Trust Aware End-to-End QoS Routing in Multi-domain SDN using Blockchain," *Journal of Network and Computer Applications*, Vol. 182, Pages. 103055, 2021. <https://www.sciencedirect.com/science/article/pii/S1084804521000795>.
10. Amit R A, & Mohan C K. (2021). A Robust Airport Runway Detection Network Based on R-CNN Using Remote Sensing Images. *IEEE Aerospace and Electronic Systems Magazine*, 36(11), 4-20. <https://doi.org/10.1109/MAES.2021.3088477>.
11. Datla R, & Mohan C K. (2021). A novel framework for a seamless mosaic of Cartosat-1 DEM scenes. *Computers & Geosciences*, 146, 104619. <https://doi.org/10.1016/j.cageo.2020.104619>.
12. Deepak K, Chandrakala S, & Mohan C K. (2021). Residual spatiotemporal autoencoder for unsupervised video anomaly detection. *Signal, Image and Video Processing*, 15(1), 215-222. <https://doi.org/10.1007/s11760-020-01740-1>.

13. Vishnu C, Datla R, Roy D, Babu S, & Mohan C K. (2021). Human Fall Detection in Surveillance Videos Using Fall Motion Vector Modeling. *IEEE Sensors Journal*, 21(15), 17162-17170. <https://doi.org/10.1109/JSEN.2021.3082180>.
14. Banerjee R & Singh M. (2021). Using noise reduction to enhance the ranking-based genomic selection. *Genetic Resources and Crop Evolution*, 68(8), 3319-3331. <https://doi.org/10.1007/s10722-021-01190-9>.
15. Kumar N, Baskaran E, Konjengbam A, & Singh M. (2021). Hashtag recommendation for short social media texts using word-embeddings and external knowledge. *Knowledge and Information Systems*, 63(1), 175-198. <https://doi.org/10.1007/s10115-020-01515-7>.
16. Francis M, & Verron T. (2021). On Two Signature Variants of Buchberger's Algorithm over Principal Ideal Domains. *Proceedings of 2021 on International Symposium on Symbolic and Algebraic Computation*, 139-146. <https://doi.org/10.1145/3452143.3465522>.
17. Madisetty S, Maurya K K, Aizawa A, & Desarkar M S. (2021). A neural approach for detecting inline mathematical expressions from scientific documents. *Expert Systems*, 38(4), e12576. <https://doi.org/10.1111/exsy.12576>.
18. Aravind N R, Cambie S, Batenburg W C van, Verclos R de J de, Kang R J, & Patel V. (2021). Structure and Colour in Triangle-Free Graphs. *The Electronic Journal of Combinatorics*, P2.47-P2.47. <https://doi.org/10.37236/9267>.
19. Aravind N R, Kalyanasundaram S, & Kare A S. (2021). Vertex partitioning problems on graphs with bounded treewidth. *Discrete Applied Mathematics*. <https://doi.org/10.1016/j.dam.2021.05.016>.
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24. Majumder A, Mathew R, & Rajendraprasad D. (2021). Dimension of CPT Posets. *Order*, 38(1), 13-19. <https://doi.org/10.1007/s11083-020-09524-5>.
25. Mathew R, Newman I, Rabinovich Y, & Rajendraprasad D. (2021). Hamiltonian and pseudo-Hamiltonian cycles and fillings in simplicial complexes. *Journal of Combinatorial Theory, Series B*, 150, 119-143. <https://doi.org/10.1016/j.jctb.2021.04.003>.
26. Mathew R, Ray, R, & Srivastava S. (2021). Fractional Cross Intersecting Families. *Graphs and Combinatorics*, 37(2), 471-484. <https://doi.org/10.1007/s00373-020-02257-7>.
27. Juyal C, Kulkarni S, Kumari S, Peri S, & Somani A. (2021). An efficient approach to achieve compositionality using optimized multi-version object-based transactional systems. *Information and Computation*, 104696. <https://doi.org/10.1016/j.ic.2021.104696>.
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30. Tavarageri S, Heinecke A, Avancha S, Kaul B, Goyal G, & Upadrasta R. (2021). PolyDL: Polyhedral Optimizations for Creation of High-performance DL Primitives. *ACM Transactions on Architecture and Code Optimization*, 18(1), 11:1-11:27. <https://doi.org/10.1145/3433103>.
31. John T A, Balasubramanian V N, & Jawahar C V. (2021). Canonical Saliency Maps: Decoding Deep Face Models. *IEEE Transactions on Biometrics, Behavior, and Identity Science*, 3(4), 561-572. <https://doi.org/10.1109/TBIOM.2021.3120758>.
32. Kumar A, Desai S V, Balasubramanian V N, Rajalakshmi P, Guo W, Balaji Naik B, Balram M, & Desai U B. (2021). Efficient Maize Tassel-Detection Method using UAV-based remote sensing. *Remote Sensing Applications: Society and Environment*, 23, 100549. <https://doi.org/10.1016/j.rsase.2021.100549>.
33. Mangla P, Singh V, Havaladar S, & Balasubramanian V. (2021). On the benefits of defining vicinal distributions in latent space. *Pattern Recognition Letters*, 152, 382-390. <https://doi.org/10.1016/j.patrec.2021.10.016>.

Funded Research Projects:

1. Antony Franklin; Development of Indian Telecommunication Security Assurance Requirement (ITSAR) (IIT Hyderabad & DoT); 278.23 L. [NSCS/CSE/F157/2021-22/G393].
2. Antony Franklin; Design and Development of Cost Effective Vehicular Mobile Edge Computing Platform for Automotive Industry; 22.59 L. [SERB/CSE/F157/2021-22/G439].
3. Antony Franklin; [Cow_1] Project Cow Pilot (6,34,90,688 JPY); 427.86 L. [SUZUKI/CSE/F157/2021-22/S180].

4. Bheemarjuna Reddy Tamma; COW V2X Pilot (Co-PI); 455.00 L. [S180].
5. Bheemarjuna Reddy Tamma; CCRAN: Energy Efficiency in Converged Cloud Radio Next Generation Access Network; 17.00 L. [S66].
6. Jyothi Vedurada; High-Performance GPU Algorithms- (Unrestricted gift); 4.48 L. [GOOGLE/CSE/F266/2021-22/S218].
7. Jyothi Vedurada; Unrestricted Grant to Support an MTech RA Position for Research Collaborations at IIT Hyderabad for 3 Years. PO Excludes Tax; 2.36 L. [Microsoft/CSE/F266/2021-22/S176].
8. Kotaro Kataoka; Fundamental Research on the Interoperability of Blockchain Platform; 48.00 L. [Denso/CSE/FO05/2021-22/S182].
9. C Krishna Mohan; Lidar and Camera Sensors' Data Based Deep Learning Algorithms for Autonomous Driving System; 45.00 L.
10. Krishna Mohan C; To Evaluate Engagement Level on Participants in meetings by using Face, Head, and Gaze Direction, Body Posture Using Limited Supervision; 27.12 L. [I'mBesideYou/CSE/FO16/2021-22/S206].
11. Krishna Mohan C; To identify actions of Table Tennis players on 30/60/120 Fps 720P/1080P Video Clips. The Model should be lightweight enough to run Inference on a Single Consumer Grade GPU on Video Streams in Near Real Time (Expected Inference Time Is Between 1/20 Seconds or Faster Per Shot). The Model should be able to Classify Actions from any View Angle; 16.28 L. [STUPA/CSE/FO16/2021-22/S173].
12. Maunendra Sankar Desarkar; Explainable and Interpretable Deep learning Models for Learning Business insights from Alternate Data; 18.00 L. [CSE/2020-21/S124].
13. Maunendra Sankar Desarkar; Hatespread: Analyzing the Spread of Hatred In Online Social Discussions; 6.60 L. [SERB/CSE/F158/2021-22/G442].
14. Maunendra Sankar Desarkar; FY21 Mapg to IIT Hyderabad -- Project Proposal: Zero-Shot Multi-Lingual Personalized Auto-Suggest Generation Where: Hyderabad. PO Does not include any Taxes Delivery Date 6/30/2022 (Po No.99893692); 14.16 L. [Microsoft/CSE/F158/2021-22/S172].
15. Praveen Aravind Babu Tammana; Building a Scalable and Secure IoT-Based Healthcare Network Using Mud; 18.91 L. [DST/CSE/F242/2021-22/G391].
16. Praveen Aravind Babu Tammana; Validating and Securing Network Protocols and Network Management Systems; 150.00 L. [NSCS/CSE/F242/2021-22/G394].
17. Rogers Mathew; Fractional intersecting families; 2.20 L. [MTR/2019/000550].
- Sakethanath Jagarlapudi; Unrestricted Gift-Google Phd Fellowship for Piyushi Manupriya (USD 50,000); 37.54 L. [GOOGLE/CSE/F197/2021-22/S189].
18. Sathya Peri; Indigenous Intelligent and Scalable Neuromorphic Multi-Chip for AI Training and Inference Solutions; 450.00 L. [G-357].
19. Sathya Peri; Concurrent and Distributed Programming primitives and algorithms for Temporal Graphs; 28.41 L. [IISc/CSE/F137/2020-21/G341].
20. Sathya Peri; Design and Development of Unified Blockchain Framework for offering National Blockchain Services and Creation of a Blockchain Ecosystem; 107.46 L. [MEITY-CDAC/CSE/F137/2021-22/G372].
21. Sathya Peri; Parallelization of Smart Contract Execution in Tezos Blockchain (USD 73,800); 59.53 L. [TEZOS/CSE/F137/2021-22/S198].
22. Sobhan Babu Chintapalli; Internship and Young Professional Portal; 1.95 L. [IRDAI/CSE/FO30/2021-22/S171].
23. Sobhan Babu Chintapalli; E-Health Application; 52.20 L. [TSMCIDC-GOT/CSE/FO30/2021-22/S199].
24. Srijith P K; Continual Learning for Computer Vision and Natural Language Processing; 25.23 L. [SERB/CSE/F184/2021-22/G444].
25. Srijith P K; Explainable and Interpretable deep learning models for learning business insights from alternate data; 19.00 L. [S124].
26. Upadrasta Ramakrishna; Unrestricted Gift-Google Phd Fellowship for S Venkatakeerthy (USD 50,000); 37.55 L. [GOOGLE/CSE/F136/2021-22/S193].
27. Vineeth N Balasubramanian; Causal Reasoning in Time-varying Data Streams; 7.40 L. [ADOBE/CSE/F121/2021-22/S217].
28. Vineeth N Balasubramanian; Google Research Scholar Award Towards the Work of Bridging Perspectives of Explainability and Adversarial Robustness"; 25.56 L. [GOOGLE/CSE/F121/2021-22/S160].
29. Vineeth N Balasubramanian; Promotion of Under-Represented Groups in CS Research; 4.51 L. [GOOGLE/CSE/F121/2021-22/S216].

Awards and Recognitions:

1. Antony Franklin has received the Best Paper Award in COMSNETS 2022.
2. Bheemarjuna Reddy Tamma received the Best paper award for NUMASFP: NUMA-aware Dynamic Service Function Chain Placement in Multi-core Servers at 14th International Conference on COMMunication Systems & NETWORKS (COMSNETS 2022) held in Bangalore, Jan 2022.
3. Jyothi Vedurada received the Google Research

- explore CSR Award 2021 with a fund of ~4.6Lakhs (<https://research.google/outreach/explore-csr/recipients/>).
4. Jyothi Vedurada received the Distinguished Paper Award for the paper titled 'MonkeyDB: Effectively Testing Correctness under Weak Isolation Levels' at OOPSLA 2021.
 5. Jyothi Vedurada received Reviewer: TOPLAS 2021 (highly respected journal in the Programming Languages community).
Jyothi Vedurada has been selected as the Program Committee Member of IEEE HiPC 2021, ISEC 2022, PPEE'21, and VSTTE'22.
 6. Krishna Mohan C and team received an excellent presentation award for their paper presented in the 14th ICMV 2021, which was held during 8-12 Nov 2021.
 7. Krishna Mohan C has been selected as the Senior Member of IEEE this year.
 8. Krishna Mohan C has been selected as the Fellow of IETE.
 9. Krishna Mohan C has been selected as the Fellow of the Telangana Academy of Sciences.
 10. Krishna Mohan C has been the awarded FIE.
 11. Krishna Mohan C has received the Excellence in Teaching Award for 2021.
 12. Maria Francis Led a panel discussion at IEEE Women in Engineering event - "Beyond Glass Barriers - 2021".
 13. Maunendra Sankar Desarkar Work on regional language hostility detection at CONSTRAINT workshop at AAAI 2021 selected as shared task best paper honorable mention award Paper title: "Coarse and Fine-Grained Hostility Detection in Hindi Posts using Fine Tuned Multilingual Embeddings"
Reference for news: <https://cs2.iitd.edu.in/CONSTRAINT-2021/>.
 14. Praveen Aravind Babu Tammana has been Invited as a TPC member of ACM/IEEE ANCS'21.
 15. Praveen Aravind Babu Tammana has been Invited as a TPC member of IEEE ICNP'22, APNet'22.
 16. Praveen Aravind Babu Tammana received TiHAN Faculty Fellowship for two years.
 17. Rogers Mathew received Teaching Excellence Award 2022.
 18. Sathya Peri has been selected as Server PC Co-Chair for ICDCIT 2022.
 19. Srijith P K has been Selected for Sony research award 2021 and Intel research fellowship for PhD students.
 20. Vineeth N Balasubramanian received Google explore CSR grant award, 2021-22.
 21. Vineeth N Balasubramanian received the Teaching Excellence Award at IIT Hyderabad, 2021.
 22. Vineeth N Balasubramanian received Best Paper Award, Causality in Vision workshop at CVPR, 2021.
 23. Vineeth N Balasubramanian received Best Paper Award, Adversarial Machine Learning in Real-World Computer Vision Systems, and Online Challenges workshop at CVPR, 2021.
 24. Vineeth N Balasubramanian received Google Research Scholar Award (earlier known as Google Faculty Research Award) in 2021.
 25. Vineeth N Balasubramanian has been selected as an Outstanding Reviewer at ICLR, 2021.



View research as an opportunity to explore and discover new things - Faith Blum



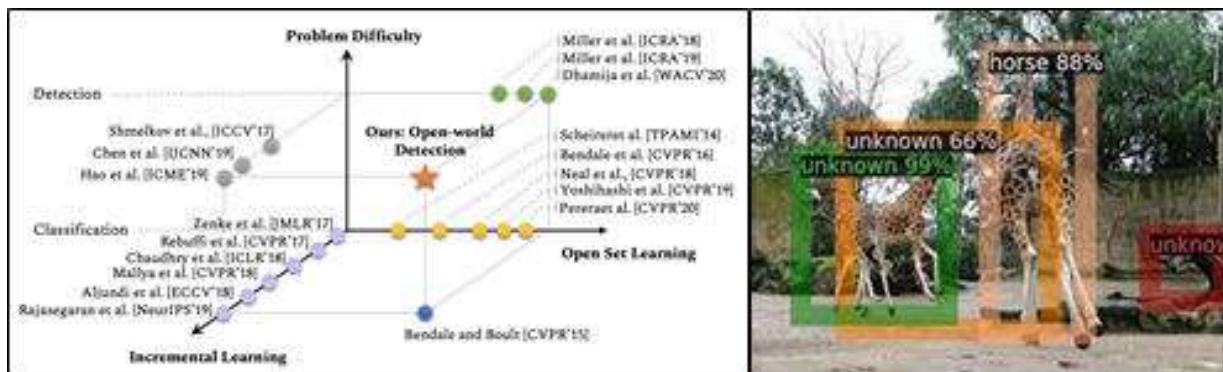
Research Highlights:

1. First subexponential parameterized algorithms by Dr Fahad Panolan

Fahad Panolan (IITH) along with Daniel Lokshtanov (UCSB), Saket Saurabh (IMSc, Chennai), Jie Xue (NYU, Shanghai), and Meirav Zehavi (BGU, Israel) designed the first subexponential parameterized algorithms for graph problems like Feedback Vertex Set and Odd Cycle Transversal on disk graphs. Prior to this work, some such algorithms were known only to subclasses of disk graphs like planar graphs and unit disk graphs. This work appeared in the proceedings of the 2022 Annual ACM-SIAM Symposium on Discrete Algorithms (SODA).

2a. Open World Object Detection by Dr Vineeth N Balasubramanian & Team

Joseph K J (PhD student, CSE at IITH) and Vineeth N Balasubramanian (IITH), along with collaborators Salman Khan (MBZUAI, Abu Dhabi) and Fahad Khan (MBZUAI, Abu Dhabi), proposed a new task in computer vision called: 'Open World Object Detection,' where a model is tasked to 1) identify objects that have not been introduced to it as 'unknown,' without explicit supervision to do so, and 2) incrementally learn these identified unknown categories without forgetting previously learned classes when the corresponding labels are progressively received. They also provided a robust evaluation protocol and a novel solution for this problem called ORE: Open World Object Detector, based on contrastive clustering and energy-based unknown identification. This work was presented at CVPR 2021, an A conference, and its corresponding codebase has over 800 stars and 120 forks on Github.



Open World Object Detection

2b. CANDLE - Causal Analysis in Disentangled Representations by Dr Vineeth N Balasubramanian & Team

Abbavaram Gowtham Reddy (PhD student, CSE at IITH), Benin Godfrey (RA, CSE at IITH), and Vineeth N Balasubramanian (IITH) developed a new image dataset for Causal Analysis in Disentangled Representations (CANDLE) along with metrics to measure the level of disentanglement achieved by any model under confounding effects. This was presented at the CVPR 2021 Workshop on Causality in Vision and received the Best Paper Award. An extension of this work was also presented at AAAI 2022, an A-rated conference.



CANDLE - Causal Analysis in Disentangled Representations

“ View research as an opportunity to explore and discover new things - Faith Blum ”

Department of Design

The Department of Design at IITH offers a vibrant environment for learning, practicing, and exploring several facets of design. The department envisions to creatively engaging in the space between technologies and people. This involves facilitating innovation in key emergent areas such as Participatory and collaborative Design, Artificial Intelligence, AR/VR/, Professional Ethics/ Sustainability, Product Systems and Services, Design and education, Wellness Crowd-Sourced Design, etc. The vision of the Design Department at IITH is to be recognized for its leadership in the discipline and the profession by advancing design excellence in evolving themes of design that positively impact daily lives and inherits cultural values. Through its interdisciplinary faculty strength, the department is keen to tackle social & global challenges towards a more sustainable future, developing entrepreneurial mindsets, and aims towards academic and research excellence. The Mission of the department is to prepare the new generation of designers to shape the quality of human experience in products, communications and system integrated solutions through design excellence. The Department of Design at IITH provides an inspiring, creative, collaborative, excellent research environment and student-centered learning environment while preparing a responsible and thriving new generation of designers who apply their knowledge, skills, and abilities to enrich the profession, the society, and the global community with socially relevant design solutions keeping future perspective and sustainability in mind.

Programs offered by the Department:

- MDes (Visual Design) - Sponsored/Self Sponsored/Online Executive.
- BDes - Product Design, Visual Communication, and User Experience Design.
- PhD in Design (Full time / Part time), Practice-based and Practice-led research.
- Design Minor for Btech.
- PG Certificate program.

New Specializations in the MDes program:

- Product Design
- Interaction Design
- Visual Design
- Strength

Labs:

AV Lab, Rapid Prototyping Lab, Perfect binding and Print Lab, IoT Lab, Mix Reality Lab photography lab.

For more information, please visit: <https://design.iith.ac.in/>

Faculty

Head of the Department



Deepak John Mathew

PhD - Center for Advanced Studies in Education, M S University of Baroda
Professor

Profile page:

<https://iith.ac.in/des/djm/>

Assistant Professor



Ankita Roy

Profile page:

<https://iith.ac.in/des/aroy/>



Delwyn Jude Remedios

Profile page:

<https://iith.ac.in/des/delwyn/>



Neelakantan P K

PhD - IIT Bombay

Profile page:

<https://iith.ac.in/des/neel/>



Prasad S Onkar

PhD - IISc Bangalore

Profile page:

<https://iith.ac.in/des/psonkar/>



Seema Krishnakumar
Profile page:
<https://iith.ac.in/des/seema/>



Shahid Mohammad
 PhD - IIT Guwahati
Profile page:
<https://iith.ac.in/des/mohammad.shahid/>



Shiva Ji
 PhD - IIT Guwahati
Profile page:
<https://iith.ac.in/des/shivaji/>



Srikar A V R
Profile page:
<https://iith.ac.in/des/srikaravr/>

Books:

1. Ankita Roy; A Tribute to Bundela Painting.

Books Chapters:

1. Indranil Saha, Deepak John Mathew. Chapter 25 - New age zero waste sustainable apparel industry: Design practices, innovative approaches, and technological intervention, Editor(s): Alexandros Stefanakis, Ioannis Nikolaou, Circular Economy, and Sustainability, Elsevier, 2022, Pages 489-506, ISBN 9780128198179, <https://doi.org/10.1016/B978-0-12-819817-9.00035-1>. (<https://www.sciencedirect.com/science/article/pii/B9780128198179000351>).
2. Saha I, & Mathew D J. (2021). Perceptions and Dynamics Affecting Acceptance of 3D-Printed Bridal Lehenga in India. In A Chakrabarti & M Arora (Eds.), Industry 4.0 and Advanced Manufacturing (pp. 197-211). Springer. https://doi.org/10.1007/978-981-15-5689-0_18.
3. Kulkarni N, Shahid M. (2021) System Mapping: Understanding the Value Chain of Organic Farming in Sikkim, India. In: Chakrabarti A, Poovaiah R, Bokil P, Kant V. (eds) Design for Tomorrow—Volume 3. Smart Innovation, Systems and Technologies, vol 223. Springer, Singapore. https://doi.org/10.1007/978-981-16-0084-5_68.
3. Meenakshi Mishra, Deepak John Mathew. (2021) Title: Study of Form, Color, and Activity Mapping for Fully Autonomous Passenger Drone Interiors. Turkish Online Journal of Qualitative Inquiry, Vol 12 Issue 9. https://www.researchgate.net/publication/342118441_USERS_SURVEY_FOR_DEVELOPMENT_OF_PASSENGER_DRONES.
4. Rautray, Priyabrata, Deepak John Mathew, and Boris Eisenbart. "Additive manufacturing-enabling digital artisans." Proceedings of the Design Society 1 (2021): 323-332. <https://doi.org/10.1017/pds.2021.33>.
5. S Som, D J Mathew, K Vincs, S Phillipson. (2021). Scaffolding design process in the light of art and design education: An artistic practice towards developing a hands-on learning program with the aid of virtual reality for Indian school student, in shodh samhita, Volume- VIII, Issue 2, 2021-2022, ISSN 2277-7067 UGC care Group 1.
6. S Som, D J Mathew, S Phillipson, K Vincs. (2021). Evaluating creative imagination: A narrative enquiry on virtual reality content under the lens of practice-based and heuristic research in: Abdullaha Kuzu, Turkish online Journal of Qualitative Inquiry, Vol. 12 No. 9 (2021), ISSN: 1309-6591, https://www.tojqi.net/index.php/journal/article/view/6017_Scopus_indexed.
7. Upasna Bhandari, Deepak John Mathew: "A Critical Review of National Education Policy 2020: Role of 21st Century Skills and Scope of Design Education in Indian Schools" at International Journal of Design Education (Accepted with revision. The paper is under final inspection by the editorial team).
8. Pawar, Tejas, Sharma Aman, Ji Shiva. (2021). Heritage Representation of Kashi vishweshwar temple at Kalabgoor, Telangana with Augmented Reality Application using Photogrammetry. 12th Indian Conference on Computer Vision, Graphics, and Image Processing. (ICVGIP 20-21). December 2021, IIT Jodhpur, India.

