



10th
RSD



**RESEARCH SCHOLARS' DAY
INDIAN INSTITUTE OF TECHNOLOGY
PATNA**

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Message from the Director

I am immensely happy that IIT Patna is organizing the 10th edition of the Research Scholars' Day in online mode on March 20, 2021. Research Scholars' Day celebration at IIT Patna encompasses various endeavors aimed at appreciating and encouraging scholars to carry out high-quality research which will benefit the nation and humanity at large.



Teaching, research, and placements are three pillars upon which the reputation of any institution is built upon. Our research scholars are supporting IIT Patna equally well in all three areas. In 2020, citation per faculty at IIT Patna stood at about 16, and 649 research articles have been published in reputed international journals. Our faculty members are handling projects and consultancies of National as well as International repute funded by various government and private agencies. I urge our faculty and young scholars to engage themselves in multidisciplinary work.

Recently IIT Patna has been recognized as a hub of interdisciplinary research after the grant of technology innovation hub (TIH) under the National Mission on Interdisciplinary Cyber-Physical Systems (NM-ICPS). Along with the already thriving Incubation Center and Technology Business Incubator at IIT Patna, I believe that TIH will provide a bridge to connect the institute's research outputs to societal and commercial needs. Young scholars should tirelessly work to support the prime minister's vision of Aatmanirbhar Bharat Abhiyaan, which has been floated to aid our country out of the looming crisis due to the present Covid-19 pandemic. Apart from that, the government has started PMRF for the most meritorious students to pursue research in the frontier areas of science & technology. Namami Gange, Make-in-India, and Start-up India are some other initiatives by the Government of India which our scholars must explore and contribute in making India self-reliant.

RSD is an event where we have a chance to know about each other's work and allow for interdisciplinary collaborations. I am sure the participants will have an intense and enriching day of interactions. I convey my best wishes and blessing to all scholars of IIT Patna.

Jai Hind Jai Bharat Jai Vigyan !!

Prof. Pramod Kumar Jain
Director, IIT Patna

Message from the Organizing Committee

Research scholars' day (RSD) is an annual event organized by IIT Patna conducted to showcase the outstanding quality and diversity of research at the institute. It encompasses research talks from distinguished speakers, oral presentations, and poster sessions by research scholars of the institute. RSD is not just a day but a platform to come together and exhibit one's work and appreciate the work of others. It provides a valuable opportunity for budding researchers to broaden their perspectives by promoting research awareness, interaction, and collaboration. This year's RSD comprises two invited talks. One of the talks is by Prof. Suman Chakraborty, Bhatnagar Awardee from IIT Kharagpur. The other talk is by Prof. Sanghamitra Bhattacharyya, Technical Director, KPMG India. To celebrate the undying spirit of IIT Patna and our passion for learning, 10th RSD is planned to be conducted in the virtual mode and hence we have made some changes in the poster presentation format. The preparation of this event started a month ago and all the scholars have shown great efforts in organizing the event well. Hope RSD 2021 will stimulate enthusiastic and meaningful interaction among the research community at IIT Patna and motivate young scholars to excel in their work.

Our very best wishes for a great and productive RSD 2021.

Happy learning!



Dr. Amit K. Verma



Dr. Richa Chaudhary



Dr. Atul Thakur

Message from the Associate Dean (Student Affairs)

The Indian Institute of Technology Patna commenced its journey on August 6, 2008. Within a year, it realized that research and development is an integral part of an educational institute of national importance. Thus, the Ph.D. programme started in 2009. To progress as a higher learning institute, IIT Patna started “Research Scholars' Day” (RSD) in 2010. RSD gives moral support to the research scholars of the institute and makes them realize their importance in IIT Patna. Research scholars are not only doing their research but also keeping the faculty members active in their research therefore, carrying forward the expertise of the faculty members of the institute. It helps the faculty members in teaching the undergraduate students well, thus going by the slogan “we teach well because we do research.”



Research scholars showcase their research works on the Research Scholars' Day. They show the importance of their research work not just in academics but also for the society. The scholars extend their talent in sports, cultural events and in leadership qualities. These are a part of the Research Scholars' Day and an innovative chance of letting the research scholars present themselves as researchers.

IIT Patna being a higher learning institute, gives all kinds of support to the students' growth, making them a complete human being. A complete human being needs to develop himself/ herself in four fields: Academic, Cultural, Sports, and Leadership. Student Affairs at IIT Patna helps the students to nurture their cultural, sports, and leadership quality, hence preparing them to serve the country as well as the society. The office staff is always active to help the scholars in all respects. I see the researchers of IIT Patna not only implementing their research findings and setting a high standard in academics, but I also see them preparing themselves as sportsmen, artists and leaders. I am sure that the Research Scholars' Day is helping the research scholars of the institute in showcasing their research work and in nurturing their different capabilities. Again, I would like to mention that the presentation of research findings by the research scholars is becoming more informative and of a higher standard day by day. I believe all the research scholars who chose and will choose IIT Patna as their destination for a research career will definitely nurture their knowledge through the dynamic faculty members of IIT Patna. I am sure that the research scholars of IIT Patna will always feel proud to be a part of its research team. I wish all of them success in their career and in the fulfilment of their dreams.

