Dear Friends,

Greetings from IIT Bombay!

Hope you are healthy and safe.

Another month passed amidst the time of the crisis with the hope of nationwide improvement. Meanwhile, the Institute commenced the new academic session with a wave of zeal and zest. The first-ever online semester, which was started from August 10, received an overwhelming response from all. The campus and classroom instructions have their aura but still, all faculty members are trying to give the best possible educational experience that IIT Bombay is known for. We welcomed all new PG entrants.

I would like to congratulate all the graduating students and wish them the very best for their future. With the immense efforts of our professors and students who have worked hard over the last two months, IIT Bombay organized first-ever virtual reality (VR) based convocation. The 58th Convocation of the Institute was held on August 23. Students were able to view their animated personalized avatar receiving awards, and degrees from the Chief Guest and the Director. We were privileged to have Mr. Stephen Schwarzman, founder and CEO of the Blackstone Group and a world-renowned investment banker as the guest of honor and Prof. Duncan Haldane, a 2016 Nobel Laureate in Physics and currently a professor at Princeton University, as the Chief Guest for the convocation. The entire event was broadcasted on DD Sahyadri and was also live-streamed on the Institute's official YouTube Channel and social media pages. A virtual campus visit of hostels, departments, and other meeting points was also organized for graduates to meet and interact with friends, faculty, and club members.

I'm ecstatic to announce that the IITB Racing team has achieved tremendous success in challenging Formula Student UK 2020. The team secured 1st position in the Engineering Design Event and 4th position overall from among 73 teams participating from 21 countries. Furthermore, two UG students Kunal Deshmukh and Kritti Sharma, while working on a research project, discovered an SUV-sized asteroid that soared just 2950 km above the surface of Earth using data from the robotic Zwicky Transient Facility (ZTF) in California. It is the closest known asteroid to fly by Earth without impacting the planet.

IIT Bombay continued its legacy of constantly creating more opportunities for the students of India in GATE 2021 too. GATE 2021 would comprise two additional papers i.e., environmental sciences and humanities and social sciences (HSS). Furthermore, 3rd-year college students will also be allowed to appear in the GATE exams this time. Additionally, to help students of other universities in the country during the pandemic, 26 undergraduate courses of IITB are to be telecast via Swayamprabha Channels of DD.

Amidst this tough time, IITB is awarded the 2nd prize in innovation and entrepreneurship under ARIIA (Atal Rankings of Institutions on Innovation). This was announced in the august presence of Hon'ble Vice-President Mr. M. Venkaiah Naidu.

The Center for Machine Intelligence and Data Science(C-MInDS) at IIT Bombay which was set up in February 2020 to contribute towards the growing significance of the role of Artificial Intelligence, Data Science, and related areas in different application domains started offering its initial programs such as Minor and IDDDP for students.

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News from IIT Bombay

IIT Bombay Racing team wins at Formula Student UK

The students at IIT Bombay Racing have hit a significant milestone on the road to progress. The team has put in their best result yet, at the Formula Student UK Competition, hosted by IMechE. The IIT Bombay Racing Team also came 1st overall amongst international teams, 3rd in the EV Category (Domestic and International) and 4th Overall at FSUK 2020, amongst 73 teams, from over 20 countries.

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Novel Silver Jubilee Alumni Batch Initiatives

The Class of 1990 has instituted two new legacy projects - Clean Green Campus Program and the IDEAS Program with the intent of creating an ongoing movement around 'Clean and Green' and 'Entrepreneurship'. The objectives of the Clean Green Campus Program are - to facilitate creation of a Model Clean, Green Campus at IIT Bombay that will be the Benchmark of every other academic institute in India, and to institutionalizing a legacy project that is inspiring and sustainable for every future batch to contribute.