Publications

1. Shahid M. (2021). Title Design in Bollywood Movie Posters: Design Features, Trends, and the Role of Technology. The International Journal of Visual Design, 14(4), 15-33. <https://doi.org/10.18848/2325-1581/CGP/v14i04/15-33>.
2. Mamata N Rao, Deepak John Mathew, "Design Briefs: Review, Reframing and analysis of a study" Journal of Design Education. <https://cgscholar.com/bookstore/works/design-briefs>.

9. Chakraborty S, Ji Shiva. (2021). Evolution of Bagbazar street through Visibility Graph Analysis (1746-2020). 12th Indian Conference on Computer Vision, Graphics and Image Processing. (ICVGIP 20-21). December 2021, IIT Jodhpur, India.
10. Ravishankar S, Ji Shiva. (2021). Bio-architecture of Living Root Bridges. Design for Tomorrow–Volume 1. Smart Innovation, Systems and Technologies, vol 221. pp 881-887. Springer, Singapore. https://doi.org/10.1007/978-981-16-0041-8_72.
11. Ravishankar S, Ji Shiva. (2021). Exploring Two Housing Typologies in the Vernacular Architecture of Assam. Design for Tomorrow–Volume 1. Smart Innovation, Systems and Technologies, vol 221. pp 949-959. Springer, Singapore. https://doi.org/10.1007/978-981-16-0041-8_78.
12. Ravishankar, Srinidhi, Ji Shiva. (2021). Influence of Culture and Art in the Tribal Architecture of Meghalaya Smart Innovation, Systems and Technologies 223, Design for Tomorrow–Volume 3, pp 775-782. Springer, Singapore. https://doi.org/10.1007/978-981-16-0084-5_63.
13. Srikar A V R; Autonomous Workplace: The Future, Accelerated, Srikar A V R, Michael, Ming Lee, Zsolt, Abhay. Platform: Corenet global Hackathon in response to COVID-19 (2020). <https://www.corenetglobal.org/files/FileDownloads/hackathonresults/final-report-autonomous-new.pdf>.
6. Seema Krishnakumar has been selected as the election committee/award committee member at IFDSSK (International documentary and short film festival of Kerala, 2021).
7. Shiva Ji has been elected as Life member with Indian National Trust for Art and Cultural Heritage (INTACH).
8. Shiva Ji has been selected as the Member of the Commission on Environmental, Economic, and Social Policy (CEESP) under the International Union for Conservation of Nature (IUCN).
9. “Within these Walls” (IITH/experimental), Animate Film, Directed by Ajay, Sagar, Tanveera, Bidyapati, Ajay, Bonzer, Arun, guided by Delwyn Jude Remedios has been selected as the Best Student Film at Preksha Online Student Film Festival.
10. “Ek Cup Chaha” (IITH/Student film/Tea Powder), Animation Film, Directed by Sumit Yempalle, Guided by Delwyn Jude Remedios got an official Selection in Calcutta International Short Film Festival, India 2021.
11. “Sad Truth” (IITH / Pixilation / stop-motion / paper-cut outs), Animation Film, Directed by Archa V, Archana C S, Arya Surendran, Gautam K, Maithelee Gupta, Mayuri Dutta, guided by Delwyn Jude Remedios got an official Selection at Up-and-coming International Film Festival Hannover, Germany 2021, at Indian Film Festival Melbourne 2021, at Screen and Story Film Festival 2021, and at Preksha Online Student Film Festival 2021.

Funded Research Projects:

1. Prasad S Onkar; Development of Sketch-based Immersive Environment for Articulated Product Concept Exploration; 28.41 L. [G368].
2. Deepak John Mathew; Integrating AI, AR, and VR in learning models and their impact; 23.10 L. [DSIR/DES/F132/2021-22/G452].

Awards and Recognitions:

1. Work (Data collection application to study and generate trends of the aftereffects of COVID-19 in recovered patients, User Interface Design) of Shreya Balakrishnan, Student of ANKITA ROY, has been shortlisted for Microsoft Design Challenge.
2. Ajith Abraham George won the '51st Kerala State Film Award' for Sound Mixing for the film 'Sufiyum Sujatayum.' The awards were presented by Kerala Chalachitra Academy and announced by the Minister of Cultural Affairs, Saji Cheriyan, in Thiruvananthapuram on Oct 16, 2021.
3. Mohammad Shahid received the Best Typography Poster awards at Typography Day 2021.
4. Seema Krishnakumar has been Shortlisted for iyarki, a grant for conservation and photography at Chennai Photo Biennale in Sept 2021.
5. Seema Krishnakumar has been selected as a participant C3- code, creativity, and community - Goethe Institute, Sept 2021.
12. “Save Our Species” (IITH / Independent film / Stop-motion animation), Animation Film, by Delwyn Jude Remedios was
 - The Winner of Best Animation at Equinox Mountain Environmental Film Festival, United States, 2021.
 - Winner for Best Editor at Mumbai Entertainment International Film Festival 2021.
 - Selected as Semi-finalist at 11 CMS Vatavaran-Environment and Wildlife Film Festival and Forum, New Delhi 2021.
 - Got Official Selection in Calcutta International Short Film Festival, India 2021.
 - Got Official Selection in Indic Film Utsav, India, 2020.
 - Got Officially Selected in New Jersey International Short Film Festival (NJISFF).
 - Got Officially Selected at North Dakota Environmental Rights Film Festival, 2021.
 - Got Official Selection at Italia Green Film Festival, 2021.
 - Got Official Selection at PIAFF, Paris International Animation Film Festival, 2021.
 - Got Official Selection at International Nature Film Festival Cödöllö, 2021.
 - Got Official Selection in Indic Film Utsav, India, 2021.
 - Got Official Selection at Mumbai Inde Film Festival, 2021.
 - Got Official Selection at Finders Flicks Film Festival, Tasmania, 2021.
 - Got Official Selection at Festival Internacional Imagem Natureza 2021.

- Got Official Selection at Tehran International Animation Film Festival 2021.
 - Got Official Selection at Changing Climate Changing Lives Film Festival, Thailand 2022.
 - Got Official Selection at Happy Valley Animation Festival, United States 2022.
13. "VR the World" (IITH / Student film / Digital 2-D), Animation Film, Directed by Pravin J, Guided by Delwyn Jude Remedios
- Received the 'Karukrit Best Direction' Award at Karukrit International Film Festival, Himachal Pradesh.
 - Tekka International Film Festival Singapore.
 - Won the Golden Sparrow International Film Festival.
 - Won the Best Animation Film - Indie online film award Paradox International Short Film Festival 2021 - Official selection Tbilisi International Animation Festival (TIAF) 2021 - Official selection Moonwhite Films International Film Festival (MWFIFF) 2021 - Official selection The 2nd annual Changing Climate Changing Lives Film Festival - Screening.
14. Delwyn Jude Remedios received Teaching Excellence Award at IIT Hyderabad for the year 2021-2022.
15. Neelakantan P K received Distinguished Paper Award at ICORD International conference 2021.
16. Srikar A V R was invited as the Chief guest and Jury Member at IDeathon'22 (KL University) - Jury panel member at National Institute of Design.

Research Highlights:

1. 'Packaging from palm and banana leaves' by **Rucmenya Basariya** and **Mudita Dubey** (M Des 2021-23) bags second place at the R2S, Project Read to Shine Hiroshima-Telangana. The team had to generate a creative solution for sustainable packaging of vegetables, meat, or beverages. Based on research and brainstorming on Indian traditional packaging styles and bio-inspired designs, they zeroed on using a material derived from banana and palm leaf for packing vegetables.



Packaging from palm and banana leaves

2. The Mural Art illustration on the video wall visually portrays the IITH motto, 'Inventing and Innovating in Technology for Humanity.' The illustration amalgamates the exciting work taking place at IIT Hyderabad. The artwork adorns the entrance wall of Academic Block A. With its brilliant yellow illustration and a dark black background, it forms a perfect backdrop for the video wall while blending in well with the space. Designed and executed by **Prof Delwyn Remedios**.



Mural Art

3. **Akanksha Singh** (M Des 2020-22) is the First runner-up at the ADI Battle Of Projects 2022 in the Furniture Design category. The spindle is an interactive bench that lets one fidget, play, and relax through its tactile experience. It has hundreds of wooden beads that rotate to give you an acupressure massage while you're resting on it. The concept behind this project was to develop a mechanism that initiates a subconscious interaction with the user, making it fun for anyone who comes across it. Channeling people's fidgeting energies, the spindle allows them to unwind and focus. Guided by **Dr Neelakantan**, Professor at the Department of design.



Spindle Furniture

4. MDes student team was selected for GDC Cohort 21 at IIT Madras for their project 'Design of Innovative mathematical toys for enhanced experiential learning'. The project research was around applications of advanced materials in product design. The Student team of **Shovan, Harsh, and Vishnu** (M Des 2021-23), under the guidance of **Prof Srikar**, worked on 3M glass bubble novel applications in toy design and allied industries. They are the first team from IITH to be selected by GDC IIT Madras for their 21st cohort to deep dive into their entrepreneurial journey.



'Design of Innovative mathematical toys for enhanced experiential learning'

5. "VR the world" by **Pravin J**(M Des 2017-19) is an animated short film focused on the conservation of Forest and Wildlife. The story is an imaginary situation that may happen in the near future where we are all on the verge of extinction because of the act of deforestation and urbanisation. Guided by **Delwyn Remedios**.

Recognitions

- 'Karukrit Best Direction' Award at Karukrit International Film Festival, Himachal Pradesh
- Tekka International Film Festival Singapore - Winner
- Golden Sparrow International Film Festival - Winner
- Best Animation Film - Indie online film award
- Paradox International Short Film Festival 2021 - Official selection
- Tbilisi International Animation Festival (TIAF) 2021 - Official selection
- Moonwhite Films International Film Festival (MWFIFF) 2021 - Official selection
- The 2nd annual Changing Climate Changing Lives Film Festival - Screening



"VR the world"
an animated short film

6. Samsung Innovation Awards are organized annually by the Samsung R & D Institute India in Bangalore, which aims to identify, encourage, and reward innovative ideas and projects. Student teams were invited from the same institute to participate, innovate, and present their best work on the 2021 theme 'Metaverse: Realizing the Virtual World.' Our Master of Design students - **Anshul Chole, Pooja Verma, Tito Sumi, and Vibhuti Sagar**, won the second runner-up prize for their project "Space_d: A Virtual Reality Experience." The project was guided by **Prof Prasad Onkar**. It aims to understand the effectiveness of virtual reality to relax a user. Following the design process, a holistic experience was constructed and tested with users. Overall, the experience received positive feedback from the participants and showed the potential of virtual reality in relieving stress and promoting relaxation.



Project "Space_d: A Virtual Reality Experience"

7. Electric Truck Carrier is a concept of eco-friendly transportation for heavy and commercial vehicles. The design of the truck carrier is useful to load trucks easily from the back and its mechanism works in such a way that the truck platform adjusts its height for loading and unloading. The unloading of the truck can be done in a short time from the front when the driver's cabin moves aside as it creates space for the truck to get accommodated to the road easily. **B Vivekananda Chary**, Technician at the Department of Design IIT Hyderabad holds the patent.



Design of Electric Truck Carrier

“View research as an opportunity to explore and discover new things - Faith Blum”

Department of Electrical Engineering

The Department of Electrical Engineering (EE) at IIT Hyderabad offers a vibrant environment for Undergraduate, Post-graduate education and Research in many areas of Electrical Engineering, committed to delivering cutting edge research and teaching in several frontier areas of Electrical Engineering. With multiple offers in hand, our BTech students are well placed across different top-notch MNCs. Moreover, offers for higher studies in Ivy league universities have become commonplace for our undergraduate toppers. Placements for Master and PhD programs have also been consistently lucrative. A couple of our research scholars have become faculty in IITs and NITs. Last but not least, the emphasis on practical work and state-of-the-art research work has led to the incubation of four start-ups. Two of these start-ups have revenue in-flow and will pretty soon be getting Series-A funding. We at EE aim to be pioneers rather than peers.

Major Equipment:

- Microscope Based Fluorescence Lifetime System
- CRETEC CABL-9500C Electron Beam Lithography
- Silicon Etch System Using XEF2
- Mask Aligner
- PECVD System
- Semi-Conductor Device Analyzer
- Electron Beam Evaporation Systems
- Deep Reactive Ion Etching, Reactive Ion Etching
- Light Field Display
- Emegasim Simulator

Key Thrust Areas:



For more information, please visit: <https://ee.iith.ac.in/>



Innovation is rewarded. Execution is worshipped. - Eric Thomas



Faculty

Head of the Department



Shiv Govind Singh
PhD - IIT Bombay
Professor
Profile page:
<https://iith.ac.in/ee/sgsingh/>

Professor



Ashudeb Dutta
PhD - IIT Kharagpur
Profile page:
https://iith.ac.in/ee/asudeb_dutta/



K Siva Kumar
PhD - IISc Bangalore
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8. Amit Acharyya; Leveraging Remaining Useful Lifetime Estimation of Electronic Systems for E-Waste Management and Cost-Effective Schooling in Developing Countries (GBP 1995); 2.07 L. [UOL/EE/F091/2021-22/S179].
9. Ashudeb Dutta; Design of Dynamic MAC and PHY SoC for Low Power and Long-Range Networks; 56.00 L. [G266].
10. Ashudeb Dutta; Design and Development of Space Grade X-band Integrated 15W Gallium Nitride (GaN) Power Amplifier; 68.00 L. [S56].
11. Gajendranath Chaudhury; Design, Analysis, Verification, and Performance Evaluation of Analog to Digital Interface Single-Channel ASIC for High-Performance Closed-Loop Capacitive Gyroscope for Inertial Navigation Applications; 179.89 L. [DRDO/EE/F192/2020-21/G365].
12. Gajendranath Chaudhury; Design and Characterization of Mems Gyroscope with Cots (Commercially off the Shelf) Components; 24.30 L. [DRDO/EE/F192/2021-22/S169].
13. Ketan P Detroja; Anomaly Detection Using Machine Learning; 12.00 L. [TOSHIBAMITSUBISHI/EE/F060/2021-22/S174].
14. Kiran Kumar Kuchi; Next Generation Wireless Research and Standardization on 5G and Beyond; 959.18 L. [MEITY/EE/F072/2021-22/G390].
15. Kiran Kumar Kuchi; Operation & Maintenance (O&M) of Indigenous 5G Test Bed; 300.00 L. [DOT/EE/F072/2021-22/G448].
16. Lakshmi Prasad N; Coding Techniques for Distributed Computing; 2.00 L. [G278].
17. Rajalakshmi P; Teachers Associateship for Research Excellence (Tare); 10.05 L. [SERB/EE/F002/2021-22/G441].
18. Rajalakshmi P; ADAS for Point-To-Point Navigation System for Autonomous Car Adaptable To Indian Scenarios; 397.64 L. [SUZUKI/EE/F002/2021-22/S186].
19. Rupesh Ganpatrao Wandhare; Design of Power Converter for 3 Phase Grid Integration of Hydrogen Fed PME Fuel Cell Using High Frequency Link Multistage Converter; 46.53 L. [DST/EE/F210/2021-22/G433].
20. Shishir Kumar; An Automated Platform for Single Cell Sorting and Culture; 54.60 L. [SERB/EE/F172/2021-22/G445].
21. Siva Kumar K; Vetting of Electrical Drawings for the Project "Construction of Lagaon Group of Villages Water Supply Scheme, District Lalitpur, and Relevant Works"; 5.90 L. [Gayatri/EE/F062/2021-22/C694].
22. Sri Rama Murty Kodukula; Speech to Speech Translation for Tribal Languages Using Deep Learning Framework; 65.92 L. [MEITY/EE/F001/2021-22/G384].

Funded Research Projects:

- Aditya T Siripuram; Hyderabad-Fast and Efficient DFT Computation for Signals with Structured Support; 10.00 L. [S184].
- Amit Acharyya; Reconfigurable Machine Learning Accelerator Design and Development for Avionics Applications; 395.23 L. [DRDO/EE/F091/2020-21/G337].
- Amit Acharyya; A Cost-Effective, Real Time, and Accurate Battery Management System (BMS) Controller Unit for Space Qualified Li-Ion Battery; 105.94 L. [DRDO/EE/F091/2020-21/G348].
- Amit Acharyya; Sanction of Operational Expenses for DRDO-IITH Research Cell at IIT Hyderabad; 75.00 L. [DRDO/EE/F091/2021-22/G383].
- Amit Acharyya; Validation of the Error Mitigation Feature for TI Arm Based 16 Bit MCU; 29.44 L. [DRDO(CARS)/EE/F091/2021-22/S188].
- Amit Acharyya; Collaboration Service for Machine Learning based Models; 27.60 L. [MOBIS/EE/F091/2021-22/S211].
- Amit Acharyya; Conducting the R&D Project on Power Optimization and Performance Enhancement of SoC (JPY 13,045,000); 88.01 L. [SUZUKI/EE/F091/2021-22/S183].

23. Sri Rama Murty Kodukula; Carrying out Research and Study Machine/Deep Learning Model for Extracting the Desired Speech Signals in Automotive Noisy Environments.; 3.75 L. [AKM/EE/F001/2021-22/S185].
24. Sri Rama Murty Kodukula; Carrying out Research and Study Machine/Deep Learning Model for Extracting the Desired Speech Signals In-Vehicle Noisy Environments. (USD 5000); 3.77 L. [AKM/EE/F001/2021-22/S208].
25. Sri Rama Murty Kodukula; To Develop a Speech Recognition for Indian English (Jpy 2400000); 15.70 L. [I'm Beside You/EE/F001/2021-22/S209].
26. Sumohana S Channappayya; Development of Digital Scene Matching Area Correlation (DSMAC) Algorithms and Prototype System; 113.00 L. [DRDO/EE/F100/2021-22/G378].
27. Sumohana S Channappayya; Deep Learning Models for Radar/Satellite Image-Based Nowcasting, Video-Based Cloud Pattern Analysis, and Scene Understanding; 25.36 L. [Weathernews /EE/F100/2021-22/S164].
28. Sundaram Vanka; Under review; Network Design for Autonomous Navigation Systems; 24.79 L.
29. Sushmee Badhulika; Covalent Surface Functionalised 2D-MoS₂ Based High Density Sensor Array for Ultra-Sensitive Detection of Bio analytes In Biological Fluids; 46.28 L. [DST/EE/F135/2021-22/G427].
30. Sushmee Badhulika; Development of Hybrid Self-Charging Photo-Capacitors for Powering Micro-Scale Aerial Vehicle (Mavs); 45.12 L. [CARS/EE/F135/2021-22/S177].
31. Vaskar Sarkar; Efficient Regulation of Photovoltaic Power Output Under the Partial Shading: A Paradigm Shift from MPPT To RPPT; 33.79 L. [SERB/EE/F025/2021-22/G430].
32. Mohammed Zafar Ali Khan; Financial Sanction of the Vajra Faculty Scheme-Collaborative Research Visit of Dr Amit Kumar Mishra from the University of Cape Town, South Africa to Indian Institute of Technology Hyderabad; 13.10 L. [SERB/EE/F013/2021-22/G400].
33. Shiv Govind Singh; E-Guna: Sensory Assessment for Quality of Fermented Foods from North-East India; 93.58 L. [MEITY-CDAC/EE/F029/2021-22/G381].

Awards and Recognitions:

1. Abhinav Kumar has been recognized as the best supervisor at IEEE GRATE 2021.
2. Aditya T Siripuram (along with student) received Qualcomm Innovation Fellowship
3. Aditya T Siripuram received Excellence in Teaching at IITH.
4. Amit Acharya received Faculty Research Excellence Award from IITH.
5. Naresh Kumar Emani Elevated to IEEE Senior Membership Grade.
6. Rajalakshmi P has been appointed as Cyient Chair in Future Communications.
7. Shashank Vatedka received the Best poster award at Stanford Compression Workshop in February 2021.
8. Shubhadeep Bhattacharjee received Institute Gold Medal for best PhD thesis from IISc Bangalore.
9. Sumohana S Channappayya received the Best Reviewer Award NCC 2021.
10. Sushmee Badhulika has been selected as Emerging Investigator by Materials Horizons.
11. Sushmee Badhulika was featured in the World's Top 2% Scientists ranking published by Stanford University 2021.
12. Vaskar Sarkar received the Teaching excellence award at IITH on the 13th foundation day.
13. V Seshadri Sravan Kumar received Teaching Excellence Award 2021 at IITH.
14. Shiv Govind Singh and two of his PhD students received Research excellence awards (2021-2022).