All the best.

Dr. Manoranjan Kar
Associate Dean (SA)

Message from the Associate Dean (Academics)

I am extremely happy that IIT Patna, like every year, is organizing its 10th edition of RSD (Research Scholars' Day) in 2021 also, despite having the venomous Corona crisis. The online mode is chosen to take into consideration all the COVID norms. This shows the spirit, passion, and courage of all research scholars at the toughest time. The RSD is the annual research fest for the research scholars in which they come up with new ideas of research as well as publication. This fest consists mainly of three events – lectures by eminent external speakers, my research in 3 minutes, and a poster presentation. Sports and cultural events are also conducted as a part of this program. This provides an opportunity for the research scholars to know each other's work, which is very necessary to flourish any institute.



IIT Patna is a 13 years old institute consisting of 10 departments that are rigorously engaged in teaching and research. The annual publication list of each department shows that they have dug fountains of research at the driest time of the pandemic. We are part of this community that produces knowledge as well as works for the well-being of people. All these efforts are a witness to our dedication and commitment to quality research.

In the end, my best wishes to all enthusiasts and my appreciation for your commendable job.

Dr. Subrata Kumar
Associate Dean (Acad)

Acknowledgment from the PGR

Research Scholars' Day (RSD) is celebrated to commemorate the spirit, struggle, and success of the scholars. This year, we are celebrating the 10th edition of RSD. It is very much special as it not only registers a pile of achievements but also shows our perseverance towards making a better tomorrow. This event makes a promise to society by showcasing the research with relevance. RSD has scaled over the years. It has incorporated sports and cultural events along with the lightning technical sessions. The keynote speakers illuminate the event by engaging us in a very fruitful discussion.



This event has been organized and hosted successfully only with the sheer dedication and hard work of volunteers under the guidance of the committee of professors and the unconditional help of administration. It is my pleasure to express sincere gratitude to our director Prof. Pramod Kumar Jain for his enlightenment and support. The convener of the event Dr. Amit Kumar Verma needs a special mention for his constant monitoring, involvement, and support. Dr. Atul Thakur and Dr. Richa Chaudhary gave valuable guidance and support for making this event successful. I would also like to thank the Associate Dean (Academics), Associate Dean (Student Affairs), Sports Officer for their valuable support.

The volunteers need a special mention. They worked tirelessly for making this happen. A loud cheer and love for all of them. I would also like to thank all the sponsors for being so generous and funding our event. I wish all my best to the scholars to keep the flame burning and make the community proud.

Harsh Kasyap
Post Graduate Representative
IIT Patna

Research Abstracts

Department of Chemical and Biochemical Engineering

About the Department

The vision of the Chemical and Biochemical Engineering department at IIT Patna is to achieve national and international recognition through the educational and research achievements and the professional service of our faculty, staff and students. Our mission is to provide students with an overall educational experience that prepares our students to become successful professional chemical engineers capable of undertaking both life-long learning and further advanced studies.

The Chemical and Biochemical Engineering department plans to provide opportunities for both course-based and research-based Masters Degrees and Doctorates in addition to undergraduate B. Tech programs. These undergraduate and graduate programs aim to develop highly-qualified graduates who are self-motivated, independent and clear thinking individuals capable of undertaking an independent work in industry and research and development programs and government and public sectors undertakings.

The department is trying to achieve fully developed infrastructure and well equipped laboratories in chemical and biochemical and Food process Engineering. Apart from this, the department envisions regularly organizing seminars and workshops on its own or with collaboration with other elite institutions. Department will be equipped with a CAD lab and others for research in chemical reaction engineering, plant and process design, quality control and transport phenomenon would be developed in due course of time. The Chemical and Biochemical Engineering department will focus on relevant curriculum and research and development in the areas of chemical products processing, biological systems engineering, food processing technology, biofuel, industrial biotechnology, bioreactor design and electrochemical energy conversion.

Total Number of Abstracts Received: 05

Posters: 03

My Research in 3 Minutes: 02

Minimizing Compression Energy in Batch Process

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Presentation Type: Poster

Batch processes are widely used in food, agrochemical, and pharmaceutical industries to generate high-priced fine chemicals. Water and energy minimization in water allocation networks and hydrogen management in refineries has been extensively explored using mathematical optimization and graphical methods for the continuous process. However, very few works have been proposed for the batch process for optimizing allocation networks. No graphical method or computational method has been reported for minimizing compression energy while satisfying the demand for batch processes in the gas allocation network (GAN). In this paper, a novel graphical method based on pinch analysis for minimization compression energy in batch GAN while minimizing resource requirement. This methodology is applicable to any fixed-scheduled batch GAN. Applications of the proposed methodology are illustrated via two illustrative examples. It is demonstrated via the example that the proposed methodology has significant energy saving potential as well as resource requirements.

Keywords: Batch Process; Compression Work; Gas Allocation Network; Pinch Analysis.