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Faculty Research at IIT Bombay

Building Sellable Products in Academic Labs: We embarked on a journey not often followed in India

Congratulations Prof. Ashwin Gumaste on receiving the Shanti Swarup Bhatnagar Prize for Engineering Sciences 2018, one of the highest Indian science/technology awards. This recognition is just another jewel added to his crown with honors such as Swaranajayanti fellowship of the Department of Science and Technology (2013), P.K. Patwardhan Award (2013), Vikram Sarabhai Research Award (2012), IBM Faculty Award (2012), Telecom Center of Excellence Award from the Ministry of Communications and Information Technology (2011), Fellow, Indian National Academy of Engineering (INAE) (2018), the Young Engineer Award of the Indian National Academy of Engineers (2010) and many others.

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Student Research activities at IIT Bombay

Novel Proof of Reserves Protocol with Shorter Proof Sizes

Name: Suyash Bagad | **Guide**: Prof. Saravanan Vijayakumaran | **Department**: EE (M.Tech.)

Cryptocurrency exchanges enable customers to own digital assets without having to mine them. They provide customers with user-friendly wallets facilitating trading in digital assets and fiat currencies. Notwithstanding the benefits to customers, the downside of such exchanges is that the customer funds are lost in case an exchange gets hacked or is involved in an exit fraud. Proof of Solvency is a technique which could avert such losses by requiring exchanges to regularly prove to the customers that they own assets at least as much as their liabilities.

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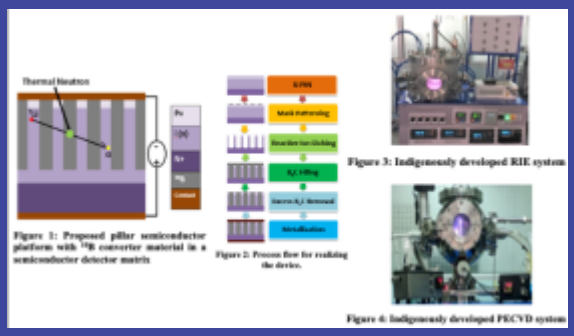

Development of 3-D solid state neutron detector

Name: Gourav Kumar | **Guide**: Prof. R O Dusane | **Department**: Metallurgical Engineering and Materials Science (Ph.D.)

High-efficiency detectors for nuclear radiations are important in various applications such as nuclear medicine, security and industrial imaging systems, personnel and area monitoring. Solid state semiconductor-based detectors owing to their remarkable advantages such as small size, compactness, low operating voltage, low power consumption, and low cost are being increasingly used over conventional detectors (gas proportional counters or scintillation detectors).

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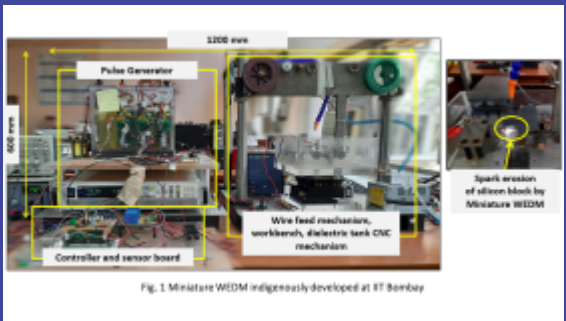

Fig. 1 Miniature WEDM indigenously developed at IIT Bombay

Making WEDM Industry-ready for Slicing Semiconductor Ingots for Solar PV Applications

Name: Makarand M. Kane | **Guide**: Prof. S. V. Kulkarni, Prof. Himanshu Bahirat, Prof. Suhas S. Joshi | **Department**: Electrical Engineering (Ph.D.)

Semiconductor wafers are extensively used in the solar photovoltaic and microelectronics industries. Previous phase of research at IIT Bombay has proved that, Wire Electric Discharge Machining (WEDM) can reduce kerf (material) loss from 40% (in conventional wire-sawing technique) to 15%. Being a non-contact process, WEDM can be used to slice hard semiconductors like Silicon Carbide (SiC) as well, which are difficult to cut with wire-sawing. Our efforts are aimed at making the WEDM industry-ready. In this direction, we have developed the following systems and solutions.