Research Highlights:

1. **New Capacity-Achieving Codes by Lakshmi Prasad Natarajan (IITH) and Dr Prasad Krishnan (IITH)**
Two large families of error correcting codes have been identified and constructed using combinatorics and algebraic methods. These codes are capacity-achieving on a class of communication channels called the binary erasure channel, and hence, they have substantial theoretical importance (and, hopefully, they might have some practical relevance too). One of these code families, called "Berman Codes", generalizes a well-studied and powerful family of codes called Reed-Muller codes to a wider range of block lengths and code rates. This is the first time that capacity-achieving codes have been identified in Indian research institutes.
2. **CCRRAN Project- Achievements by Kiran K Kuchi**
 - 2a. **Massive MIMO:** Experimentally, it is shown that 36 users can be paired and served in the same time/frequency resources using 48 antennas. This is a significant achievement over the state-of-the-art, where the existing 5G systems allow a maximum of 16 users to be served using 64 antennas. The results of this research will be proposed to further releases of 5G standards and 6G. The Cloud RAN concept has been experimentally demonstrated where multiple small cells are connected by fiber, and radio processing is executed in a baseband cloud. This concept, alternatively known as "Cell-free MIMO," is being considered for 6G standards. IITH is perhaps one of the first entities to successfully build and demonstrate a large scale cell-free MIMO concept.



Massive MIMO set-up at IIT Hyderabad

2b. $\pi/2$ BPSK with spectrum shaping feature at 3GPP

Developed $\pi/2$ BPSK with spectrum shaping technology, and the specification of this technology is completed in 3GPP Release 15, 16, and 17 of 3GPP. IITH had cooperation from CEWiT, IITM, Reliance Jio, and Tejas Networks in pushing this key technology as an “optional” feature in 3GPP. The feature allows a maximum UE (User Equipment) power level of 26 dBm in the current releases of 3GPP. The proposals are made to 3GPP to increase the power level up to 32 dBm. Given that existing 4G handsets operate at a 23 dBm power level, this technology will have a significant impact in enabling large cells (LMLC) in 5G deployments. The newly introduced waveform technology is expected to provide up to a two-fold increase in cell coverage, enable LMLC (Low-Mobility-Large-Cell) deployments, significantly useful to reduce dropped calls, and increase the battery life of 5G handsets. Waveform changes typically happen once in a decade, especially when cellular technologies go through a generational change. India bagged this opportunity and started leading the development of 5G standards in a big way.

3. Revolutionizing the Diagnosis: AI-Powered Low-Cost, Point of Care Electronic Testing Kit (X-HOME) Researchers by Prof Govind Singh (IITH), Gajendranath Ch (IITH)

Point of care, rapid and accurate, is need of hrs. For this proposal and alternative technology, electronics test kits were developed for different disease diagnosis. At the arrival of COVID-19, the same technology was modified for the diagnosis of COVID-19 nucleotide, which is the gold standard for SARS-2 virus diagnosis. This developed technology was tested at a different hospital for clinical testing. ICMR testing and validation partner CCMB, CSIR, Hyderabad has validated this rapid electronics testing kit independently and found the efficiency of the kit 94.2%, sensitivity 91.3%, and Specificity 98.1% issue the certificate for the same. This is the first nucleotide based electronics test kit validated for SARS-2 virus detection in India.

Department of Entrepreneurship and Management

The Department of Entrepreneurship and Management is one of the recently established departments in IITH. The department is headed by Dr M P Ganesh and has two faculty members, namely Dr Nakul Parameswar and Dr Lohithaksha Maniraj Maiyar. The department also currently has seven PhD students and five dual degree MTech (Techno-Entrepreneurship) students. The department also offers a minor in entrepreneurship for the BTech Students.

For more information, please visit: <https://em.iith.ac.in/>

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Book Chapters:

1. Book chapter on "Fighting food waste: How can Artificial Intelligence and Analytics help?" accepted for publication in the book "Innovation Analytics: Tools for Competitive Advantage" by World Scientific.
2. Parameswar N (2021). De-globalization and its Effect on International Joint Venture. In J Paul & S Dhir (Eds.), Globalization, Deglobalization, and New Paradigms in Business (pp. 87-102). Palgrave Macmillan. <https://doi.org/10.1007/978-3-030-81584-45>.

Publications:

1. Parameswar N, Dhir S, Khoa T T, Galati A, & Ahmed Z U, (2021). Dynamics of the termination of global alliances: Probing the past, analyzing the present, and defining the frontiers for future research. International Marketing Review, ahead-of-print(ahead-of-print). <https://doi.org/10.1108/IMR-01-2021-0046>.
2. Parameswar N, Hasan Z, & Dhir S (2021). Role of management practices and their effects on firm performance: Emerging market context. Strategic Change, 30(5), 467-479. <https://doi.org/10.1002/jsc.2461>.



IITH announced a self-sponsored MTech program in Techno-Entrepreneurship.

Read more:

<https://bit.ly/3vLcX5w> &

View Video Abstract:

<https://youtu.be/mvy9IIE28Is>

“

“Business only has two functions – innovation and marketing. - Milan Kundera

”

Department of Liberal Arts

The Department of Liberal Arts at IITH is a leading center for the study of a highly diverse range of subjects, including Cognitive Science, Cultural Studies, Development Studies, Economics, English (Literature and Language), Linguistics, Psychology, Sociology, and Social Anthropology. While its primary focus remains world-class research in the fields of humanities and social sciences, the department is also deeply committed to teaching innovative and intellectually stimulating courses to undergraduate and postgraduate students of the institute. In addition, Liberal Arts at IIT Hyderabad places much importance on interdisciplinary collaborations through projects of national and international importance. Currently, the department offers undergraduate courses at the institute and also has a strong post-graduate program that confers MA in Development Studies and PhD in all disciplines listed. A New Teaching program, MA in Health, Gender, and Society, has been started at the department of Liberal Arts.

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Book Chapters:

1. Haripriya Narasimhan; Mahati Chittem, Pooja Purang) 'Pandemic Times in WhatsApp-ed Nation: Gender ideologies in India during COVID-19' in *Viral Loads: Anthropologies of urgency in the time of COVID-19*, (ed) Lenore Manderson, Nancy J Burke, and Ayo Wahlberg, UCL Press, UK.
2. Shubha Ranganathan; Kottai S & Ranganathan S. (2021). When 'care' leads to 'chronicity': exploring the changing contours of care of homeless people living on the streets in India. in L Montesi and M Calestani (Eds.). *Managing Chronicity in the Unequal States: Ethnographic perspectives on caring*. UCL Press.
3. Shuhita Bhattacharjee; *Shockwaves of Rape and Shattering of Power in the Contemporary Indian Web-Series: The Case of Delhi Crime, Made in Heaven, and Judgement Day. in the Politics of Emotional Shockwaves*. Lisbon: Palgrave Macmillan, 2021.

Publications:

1. Editorial Collective: Khandekar Aalok, Noela Invernizzi, Duygu Kaşdoğan, Ali Kenner, Angela Okune, Grant Jun Otsuki, Sujatha Raman, Amanda Windle, and Emily York (2021). "Infrastructuring ESTS." *Engaging Science, Technology, and Society* 7(1): 1-11. <https://doi.org/10.17351/ests2021.1275>.
2. Editorial Collective: Khandekar Aalok, Noela Invernizzi, Duygu Kaşdoğan, Ali Kenner, Angela Okune, Grant Jun Otsuki, Sujatha Raman, Amanda Windle, and Emily York (2021). "Publishing ESTS." *Engaging Science, Technology, and Society* 7(2): 1-9. <https://doi.org/10.17351/ests2021.1407>.
3. Khandekar A, Costelloe-Kuehn B, Poirier L, Morgan A, Kenner A, Fortun K, Fortun M, & Team T P D. (2021). Moving Ethnography: Infrastructuring Doubletake's and Switchbacks in Experimental Collaborative Methods. *Science & Technology Studies*, 34(3), 78-102. <https://doi.org/10.23987/sts.89782>.
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 12. Majumdar A. (2021d). Remembering deceased kin through assisted conception in India. *Contemporary South Asia*, 29(1), 24-36. <https://doi.org/10.1080/09584935.2021.1884662>.
 13. Majumdar S & Majumdar A. (2021). The birth professionals: Emerging practices of birthing in contemporary India. *Asian Journal of Women's Studies*, 27(4), 555-574. <https://doi.org/10.1080/12259276.2021.1993600>.
 14. Majumdar A. (2021). Infertility as inevitable: Chronic lifestyles, temporal inevitability & making of abnormal bodies in India. *Anthropology & Medicine*, 0 (0), 1-15. <https://doi.org/10.1080/13648470.2021.1874872>.
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 18. Akram V, & Rath B N. (2021b). Understanding the evolution of fiscal performance of Indian states. *Growth and Change*, 52(4), 2172-2193. <https://doi.org/10.1111/grow.12544>.
 19. Akram V, Rath B N, & Sahoo P K. (2021). Do COVID-19 cases follow a similar transition path? Evidence from Indian states. *MethodsX*, 8. <https://doi.org/10.1016/j.mex.2020.101196>.
 20. Behera C, & Rath B N. (2021a). The connectedness between Twitter uncertainty index and stock return volatility in the G7 countries. *Applied Economics Letters*. <https://doi.org/10.1080/13504851.2021.1963656>.
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- event study analysis. *Buletin Ekonomi Moneter Dan Perbankan*, 24, 1-14. <https://doi.org/10.21098/BEMP.V24I0.1483>.
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Funded Research Projects:

1. Aalok Dinkar Khandekar; Cool infrastructures: Life with Heat in the off-Grid City (GBP 480,298.00); 485.00 L. [UCUE/LA/F196/2021-22/S168].
2. Aalok Dinkar Khandekar; Tackling a Global Pandemic

in Asian Megacities: Uneven Vulnerabilities, State Responses and Grassroot Practices (AUD 1640); 0.89 L. [UOM/LA/F196/2021-22/S196].

3. Aardra Surendran; Labour Supply Chains and the Construction industry: Circular Migrants, Contracting, and Covid; 10.70 L. [APU/LA/F265/2021-22/S191].
4. Neeraj Kumar; Nature of Plasticity in Somatosensory Cortex and its Role in Motor Learning and Memory Consolidation; 30.91 L. [SERB/LA/F259/2021-22/G431].
5. Prakash Chandra Mondal; Semantic Processing in Bilingual Children and Factors Affecting them (I'm a Mentor/Co-PI of this Project); 21.90 L. [DST-CSRI/LA/KK/2021-22/PDF54].
6. Shubha Ranganathan; Disability, family, and care in the time of COVID-19; 6.93 L. [ICSSR/LA/F086/2020-21/G343].
7. Shubha Ranganathan; A Qualitative Exploration of Families' Lived Experiences of Using Various therapies for Persons with Intellectual and Developmental Disabilities; 5.61 L. [YASH/LA/F086/2021-22/S204].

Awards and Recognitions:

1. Aalok Dinkar Khandekar has been appointed to the Editorial Board for the Sage journal Science, Technology & Human Values for a 3-year term starting June 2022.
2. Aalok Khandekar has been awarded two new international research grants (contracts with IITH are currently underway): Regional Studies Association Policy Expo 21 grant (anchored at the University of Melbourne) under the thrust of Pandemics: Regional Resilience and Regional Policy Responses to develop a comparative understanding of policy responses to COVID in South and South-East Asian megacities; Grant on "Towards inclusive methods for assessing technologies for development" awarded collaboratively with the Koen Beumer at Utrecht University under the NWO-WOTRO Impacts and Innovation Grants."
3. Aardra Surendran has been Selected as a member of the working group on 'Knowledge Economy, Employment and Skills' of the Kerala State Planning Board for the drafting of the 14th five-year plan of the state of Kerala and was part of the drafting committee for the report.
4. Aardra Surendran received Azim Premji Research Foundation Grant for two years for 'Labour Supply Chains in the Construction Industry: Circular Migrants, Contracting, and Covid' (INR 10,70,300) commencing in July 2021.
5. Aardra Surendran Took over as Co-Editor, Book Reviews for the international journal Gender, Place and Culture in April 2021.
6. Aardra Surendran has received ICSSR Major research grant - 'Migrant Labour Supply chains in the

construction industry in Hyderabad.'

7. Haripriya Narasimhan has been selected as a Consultant Anthropologist (expert) for 'A study of food consumption patterns of tribes in Tamilnadu,' Tribal Research Centre, Ooty, January 2022.
8. K P Prabheesh, Haripriya Narasimhan, and Shubha Ranganathan are engaged as experts in a third-party evaluation of the Polavaram irrigation project along with K V B N Phanindra and Satish Regonda from CE (~22 lacs).
9. Mahati Chittem received 3D imaging-based vein intrusion guide system for pediatric and geriatric healthcare, Sree Padmavathi Venkateswara Foundation (SreePVF) Grant (INR 2, 38, 00, 000).
10. Home' work in the time of COVID-19: A longitudinal qualitative study of lockdown on mothers in Hyderabad, Telangana, Indian Council of Social Science Research (INR 400, 000) by Mahati Chittem and Haripriya Narasimhan.
11. M P Ganesh has been appointed as the Member Board of Studies at Tamilnadu Teachers Education University by the office of the Governor of Tamilnadu.
12. M P Ganesh (Co-PI) received ICSSR Major project Competitiveness of Indian Technological Start-ups - An Exploratory Study for Rs.6,60,000.
13. Neeraj Kumar received a SERB-SRG grant.
14. Prakash Chandra Mondal has been appointed as a Review Editor in Frontiers in Psychology (Section: Language Sciences).
15. Prakash Chandra Mondal has been Elected as an International Affiliate of the American Psychological Association.
16. Prakash C Mondal has been mentoring a DST-sponsored Post-doc Project Entitled 'Semantic Processes in Bilingual Children and Factors Affecting Them' by Keerthana Kapiley.
17. Shuhita Bhattacharjee received the Outstanding Woman Researcher Award in English Literature, 7th Venus International Women Awards (2022).
18. Shubha Ranganathan received a Grant for a one-year sponsored research on 'A qualitative exploration of families' lived experiences of using various therapies for intellectual and developmental disabilities funded by Yash Charitable Trust (Project start date: 1st January 2022. Award Rs. 5,60,672/-).
19. Disability, family, and care in the time of COVID-19. ICSSR Special Call on COVID-19 projects (INR 6,60,000) by PI Shubha Ranganathan.

Department of Materials Science & Metallurgical Engineering

Namaskar! The historical academic year (2021-22) it was for the department of Materials Science and Metallurgical (MSME) where the foremost, it got its building (inaugurated on 18th August 2021) and the whole department got shifted to its new and permanent abode over the next few months. MSME family cherishes for having the first department building in the IIT Hyderabad campus.

MSME boasts to be associated with Distinguished Professor Prof Chennupati Jagadish (Australian National University, Australia), Prof K Bhanu Sankara Rao joined MSME as Adjunct Professor who also got selected as INAE Distinguished Professor. Dr Ranjith R rejoined the department as a Full Professor. MSME welcomed a new member, Dr Ashok Kamaraj (Assistant Professor), to its family. Dr Nagini M joined as Post-Doctoral Fellow.

The faculty of MSME initiated two pioneering Online MTech programs (Industrial Metallurgy and Integrated Computational Materials Engineering) where the teachings take place after regular office hours and during the weekends. These programs are meant for those working professionals who could not get opportunities earlier in getting higher degrees and have a desire to progress further in their professional lives. Both programs are running successfully.

Several members of the department brought accolades. The names of three faculty members (Prof B S Murty, Prof G D Janakiram, and Prof Pinaki P Bhattacharjee) appeared in the top2% Scientists in Materials Science and Engineering. Prof Pinaki P Bhattacharjee received the SERB-STAR award from the DST. Dr Saswata Bhattacharya and his research team, a part of a multi-PI project funded by NSM, played a crucial role in creating the first indigenous open-source HPC software to simulate microstructural evolution using phase-field method. Mr Sontam Govardhan Reddy (BTech 2017 batch), who worked under the guidance of Dr Shourya Dutta Gupta, received the Best Project Award 2021 (BTech) from the Indian National Academy of Engineering (INAE). Several faculty members brought many research projects (SERB-SRC, SERB-CRC, DST-SUPRA, DRDO, and so on) from various public/private agencies (SERB, DST, TATA STEEL, KENA METALS, and so on). More exciting scientific outcomes are mentioned alongside each faculty's profile in this annual report.

For more information, please visit: <https://msme.iith.ac.in/>



“

You can't use up creativity. The more you use, the more you have. - Maya Angelou

”

Faculty

Head of the Department



Suhash Ranjan Dey
PhD - University Paul-Verlaine -
Metz, France
Professor
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Professor



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Assistant Professor



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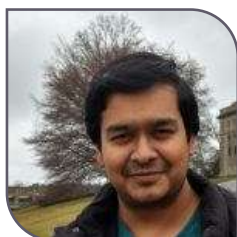
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Adjunct Professor



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Munirathnam N R
Ex-Director General, Centre for Materials for Electronics Technology (C-MET)
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<https://scholar.google.co.in/citations?user=cBxPmdgAAAAJ&hl=en>

Patents:

Filed:

1. Chandrasekhar Murapaka; Reconfigurable Logic Via Gate Controlled Skyrmion Motion; 202141057701.
2. Mudrika Khandelwal; Pharmaceutical Compositions and Delivery Systems for Prevention and Treatment of Candidiasis; US 17/276,478.
3. Ranjith Ramadurai; Optimum strain gradient for strong electro-mechanical coupling; 202111048321.

Published:

1. Suhash Ranjan Dey; High Entropy Alloy and Quinary Alloy Nanowires; 202043041990.

Books:

1. Reddy S R, Sunkari U, & Bhattacharjee P P. (2021). Recrystallization Behavior of High Entropy Alloys. in Encyclopaedia of Materials: Metals and Alloys. <https://doi.org/10.1016/B978-0-12-819726-4.00122-8>.

Book Chapters:

1. S Goolaup, Chandrasekhar Murapaka, W S Lew, D Emerging non-volatile memory technologies, Springer (2021).

Publications:

1. Anand Kumar M, Lathe A, Palve A M, & Deshpande A S. (2021). Single-phase Gd_{0.2}La_{0.2}Ce_{0.2}Hf_{0.2}Zr_{0.2}O₂ and Gd_{0.2}La_{0.2}Y_{0.2}Hf_{0.2}Zr_{0.2}O₂ nanoparticles as efficient photocatalysts for the reduction of Cr (VI) and degradation of methylene blue dye. Journal of Alloys and Compounds, 850. <https://doi.org/10.1016/j.jallcom.2020.156716>.
2. Damodar D, Mahanta U, & Deshpande A S. (2021). N-doped MWCNTs from catalyst-free, direct pyrolysis of commercial glue. Materials Chemistry and Physics, 262. <https://doi.org/10.1016/j.matchemphys.2021.124319>.
3. Mahanta U, Khandelwal M, & Deshpande A S. (2021). Antimicrobial surfaces: A review of synthetic approaches, applicability, and outlook. Journal of Materials Science, 56(32), 17915-17941. <https://doi.org/10.1007/s10853-021-06404-0>.
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Effect of nitrogen on grain boundary character distribution in 316 stainless steel. Materials Letters, 288. <https://doi.org/10.1016/j.matlet.2021.129387>.

7. Chandrakant Reddy N S & Panigrahi B B. (2021). Electro spark coating of AlCoCrFeNi high entropy alloy on AISI410 stainless steel. Materials Letters, 304. <https://doi.org/10.1016/j.matlet.2021.130580>.
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9. Lee S, Narayana P L, Seok B W, Panigrahi B B, Lim S-G, & Reddy S N. (2021b). Quantitative estimation of corrosion rate in 3C steels under seawater environment. Journal of Materials Research and Technology, 11, 681-686. <https://doi.org/10.1016/j.jmrt.2021.01.039>.
10. Mane R B, Sahoo R, Reddy B K S, Ravula V, Panigrahi B B, Borse P H, & Chakravarty D. (2021). Doping-induced coloration in titania. Journal of the American Ceramic Society, 104(7), 2932-2936. <https://doi.org/10.1111/jace.17790>.
11. Mane R B, Vijay R, Panigrahi B B, & Chakravarty D. (2021). High-temperature decomposition kinetics of Ti₃GeC₂ MAX phase. Materials Letters, 282. <https://doi.org/10.1016/j.matlet.2020.128853>.
12. Murthy S S N, Patel M, Reddy T S, Prasad V V B, & Panigrahi B B. (2021). Processing and characterization of carbon fibre reinforced ZrB₂ ultra-high temperature ceramic matrix composite. Ceramics International, 47(22), 32438-32444. <https://doi.org/10.1016/j.ceramint.2021.08.145>.
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15. Reddy B S, In K H, Panigrahi B B, Paturi U M R, Cho K K, & Reddy N S. (2021). Modeling tensile strength and suture retention of polycaprolactone electrospun nanofibrous scaffolds by artificial neural networks. Materials Today Communications, 26. <https://doi.org/10.1016/j.mtcomm.2021.102115>.
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- Fe₂CoCrMnNi high-entropy alloy powder. *Powder Metallurgy*, 64(1), 64–74. <https://doi.org/10.1080/00325899.2020.1858586>.
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 60. Tushar Jogi and Saswata Bhattacharya; Interfacial dislocation network in precipitation strengthened alloys during creep: a discrete dislocation dynamics (DDD) study in three dimensions, , *Modelling and Simulations in Materials Science and Engineering*, 29(3), 035010, 2021. <https://doi.org/10.1088/1361-651X/abe0a8>.
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Funded Research Projects:

1. Atul Suresh Deshpande; Pressure Less Fabrication of Carbon Foam Using Bituminous Coal for Ablative Applications; 54.36 L. [DRDO/MSME/F083/2020-21/G353].
2. Bharat Bhooshan Panigrahi; Development of Fibers Reinforced Alumina and Zirconia Matrix Composites for High-Temperature Applications; 118.20 L. [DRDO/MSME/F085/2021-22/G379].
3. Bharat Bhooshan Panigrahi; High Entropy Carbide Based Cutting Tool inserts; 73.03 L. [SPR/2021/000494].
4. Deepu J Babu; Separation with Nanoporous Materials by Hindering Lattice Flexibility in Metal-Organic Frameworks; 31.70 L. [SERB/MSME/F251/2021-

22/G428].