A Numerical Study on Thermal Management of a Lithium-Ion Battery Module for Electric Vehicle Applications via Forced-Convective Air Cooling

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Presentation Type: Poster

Global environmental concerns over increased emissions from transportation vehicles have driven research instincts towards the development of clean energy vehicles. Pure and hybrid electric vehicles coupled with lithium-ion batteries for energy storage are environmentally friendly options to realize the future dream of low carbon emissions. However, an efficient battery thermal management system is a prerequisite for the safe operation of such high power batteries to avoid thermal runaway and degradation, thereby maintaining the temperature uniformity in the battery pack. Thus, the present work numerically investigates the performance of an air-cooled battery module for efficient removal of heat generated during the discharge process at different values of air-flow velocity, cell configuration, and the number of cells in the battery module. A coupled electrochemical-thermal model is employed to model the discharge behavior of the battery in conjunction with the two-dimensional flow and heat transfer model to monitor the temperature of each battery cell.

Keywords: Lithium-ion Battery; Mathematical Modelling; Air-cooled BTMS; Discharge Rate; Inline and Staggered Arrangement.

Utilizing Solar Energy for CO₂ and N₂ Conversion into Fuels

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Presentation Type: Oral (My research in 3 minutes)

When two semiconductors are electronically coupled, their photocatalytic performance can be greatly enhanced. Herein, we formed a heterostructure between Cu₂O and SnS₂/SnO₂ nanocomposite using a solvothermal reactor, which reduced CO₂ by H₂O at ambient conditions to produce CO, H₂, and CH₄. With the inclusion of Cu₂O, apparent quantum yield, a measure of photoactivity, has increased from 7.16% to 8.62%. In addition, the selectivity of CH₄ over CO was approximately 1.8-times higher than that of SnS₂/SnO₂. Interestingly, the as-synthesized catalysts were able to fix N₂ to NH₃ under light illumination at ambient conditions. Oxygen vacancies act as active sites to chemisorb nitrogen molecules, which follow associative steps to generate NH₃. In absence of a sacrificial agent, the NH₄⁺ generation rate was 66.35 μmol.g⁻¹h⁻¹ for Cu₂O/SnS₂/SnO₂, which is 1.9-fold higher than SnS₂/SnO₂. The results clearly illustrate a promising strategy to use oxygen vacancies-rich heterostructure for wide application in photocatalysis.

Keywords: Photocatalytic performance; CO₂ reduction; N₂ fixation.

A Goal Programming Approach for Optimizing Natural Gas Transportation Network

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Presentation Type: Oral (My research in 3 minutes)

Natural gas is widely transported through the high-pressure pipeline network. The compression procedures involve huge amounts of energy and investment. So designing any pipeline network in NG transportation also needs to include conflicting goals of various criteria with the priority like maximization of demand satisfaction and minimization of compression energy and investment cost. In this paper, a goal programming model based on the Lexicographic method is proposed for solving the multi-criteria problems in natural gas transportation where each criterion is incorporated on a priority basis to achieve targeted goals. The applicability of the proposed model is illustrated through examples. Maximization in demand satisfaction is the prime objective and remaining targeted goals are attained on a priority basis. The deviation variable in the proposed model is solved in GAMS by using the CPLEX

solver. These deviation variables provide flexibility to the decision-maker to change their priorities according to social, environmental, and economical constraints.

Keywords: Natural Gas Network; Multi Decision Criteria; Optimization; Goal Programming.

Department of Chemistry

About the Department

The Department of Chemistry in IIT Patna has been established since the setting up of the Institute in 2008. The department started the PhD program in Chemistry from July 2009. A vibrant multidisciplinary research program in the Department of Chemistry at IIT Patna is supported by energetic faculty members and state-of-the-art research facilities. The faculty members of the department are committed to quality teaching and research. With a strong foundation in the conventional areas and quest for emerging areas of Chemistry, faculty and students are engaged in a range of dynamic research programs that include Supramolecular Chemistry, Target and Diversity oriented Organic synthesis, Nanochemistry, Catalysis, high resolution and Bio-Spectroscopy, Polymer and Biochemistry.

Total Number of Abstracts Received: 19

Posters: 16

My Research in 3 Minutes: 03

Breakdown of the Stokes-Einstein Relation in Supercooled Water/Methanol Binary Mixture: using Translational Jump-Diffusion Approach

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Presentation Type: Poster

A recent experiment has directly checked the validity of the Stokes-Einstein (SE) relation for pure water, pure methanol, and their binary mixtures of three different compositions at different temperatures. While in the majority of the systems, an increasing SE breakdown is observed with decreasing temperature, the breakdown is already significant at higher temperatures for the equimolar mixture. Violations of the SE relation in pure supercooled water have been previously explained using the translational jump-diffusion (TJD) approach. We have used the same TJD approach for explaining the SE breakdown for the methanol/water binary mixtures of compositions studied in the experiment over a wide range of temperatures between 220 K and 300 K. We have understood that the jump-diffusion is the key responsible factor for the SE breakdown. This study, therefore, provides molecular insight into the SE breakdown for the supercooled water/methanol binary mixture, as found in the experiment.

Keywords: Water/Methanol binary mixture; Breakdown of SE relation; Translational Jump diffusion.