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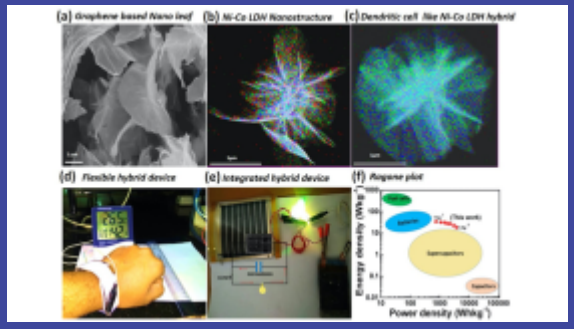

Surface Enhanced Graphene Based Nano hybrids for Enhanced Energy Storage and a Device Thereof

Name: Sarigamala Karthik Kiran | **Guide**: Prof. Sumit Saxena | **Department**: Center for Research in Nano Technology and Science (Ph.D)

Synthesis of low-dimensional materials have generated curiosity among researchers working not only in fundamental materials research & but also their applications, due to their exotic properties & immense potential. Especially, 2D materials with ultrathin surface morphologies have unwrapped new frontiers with their excellent electronic, mechanical, & optical properties. The research focus on 2D materials was actually stimulated with breakthrough of isolation of graphene in 2004 by Geim & Novoselov. Graphene is a two dimensional honey comb lattice with one atom thick sp2 layer of carbon atoms.

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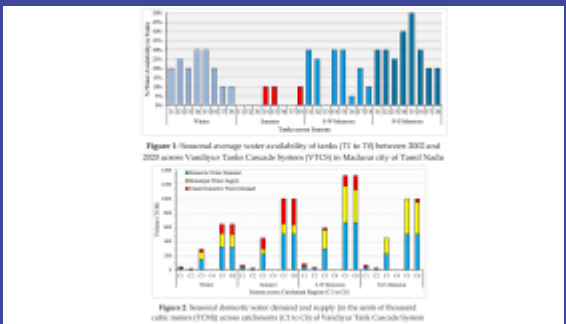

Study of Spatio-temporal Variability of Water Balance in Semi-arid Region of Southern-India: A case of Cascading Tanks in Madurai

Name: Aman Srivastava | **Guide**: Prof. Pennan Chinnasamy |
Department: CTARA (M.Tech.)

Most parts of Southern-India are climatically classified from dry sub-humid to semi-arid conditions, especially the states like Tamil Nadu, Andhra Pradesh, and Telangana. These regions have unfortunate historical evidence of witnessing extreme events such as droughts, floods, and cyclones. The reasons have been attributable to the short spell of monsoon season followed by a long spell of dry seasons leading to surplus runoff during rainfall causing limited storage availability in dry periods. This necessitated the creation of surface water storage structures intending to facilitate the water needs during non-monsoon seasons. One such structure is 'Tank Cascade Systems' (TCSs) built and maintained for more than 2000 years across dry rural regions of Southern-India.

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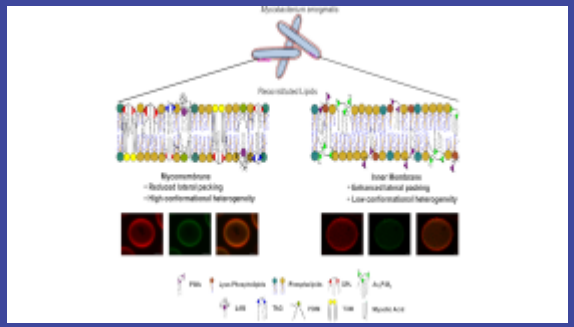

Understanding the organisation of the spatially and compositionally exclusive lipids of the mycobacterial inner and outer membranes

Name: Aswin Srivatsav T| **Guide**: Prof. Shobhna Kapoor | **Department**: Chemistry (Ph.D.)