5. Mudrika Khandelwal; Bacterial cellulose-based carbon electrodes for batteries; 5.00 L. [G211].
6. Mudrika Khandelwal; Biodegradable food packaging for shelf-life extension; 7.00 L. [S127].
7. Pinaki Prasad Bhattacharjee; investigating the evolution of heterogeneous microstructure in metallic alloys by thermomechanical processing using correlative FIB-SEM and in-situ TEM techniques; 81.14 L. [G-392].
8. Pinaki Prasad Bhattacharjee; Turning Crystalline Amorphous Band Heterogeneous Nanostructure in Extremely Low Stacking Fault Energy High Entropy Alloys for Simultaneous Enhancement of Strength and Ductility; 38.65 L. [SERB/MSME/F034/2021-22/G412].
9. Sai Rama Krishna Malladi; Investigating the Evolution of Heterogeneous Microstructure in Metallic Alloys by Thermomechanical Processing Using Correlative Fib-Sem and in-Situ TEM Techniques; 81.14 L. [DRDO/MSME/F190/2021-22/G392].
10. Saswata Bhattacharya; "Repository of High-performance phase-field solvers for Microstructure Simulation (MicroSim)"; 20.49 L. [DST/NSM/R&D_HPC_Applications/2021/03 (G-361)].
11. Saswata Bhattacharya; Assessment of High-Fidelity Diffusion Coefficients in Ternary and Multicomponent Ni-Ai-X (X=Mo, Ta, Re, W) Alloys and their Effect on Ostwald Ripening; 14.96 L.
12. Subhradeep Chatterjee; National Centre for Clean Coal (a joint consortium of IISc and IITs); 10.41 L. [G-158].
13. Suresh Kumar Garlapati; A General Route towards Low Voltage, High-Current Power Printed Electronics; 33.00 L. [SERB/MSME/F252/2021-22/G426].
6. Rajesh Korla received the Best Poster award in NMD ATM-2021.
7. Sai Rama Krishna Malladi received the "Certificate of Teaching Excellence" for 2021.
8. Saswata Bhattacharya was invited as a speaker for the DSL 2022 conference in Florence, Italy (Talk: development of diffusion mobility databases in multicomponent alloys using a combination of physics-informed neural network-based numerical inverse method and pseudo-binary and pseudo-ternary diffusion couples).
9. Shourya Dutta Gupta and S Govardhan Reddy have been awarded the Best innovative Thesis award (BTech) for the year 2021 by the Indian National Academy of Engineering (INAE) for work carried out in the lab.
10. Shourya Dutta Gupta received a Reviewer appreciation certificate by JALCOM (2021).
11. Suhash Ranjan Dey received an incubation Support for a Start-Up under the NICE (NMDC innovation and incubation Centre) Program; Funding agency: NMDC and i-TIC Foundation (IIT Hyderabad). Founder: Dr Chokkakula L P Pavithra and Co-Founder: Dr Suhash Ranjan Dey (Starting date: April 2021); Sanctioned INR 25 lakhs for two years.
12. Suhash Ranjan Dey and Brijesh Singh Yadav (MS15RESCH11001) received DST-AWSAR Award for Best Popular Science Stories under the PhD Category. He did PhD in the research group of Suhash Ranjan Dey.
13. Suhash Ranjan Dey and Brijesh Singh Yadav (MS15RESCH11001) received Research Excellence Award 2021 under PhD Category. He did PhD in the research group of Suhash Ranjan Dey.
14. Suhash Ranjan Dey and Kukkadapu Madhuri (MS16RESCH11005) received Research Excellence Award 2021 under PhD Category. She is doing her PhD in the research group of Suhash Ranjan Dey.

Awards and Recognitions

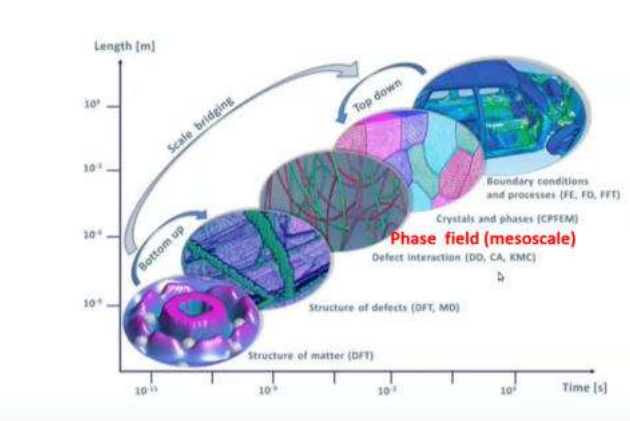
1. Mudrika Khandelwal received the Women Excellence Award 2022.
2. Pinaki Prasad Bhattacharjee received the Science and Technology Award for Research (STAR), awarded by the Science and Engineering Research Board (SERB-STAR), Department of Science and Technology (DST), Government of India, for 2021.
3. Pinaki Prasad Bhattacharjee appeared amongst the top 2% of the scientists in the area of Materials Science and Engineering prepared by Stanford University, USA.
4. Pinaki Prasad Bhattacharjee was awarded the Japan Society for the Promotion of Science (JSPS) invitational fellowship for FY 21-22.
5. Pinaki Prasad Bhattacharjee was Awarded the Japan Society for the Promotion of Science (JSPS)

Research Highlights

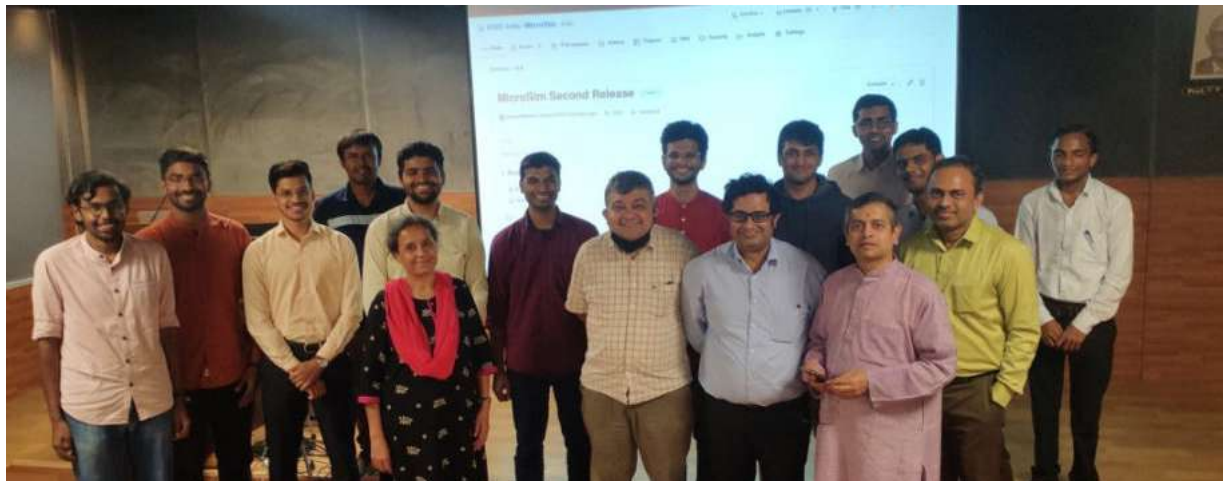
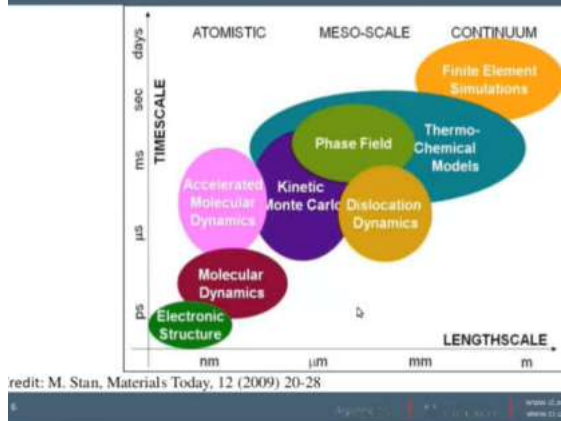
Microsim is a project under the National Supercomputing Mission, Govt of India by Saswata Bhattacharya & Team from reputed Indian Institutes

The project offers a set of Codes that can use high-performance computing to simulate microstructure evolution using the phase-field technique. Microsim is a software stack that consists of phase-field codes that offer flexibility with discretion, models as well as high-performance computing hardware (CPU/GPU) that they can execute on. Along with this, the stack also consists of Multi-physics solver modules that are based on OpenFoam and AMReX libraries (which will be added soon). The stack has an integrator interface that is built using python allows one to create the input and filling files required for the solvers as well as provides a consolidated framework to choose the solver, compile, execute, and visualize simulation results. The project is developed and maintained by the consortium of researchers from IISc Bangalore, IIT Hyderabad, IIT Bombay, IIT Madras, Savitribai Phule Pune University, and C-DAC Pune. This is the first release of our phase-field software stack consisting of different phase-field models utilizing separate discretization strategies as well as the Cahn-Hilliard descriptions. The discretizations include FDM, FVM, and FFT.

Materials Modeling/ICME



Material Science, Methods and Scales



MicroSim Second Release

“ All things are difficult before they are easy. - Thomas Fuller ”

Department of Mathematics

The Department of Mathematics, founded along with the Institute in 2008, aspires to evolve into an internationally acclaimed center for theoretical, interdisciplinary, and applicable mathematical research, supporting and complementing the expertise extant in and around Hyderabad. As one of the basic science departments, the department remains the fulcrum of teaching that offers a large share of the science credits for the entire community of students at IIT Hyderabad.

Our masters' students have done well in competitive exams, with many of them landing doctoral positions in various IITs and other national institutes of excellence - proof enough that the department was able to mitigate the effect of the pandemic through its innovative modes of instruction and discussion. The challenge thrown by the pandemic did not deter the department, which was quick to make up for the lost time and has kept up its research output both in terms of quantum and quality, as is visible from the impressive list of journals that have featured our submissions and the post-doctoral positions obtained by our recent graduates."

The department is proud to see the passing out of its students from the BTech (Mathematics and Computing) program with a 100% placement record, with student remunerations far exceeding the institute's average. We congratulate each of these pioneers who had placed their faith in us and have done us proud.

For more information, please visit: <https://math.iith.ac.in/>

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Publications:

1. Ravindra G V & Tripathi A (2021). Grothendieck-Lefschetz and Noether-Lefschetz for bundles. Proceedings of the American Mathematical Society, 149(12), 5025-5034. <https://doi.org/10.1090/proc/15519>.
2. Chen H, Majumdar A, Wang L, Kar S, Brown K M, Feng H, Turman, C Dennis J, Easton D, Michailidou K, Simard J, Bishop T, Cheng I C, Huyghe J R, Schmit S L, O'Mara T A, Spurdle A B, Gharahkhani P, Schumacher J, ... Lindström S (2021). Large-scale cross-cancer fine-mapping of the 5p15.33 region reveals multiple independent signals. Human Genetics and Genomics Advances, 2(3). <https://doi.org/10.1016/j.xhgg.2021.100041>.
3. Feng H, Mancuso N, Gusev A, Majumdar A, Major M, Pasaniuc B, & Kraft P (2021). Leveraging expression from multiple tissues using sparse canonical correlation analysis and aggregate tests improves the power of transcriptome-wide association studies. PLoS Genetics, 17(4). <https://doi.org/10.1371/journal.pgen.1008973>.
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5. Majumdar A, Patel P, Pasaniuc B, & Ophoff R A (2021). A summary-statistics-based approach examines the role of serotonin transporter promoter tandem repeat polymorphism in psychiatric phenotypes. European Journal of Human Genetics. <https://doi.org/10.1038/s41431-021-00996-6>.
6. Balasubramaniam Jayaram; Gupta V K, & Jayaram B (2021). Importation lattices. Fuzzy Sets and Systems, 405, 1-17. <https://doi.org/10.1016/j.fss.2020.04.003>.
7. Gupta V K, & Jayaram B (2021). Order based on associative operations. Information Sciences, 566, 326-346. <https://doi.org/10.1016/j.ins.2021.02.020>.
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9. Prosanjit Das, Sarifuddin, Jyotirmoy Rana and Prashanta Kumar Mandal (2021): Solute dispersion in transient Casson fluid flow through a stenotic tube with an exchange between phases, Physics of Fluids 103, 023206, AIP Publishing. <https://doi.org/10.1063/5.0052770>.
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11. Banerjee P, & Bera R (2021). Corrigendum to "On a generalization of a conjecture of Grosswald" [J Number Theory 216 (2020) 216-241]. Journal of Number Theory, 222, 426-428. <https://doi.org/10.1016/j.jnt.2020.11.002>.
12. Bala N, & Ramesh G (2021a). A Bishop-Phelps-Bollobás type property for minimum attaining operators. Operators and Matrices, 15(2), 497-513. <https://doi.org/10.7153/oam-2021-15-35>.
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14. Kulkarni, S H, & Ramesh, G (2021). There is absolutely minimum attaining closed operators. Journal of Analysis, 29(2), 473-492. <https://doi.org/10.1007/s41478-019-00189-x>.
15. Ramesh, G, & Osaka, H (2021). On a subclass of norm attaining operators. Acta Scientiarum Mathematicarum, 87(1-2), 247-263. <https://doi.org/10.14232/actasm-020-426-9>.
16. Ramesh G, Sudip Ranjan B, & Venku Naidu, D (2021). Cartesian decomposition of C-normal operators. Linear and Multilinear Algebra. <https://doi.org/10.1080/03081087.2021.1967847>.
17. Naqvi S, Chan P S, & Mishra D B (2021). System signatures: A review and bibliometric analysis. Communications in Statistics - Theory and Methods. <https://doi.org/10.1080/03610926.2021.1937653>.
18. Naqvi S, Ding W, & Zhao P (2021). Stochastic comparison of parallel systems with Pareto components. Probability in the Engineering and Informational Sciences. <https://doi.org/10.1017/S0269964821000176>.
19. Naqvi S, Misra N, & Chan P S (2021a). Applications of TP2 Functions in Theory of Stochastic Orders: A Review of some Useful Results. Journal of the Iranian Statistical Society, 20(1), 269-287. <https://doi.org/10.52547/jirss.20.1.269>.
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21. Sasmal P, Jampana P, & Sastry C S (2021). Construction of Binary Matrices as a Union of Orthogonal Blocks via Generalized Euler Squares. IEEE Signal Processing Letters, 28, 882-886. <https://doi.org/10.1109/LSP.2021.3072572>.
22. Sasmal P, Theeda P, Jampana P, & Sastry C S (2021). Nullspace Property for Optimality of Minimum Frame Angle Under Invertible Linear Operators. IEEE Signal Processing Letters, 28, 1928-1932. <https://doi.org/10.1109/LSP.2021.3112105>.
23. Sebastian G, & Daniel S (2021). A weaker Gleason-Kahane-Zelazko theorem for modules and applications to Hardy spaces. Colloquium

Sukumar D (2021). Some comparative results on eigenvalues, pseudospectra, and conditionspectra. *The Journal of Analysis*, 29(2), 607-617. <https://doi.org/10.1007/s41478-019-00201-4>.

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25. Narasimha Kumar Ch, On Mod p congruences for Drinfeld Modular forms of level pm (joint with Tarun Dalal), *Journal of Number Theory* 228 (2021), no. 11, 253-275. <https://doi.org/10.1016/j.jnt.2021.04.020>.
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Funded Research Projects

1. Lakshmi Narayana P A; The effect of heat source on non-Newtonian fluid flow through a horizontal porous bed; 3.25 L. [SERB/MA/F071/2018-19/PDF31].
2. Mrinmoy Datta; Bounds on The Number of Rational Points on Varieties Over Finite Fields and Applications to Linear Error-Correcting Codes; 14.53 L. [SERB/MA/F247/2021-22/G410].
3. Neeraj Kumar; Koszul Algebras and Diagonal Subalgebras; 2.20 L. [G316].
4. Pradipto Banerjee; Investigations into Algebraic Properties of Integer Polynomials; 6.60 L. [SERB/MA/F147/2021-22/G443].
5. Ramesh G; on Invariant Subspaces of a Subclass of Norm Attaining Operators; 2.20 L. [MTR/2019/001307].
6. Subrahmanya Sastry Challa; Sparse Approximations with prior Support Constraint and Application to Interior Tomography; 15.16 L. [CSIR/MA/F022/2020-21/G404].
7. Venkata Ganapathi Narasimha Kumar Ch; Sign changes for the product of Fourier coefficients of Hilbert modular cusp forms; 2.00 L. [MTR/2018/000137].

Awards and Recognitions:

1. Sayantee Jana received Fields Research Fellowship from Fields Research Institute in Mathematical Sciences to conduct research at the University of Toronto.



Intelligence is the ability to adapt to change. - Stephen Hawki



Department of Mechanical and Aerospace Engineering

New Faculty Dr Prakar Gupta, Dr Vishu Unni, Dr Anurup Datta, Dr Prabhat Kumar, and Dr Sachidananda Behera joined the Department this year, bringing the total faculty strength to 32. We have started a new BTech program on Computational Mechanics spearheaded by Dr Niranjan Ghaisas. Dr K Badarinath, Dr V C Prakash, and Dr Venkata Subbiah were inducted into the reputed International Journal editorial board. Department Faculty colleagues received several projects from DST, Honeywell, DRDO, and other funding agencies. The work of Srinath Gudur and Shivam Shukla titled "Controlling waviness in additive manufacturing of thin walls by laser directed energy deposition process" has been selected for the best paper award at the AIMTDR Conference. This work is carried out with the guidance of Dr Gopinath and Dr Suryakumar. Ms Smita Santram Sontakke, Arkajyoti Jha, and Vinod V have been awarded the Prime Minister's Research Fellowship (PMRF).

A research article published by our PhD student Junaid Shaik got featured on the ASME website. A paper titled "Numerical investigation of aerospike semi-cone angle and a small bump on the spike stem in reducing the aerodynamic drag and heating of spiked blunt-body: New correlations for drag and surface temperature" by Mr Veeresh Tekure under the supervision of Dr Venkata Subbiah has appeared in Physics of Fluids and selected as an editor's pick article. Dr Ranabir Dey's research on how self-propelling droplet microswimmers adapt to increasing viscosity in their surrounding by exhibiting a non-intuitive bimodal motility has appeared in Physical Review X. A paper titled "Experimental investigation of a nonspherical water droplet falling in air" by MAE PhD student.

Ms Meenu Agrawal, under the supervision of Dr Badarinath Karri, has been selected as an editor's pick article. IITH has signed a memorandum of understanding (MoU) with the ISRO Inertial System Unit (IISU) on January 13, 2022. As a part of this MoU, collaborative research will be done in the area of gyroscopes. Dr Chandrika Prakash Vyasarayani from the MAE department is involved in this work.

For more information, please visit: <https://mae.iith.ac.in/>



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Patents:

Published:

1. Raja Banerjee; A System and Process for Segregation of Low Ash Clean Coal from Coal Tailings; 202031005007.
2. Suryakumar S; Reusable Respiratory Mask with Disposable Filter Element; 202041023866.

Book Chapters:

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8. Niranjana Shrinivas Chaisas; Petascale simulations of large wind farms sited on complex heterogeneous terrain; 22.98 L. [G359].
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11. Ramji M; LCF and HCF test of bolt material; 5.90 L. [S125].
12. Ramji M; Specimen fabrication; 0.18 L. [S126].
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16. Safvan Palathingal; Analysis and Design of three Dimensional Connected Bistable Arches; 31.71 L. [SERB/MAE/F250/2021-22/G419].

Funded Research Projects:

- Amrita Datta; Missing Women in India's Workforce; 8.00 L.
- Ashok Kumar Pandey; Design and Analysis of High Accuracy Membranes Accelerometers and Gyroscope for closed Loop Sensing; 114.44 L. [DRDO/MAE/F044/2021-22/G377].
- Chandrika Prakash Vyasarayani; Nonlinear Dynamics and Control for Coriolis Vibratory Gyroscope (CVG); 19.70 L. [ISRO/MAE/F090/2021-22/S207].
- Harish Nagaraj Dixit; On the Role of Inertia and Surfactants in Moving Contact Line Flows; 54.03 L. [SERB/MAE/F123/2021-22/G446].
- Karri Badarinath; Study of Cavitation Bubble Induced Vortex Rings and Bubble Behaviour between Curved Boundaries; 29.18 L. [SERB/MAE/F129/2021-22/G421].
- Lakshmana Dora Chandrala; Role of Surfactants in Break-Up and Dispersion of Underwater Oil Jets: Application of Oil-Well Blowouts; 33.15 L. [SERB/MAE/F248/2021-22/G432].
- Muvvala Gopinath; Laser Cladding of Functionally Graded Ceramic Coating for High Temperature and Wear Applications: Assessment of Mechanical Properties and their Correlation with Molten Pool thermal History and its improvement Laser Shock Peening; 105.07 L. [DRDO/MAE/F220/2020-21/G351].
- Safvan Palathingal; Analysis and Design of three Dimensional Connected Bistable Arches; 31.71 L. [SERB/MAE/F250/2021-22/G419].
- Safvan Palathingal; Nonlinear mechanics of slender arches and shells with applications to compact piezo-actuated pump and quasi-zero-stiffness isolators; 14.07 L. [S144].
- Saravanan Balusamy; Development and Determination of Operability Margins of a 3D Printed Hydrogen Burner System; 73.29 L. [DST/MAE/F151/2021-22/G438].
- Sayak Banerjee; DST Bioenergy and H2 ICMAP; 235.00 L. [DST/MAE/F219/2021-22/G450].
- Surya Kumar S; Machine Learning Approach for Decision Making In Metal Additive Manufacturing Components (USD 20000); 15.00 L. [Boeing/MAE/F056/2021-22/S192].
- Venkatesham Balide; R&D Innovation Project TI Prediction; 22.66 L. [BOMBARDIER/MAE/F057/2021-22/S165].
- Venkatesham Balide; Quieter Solutions for Smoke detector; 2.00 L. [HONEYWELL/MAE/F057/2021-22/S195].
- Viswanath Chinthapenta; Direct Metal Laser Sintering of C103 Refractory Alloy; 72.80 L. [DRDO/MAE/F117/2020-21/G352].