Non-Adiabaticity in Photodetachment Process of Al_6N^-

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Presentation Type: Poster

This present work is an effort to explain the non-adiabaticity in the photo-detachment process of Al_6N^- anion by considering the seven low-lying electronic states. This effort includes the electronic structure calculations and nuclear dynamics approach. Electronic structure calculations are performed by applying the outer-valence green function method whereas time-dependent and time-independent nuclear dynamics are performed using multi-configuration time-dependent Hartree program module. For this study, a linear vibronic coupling model is applied to construct the molecular hamiltonian in diabatic electronic representations. The present nuclear dynamics study suggests that the non-adiabatic effect is extremely important in the photo-detachment process of Al_6N^- anion.

Keywords: Non-adiabatic; Nuclear dynamics; Diabatic; Hamiltonian.

Triptycene-Based and Schiff-Base-Linked Porous Networks: Selective CO₂ Capture and Excellent Antiproliferative Activity

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Presentation Type: Poster

The design and synthesis of functional porous materials is a frontier research area. A set of unique triptycene-based and organic Schiffbase-linked polymers (TBOSBLs) have been conveniently synthesized via a facile condensation reaction between di- or triaminotriptycene and 1,3,5-triformylphloroglucinol. The resulting polymers were well characterized using FTIR and NMR spectroscopy, thermogravimetric analysis, and X-ray diffraction. TBOSBLs are amorphous, thermally stable with a reasonable surface area (SA_{BET} up to 649 m²/g), and have abundant nanopores (pore size < 100 nm). Importantly, TBOSBLs have the ability to capture small gas molecules, such as CO₂, H₂, and N₂. The CO₂ uptake capacities are greater than 125 mg/g at 273 K and 1 bar pressure, TBOSBLs demonstrate remarkable CO₂/N₂ selectivity (up to 108) at 273 K. Furthermore, TBOSBLs store hydrogen up to 19.5 mg/g at 77 K and 1 bar pressure. In addition, TBOSBLs show superior antiproliferative activity against human colorectal cancer cells. It is also noteworthy that antiproliferative activities of TBOSBLs are superior compared to those of phloroglucinol containing covalent organic frameworks.

Keywords: Triptycene; Schiffbase; Porous polymer; Selective CO₂ capture; Antiproliferative.

Cationic Dyes and CO₂ Loving Triptycene based Porous Polymer for Environmental Remediation

Mosim Ansari, and Neeladri Das*

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Presentation Type: Poster

In recent decades, global warming and water pollution have emerged as serious environmental concerns. Increasing concentration of carbon dioxide (CO₂) in air is considered as one of the reasons for global warming. On the other hand, hazardous organic dye stuff present in the industrial effluents causes harmful effects on aquatic life. Therefore development of novel materials for efficient and selective capture of dyes and CO₂ is of great significance. We have designed and synthesized triptycene based porous material that has high surface area up to 824 m² g⁻¹. The presence of permanent porosity, π -rich cavities, and CO₂-loving groups in TBHAP makes it effective sorbent for CO₂ (145 mg/g: 273 K, 1 bar) and toxic cationic dyes Methylene blue ($Q_m = 250$ mg g⁻¹) and Rhodamine B ($Q_m = 588$ mg g⁻¹). Thus, TBHAP is a promising material in the domain of environmental remediation.

Keywords: Porous polymer; CO₂ capture; Water purification; Dye adsorption.

Quantum and Classical Dynamics of N(2D) + N₂ Reaction on its Ground Doublet-state N₃ Potential Energy Surface

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Presentation Type: Poster

Initial state-selected dynamics of N (²D) + N₂ (X¹Σ) → N₂ (X¹ Σ) + N (²D) exchange reaction on its electronic ground doublet-state N₃ (1²A'') potential energy surface (PES) has been studied here by time-dependent quantum mechanics (TDQM) and quasi-classical trajectory (QCT) methods. Dynamical attributes such as total reaction probabilities, state-selected integral cross sections, and initial state-selected rate constants have been calculated. The presence of metastable quasi-bound complexes in the collision process is confirmed by substantial oscillatory structures in the reaction probability curves. Also, rotational excitations of reagent N₂ on the reactivity has been examined by calculating the probabilities for the two-body rotational angular momentum up to j = 10. We conclude that the reagent rotational excitation increases the reactivity. The TDQM results are compared with QCT results.

Keywords: Time dependent Quantum-mechanics; Quasi-classical trajectory; State-selected integral cross-sections.

One-Pot, Borax-Mediated Synthesis of Structurally Diverse N,S-Heterocycles in Water

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Presentation Type: Poster

Borax-mediated, convenient and efficient strategy for the synthesis of prominent structurally diverse N, S-heterocycles in water was elaborated. The reaction proceeds through a borax-mediated synthesis of quinazolin-4(3H)-one, benzothiadiazine 1,1-dioxide, benzothioazole, and benzoxazoles from readily available 2-aminobenzamide/2-aminobenzenesulfonamide/2-aminothiophenol/2-aminophenol with α,α,α-trihalotoluenes at 100 °C. By using aldehydes in place of α,α,α-trihalotoluenes, the reactions are catalyzed by borax through domino strategy for the synthesis of 2,3-dihydroquinazolin-4(1H)-one, 3,4-dihydrothiadiazine 1,1-dioxide, and benzothiazoles in one-pot at 60 °C. The advantages of this protocol include practical simplicity, substrate scope, moderate to excellent yields, and cheapness of benign solvents.