Mycobacterium tuberculosis (Mtb) is one of the most successful human pathogens and causes tuberculosis – one of the leading causes of death worldwide. Mtb is one of the most robust bacteria present and this is attributed to its remarkable defence mechanism and the use of the same as offense to survive the host inflammatory response. This is the bacteria's complex cell envelope architecture and the lipids associated with it which is common to Mycobacteriaceae family. The bacteria employ long chained (C60-90) atypical lipids that have extensive branching to make up the cell envelope. Mycobacterial membranes pose a challenge when it comes to the permeability of drugs across its membrane and the development of new antimycobacterial drugs.

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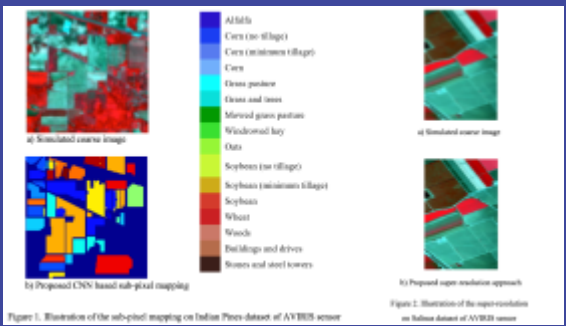

Novel Deep Learning Algorithms and Architectures for Hyperspectral Image Processing

Name: Arun P V | **Guide**: Prof. B Krishna Mohan & Prof. Alok Porwal | **Department**: CSRE (Ph.D.)

Satellite and airborne-hyperspectral sensors collect images in large number (100-400) of narrow (5-10 nm) and contiguous wavelength bands. Due to their ability to resolve subtle spectral features and unbiased and synoptic coverage of large areas, they have been widely used for composition mapping in a variety of domains covering agriculture, forestry, pedology, geology, planetary studies, hydrology, land use and land cover studies, etc. This research contributes to the extraction of reliable information from the hyperspectral images; particularly it attempts to resolve the issue of the spatial-spectral resolution tradeoff.

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Commuters' willingness to pay to reduce travel time: An application of discrete choice experiment

Name: Sujit Chauhan | **Guide**: Prof. Haripriya Gundimeda | **Department**: HSS (M.Phil.)

Over the last six decades, a large quantum of studies has explored the value of travel time savings (VTTS). The travel time savings constitute a significant proportion of many transport improvements, cost-benefit analyses of transport services, traffic forecasting models, & congestion pricing schemes. The present study aims to estimate commuters' value of time (VOT) or the willingness to pay (WTP) to reduce travel time by one-hour in Mumbai, India. It applied a discrete choice experiment to estimate the value of time of automobile commuters. The discrete choice experiment follows the Lancasterian theory of value & the random utility model.

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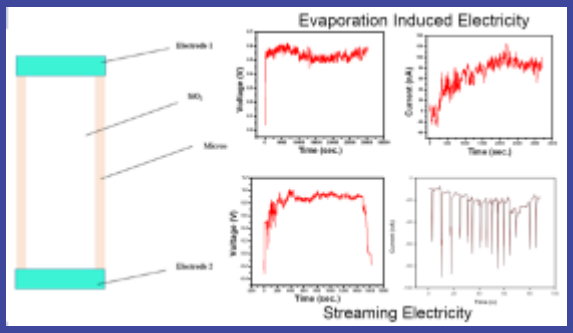

Self-Powered Humidity Sensors

Name: Shailesh Jain | **Guide**: Prof. Aswani Yella | **Department**: MEMS (M.Tech.)