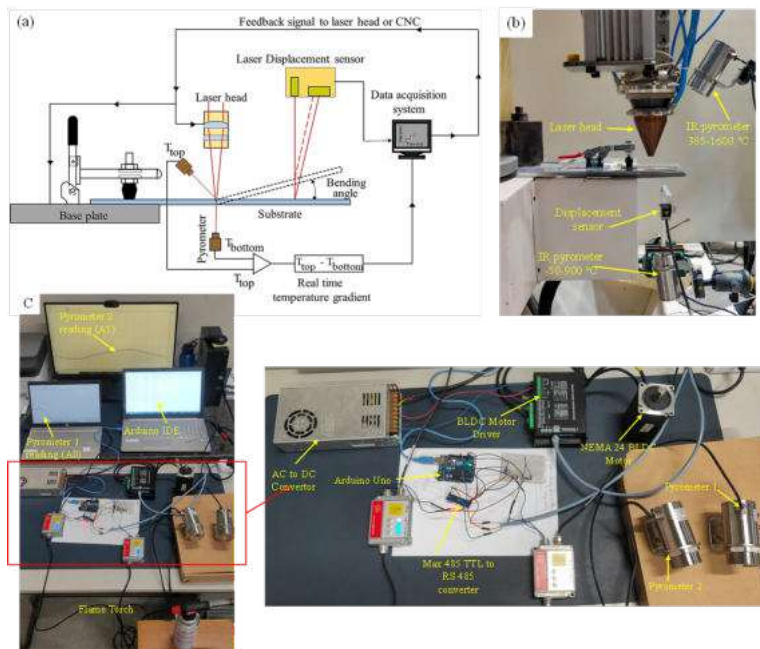
Awards and Recognitions:

1. Muvvala Gopinath won the Best Paper Award in All India Machine Tool Design and Research Conference (AIMTDR 2021) for the Paper Titled Controlling waviness in additive manufacturing of thin walls by laser directed energy deposition process.
2. Niranjan Shrinivas Ghaisas received IITH Teaching Excellence Award (2021-22).
3. Sayak Banerjee received Excellence in Teaching award for 2021-2022 Academic Year at IITH.
4. Venkatesham Balide Recognized as the best reviewer for the year 2020 of Noise Control Engineering Journal.
5. Vishnu Rajasekharan Unni won the Best Paper Award, ASME Turbo Expo, "Predicting the Amplitude of thermoacoustic Instability Using Universal Scaling Behaviour": Induja Pavithran, Vishnu R Unni, Abhishek Saha, Alan J Varghese, R I Sujith, Norbert Marwan, Jürgen Kurths.
6. Vishnu Rajasekharan Unni is the Founding member of the start-up, VYOM, which was selected for the European Union's Copernicus Accelerator Program 2021.

Research Highlights:

1. **Development of real-time monitoring and control system for Laser Forming using non-contact type displacement sensor and pyrometers by Venkata Reddy**

Laser forming is a non-contact type process used for bending, spatial forming, and alignment of metallic components through controlled application of laser energy. It has promising applications in rapid prototyping and shape corrections in aerospace, marine and automotive sectors. The process involves localized rapid heating inducing thermal strains exceeding the elastic strain of the material resulting in plastic compressive strains. During the cooling phase, the material undergoes shrinkage leading to bending of the irradiated zone. Laser forming process involves complex interactions of a large number of process parameters related to laser and thermophysical properties of the material being irradiated. Above this, the process becomes much more complex in multi-pass bending due to the strain hardening effect. This makes achieving the desired angle difficult. Therefore, the current research is focused on investigating the bending mechanism and developing a real-time monitoring and control system which continuously monitors the temperature gradients using two pyrometers one at the top and the other at bottom while a displacement sensor monitors the bending angle (Fig. 1(a) and (b)). The displacement data was utilized for understanding the bending mechanism in multi-scan laser forming in which counter bending and bending phenomena can be seen in the heating and cooling cycle. Also, the variation in the temperature gradient can be observed from the pyrometer reading and it is utilized in determining the mode of bending mechanics. The output of these monitoring devices continuously updates the empirical model for the strain hardening coefficient and also sends input to the motors deciding the scan speed to obtain a desired bending angle (Fig. 1(c)).



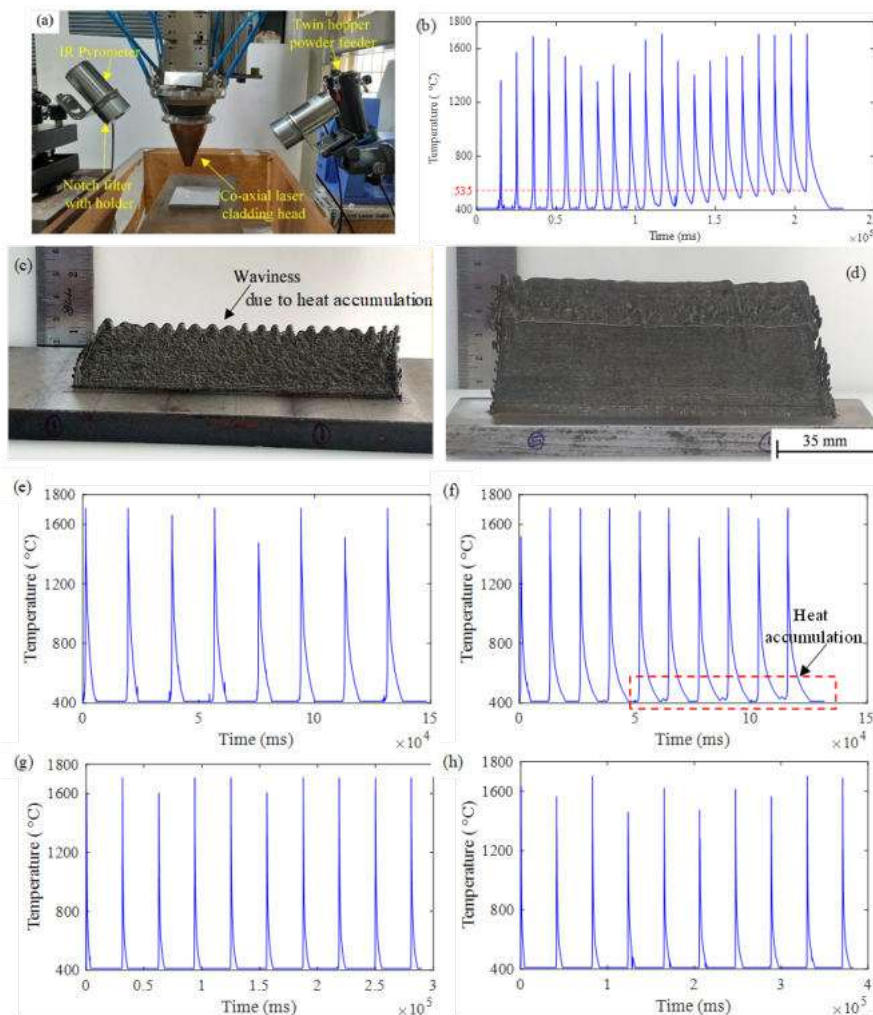
Schematic representing the working of real-time monitoring and control system and (b). experimental setup (c). Real-time monitoring and control system

2. Real-time monitoring of molten pool thermal history and controlling waviness in additive manufacturing of thin walls using laser directed energy deposition technique by Muvvala Gopinath

Laser-directed energy deposition (L-DED) is a metal-based additive manufacturing technique which is becoming a prominent approach for the freeform production of thin-wall and large-scale structures. However, its diffusion into the industry is still limited due to the challenges in controlling the geometry. Though L-DED is well established for 2D surface coatings, in the case of depositing 3D components, the process encounters a large range and variety of problems. This includes a dynamic molten pool whose shape and size vary with layer number due to heat accumulation. This becomes more prominent when depositing thin walls. In the case of a multi-layer thin wall deposition process, the initial few layers close to the substrate cool or solidify fast by dissipating the heat to substrate, maintaining the molten pool stability. However, with an increase in layer number, the distance between the molten pool or processing zone and the substrate increases, decreasing the heat dissipation capacity through conduction. Further, due to the thin nature of the wall i.e., single layer depositions, the lateral conduction will also be insignificant. This leads to an increase in molten pool lifetime, leading to the spreading of molten pool losing the dimensional accuracy.

Further, the catchment efficiency under optimized conditions for thin walls is typical of the order of ~50%. Therefore, this leaves a chance for an increase in catchment efficiency with any additional energy or heat being provided. Also, the laser absorptivity in metals increases with an increase in substrate temperature. Thus, the heat accumulation results in the availability of additional energy as well as an increase in laser absorptivity. This results in variation in molten pool size with layer number causing geometrical inaccuracy or waviness.

Therefore, it can be observed that maintaining the geometrical integrity in the case of multi-layered thin walls is a challenging task involving a large number of process parameters and processing conditions. Therefore, a deep understanding of the spatiotemporal variations of the molten pool thermal history throughout the build, individual tracks, and layers is critical to the control of undesired deposition profiles in the L-DED process. Therefore, in the present study, monitoring of molten pool thermal history using non-contact type IR pyrometer was carried out and its variation in real-time with layer number is investigated. Based on this energy input was systematically varied with layer number to overcome the issue of heat accumulation.

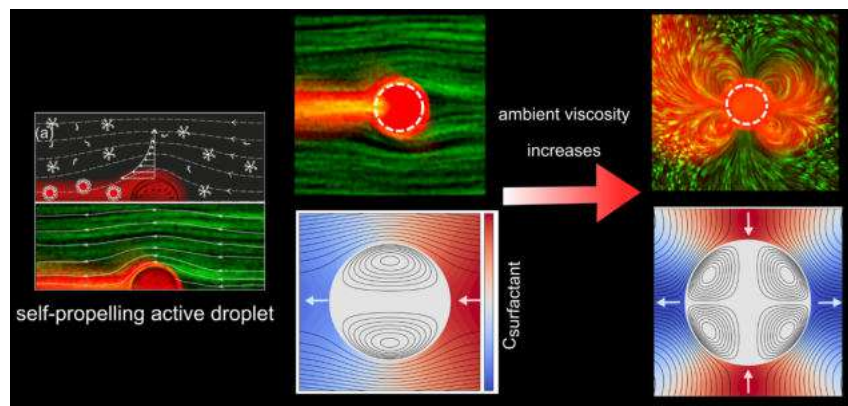


Experimental results depicting the formation of waviness due to heat accumulation and its control through monitoring the thermal cycles, mitigating the waviness

Further, the study also investigates and reports the possibility of mitigating the existing/generated waviness through judicious selection of relative position between the powder focusing point and the peak and valley position of the undulating surface. Fig. 2 shows the results related to this study. From Fig. 2(b), it can be observed that as the layer number increases, temperatures of the substrate or previously deposited layer increases resulting in an unstable molten pool leading to waviness as depicted in Fig. 2(c). Therefore, based on the molten pool thermal history shown in Fig. 2 (f) - (h), the input energy was changed systematically by increasing the laser velocity controlling the heat accumulation. Fig. 2(d) shows the wall built with 212 layers using this approach where the waviness is effectively controlled.

3. Emergence of bimodal motility in active droplets by Ranabir Dey

Self-propelling artificial microswimmers (active droplets) surprisingly adapt to increasing viscosity of the surrounding medium by exhibiting increasingly chaotic motion even in the non-inertial regime (Stokes regime). Such non-intuitive behaviour stems from the underlying coupling between the hydrodynamic and solute (surfactant) transport aspects of the active droplet system. With increasing viscosity, higher hydrodynamic modes become excitable. The droplet then recurrently switches between the two dominant modes due to interactions with the self-generated chemical (filled micelle) gradients associated with the higher of the two modes. This mode switching results in the emergence of multimodal motility, which has never been explored before. Such bimodal motility promotes self-avoiding walks mimicking examples of efficient spatial exploration strategies observed in nature. (B V Hokmabad, R Dey, M Jalaal, D. Mohanty, M Almkambetova, K A Baldwin, D. Lohse, C C Maass, "Emergence of bimodal motility in active droplets", Physical Review X, 11 (1), 011043, 2021.)



Emergence of bimodal motility in active droplets

4. Development of Quieter Bearings for Electrical Vehicles by B Venkatesham

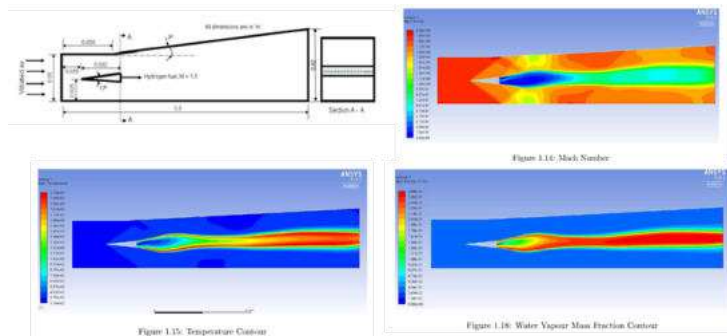
To meet the power requirements and perform similarly to IC engines, electric vehicles require high-speed motors. However, increasing the angular velocity of the shaft introduces new challenges such as increased vibrations, noise, skidding, overheating of supporting bearings, and so on. And since 40% to 70% of motor failures are related to bearings, it's no surprise that high-quality bearings are key for reliable motors. Electric vehicles use deep groove ball bearings in general, as they allow high operating speeds, accommodate radial and axial loads (up to a certain extent), and require a minimum amount of maintenance. A high-speed bearing test rig to measure the vibration and noise characteristics of deep groove ball bearings has been developed. This research is funded by DHI, Government of India, New Delhi, and NEI, Jaipur.



Test rig for high speed bearing noise measurement

5. Simulation of Hypersonic Combustion in Scramjet Configuration by Sayak Banerjee and Raja Banerjee

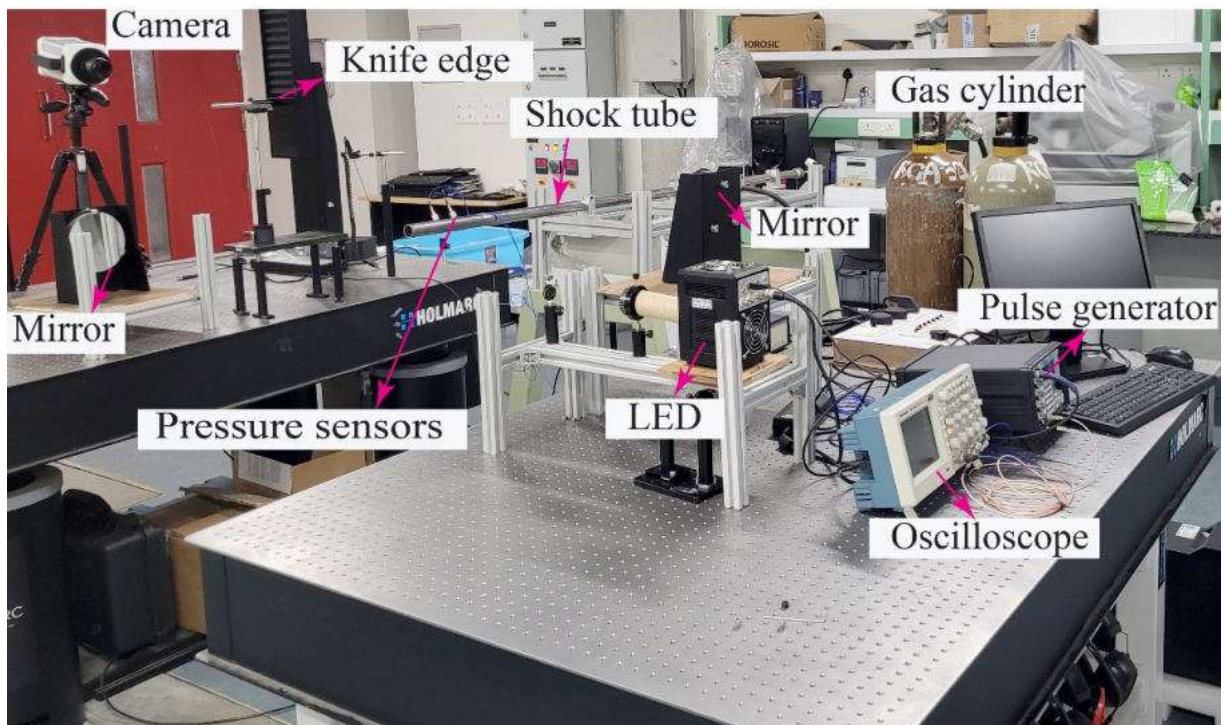
Hypersonic air-breathing propulsion systems like the scramjet are at the cutting edge of modern aviation and defence-related technologies. One of the major challenges in scramjet propulsion is to trigger and sustain air-fuel combustion at such high flow velocities where typical residence times can be in the order of a millisecond or less. In such conditions, the utilization of struts to induce shocks and recirculations inside the engine becomes vital in order to increase the residence time to the point where ignition and flame stabilization can be achieved. Hydrogen has often been used as the fuel of choice in such applications due to its high diffusivities and short ignition times. However, hydrogen has storage and safety problems, and more recently, heavier hydrocarbons like ethylene or kerosene are being investigated as potential replacement. The current study aims to first validate the onset and sustainability of combustion in a scramjet engine with hydrogen injection struts and then seeks to explore the ability of such geometries to sustain hydrocarbon based combustion. The initial validation studies conducted over the past 1 year with hydrogen in RANS based solvers in ANSYS-FLUENT have proved promising. These results are shown below. Future work will seek to replicate the combustion simulations for heavier hydrocarbon based fuels and investigate optimized strut configurations that can achieve efficient combustion in these regimes.



(a) Mach Number, 5(b) temperature contour, 5(c) Water Vapour Fraction Contour

6. Transient supersonic jets by Lakshmana Dora Chandrala

A transient under-expanded supersonic jet is generated when gases at a higher pressure are discharged into lower pressure gases through an opening, such as a nozzle or orifice. These jets are used in many flow configurations, from gun muzzles to diesel exhaust mufflers to non-lethal weapons. We established an open-ended shock tube facility to simulate these jets in the laboratory. State-of-the-art facilities like high-speed schlieren are developed in-house to visualize the flow.



Shock-tube facility

Department of Physics

The Department of Physics at IITH continues to stride forward in its path of excellence in research and teaching by performing cutting-edge research, implementing novel instructional methodologies, and designing new programs/courses joining hands with other departments and our partners in the industry. The department has excellent faculties in five major research areas (condensed matter physics experiment, condensed matter theory, high energy physics, astrophysics, and optics). Apart from the core teaching of the department, four of our faculties are involved in MTech (ISS) and one in MTech (EST). At present, the department has a total of 23 faculty members and 249 students (PhD, MSc, and BTech Engineering Physics). FY 21 - 22 has been a fruitful year in terms of research and student achievements. Faculties of our department have published nearly 125 international journal articles and delivered numerous talks at various conferences/workshops. Department established major facilities like XRD, VSM (FIST supported), MOKE, AFM, SQUID, Femtosecond Laser, etc., for in-house research and support for external users.

Our faculties have built a departmental HPC facility with 384 computing cores and are also planning to expand it further. Several members of our faculty were elected to prestigious scientific professional societies and science academies - one elected as an executive council member of "The Society of Materials Chemistry" and inducted as members of the Indian National Young Academy of Science (INYAS) and an associate fellow of Telangana Academy of Sciences. Several members of the faculty were also inducted into the editorial boards of prestigious international journals such as the Editorial Board of Electronic structure (Institute of Physics) and the Indian Journal of Physics and elevated to high ranks in technical professional organizations such as the IEEE. In addition, two of our faculties are also involved in the Belle and Belle II experiment. Our faculties continue to establish various National and International collaborations and are actively involved in joint programs, such as GIAN, SPARC, and international bilateral research programs.

Students of the department continue getting placed at various eminent National and International Universities/ Research Laboratories for pursuing their higher studies. Our students obtained various international-level fellowships such as the Newton Bhabha fellowship, NIMS-ICGP fellowship, etc. Physics faculties are actively involved in obtaining sponsored projects from DST, SERB, DRDO, Sree padmavathi Venkateswara foundation, IISc Bangalore, and many other funding agencies during FY 21 - 22, which is worth 550 Lakhs. The Department welcomes two new members of the faculty, Dr Satish Laxman Shinde and Dr Mahesh Peddigari. Dr Shinde's research interests are in nanophotonics, interface nanoscale physics, and materials for energy conversion. Dr Peddigari's research focuses on the development of relaxor ferroelectrics and vibration-based energy harvesters.