Keywords: Quinazolin-4(3H)-one; Benzothiadiazine 1,1-dioxide; Benzothioazole; α,α,α -trihalotoluene; Borax.

A Thixotropic Supramolecular Metallogel with a 2D Sheet Morphology: Iodine Sequestration and Column Based Dye Separation.

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Presentation Type: Poster

Sequestration of hazardous radioactive iodine and dye separation to reduce industrial waste through reutilization is pivotal for environmental safety. Herein, we have synthesized a new waterborne ultrasensitive supramolecular metal-organic gel ($Mg@\text{DEOA}$) by the direct mixing of the magnesium nitrate hexahydrate and low molecular weight gelator diethanolamine (Figure 1). The 2D sheet material was fully characterized by the FE-SEM, HR-TEM, AFM, TGA and rheology analysis. This porous metallogel was used effectively for iodine sequestration from the solution. Besides, $Mg@\text{DEOA}$ was found very effective to remove rhodamine B from the mixture of dyes through xerogels packed columns, and as an adsorbent for the synthetic organic pollutant and carbon dioxides.

Keywords: Metallogel; 2D morphology; Iodine sequestration.

Hybrid DNA-Carbon Dot-Polyvinylpyrrolidone Hydrogel with Self-healing and Shape Memory Properties for Simultaneous Trackable Drug Delivery and Visible-Light-Induced Antimicrobial Photodynamic Inactivation

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Presentation Type: Poster

A two-step methodology for simultaneous conjugation of DNA and polyvinyl pyrrolidone (PVP) polymer to a single Carbon Quantum Dot (CD) is demonstrated for the first time to fabricate a pH responsive DNA-CD-PVP hybrid hydrogel. The pH responsiveness was achieved through the formation of DNA I-motif conformation at neutral to acidic pH that infuses self-healing and shape memory properties in the hydrogel. The hydrogel is capable of loading and sustained delivery of drugs for more than two weeks as demonstrated using a model drug, Hemin. The quenching of fluorescence of CD by Hemin was trackable even through simple visual monitoring. Most significantly, the chosen CD generates Reactive Oxygen Species (ROS) upon visible light irradiation arming the hydrogel with worthy antimicrobial activity. Biocompatibility of the DNA-CD-PVP hydrogel was established on human fibroblast cells indicating their potential use in the biomedical area pertaining to wound healing.

Keywords: Carbon dot (CD); DNA; Hemin.

5-Nitroisophthalate based Structurally Diverse Coordination Polymer for Catalytic Applications

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Presentation Type: Poster

Porous Coordination Polymers (PCPs) are Organic-Inorganic hybrid highly crystalline materials, and they possess several superior features such as controllable structural diversity, tunable porosity, higher stability, scalability, and functionality. Inspiring from these facts and considering the novelty of these materials, four nitroisophthalic acid based coordination polymers have been synthesized via hydrothermal synthetic methodologies. All coordination polymers, 1 [$\text{Cu}(\text{nipa})_2(4\text{-abpt})(\text{H}_2\text{O})$], 2 [$\text{Cu}(\text{nipa})_2(4\text{-abpt})$], 3 [$\text{Ni}(\text{nipa})(4\text{-abpt})(\text{H}_2\text{O})_2$], 4 [$\text{Ni}(\text{nipa})(4\text{-abpt})(\text{H}_2\text{O})$] [NIPA = 5-Nitroisophthalic acid, 4-ABPT = 3,5-di(pyridin-4-yl)-4H-1,2,4-triazol-4-amine] exposes nitro functionality, along with open metal sites. Within two Cu(II) compounds compound 2 possesses one coordinated water molecule, whereas compound 1 has no coordinated water molecule. Similarly, within two Ni(II) compounds compound 3 possesses two, and compound 4 possesses one water molecule. It is expected that this structural diversity will reflect in their catalytic behavior. The poster will present the synthesis, structure, and related properties of these compounds.

Keywords: Porous Coordination Polymer; Catalytic Activity.

Ruthenium (II)-Catalyzed Regioselective *ortho*-C-H Alkenylation of Benzamide via Weakly Coordinating Primary Amide as Directing Group

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Presentation Type: Poster

Considering the high importance of olefinated-arenes across the field of science, including pharmaceuticals, materials, and agrochemical industry, we aim herein to design and develop a mild and efficient synthetic route for the synthesis of alkenylated-arenes via the C-H activation/functionalization using commonly occurring functional group primary amide as a directing group. In this context, A highly regioselective Ruthenium catalyzed amide directed ortho olefination of benzamide with olefins via C-H bond activation has been developed. A vital advantage of the present method is the use of a primary amide motif (-NH₂) as a desired directing group to activate the robust C-H bond and avoid an elaborated

synthetic strategy, including installation and removal of extra auxiliary. This newly developed protocol has demonstrated excellent reactivity, regioselectivity, and good functional group tolerance.

Keywords: C H Activation; Ortho Olefination; Ruthenium Catalysis.