Humidity measurement is very important for every industry. Relative Humidity (RH) of the environment significantly affects human comfort. Concept of Self-powered device comes from the fact that most electronic sensors run on battery power. Batteries require frequent charging (thus consuming electricity) and replacement, which causes serious impact on the environment. All of these problems are being handled by diverting our attention towards Renewable sources of energy. One such source is Water, having a tremendous amount of energy in different forms. Development of a device, capable of generating electricity from moisture and at the same time, measuring the humidity, is of great importance for the modern world.

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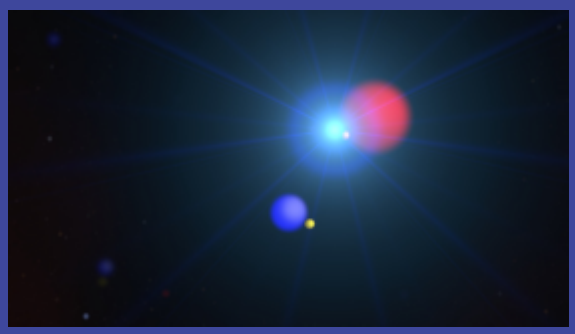

X-ray Data analysis

Name: Akshat Singhal | **Guide**: Prof. Varun Bhalerao | **Department**: Physics (Post Doc.)

Detectors used in measuring high energy photons, have by design poor spatial resolution, with which it becomes very difficult to pin point the location of their sources in the sky. However, historically lunar and earth occultation techniques have been used to resolve sky position. The idea is that, if while observing the source, the moon obstructs the line of sight (called occultation), we would see a drop in our measurement. By carefully measuring the time of the drop and knowing the position of the moon at time allows us to narrow down the source's position. Similar technique can be used for the satellites, when Earth obstructs, which is a useful technique for orbiting X-ray and gamma ray instruments to study high energy source.

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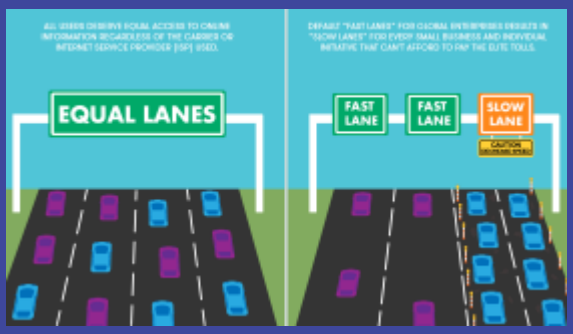

FairNet: Measurement Framework Traffic Differentiation Detection on the Internet

Name: Vinod Sarjerao Khandkar |
Guide: Prof. Manjesh Kumar Hanawal |
Department: Industrial Engineering and Operations Research (Ph.D.)

As the Internet evolves as a preferred platform for many commercial activities, the guarantee of high - performance is expected from Internet service providers (ISPs). Often ISPs themselves are content providers (CPs), and would like to ensure higher performance guarantee to their content than that of their competitors, or, in the worst case, can even degrade competitors performance to capture higher market share. There have been cases of ISPs giving preferential treatment to specific CPs, which has prompted regulators worldwide to advocate Network neutrality. To enforce any neutrality laws, one has to have a mechanism to identify any violations. Our work proposes a method to detect any deliberate discrimination of content of a particular service on the Internet.

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Informal Work in India: A Tale of Two Definitions

Name: Rayees Ahmad Sheikh | **Guide**: Prof. Sarthak Gaurav & Prof Trupti Mishra |
Department: Shailesh J Mehta School of Management (Ph.D.)

A large share of the workforce in the developing world is outside the purview of legislation and excluded from social security benefits. Despite increasing attention in policy as well as academic discourse, measuring the incidence and causes of informality remains a challenge. This is primarily due to the prevalence of multiple definitions and ambiguity in the conceptualisation of informality. In this study on informality in the Indian labour market we use unit-level data from a nationally representative sample comprising of approximately half a million individuals for the year 2011–2012. The study intends to examine whether determinants of informality differ by the definition followed, and assess the implications of such differences.

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