For more information, please visit: <https://physics.iith.ac.in/>

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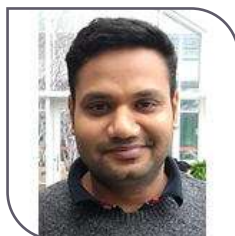


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Patents:

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Funded Research Projects:

1. Arabinda Haldar; Development of Self-Biased Magnetic Materials for Low-Loss Bias-Field-Free Passive Microwave Devices; 51.19 L. [ARDB(DRDO)/PHY/F182/2021-22/G397]
2. Arabinda Haldar; Control of Magnetic Microwave Properties Using External Electric Current; 24.01 L. [BRNS/PHY/F182/2021-22/G387]
3. Kiritkumar Makwana; Resolving Ion-To-Electron Scale Physics in Kinetic Alfvén Wave Turbulence; 10.00 L. [IISc/PHY/F246/2021-22/G374]

4. Kiritkumar Makwana; Kinetic Scale Current Sheets and Wave interactions in Space Plasma Turbulence; 16.64 L. [SERB/PHY/F246/2021-22/G425]
5. Narendra Sahu; Towards a Unified theory of Dark Matter, Neutrino Mass and Matter Antimatter Asymmetry of the Universe; 19.43 L. [DAE-BRNS/PHY/F080/2021-22/G403]
6. Prem Pal; Development of Processes for SOI Wafer Dissolution and Glass Wafer through Holes towards the Realization of MEMS inertial Sensors; 45.95 L. [DRDO/PHY/F037/2021-22/G380]
7. Priyotosh Bandyopadhyay; Physics at the Large Hadron Collider; 12.00 L. [CRG/2018/004971]
8. Priyotosh Bandyopadhyay; Understanding Higher Gauge Symmetries at the LHC; 2.20 L. [MTR/2020/000668]
9. Shantanu Desai; Explorations in Astrophysics Data mining, Astrostatistics, and Astroinformatics; 19.65 L. [G-207]
10. Vandana Sharma; 3D Imaging based Vein intrusion Guide System for Pediatric and Geriatric Healthcare; 237.00 L. [S156]
9. Nithyanandan Kanagaraj has been selected as the Member of 'Bureau of Indian Standards (BIS) in the Optics and Photonics Division.
10. Nithyanandan Kanagaraj has been selected as the Visiting Research Fellow at the Optoelectronic Research Centre University of Southampton, UK.
11. Nithyanandan Kanagaraj has been selected as the Editor of the Optical Society of India - Newsletter.
12. Nithyanandan Kanagaraj has been selected as the Chair of the OSA Technical Group - Laser Science in Manufacturing.
13. Priyotosh Bandyopadhyay and Shilpa Jangid (ph19resch02006) got research excellence award 2021 from IITH.
14. Raavi Sai Santosh Kumar received incubic Milton Chang Grant at Optical Society's (OSA) Annual Meeting- Frontiers of Optics (FIO)- 2021.
15. Raavi Sai Santosh Kumar received Jean Bennett Grant at Optical Society's (OSA) Annual Meeting- Frontiers of Optics (FIO)- 2021.
16. Raavi Sai Santosh Kumar has been selected as the Member of the Indian National Young Academy of Science (INAYAS) (2022-2026).

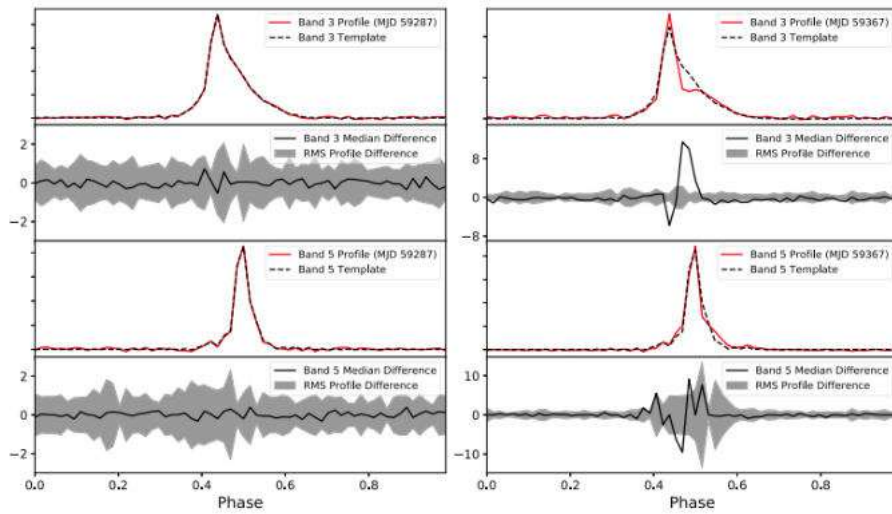
Awards and Recognitions:

1. Arabinda Haldar Received the prestigious Young Scientist Research Award (YSRA), BRNS, 2021.
2. Arabinda Haldar has been selected as the Senior Member of IEEE this year.
3. Kanchana V has been Elected as a Fellow of the prestigious institute of Physics.
4. Kanchana V received the "MRSI Medal" for the year 2021.
5. Kanchana V has been Elected as a "Fellow of Academy of Sciences, Chennai - 2021.
6. Kanchana V has been Elected as the Editorial Board Member of the Journal "Electronic structure Theory (IOP) - 2021.
7. Narendra Sahu has been selected as Guest Editor for Frontier in Physics journal (I.F. = 3.560) since January 2021.
8. Nithyanandan Kanagaraj was Designated as 2021 class of OSA Senior Member.
17. Raavi Sai Santosh Kumar has been selected as the Review Editor for Frontiers in Materials - Energy Materials section.
18. Saket Asthana has been selected as the Fellow of the Royal Society of Chemistry.
19. Shantanu Desai has been elected to Editorial board of Indian Journal of Physics (2021).
20. Shantanu Desai has been listed among the top 2% Scientists in the world according to survey conducted by Stanford University.
21. Suryanarayana Jammalamadaka has been selected as the Associate Fellow of the Telangana Academy of Sciences.
22. Suryanarayana Jammalamadaka has been selected as the IEEE Senior member.
23. Vandana Sharma has been selected as the Review Editor for Frontiers in Physics: Atomic and Molecular Physics.

Research Highlights

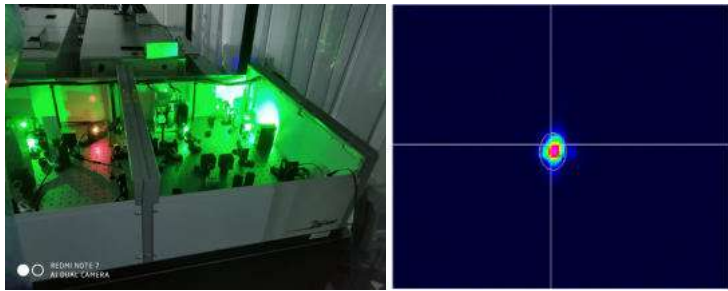
1. **Shantanu Desai and BTech EP student Divyansh Kharbanda** are part of the InPTA collaboration, which detected frequency-dependent profile mode changes in the millisecond pulsar (PSR1713+0737) around May 2021, using observations with the upgraded Giant Meter Wave Radio Telescope. This pulsar was previously considered a very stable millisecond pulsar and one of the best-timed pulsars. These mode changes also led to a discontinuity in the timing residuals of around 50 microseconds.

This pulsar is one of the flagship objects used to search for nanoHz gravitational waves using pulsar timing arrays (PTAs), and the detection of this mode change has profound implications related to the precision achievable for PTA experiments, which rely on the high stability of millisecond pulsars. Further work is ongoing to determine if (and when) this pulsar has recovered to its pre-mode change state.



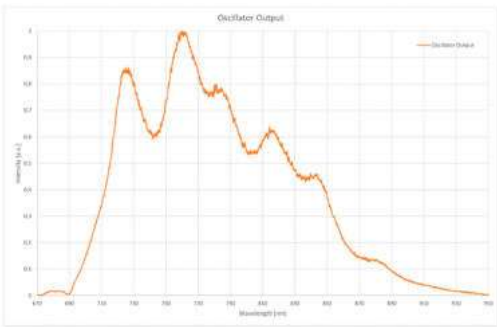
Comparison of profiles for PSR1713+0737 before the mode change (left panel) and after the mode change (right panel) in Band 3 (300-500 Mhz) and Band 5 (1260-1460 MHz)"

Studying the new physics effects due to Z' bosons in B(Bs) semileptonic decays, various observables which can be tested in Falour experiments were also explored. (M Mohapatra, A Giri PRD 104, 095012, 2021).

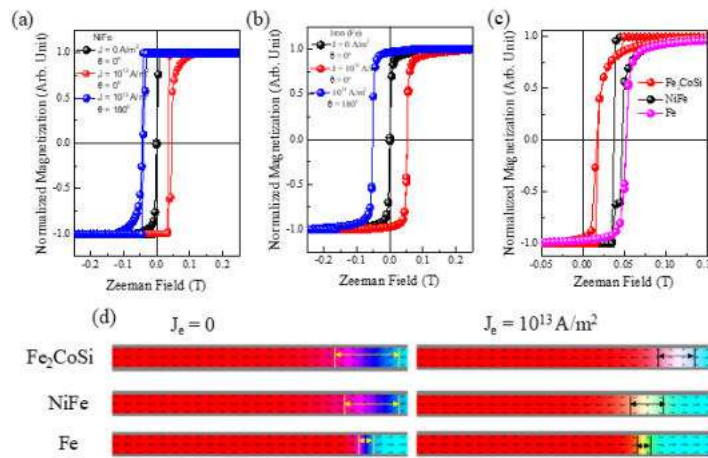


Terawatt Femtosecond Laser @IITH

The interaction of intense laser pulses with matter is opening up new frontiers in physics via the production of extreme pressures, temperatures, intense electric and magnetic fields. This is leading to the use of high-power laser radiation for exploring the properties of hot dense matter, the production of high-energy particles and radiation and the development of schemes for “table top ion acceleration”. These advances are driven by rapid developments in ultrashort pulse laser technology, which have enabled new regimes in laser power and intensity to be reached. The optics group at IITH has installed a state of art laser facility to explore physics at these unprecedented intensities. The group works on various topics like exploring the dynamics of ultrafast transitions in molecules, spectroscopy, solar physics and fibre lasers.

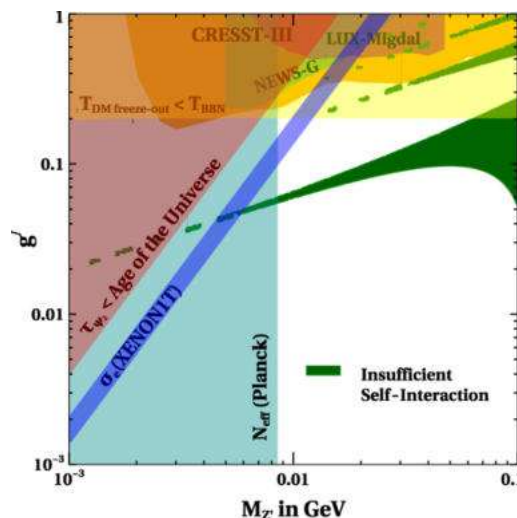


2. **Dr Mayukh Pahari's** group published a research result in the Nature, where using Hubble Space Telescope data being observed for the first time the presence of white dwarf accretion disc winds in the Ultraviolet. Not only that but also could observe them simultaneously with optical wind signatures (and tentatively also X-ray wind signatures). This reveals a multi-phase and/or spatially stratified evaporative outflow from the disc. Also used the photon counting nature of the Hubble Space Telescope to show that this wind is not affected by strong luminosity variations from the source which, up to date, was an unconfirmed prediction from sophisticated simulations. The link to the paper is here.
3. **Priyotosh Bandyopadhyay** with his team in the last one year or so, have mainly explored the vacuum stability of different BSM scenarios and showed that the most popular models fail to have three generations of heavy neutrinos or Leptoquarks if demanded Planck scale perturbativity at two-loop level (JHEP02(2021)075, Eur. Phys.J.C 82 (2022)516). In that context they also explored the gravitational wave signature (2111.03866 [hep-ph]). On the other hand they explored new signatures of heavy neutrinos (Eur.Phys.J.C 82 (2022) 3, 230) and relativistic dark matter (JHEP05(2021)150). Also showed how can the segregation done with the different Leptoquark models at different colliders (Nucl.Phys.B 971 (2021) 115524, Eur.Phys.J.C 81 (2021) 4, 315). The prospect of muon collider for a complex triplet and dark matter without any discrete symmetry is summarized in Phys.Rev.D 103 (2021) 015025.
4. **Suryanarayana Jammalamadaka:** Spin transfer torque Bias (STTB) due to domain wall resistance in an infinitely long ferromagnetic nanowire.



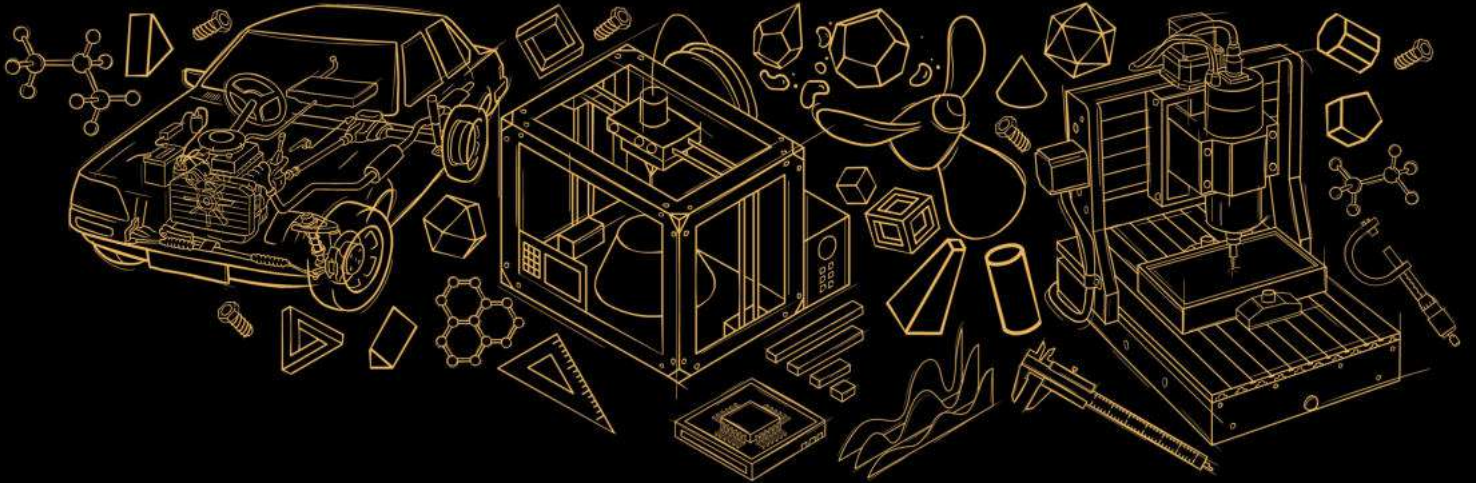
The shifted MH loop of the Ni80Fe20 and Fe with STT (red (0°) and blue (180°)) and without STT (black) respectively. (c) comparison of STTB for the three nanowires (Fe₂CoSi Ni80Fe20 and Fe). It infers that for the same parameters the Fe material gives the maximum STTB. (d) the spin configuration at the transition in the absence and presence of the current. The spin configuration infers that smaller the Néel domain wall width more will be the STTB. (Journal ref. IOP-Nanotechnology. 1361-6528, (2022))

5. **Dr Narendra Sahu's** group published 10 papers in reputed international journals in 2021 – 2022. His group plays a leading role in explaining the g-2 anomaly observed by the E989 experiment at Fermilab [Phys. Rev. D105 (2022), 015029], excess of electronic events observed by XENON1T experiment in the recoil energy range 1 – 7 keV, peaked around 2.4 keV [Phys. Rev.D103 (2021), 095018]], anomalous W-boson mass observed by CDF experiment [Phys. Lett.B831 (2022), 137196]].



Summary plot for inelastic self-interacting DM showing the final parameter space from relevant constraints. The white region represents the allowed parameter space available after imposing all the constraints. The blue patch represents the parameter space allowed by XENON1T for 1 GeV inelastic DM with mass splitting $\Delta m=2 \text{ keV}$ and kinetic mixing parameter $\epsilon=4 \times 10^{-8}$.

VIRTUAL DEPARTMENTS



Department of Climate Change

The Department of Climate Change at IITH integrates academic and practical knowledge by bringing together a diverse array of stakeholders, including scientists, engineers, policy researchers, practitioners, and students in order to develop a holistic understanding of Climate Change. We aspire to be a leading institute in developing real-world solutions to the many complex challenges brought forth by Climate Change. Currently, the department comprises 23 faculty from across various science and engineering departments, as well as departments of Design, Entrepreneurship, and Liberal Arts.

Our innovative interdisciplinary curriculum involves a mix of core and elective courses, an industry lecture and seminar series by leading experts. Students in the Climate Change department come from a variety of (engineering and non-engineering) academic backgrounds and nationalities and are actively involved in both academic and industry oriented national and international projects.

For more information, please visit: <https://cc.iith.ac.in/>

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Publications:

1. Prabhakaran D, Banerjee S; "Development of a Reduced Combustion Kinetic Mechanism for Lemon Peel Waste Oil as a Jet-fuel", 48th FMFP Conference, BITS Pilani, India. (2021).
2. Ambika S, Jagratti Shikar, Gaurav; Sustainability Assessment of Crops in India, Current Research in Environmental Sustainability. (2021). <http://doi.org/10.1016/j.crsust.2021.100074>.
3. Eregowda T, Chatterjee P, Pawar D S; "Impact of lockdown associated with COVID19 on air quality and emissions from transportation sector: case study in selected Indian metropolitan cities" Environment Systems and Decisions 41(3), pp. 401-412. (2021). <https://doi.org/10.1007/s10669-021-09804-4>.
8. Science to Governance, funded by Azim Premji Foundation, India (2016-2019). This is a collaborative project with Kim Fortun, University of California, Irvine, USA.
9. Satish Regonda; Understanding space-time variability of climate extremes for societal resiliency in Indonesia and India, funded by Asia-Pacific Network (APN) for Global Change Research (2019 -2020). This is a collaborative project with Mas Yanto, Jenderal Soedirman University, Purwokerto, Indonesia, and Balaji Rajagopalan, University of Colorado at Boulder, USA.
10. Digivijay S Pawar; Smart Cities Development for Emerging Countries by Multimodal Transport System Based on Sensing, Network and Big Data Analysis of Regional Transportation, funded by the Japan Science and Technology Agency (JST) and the Japan International Cooperation Agency (JICA), (01 April 2017 to 31 March 2022), This is a collaborative project.

Funded Research Projects:

1. Niranjana S Ghaisas; Wind turbine wake interactions with surface roughness heterogeneities: Large Eddy Simulation and analytical modelling studies", [DST-SERB, 2020-2022].
2. Niranjana S Ghaisas and Harish N Dixit; Petascale simulations of large wind farms sited on complex heterogeneous terrain", DST-National Supercomputing Mission, 2021-2023.
3. Kishalay Mitra (PI) & Soumya Jana (co-PI); Robust wind energy conversion system - when deep learning meets sustainable energy utilization, DST - National Supercomputing Mission, 2021 - 2023.
4. Kishalay Mitra (PI), & Raja Banerjee (co-PI); Wind farm layout optimization under uncertainty using wind speed forecasting through probabilistic models and comparison with machine learning algorithms - SPARC, MoE & UKIERI, UK - 2019 - 2021, collaboration with University of Exeter, UK (Richard Everson & Jonathan Fieldsend).
5. Aalok Dinkar Khandekar;; Cool infrastructures: Life with Heat in the off-Grid City (GBP 480,298.00); 485.00 L. [UCUE/LA/F196/2021-22/S168]
6. Aalok Dinkar Khandekar; Assessment of the Actual and Potential Contributions of Smart City Projects to Climate Resilience in Selected AsiaPacific Cities, funded by Asia Pacific Network (APN) for Global Research Change (2019-2020). This is a collaborative project with Ayyoob Sharifi et al, Hiroshima University, Japan.
7. Aalok Dinkar Khandekar; Pathways in Air Pollution Governance in Indian Cities: From Education to

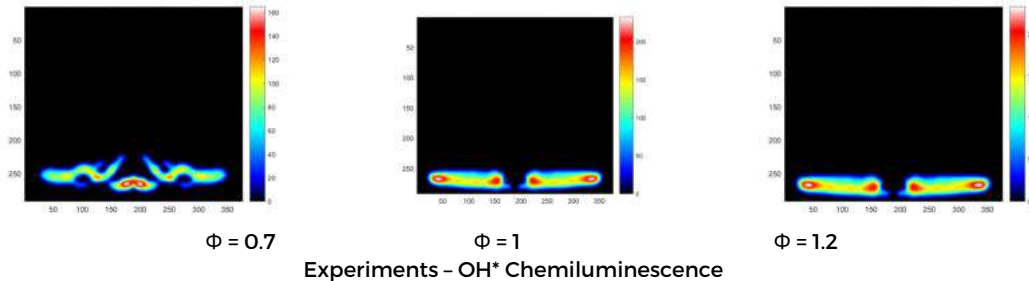
Awards and Recognitions:

1. MTech students, Rohan Singh Rawat, Vishal Narena Mate, and N S V Sarath Chana received academic excellence awards for their brilliant performances in academics.

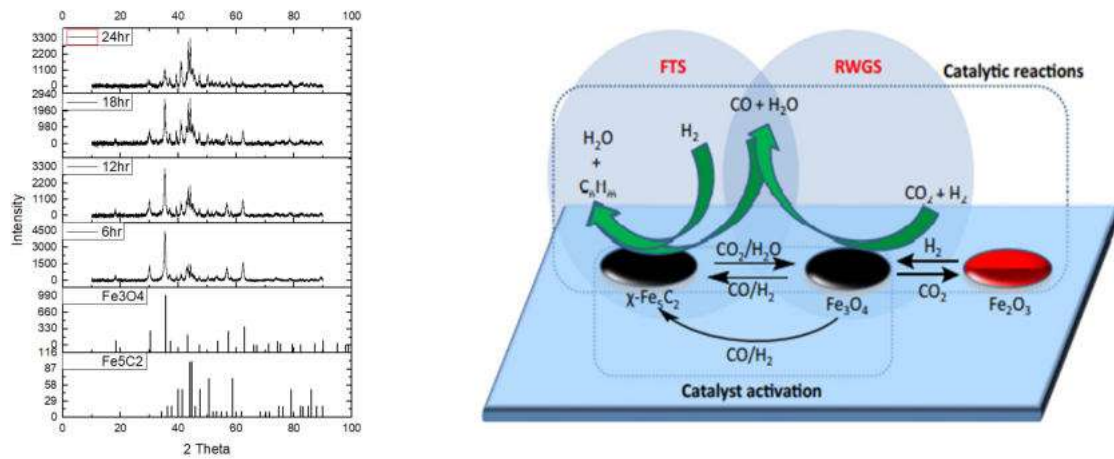
Research highlights:

- LPO as biofuel:** Development and Validation of a combustion kinetic mechanism for lemon peel oil as Jet-fuel. The objectives of the project:

- Identify suitable surrogate species for conventional jet fuel & lemon peel oil.
- Obtain the chemical kinetic combustion mechanism for the surrogates using CHEMKIN software.
- Validation of temperature & species profile using experimental flat flame burner set-up.
- Mechanism reduction & creation of optimal surrogate fuel blend models.