A Novel Zr–Ion Induced Metallogel: Synthesis, Characterisation, and Iodine Sequestration

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Presentation Type: Poster

In recent years, designing soft and smart materials by introducing metal into organic-based gelators is one of the prodigious research interests. Multifarious advantageous properties like conductivity, catalytic behaviour, and stimuli responsive behaviour is the strategy behind the development of this kind of soft materials. Herein, we are reporting low molecular weight gelators (LMWG) having four terminal acid binding sites, upon reaction with Zirconium metal salt forms a novel metallogel. Amorphous nature of the metallogel is affirmed by the PXRD (Powder X-ray Diffraction) pattern. In addition, it has compact morphology with columnar structure confirmed by FE-SEM (Field Emission Scanning Electronic Microscope). The metallogel absorbs light in the UV range ($\lambda_{\text{max}}=350$ nm), and it can be a potential material for luminescence and photocatalytic behaviour. The material is a very good host matrix for the iodine sequestration.

Keywords: LMGW; Morphology; Metallogel; Conductivity; Luminescence.

Post-Polymer Modification of Chitosan with Absolute Control in the Predefined Feed Ratio

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Presentation Type: Poster

Hydrophobic modification of chitosan is the imperative issue at present. Hence, it is highly desired to develop an efficient synthetic protocol for post-polymer modification of chitosan with different hydrophobic moieties. To address this issue, we have developed synthetic procedures to synthesize functional chitosans via post polymer modification using modified azetidinium based compounds in water. The developed synthetic procedure involves - one pot reactions, high reaction conversion (>95%), need no catalyst or additive, and use of water as only solvent. In the 1st stage we have synthesized a library of azetidinium functionalized molecules, where the molecules consist of reactive azetidinium groups attached with different hydrophobic and hydrophilic moieties (target functionality). In the next stage those azetidinium functionalized reagents reacted with chitosan via azetidinium amine reactions.

This helps the target functionalities linked within the chitosan backbone. Very interestingly the feed ratio of the reaction exactly matches the calculated degree of modification with chitosan.

Keywords: Functional chitosan; Azetidinium chemistry; Hydrophobic/Hydrophilic modification.

Hierarchical Porous Polymers via a Microgel Intermediate: Green Synthesis and Applications toward the Removal of Pollutants

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Presentation Type: Poster

Exploring a synthetic approach to prepare processable hierarchical porous polymers (PPs) is challenging. Herein, a strategic approach is presented, where polymerization (hyperbranching)-induced self-assembly in water leads to the formation of porous microgels, which is followed by spontaneous cross-linking of intermediate microgels, leading to the formation of PPs. The synthetic process involves simple, green and upscalable reactions. During this process, hydrophobicity of chosen monomers controls the morphology and porosity of the microgel, which in turn dictates the hierarchical porous morphology of the PPs. Such a synthetic hierarchy during the PP formation in water ensures increase of both surface area and active functionalities. Furthermore, under right conditions, the microgel-based emulsion can be used to form homogeneous porous thin films, which is important in the context of processability of such polymers. The synthesized hierarchical PPs exhibited excellent adsorption capacities for different pollutants, such as iodine, dyes and high CO₂ adsorption with good selectivity.

Keywords: Porous polymers; Microgels; Removal of pollutants; Hierarchical synthesis; Thin films.

Synthesis and Application of a 2D-Pb MOF based on Thiol Ligand

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Presentation Type: Poster

The special porous class of coordination polymers consisting of metal ions or clusters and organic ligands to form 2D and 3D structures are called metal-organic framework (MOF). Due to distinct advantage from hard nature (HSAB) of the carboxylic acid group and soft nature of the thiol group, MOF containing thiol based carboxylic acid shows applications such as heavy metal adsorption, electrocatalysis, and bio mimicking of active enzyme sites (e.g., iron-sulfur cluster etc)¹. Herein we have synthesized a two dimensional (2D) Pb MOF with 2,5-dimercapto terephthalic acid ligand and ethylenediamine as a linker. Pb coordination of 2,5-dimercapto terephthalic acid with both the carboxylate and the thiol functionality

results in a one dimensional chain which are interconnected by ethylenediamine to form the two dimensional layer. The compound crystallizes in P, $a = 6.6510 \text{ \AA}$, $b = 12.0907 \text{ \AA}$, $c = 12.7453 \text{ \AA}$, $\alpha = 108.564^\circ$, $\beta = 91.006^\circ$, $\gamma = 97.586^\circ$, $V = 961.15 \text{ \AA}^3$ (Space group = P-1 Triclinic).

Keywords: Thiol; Electrocatalysis; Bio mimicking.

Isocyanate and Phosgene-free Synthesis of Polyureas using TAD-indole Chemistry

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Presentation type: Poster

Ureylene group (-NHCONH-) in the polymer backbone known as Polyureas (PUAs) are polymeric materials that shows special properties like anti-corrosion properties, excellent mechanical properties, hydrolysis resistance, and hence are used in industrial and commodity products for applications like coating, greases and microcapsules. However industrial synthesis of polyurea largely relies on the usage of isocyanates and phosgenes, which are environmentally toxic. This makes isocyanate/phosgene-free synthesis of polyureas a very important research field. Herein, we synthesized PUAs using bifunctional triazolinedione (bis-TAD) molecules and bifunctional indoles (bis-In) via TAD-indole chemistry. For this purpose a library of bis-TAD molecules and bis-In were synthesized as monomers and characterised by NMR and HRMS. These monomers reacted together, resulting in very fast synthesis of polyurea. Characterization of PUAs was done using NMR and molecular weight was determined using SEC. In addition the synthesized PU possesses dynamic properties due to thermo-reversible characteristic of TAD-indole linkage.