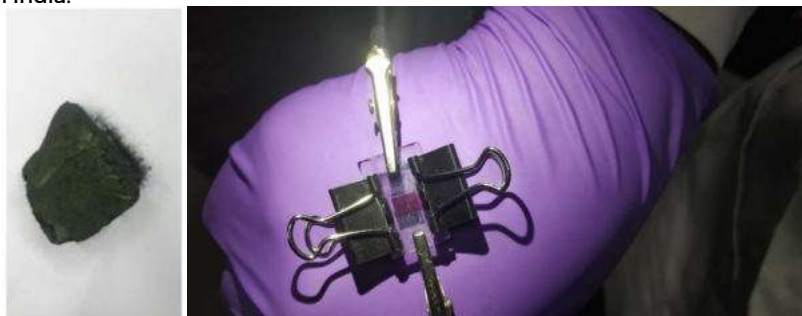


- CO₂ to Aviation Fuels:** CO₂ Reforming for Syngas: Direct Conversion of CO₂ to Fuels using iron-based catalysts.



Catalyst activation

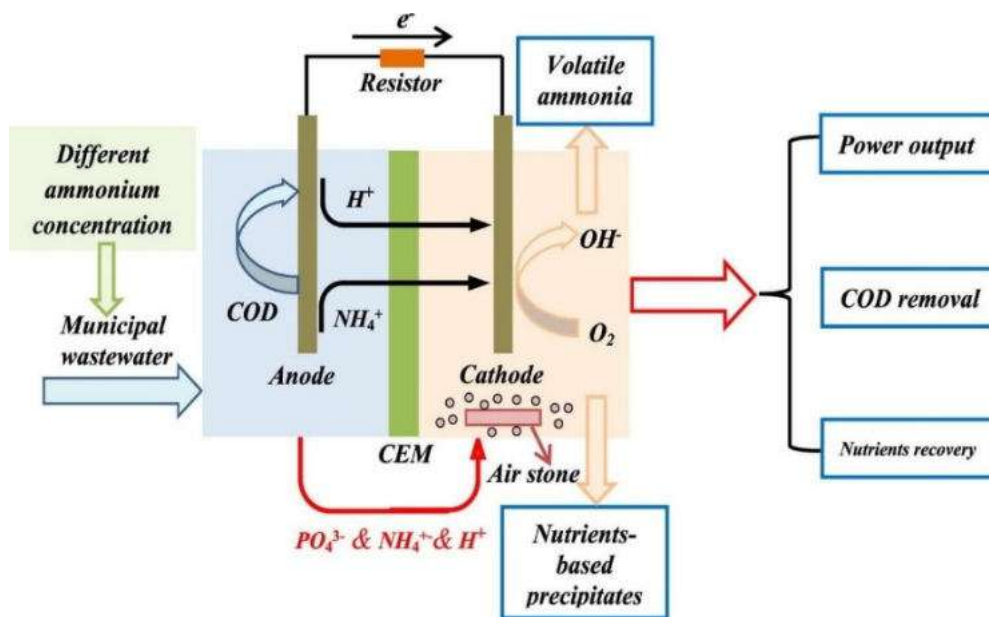
- Low Cost "Green" aqueous Dye Sensitized Solar Cells by Sai Santosh Kumar Raavi:** Scientists at IITH have developed low-cost environment friendly solar cells by employing an off-the shelf dye used to make Kumkum or vermilion in India.



Low Cost "Green" aqueous Dye Sensitized Solar Cells

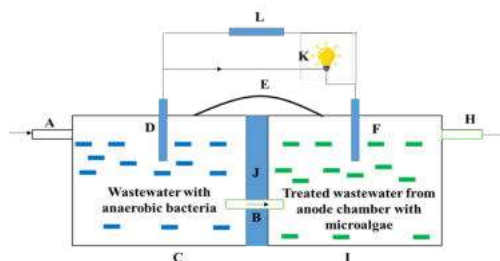
- Carbon capture: way to bio refineries:**

Bio-electrochemical Systems for Nutrient Recovery: To evaluate the comparative performance assessment of different configurations of BES for nutrient recovery from wastewater and to optimize the influencing parameter for higher recovery yield.



Bio-electrochemical Systems for Nutrient Recovery

Microbial electrosynthesis for Xenobiotic removal from sewage: Development of a self-sustainable integrated m-MFC system for organic matter removal, pharmaceutical removal, CO₂ sequestration and electricity generation from microalgae biomass.



Microbial electrosynthesis for Xenobiotic removal from sewage

Microbial electrosynthesis: Towards sustainable biorefineries: To synthesize valuable chemicals from industrial flue gas containing CO₂.

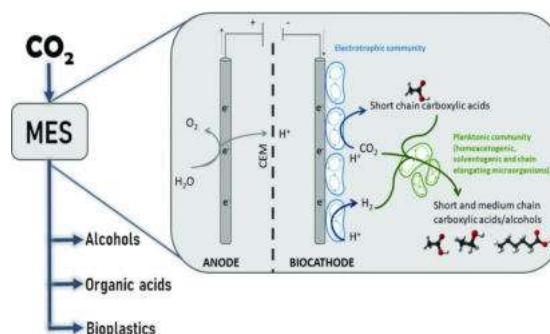


Figure 6. Microbial electrosynthesis

• Electric Vehicle as a low carbon mobility option: To estimate vehicular exhaust emission under real-world living conditions for different vehicle types and investigate the impact of living behaviour on vehicular emissions.

Other Critical Analysis under study:

5. Rainfall estimation using ML techniques from radar data.
6. Estimation of rainfall applying machine learning techniques on multiple source data (satellite, radar, and rain gauge) at hourly intervals for the Hyderabad region.
7. Statistical Analysis of factors affecting Microbial Electrosynthesis cell (MES) performance from literature data and techno-economical evaluation of MES.

8. Post pandemic travel pattern and carbon estimation.
9. Development and Validation of a combustion kinetic mechanism for lemon peel oil as Jet-fuel.
10. Himalayan glacier evolution under climate change.
11. Tropical cyclone intensity prediction in the Indian basin using MI techniques and HPC.
12. Climate adaptation in the context of rising temperatures among low-income communities in Hyderabad.
13. A numerical investigation of Ammonia Combustion in Gas turbines and IC Engines.
14. Sustainable development initiatives in response to climate change.
15. Industrial scale centralized emission control systems.
16. Deep learning-based approaches towards modelling of environmental parameters (PM, CO₂, etc.).
17. Urban Heat Island detection using GIS-Hyderabad city.
18. Nuclear Disarmament and Climate Change.



Big results require big ambitions. - *Heraclitus*



Department of Engineering Science

BTech in Engineering Science at IITH is a unique program being offered for the first time in India. It opens the doors to different specializations and provides a holistic engineering education. The basic structure is as follows: for the first two years (4 semesters), the student does basic courses in Mathematics, Physics, Chemistry, and different fields of engineering. In the last two years (4 semesters), the student then specializes in any field of their choice -- specialization is entirely open: It could be any branch of engineering -- BioTech, Biomed, Chemical, Civil, Computer Science and Engineering, Electrical, Mechanical, Material Science, -- Chemistry, Design, Economics, Mathematics, Physics or Psychology, etc. Note, however, that the number of students moving into a particular branch is limited to 10% of the strength of the batch. The final degree will read BTech in Engineering Science and Specialization in XXX. This is the first program that caters to what is often referred to as the "T Education." The horizontal line in 'T' corresponds to an education giving breadth, while the vertical line in 'T' corresponds to education giving depth. The new Engineering Science Program achieves breadth as well as depth.

For more information, please visit: <https://es.iith.ac.in/>

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<https://iith.ac.in/che/devarai/>



Siva Rama Krishna V
Electrical Engineering
Profile page:
<https://iith.ac.in/ee/svanjari/>



Surendra Kumar Martha
Chemistry
Profile page:
<https://iith.ac.in/chy/martha/>



Syed Nizamuddin Khaderi
Mechanical & Aerospace
Engineering
Profile page:
<https://iith.ac.in/mae/snk/>

Assistant Professor



Abhinav Kumar
Electrical Engineering
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Chandrasekhar Murapaka
Materials Science & Metallurgical
Engineering
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Digvijay S Pawar
Civil Engineering
Profile page:
<https://iith.ac.in/ce/dspawar/>



Ramakrishna Upadrasta
Computer Science & Engineering
Profile page:
<https://iith.ac.in/cse/ramakrishna/>



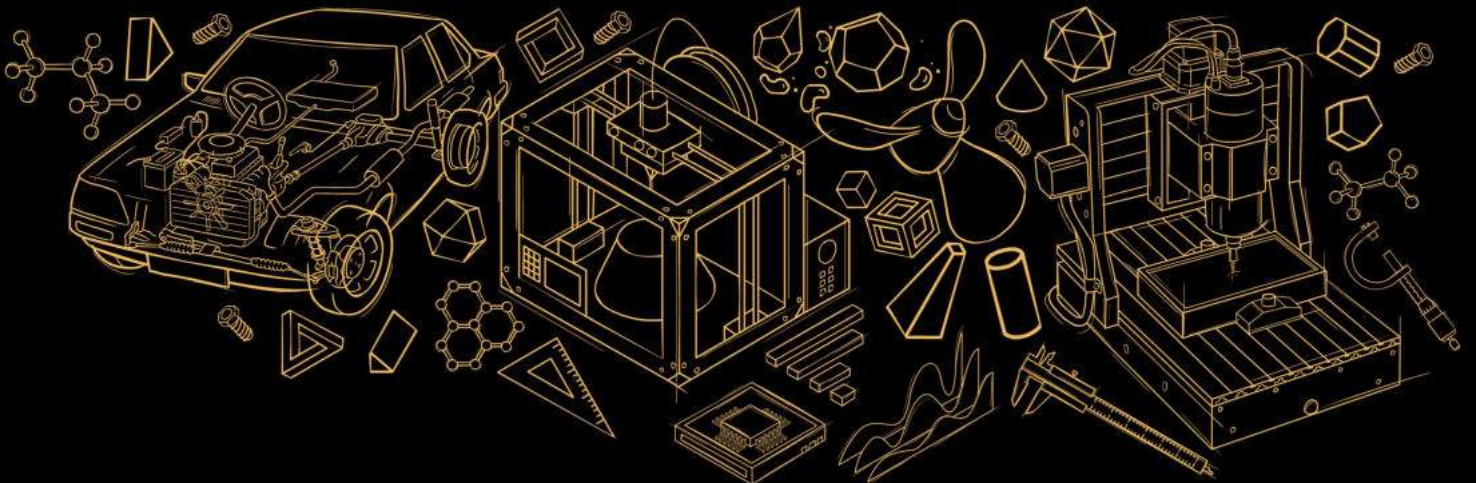
Tanmoy Paul
Mathematics
Profile page:
<https://iith.ac.in/math/tanmoy/>

“

The value of an idea lies in the using of it. - Thomas A Edison

”

HAPPENINGS



BUILD Project

BUILD program is a Bold and Unique Ideas Leading to Development. Its objective is to Promote creativity and innovation among students. With a duration of 6 months and Funding of up to 1 Lakhs. Outcome - is to create a Product/prototype (hardware or software or app) and it is open to all students of IITH, BTech/BDes/MTech/MDes/MSc/PhD. The call for the proposals is done twice a year.

A few BUILD Projects for the Financial Year 2021-2022:

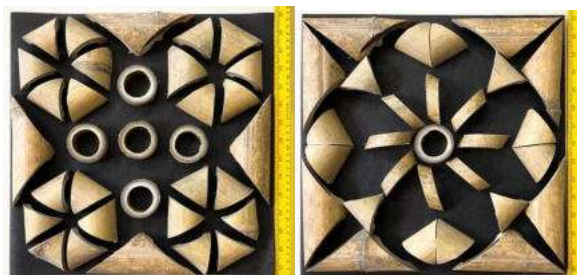
Rakshak: An extendable mobile robot platform for emergency situations by Soham Kulkarni

Current Status of Project

4G LTE Router	RPLidar A1 (1D)
GPS/GLONASS Antenna	10000 mAh Power Bank
USB Hub	8000 mAh 3S 11.1V LiPo
LED Status Screen	Teensy 4.0 + PDC
Emergency Stop Switch	nVidia Jetson nano 4GB
Two channel Motor Driver (20A Avg., 60A peak)	Optocoupler
Fog Lights for variable visibilities	Arduino Mega 2560
RasPi 12.3 MP HD Camera (Sony IMX477)	PI NoIR Night Vision
Steaxis wireless joystick controller	Lenovo FHD Webcam
	High-resistance truggy wheels



Shaanti Tiles - Sustainable Silence by Chaitanya Solanki: Design elements cut from bamboo



Medicine from the sky K Naveen Kumar:



Autonomous vision perception system (AVPS) for medical drone delivery using AI

Handheld portable microscope- based detection of prognostic biomarkers of diabetic retinopathy on a microfluidics based chip in remote and rural areas by Dr.Sayantan:



Collection of Tear Sample and Centrifugation of tear sample

“ The best vision is insight. - Malcolm S Forbes ”

Tinkerer's Lab

Across different IITs, Tinkerers' Lab at IIT Hyderabad serves as a platform for innovations with a vision to provide an environment to bootstrap a culture of genuine excitement regarding technology and a hands-on approach to entrepreneurship such that leaders thus created are ready to face and solve the problems for the better future.

Talking about the three events, we focus on daily, special & outreach events.

In daily events, we keep ourselves open from 6 pm to 1 am (after the academic hours) for the students to help them by arranging the inventory they need, by mentoring them with the project, either ourselves or by introducing them to other students/organizations/& even the respective professors within/outside IIT Hyderabad who has done a project specialized to their topic of interest.

Under special events, we have 'TINK BIG,' 'Tinkering Night,' 'How things work,' 'Workshop,' 'TL Talks,' 'Hackathon,' & 'Orientation program.' Unlike hackathons, 'TINK BIG' is a long and ongoing process where people can approach TL to get their prototypes funded. In 'Tinkering Night,' all the tinkerers out there are given an opportunity to Tinker, Build or Develop anything of their interest, irrespective of domain. Talking about 'How things work,' 'Workshop,' and 'Hackathon,' here we focus on teaching the student community from the latest technology down to the fundamentals & providing them funds to work on short-term projects & to showcase their skills to the community. Prominent entrepreneurs/persons from various tech sectors (industry or an organization) are invited to talk on any specific topic, such as AI/ML to Li-Fi or Dark matter, under 'TL Talks.' Every year, freshers are introduced to the Tinkerers' Lab at IIT Hyderabad under the 'Orientation program' event, with a huge turn up (participation) from the student community.

Inspired by the Idea of Tinkerers' Lab, we believe & aim to expand ourselves day by day, with a zeal to establish similar labs & organizations. Under the 'Outreach Events,' Sree Nidhi Institute of science and technology (SNIST) reached out to see Tinkerers' Lab, know it's working, and guidance in helping similar labs. As part of our outreach program, the tinkerers' Lab at IIT Hyderabad also conducted a one-day workshop for PG science students from St. Pious X PG and Degree college.

Currently, the TL team 2022 comprises nine members in total, with managers in finance, Events & web, social media & PR reach, and Inventory with an overall coordinator.

Speaking of ourselves, a total of 400+ projects are done, around 170 projects were done over in an academic year (data before 2022), 180 documented projects done with ongoing IDP projects in TL, with eight outstanding projects so far, & an annual 400+ participation & visits across the student community.



“

Price is what you pay. Value is what you get. - Warren Buffett

”

NSS Activities

During the academic year 2021-22, NSS, IIT Hyderabad was proactively involved in many community development activities in online and offline modes. A total of 300+ volunteers participated in various activities organized by NSS IITH. Under the able leadership and guidance of the faculty in-charge and associate in-charge, NSS IITH pledged to devote the best efforts to the betterment of society. NSS IITH has around 500+ registered students. NSS IITH has been successfully doing its part for society since dawn. Here's a descriptive list of all the activities it has undertaken during the academic year 2021-22.

Swachh Bharat:



Swachh Bharat is a cleanliness drive that ensures our campus is clean and plastic-free. This event is an hour-long and involves active teamwork. All the necessary equipment (gloves, bags, etc.) is provided to the volunteers by the team.



Weed Removal Drive:



The drive aims to remove weeds on the campus for cleaner and safer surroundings. The students were grouped, and weeds such as Parthenium, Subabul, etc., were removed. All the necessary equipment (sickle, gloves, bags, etc.) is provided to the volunteers by the team.



Plantation Drive:



The plantation is the easiest and most sustainable way to turn our campus green and pollution-free. This is an hour-long event involving active teamwork and aims to create an eco-friendly environment.



Covid Relief Fund:

During the hard times of the pandemic, NSS ran a relief fund collection drive for two days to help provide relief to the people affected via the PM Cares Fund and could collect a total amount of INR 27,404/-.

PM CARES
Pradhan Mantri Cares Fund
to Support Disaster Relief

Receipt No: **PM CARES/Web/202105152216137387** PAN: **AAET7099P** Date: **15-05-2021**

Dear **N/S NSS IIT HYDERABAD**

Thank you very much for contributing to PM CARES Fund. Prime Minister Shri Narendra Modi expresses his gratitude for the thoughtful and compassionate gesture on your part. The valuable contribution will greatly help India in fighting distress situations like COVID-19.

Under Secretary
PM CARES Fund

Received with thanks from: **N/S NSS IIT HYDERABAD**
IIT Hyderabad, Raidi, Mansoorabad, Telangana, India 503045

The sum of **INR 27,404 (INR Twenty Seven Thousand Four Hundred Four Only)**

(Contributions to PM CARES Fund have been notified for 100% deduction from taxable income under Section 80G of Income Tax Act, 1961)

Prime Minister's Office, New Delhi



Walkathon:
To inaugurate Vigilance Awareness Week 2021, NSS conducted a walkathon and encouraged all the students to participate. The theme is "Independent India @75: Self Reliance with Integrity". A total of around 280 people participated.



Mattress Donation Drive:

NSS collected the mattresses and pillows that the graduated students left in their rooms before vacating. With the help of the IITH authority and the student community, donated 61 mattresses and a few pillows to the "Mahima Ministries Orphans and Oldage Home" on behalf of NSS IITH.



Fitness Walkathon:

In order to instill a fit and healthy lifestyle among the student community, NSS organized a fitness walkathon in the month of March.



Book Donation Campaign:

NSS organized a book donation campaign in February. The campaign is led by the team where NSS volunteers collected books from the student community. The books relevant to engineering are donated to our IITH Library and the rest are planned to be donated to the orphanages and old age homes.



Blood Donation Camp:

NSS organized a blood donation campaign in association with Niloufer blood bank .



Helping self-quarantined students at the campus:

A non-credited event where NSS volunteers along with IITH gymkhana came forth to deliver packed food from mess to self-quarantined students in hostel rooms for two days.

Vidyadaan:

NSS organized a Vidyadaan event in April. The selected volunteers of this event visited nearby primary and secondary schools in Rudraram, and taught the students their respective lessons.



EML Series

Lieutenant General (Dr) Madhuri Kanitkar AVSM, VSM is a serving General Officer in the Indian Army.

She is the third woman in the Indian Armed Forces to be promoted to a Three-star rank.

Awards and Decorations

- Gen Kanitkar has been awarded the OOC-in-C Commendation Card and has been awarded the Chief of the Army Staff Commendation Card five times.
- She was also awarded the Vishisht Seva Medal in 2014 and the Ashi Vishisht Seva Medal in 2018.

E-talk on -
Through the journey of Lt. Gen. Madhuri Kanitkar

29 MAY SATURDAY 1:00 PM

LIVE

follow us @emliith

IITH conducted an insightful and thought-provoking session of EML by Lieutenant General Madhuri Kanitkar a soldier, a doctor, and a teacher has taken on all these roles with great determination and pride.

Prof. Rohini Godbole
A CRUSADER FOR WOMEN IN SCIENCE

Live talk on
"Need for more women scientists"

Particle physicist at CERN
Padma Shri awardee

mark your calendars on 30th october at 5pm

LIVE

Follow us on @emliith

Human journey beyond Earth
Where will it lead to..?

Dr. Y S Rajan
Distinguished professor in ISRO, Scientist, Padmashri awardee.

Talk on:
"Impact of advancing space technology in improving quality of human life"

Co-author of book "India 2020", "Beyond 2020" and "The scientific Indian" with Dr APJ AbdulKalam, and author of "Way beyond the three Rs" and "Mission 2020".

August 14th at 5pm.

LIVE

@emliith

EML, IITH organized the electrifying session on "Impact of advancing space technology in improving quality of human life" by Padma Shri Dr Y S Rajan, a distinguished professor at ISRO, as well as a scientist and administrator.

EML IITH has proudly announced having one of the famous Indian Women scientists, Prof Rohini Godbole (A crusader of women in science), as the enthusiastic Speaker at EML.

IITH had organized an EML session with renowned Padma Bhushan Prof P Balaram, Prof P Balaram is an Indian biochemist and the former director of the Indian Institute of Science. Prof Balaram delivered a talk on "Indian Higher Education: The New Education Policy Viewed Through the Lens of Recent History."

Prof. Padmanabhan Balaram

E-talk on -
Indian Higher Education: The New Education Policy Viewed Through the Lens of Recent History

Awards and Decorations

- Padmanabhan Balaram is an Indian biochemist.
- Former director of the Indian Institute of Science in Bangalore, India.
- He is a recipient of the third highest Indian civilian Honour of Padma Bhushan as well as the TWAS Prize.

30 SEP THURSDAY 5:00 PM

LIVE

follow us @emliith



EML of IITH conducted the Talk on "Striving For Excellence" by Prof Pulickel Ajayan, Distinguished Professor, IIT Hyderabad.



EML at IITH conducted a session on "Cancer and Diabetes as two sides of the same coin", by Dr Undurti Narasimha Das

Ek Bharat Shrestha Bharat

Dussehra Celebrations

Dandiya Night:

One of the most famous dance forms of Gujarat is the Dandiya Raas. Here Dandiya is a name given to the wooden sticks which are used in this dance. The sticks represent the sword of Goddess Durga. This dance form is performed from the times of Lord Krishna. He used to perform this form along with his gopis. In this dance form men and women form concentric circles and these circles move in opposite directions. Here the amazing part is along with the footsteps is the way the sticks are used. The sound of the sticks is very sweet and this sound becomes the Centre of musical rhythm played during the dance. As part Dussehra celebrations EBSB, which has been dormant for some time due to the pandemic, proposed to organize the first offline event after over a year. This was also the first offline event for the batch of 2024.

The event was held near the mess grounds and was kicked off by the director himself along with the dean and FIC. The ground was well prepared by arranging mats, so that dust doesn't set in and dandiya sticks were provided by the EBSB club itself, one pair per person, to whoever it was required.

The whole event lasted 3 and a half hours, from 7:30-11:00 PM. Proper music system were setup and a good lighting environment were also arranged. At the end of the event the feedback given by the students and everyone in general was that they enjoyed the event very well.



Kho-Kho Tournament:



Kho-Kho is a traditional Indian sport, that is one of the oldest outdoor sports, dating back to ancient India. It is played by two teams of 12 nominated players out of fifteen, of which nine enter the field who sit on their knees (Chasing Team), and 3 extra (Defending Team) who try to avoid being touched by members of the other opposing team.

The event was organized at the sports grounds with ground properly marked and poles set in place. Nearly 15 teams of 12 members each participated and the winner and runner up were given medals and celebration packs. There were a lot of spectators as well. The whole IITH fraternity took the event wholeheartedly.

Diwali Quiz:

On 3rd November 2021, EBSB club IITH organized an online Diwali Quiz for the entire community of IITH. It started at morning 12:00 A.M and lasted for 24 hours. The idea of the event was to promote our wonderful culture and heritage of Diwali. First 3 entries were selected and given prizes, for their score in the quiz regions.



What If:

The EBSB Club of IITH has come up with an event "What If" to add more colours to the celebration of the festival of Diwali. Following were the rules of the competition:

- For this fun event, all participants need to do is to come up with creative answers to the hypothetical scenarios mentioned.
- Entries will be judged based on creativity and originality of the content.
- Apart from winning prizes, the best entries will get featured on our page.



Dot-Joining Rangoli:

The event was mainly for IITH community who were not on campus, to encourage them with the rangoli making competition, with the comfort at their home. Template was sent in the mail, along with a sample (attached below).

Dialogue Diesta:

The event was conducted mainly for the IITH community who were not on campus, to encourage them with the Matribasha Diwas competition, in the comfort of their home by recording performing a famous dialog in your mother tongue.





Diwali Pics

The “Diwali Pics” was the event to bring closeness among IITH community by sharing there Diwali Pictures and memories.



DIY Diyas:

The contest, was held to share the decoration/creativity with the diyas during festive season of Diwali.



Traditional Day:

We (Ek Bharat Shreshtha Bharat team) invited the community to spread the essence of EBSB on our campus as we near Diwali (3rd November). Students and Faculty were encouraged to wear traditional attire on the occasion of Diwali for the entire day.



Rangoli and Diya-Decoration Competition:

We all know Rangolis and diyas have been an indispensable part of Diwali celebrations at home. Here's your chance to make this campus a little more home-like. Join us to make some interesting displays at the Mess lawns. Colors and diyas were provided

Ethnic night: The lighting of diyas and Sky Lanterns:

The event was organized near the mess lawns. The program was initiated by the Director sir. Students registered in groups (5 members each) for lighting the Sky lantern, only students who had completed both doses of vaccination were allowed to register.



Antakshiri and Bonfire:

The EBSB Club of IITH has come up with a Bonfire event to add more lights to the celebration of the festival of Matribasha Diwas. IITH community gathered near the mess lawns and played games of Antakshiri near a bonfire that was in the constant supervision of EBSB team members. The event started sharp at 7:30 P.M and lasted for 3 hours. IITH community gathered and enjoyed while playing games of Antakshiri.

“ Don't worry about failure; you only have to be right once. - Drew Houston ”

ELAN & ηVision

Elan & ηVision is the annual techno-cultural fest of IIT Hyderabad and among the most prominent college fests in South India. Since its inception, it has touched thousands, leaving behind beautiful memories in the hearts of everyone involved with us. Due to Covid-19 Pandemic, we had to conduct the fest online for two years; nevertheless, this year, we ran the fest in a hybrid model (both offline & online). This year, the fest went on for three days, from March 25th to 27th, with various online and offline events. Apart from the three days of the fest, Elan & ηVision has been active throughout the year and conducted various events.



The first one amongst those is musical events by renowned artists. We are bringing multiple artists to perform in a virtual live concert, such as Sudhanshu Raj Khare, Tejas Kartha, and The Lost Diadem (our very own IIT Hyderabad group of enthusiastic students performing in Musical events).



Navratri Dance Challenge in collaboration with The Shuffle Crew, the Dance Club of IITH, exclusively for our students. This event received an overwhelming response from the student community. We have also conducted various gaming events in collaboration with Glitch, the Game Dev Club of IITH.



Apart from the Navratri Dance Challenge, Diwali Style Up Challenge was a part of the Cultural event. The Challenge was to dress up for the occasion of Diwali and shine bright and elegant with lights. Not just cultural events, Elan & ηVision, has also conducted various technical events in online mode. A few are LIVE Sessions on Research Writing & Presentation Skills, CodeKaze'22 in collaboration with Coding Ninjas, and workshops on Website Design.



Elan & ηVision 2022 has engaged students more in games and activities like DodgeBall, Red Light-Green Light, and Housie (Tambola).



Elan & ηVision 2022 has successfully conducted its 13th edition of the fest amid the Covid-19 Pandemic in both online & offline mode. This edition is sponsored by Hero Xtreme 160R, in association with Nisarga, Information Technology Solutions Pvt. Ltd. The three days were packed with various literary, technical, and cultural competitions, along with the Pro shows. Our theme for this year is "Zora-e-Sukoon"



MILAN

Turning back the pages of time, before the times of Covid, the ecstatic 7-day Inter-Hostel Championship was conducted for the first time in the history of IITH in February 2020.

MILAN THE GC

Milan'20 included a wide range of competitions in Sports, Cultural, and Sci-Tech. It is an understatement to say the first General Championship was a huge success.

We have witnessed fierce rivalries between blocks and a neck-to-neck competition between Bhaskara and Kautilya. Kautilya got the best of it and was named the Champions of Milan. The student community was firmly moved, and the enthusiasm spread as everyone was very excited for the coming years. Unluckily, the pandemic hit, and Milan was called off in the year 2021. Disheartened students were hoping for an even bigger comeback for the following year. After two long years, Milan the General Championship took place from the 25th of February to the 6th of March. Adding new competitions from the previous happening, Milan had 44 events in total. All was set for the clashes to get fiery. Pumped up student community was getting ready for a battle to bring the GC home. All eyes are on the trophy. With the added enthusiasm from Diesta, the grounds were full of students prepping up to bring their A-game to matches. Meanwhile, Hostel Representatives were busy smashing their brains to strategise and outplay other blocks. Adding to the previous Milan, the new Hostel Block Ramanuja was keen to prove that it wasn't any less in competition to other hostels, even with the majority just being UG second years. The two added Girls' Hostels were ready to bring up further competition to Maitreyi and Gargi. The defending champions were planning to repeat the magic, but easier said than done, the rest of the blocks were ready to bring the glory their way. Competitiveness was in the air, and so started Milan'22...



The lighting of lamps by guests and the Olympic Torch Relay with all the Hostel Representatives kickstarted the General Championship on 25th Feb. The flames of the torch carried the spirit of sportsmanship and healthy competitiveness.



In Sci-Tech, all the nine competitions were worth 100 points each. Everyone realized that to win the Overall Trophy, Sci-Tech competitions were going to play an inevitable role. The efforts and brains put into the contests by many blocks were hardly getting fruitful results. As the other blocks were suffering to score points in Sci-Tech,



Charaka was soaring high, touching the unbelievable 300 points mark. Needless to say, Charaka won the Overall Sci-Tech trophy on a colossal margin taking them further up in the overall rankings. Kautilya was a distant second with 163 points. The rest of the hostel blocks were comparatively well behind.



The creation of a thousand forests is in one acorn. - *Ralph Waldo Emerson*





In Cultural events, Fashion Show, Stage Play, Budget Masterpiece, Milliehunt, Hostel Decoration, Life@IITH were worth a whopping 100 points each.



From mask paintings to hostel decorations, extravagant band battles to energetic dance competitions, all the performances were an ardent mix of emotions with genuine efforts.



With every event turning the lead of points and the tide of the GC, the Cultural events ended in a nail-biting finish with Gargi lifting the trophy for Overall Culturals with 178 points.

Kautilya and Charaka were a close runner up and the second runner up with 170 and 157 points in Culturals respectively. Gargi won Sports-Women Overall Trophy with 248 points. In Sports-Men Overall, Varahamihira was first with 166 points, and a noteworthy performance by Ramanuja ended up in a second place with 154 points. The last two days of the Milan included salsa steps from the Prom couples and a few mesmerising band performances.



On 5th March, the Pronite events started with Prom Night, which continued with band performances by Safar and The Three of us & Her. The crowd was delighted with the band performances and the mouth savoury food from installed food trucks. The schedule of the next day was to first, distribute the prizes; second, band performance by C6; and third, DJ night as a finishing event.

It was the final night of Milan and the time to name the new champion. And the winner of the General Championship of IIT Hyderabad, Milan 2022 is...(drumroll) Charaka with 587 points! Runner Up and Second Runner Up are Gargi and Kautilya with 468 and 443 points respectively. The roars reverberated in the hostels as the slogans were shouted out as Charaka lifted the trophy to become the Champion of Milan'22.



DIESTA

Our efforts and perseverance lifted us out of the haze of the pandemic and its restrictions and brought us back to the threshold of the desired campus life. The gust of euphoria that DIESTA brought with itself is unparalleled. IITH is a national educational institution whose excellence need not be justified and it takes pride in a lot of diversity with more than 3000 students.



11 sports and 11 cultural events took place in this wonderful event which lasted for 11 days. Another element of beauty is the number 11 (you know, the number of engineering departments in IITH is also 11! just a fact).

Cultural Council organized 7 online and 4 offline events with prestigious and proven provenance. These competitions continued to progress continuously throughout the festival. Along with the participation, we got to see the gaiety and throng of our dear and integral spectators who are a testament to the hard work of the Cultural Council. While different online events were organized by various cultural societies, LitSoc went ahead with the first offline event.



Some departments looted the prizes, and some participants filled the audience's hearts with their wonderful performances and mesmerizing arts. The 11 days went by as quickly as lightning. The event gave students a reason to rediscover and reevaluate their interests. The event had come to fruition. After Blood, Sweat, and Tears, the "Mechanical and ID" team" won the trophy for the event. A grand Awards and Closing Ceremony ended with a spectacular Open Mic, the much-talked flagship event of the Cultural Council.

The opportunity gave students the much-needed exposure to introduce themselves to the entire IITH. People thoroughly enjoyed the other dance, music, and literary performances. The euphoria that DIESTA had filled the people with was still alive. Those 12 days, those memories, are etched in our hearts forever.

E Summit

E-Summit is one of the biggest entrepreneurship conclaves in India and a flagship event of E-Cell, IIT Hyderabad which aims to bring early entrepreneurs, students, corporates, venture capitalists, and startups with budding ideas from all over the country to one platform sharing their entrepreneurial endeavors and experiences. It hosts thought-provoking talks, Panel Discussions, competitions, and many more. The E-Cell has initiated an outreach that covered more than 1,00,000 people. Over 100+ startups are expected to participate in this event.

This year's list of Keynote speakers include:

1. Ashish Chauhan - MD & CEO of Bombay Stock Exchange (BSE)
2. Dr. Anurag Batra - Chairman & Editor-In-Chief, Business World
3. Prakhar Gupta - Youtuber (Prakhar ke Pravachan)
4. Devvrat Arya - Vice President of Technology, Pepperfry
5. Ashish Deshpande - Co-Founder & Director, Elephant Design
6. Uday Mahajan - Sr. VP (Hardware Products), Rebel Foods (which includes Behrouz Biryani)

This year's list of Topics for Panel Discussions include:

1. Future of cryptocurrency in India
2. Jack of All vs Master of One: General vs Nice Markets
3. Rise of Commercial Space Age
4. Women in Entrepreneurship

Encouraging the Students' enthusiasm for entrepreneurship in the given scenario, Prof B S Murty, Director, IITH, said, "IITH has a robust entrepreneurship ecosystem. We have more than 100+ start-ups. E-Summit by E-Cell is a commendable event that nucleates the entrepreneurship instinct in the young & brilliant future stars of the nation. With the nation celebrating Start-up week, this is a dynamic move towards Aatma Nirbhar Bharat and marks the celebration of Azadi Ka Amrit Mahotsav."

Summarizing the event's intent, Faculty-in-Charge, E-Cell, IITH, Dr M Praveen, said, "The key to the advent of technology and the modern insurmountable challenges is innovation and entrepreneurs innovate. Young minds with no boundaries are best equipped to transform ideas into innovations. Esummit, in particular, with a huge diversity in terms of speakers and topics is bound to provide an ideal platform for the budding innovators and entrepreneurs."



The banner features the E-Cell logo on the left, the text "E-Summit '22" and "EXORCISM OF RESURGENCE" with dates "21st-23rd January", and the IIT Hyderabad logo on the right. The central text reads "KEYNOTE SPEAKERS". Below this, four speaker portraits are shown with their names and titles:

Portrait	Name	Title
	Ashish Chauhan	MD & CEO, Bombay Stock Exchange
	Dr. Anurag Batra	Chairman & Editor-In-Chief, BW Businessworld
	Ashish Deshpande	Director and Co-founder, Elephant Design
	Uday Mahajan	Sr. VP (Hardware Products), Rebel Foods

Japan Day 2021

Japan External Trade Organization (JETRO), Japan International Cooperation Agency (JICA), and IIT Hyderabad co-hosted the fourth edition of the job fair “JAPAN DAY” on the 24th and 25th of September. The event was organized online, same as last year due to COVID-19 and 13 Japanese companies, comprising of startups, SMEs, and large corporates, participated in promoting their businesses/cutting-edge technologies to attract students from IIT Hyderabad. This year, in response to last year's event's survey, which showed that more than half of the participating companies were interested in future collaborative research with IIT Hyderabad, an Industry-Academia-Government session was planned for Day 1. Although “JAPAN DAY” has stayed as an interactive opportunity between IIT Hyderabad and Japanese companies, the Day 1 event is expected to establish a long-lasting relationship between IIT Hyderabad laboratories and Japanese companies, which might enable the companies to acquire ideal talent based on research collaborative projects.

JETRO has been conducting “JAPAN DAY” at IIT Hyderabad since 2018 based on a Memorandum of Cooperation (MOC) on a Japan-India Digital Partnership, which was signed between the Ministry of Economy, Trade, and Industry (METI) and the Ministry of Electronics and Information Technology, India. So far, 10 Japanese companies, mostly large corporations, joined the event in 2018; subsequently 5 Japanese companies mainly startups joined in 2019. Last year, the first-ever online “JAPAN DAY”, we got an overwhelming response, and the number of companies increased to 20. More than half were startups aiming to recruit top Indian talents to develop their technologies and products to compete in the global market.

Expressing his delight on the occasion, Mr. Takashi Suzuki, Director General of JETRO Bengaluru, said, “Japanese business interest in India is steadily increasing even under the COVID-19 situation. India has one of the youngest populations in the world who are gifted in math and IT technology. Besides, they have effective communication skills and are open to cultural diversity. Japan should involve such mindsets so that we can be succeeded in global businesses.”

JAPAN DAY 2021 Website: <https://www.jetro.go.jp/en/events/iithjapanday2021.html>

JAPAN DAY 2021 Promotion Video:
<https://www.youtube.com/watch?v=Dv6vKNFte3s>



“

Think big. Start small. - Seth Godin

”

Green Office

The Green Office at IIT Hyderabad encourages people to "Reduce, Reuse, Recycle and Turn-Off". Its team consists of students, faculty, and staff of IITH. The green office is organized into four committees - Campus Biodiversity, Solid Waste Management, Energy Conservation, and Outreach. These committees are coordinated by a faculty member who serves as Convener for Green Office. It strives hard to implement various activities that will contribute toward eco-friendly and sustainable practices on the IITH campus. Getting involved with this body offers an excellent opportunity to make a difference in the IITH community and to prepare for a deeper engagement with the world at large.

Initiatives:

- A campus recycling program has been initiated covering paper, plastic, packing material, scrap metal, and hazardous e-waste. Separate bins were installed for this purpose.
- Bike program has been implemented by which rent-free bicycles are available on a short-term basis for commuting within the campus.
- Prepared white paper containing a list of indigenous tree species suitable for plantation on the IITH campus
- Created inventory of all equipment (water and electricity-consuming devices).
- Established an on-campus snake rescue program, for the relocation of snakes, in cooperation with Friends of Snake Society.
- Pasted posters with energy-saving tips in all offices and labs of IITH.

A recycling program was initiated on campus by Prakriti Nature Club in fiscal 2012-2013, this program is now being continued by the Green Office. The recycling program resulted in a significant reduction of our impact on the environment. Further, the recyclable material was sold to a vendor, selected by means of open tender, and the money was deposited in the IITH account.

The Green Office has been relentlessly conducting the monthly plantation drives on the 1st Saturday of every month by planting a variety of plants like African Tulip, Gulmohar saplings, Parkia biglobosa, Spathodea Campanulata, Muntingia calabura (Jamaican cherry), Mangifera Indica, Pongamia, Bougainville Spathodea, Pongamia Pinanata, Mango saplings, Delonix regia, Butea monosperma, Spathodea campanulata, Lemon, Orange, Blackberries, Mango, Sapodilla, and Water Apple plants with the involvement of Students, Faculty, and staff. It aims to create awareness of the environment.



The Green Office has established a plant Nursery to propagate a vast Variety of plants for plantation on the campus to create a green and healthy environment. Almost 60% of the Plantation area has been facilitated with a Drip irrigation facility to supply recycled water to all plants in a proper and effective way to eliminate wastage of water.

New Infra @Campus



IIT Hyderabad now has a new PINCODE, 502284. Sub post office inaugurated at IIT Hyderabad Campus by India Post



Department of Material Sciences and Metallurgical Engineering Building Inauguration. Read more at: <https://tinyurl.com/vraupbdv>



New security check post inaugurated at IITH. Check post is equipped with the Biometric Scanning of the employee & students.



IITH has set up a comprehensive waste management system on Campus. Read more at: <https://tinyurl.com/r4s6mfr4>



DAV Campus School Inauguration by our esteemed Chairman, BoG, Dr B V R Mohan Reddy, and beloved Director Prof B S Murty.



IITH established its first astronomical observatory with a large telescope for public outreach.



Continental Hospitals set up a super specialty clinic on the IIT Hyderabad Campus.



Prof Balram Bhargava, DG-ICMR, Secretary, Department of Health Research, MoFHW, inaugurated leading-edge BME-BT Building at IIT Hyderabad.



Cyient Foundation digitalized IIT Hyderabad's DAV Campus School. Read more: <https://tinyurl.com/4wchdkfs>



For effective utilization of the computation resources, IITH has renovated the Institute Datacenter (IDC) to facilitate the hosting of additional servers/ clusters by adding 633 Trillion FLOPS computation power to its existing capacity which provides wide scope for Faculty and students in performing their research activity.



Dr BVR Mohan Reddy, founder chairman, Cyient, has inaugurated the Hybrid Classrooms at IITH.
Read more: <https://bit.ly/3Mr5NK>
Have a look: <https://youtu.be/T03on3tHwml>.



Technology Research Park of 1,50,000 sq. ft. inaugurated at IITH.
Read more: <https://bit.ly/3OxniuC>
<https://www.youtube.com/watch?v=fZw1VOyxZM>



Primary Health Centre Inaugurated at IITH by Continental Hospitals' Founder and Chairman, Dr T Gurunath Reddy.
Read more: <https://bit.ly/3Kj1AHo>.

Contributions



IITH has jointly developed 'Swarajability', India's 1st AI triggered Job Platform for PwDs, with Youth4Jobs & Visual Quest with support from Kotak Mahindra Bank Ltd.
Read more: <https://bit.ly/3KdmSX4> &
View Video Abstract: <https://youtu.be/FLiCq-4JMyg>

Get one-stop COVID updates at 'covid19tracker.in' portal by IIT Hyderabad
Prof B S Murty, Director, IITH launched the portal and declared it open for public use
Read more: <https://tinyurl.com/ytax>



IITH in association with Akshardaan, launched Free educational services, Aksharamaala - Online Learning Interface for 10th Class Telugu & English Medium Students.

Smart IoT-based, indigenously-developed, ICU Ventilator "Jeevan Lite" inaugurated by Dr (Smt.) TAMILISAI Soundararajan, Hon'ble Governor, Telangana & Hon'ble Lt. Governor, Puducherry at IITH.
Read more: <https://bit.ly/3EJkhCS> &
Have a glimpse: https://youtu.be/-3 ueqe8_00



IITH is pleased to receive the coveted Haritha Haram Awards by CII Telangana Chapter from Shri K T Rama Rao, Minister for Municipal Administration & Urban Development, Industries & Commerce, and Information Technology of Telangana.

Collaborations



Work together & excel together; with this objective, several MoUs have been signed with institutes & organizations of International & National Repute, namely, PharmCADD, IISc, IAMRAI, IPE, RGKUT, Military College of Electronics & Mechanical Engineering, and Kepler Aerospace - Aidin.

To accelerate the research in Advanced Automotive Technologies, IITH joined hands with Mobis India. IITH has also signed an MoU with Basavatarakam Indo American Cancer Hospital & Research Institute (BIACH&RI) for Academic & Research Collaboration, APUNA to promote UN objectives of the 2030 SDGs agenda, ECIL for Enhancing Academic & Intellectual Interaction to promote Mutual Intellectual Growth & Indigenous Technological Solutions and with Centre for Adivasi Research and Development Odisha (CARD) for Promotion, Awareness & Empowerment of Marginalized Communities.

“ Do what you can, with what you have, where you are. - Theodore Roosevelt ”

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