Keywords: Polyureas (PUAs); TAD-indole chemistry; Dynamers.

How does Phenylalanine Perturb the Lipid Membrane? Insights into the Phenylketonuria Disease

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Presentation type: Poster and Oral (My Research in 3 Minutes)

Phenylketonuria (PKU) - an age-old known inherited disorder of phenylalanine (PHE) metabolism has attracted researchers for the past few decades. Phe, an essential amino acid (AA), forms different fibril and non-fibril aggregates in bulk aqueous solution. When accumulated to pathological concentration in our body it damages various cells, including brain cells. Recent experimental studies have shown an increase in fluidity and permeability of a model cell membrane. However, a molecular-level picture of

cell damage is not explored. In this study, we have attempted to unveil how PHE perturbs the cell membrane structure using molecular dynamics simulation. A model DPPC bilayer is exposed to ~180mM concentration of phe at two characteristic temperatures: 325 K and 350 K. Unlike in the bulk aqueous solution, PHE forms smaller clusters (including dimer and trimer aggregates) with phe arranged favourably in a lateral arrangement (fibrils) near the lipid membrane. The observations epitomize that even these smaller clusters can interact strongly with the membrane via strong hydrogen bonding and electrostatic interactions. This contradicts the common understanding motivated from several in vitro studies that it must be the bigger PHE aggregates as seen in bulk that attack the membrane and cause significant modulation of membrane structure and dynamics. Decreased lipid packing density and increased mobility of the membrane increase the rate of water permeation across the membrane more strongly at 325 K exemplifying the cytotoxic behaviour of PHE in PKU.

Keywords: Phenylketonuria; Phe clusters; Membrane fluidity.

Effect of TMAO on the Structure and Phase Transition of Lipid Membrane under Osmotic Stress Condition

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Presentation Type: Oral (My Research in 3 Minutes)

Extremophiles adopt strategies to deal with different environmental stress factors, which are severely damaging for cell membrane. To combat high osmotic stress, deep-sea organisms synthesize osmolytes, small polar organic molecules, like trimethylamine-N-oxide (TMAO). TMAO is known to protect cells against high osmotic or hydrostatic pressure. Using the molecular dynamics (MD) simulation technique, we have demonstrated the effect of TMAO on two saturated fully hydrated lipid membranes in their fluid and gel phases. We have captured the impact of TMAO's concentration on the membrane's structural properties along with the fluid/gel phase transition temperatures. On increasing the concentration of TMAO, we see a substantial increase of the packing density of the membrane. Addition of TMAO also increases the fluid/gel phase transition temperature of the membrane bilayer. This study, therefore, provides a molecular-level understanding of how TMAO can influence the cell membrane of deep-sea organisms and help in combating the osmotic stress condition.

Keywords: Lipid; Osmolyte; TMAO; Gel; Fluid.

Spectroscopic Investigation of a Red Emitting Dye in the Companionship of Serum Albumins and Cucurbit[7]uril

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Presentation Type: Oral (My research in 3 minutes)

The binding interaction of nile blue A (NBA) with bovine serum albumin (BSA) and human serum albumin (HSA) along with gradual addition of cucurbit[7]uril (CB7) is studied. The change in spectra of NBA in presence of BSA, HSA and CB7 suggest interaction between the species in the solution. The binding constant as calculated for NBA-HSA and NBA-BSA indicates that the NBA prefers binding to HSA than BSA. From the lifetime and rotational relaxation data, it is evident that the NBA experiences a more restrained environment with HSA than BSA with the addition of CB7 in the solution. Circular dichroism study indicates that both BSA and HSA, experiences a perturbation in their secondary structures in the presence of NBA and CB7. However, the secondary structure of BSA is stabilized whereas; HSA is destabilized in the presence of the NBA. It is evident that the NBA in NBA-BSA-CB7 system undergoes competitive interaction whereas, in NBA-HSA-CB7 system, NBA undergoes cooperative interaction.

Keywords: Nile Blue A; CB7; Competitive Interaction; Cooperative Interaction.

Department of Civil and Environmental Engineering

About the Department

Welcome to the Department of Civil and Environmental Engineering (DCEE) at Indian Institute of Technology Patna (IIT Patna) that consists of five independent disciplines; Structural Engineering, Geotechnical Engineering, Transportation Engineering, Water Resources Engineering, and Environmental Engineering. DCEE is one of the new departments established in 2013 that offers a four-year course (Bachelor's degree) and two-year course (Master's degree) in Civil and Infrastructure Engineering. The department also provides doctoral programmes on emerging research areas (viz., Structural Engineering, Geotechnical Engineering, Railway Engineering, Water Resources Engineering, and Environmental Engineering). The DCEE is an innovative and vibrant place of learning, where students pursue their educational and research interests in order to lead the next generation in transforming the disciplines of civil and environmental engineering. Department is actively involved in basic as well as advanced research and provides high quality technical advisory support through various R&D projects and consultancy to various organizations.

Goal of the DCEE is to reach the level of excellence in the latest technical front as well as advanced research; to provide a high quality teaching and learning environment in the field of Civil and Environmental Engineering to make students capable of innovative thinking. Instead of compartmentalizing, DCEE at IIT Patna is adopting an integrated approach to forge all these areas into a multi-disciplinary and application oriented course. This interdisciplinary nature will lead to development of creative and analytical ability of the students to handle the novel challenges of the society; further improving the lifestyle of the society by creating various innovative works and transferring technological knowledge from classroom to real life.

Total Number of Abstracts Received: 15

Posters: 12

My Research in 3 Minutes: 03

The Behavior of Geocell Reinforced Bed under Vibration Loading: Insights from Experimental, Analytical, and 3D Numerical Studies

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Presentation Type: Poster

This poster highlights the behavior of geocell reinforced bed subjected to vibration loading from three different perspectives namely, field, analytical, and numerical studies. Primarily, a series of field vibration tests were performed on the unreinforced and geocell reinforced foundation beds. The vibration isolation potential was quantified in terms of displacement amplitude versus frequency, and peak particle velocity (PPV) variation. From the results, the PPV of the foundation bed was distinctly reduced by 49% due to the inclusion of geocell reinforcement. The efficacy of the mass-spring dashpot (MSD) analogy was examined in predicting the experimental amplitude versus frequency response through the analytical investigation. This comparison is beneficial to understand the damping behavior of different reinforced beds. Further, insights into the mechanism responsible for vibration isolation efficacy of geocell reinforced bed is emphasized using the 3D numerical studies. To carry out the numerical analysis, finite difference software FLAC^{3D} has been used.

Keywords: Geocell; Vibration loading; Field vibration test; FLAC^{3D}; MSD analogy.

Interaction Behaviour between Geogrid and Sand-Crumb Rubber Mixtures

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Presentation Type: Poster

In recent years, geosynthetics have been effectively used to increase the strength and stability of the retaining structures. If geosynthetics are to be used as reinforcement with the soil containing crumb rubber, it is essential to understand the physical interaction behavior between soil-rubber mixtures and the geosynthetics. In the present study, the interaction behavior of the sand-rubber mixtures with biaxial geogrid was studied. Rubber–sand mixtures with mixing ratios of 10:90, 20:80, and 30:70 by volume were studied. Pullout tests were conducted at five different normal stresses, where pullout forces were applied to the geogrid specimen at a strain rate of 1 mm/min. The peak pullout load was observed at the verge of the failure of geogrid. Two different types of failure of geogrid were observed (i.e., slippage and tensile failure). The 30:70 mixing ratio of rubber-sand showed the highest interaction, thus giving the optimum pullout capacity of the geogrid.

Keywords: Geogrid; Pullout load; Crumb rubber; Strain rate.

Flexural Strengthening of Low-Strength Unreinforced Masonry using Wire Reinforced Cementitious Matrix

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Presentation Type: Poster

Seismic strengthening of vulnerable structures is important and significant research has been performed on their strengthening. In this study, welded wire-mesh embedded in the cementitious matrix (WRM) has been used as external reinforcement for the strengthening of unreinforced masonry walls. Initially, a detailed experimental study was conducted to show that the type of cementitious matrix and welded wire mesh can play an important role in contributing to the flexural strength and deformability of the masonry. Further, a database of all existing predictive equations in the literature has been created and used to predict the flexural strength of strengthened masonry. Results showed that the available equations did not provide a consistent prediction for the flexural strength of strengthened specimens. Lastly, a new equation was proposed for flexural strengthening of unreinforced masonry using WRM. The analytical results showed that the developed methodology was able to provide a better and consistent prediction.

Keywords: Welded wire mesh; Unreinforced masonry; Strengthening; Flexural strength.

Effect of Coal Fouling on Railroad Ballast under Direct Shear Loading Conditions

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Presentation Type: Poster

Large-scale direct shear tests were performed to explore the behavior of coal fouled geogrid-stabilized ballast at different void contamination index (VCI) values ranging from 0 to 60% and at a constant applied normal stress (σ_n) of 90 kPa and shearing rate (S_r) 3 of mm/min. Fresh granite ballast with an average particle size (D_{50}) of 42 mm, and triaxial geogrid having 69×69 mm aperture were used for this current study. The laboratory experimental results confirm that the interface shear strength is influenced by the coal fouling. The friction (ϕ) and dilation (ψ) angles of unstabilized ballast are found to be decreased as the VCI increases from 0 to 60%. It is further observed that the breakage of ballast (B_g) decreases with the presence of coal fines. However, the presence of geogrid was found to increase ϕ and

reduced B_g and ψ of fresh and coal-fouled ballast. These test results show the effectiveness of triaxial geogrid in stabilizing the fresh and coal-fouled ballast.

Keywords: Ballast; Geogrid; Shear strength; Void contamination index (VCI); Coal fouling.

Enzymatic Bio-Fenton Process to Recover Metals from Waste Printed Circuit Boards

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Presentation Type: Poster

Biohydrometallurgy is an eco-friendly technique to extract metals from the waste stream. Given the volumes of electronic waste being generated and the content of valuable metals present, it is necessary to extract valuable metals from e-waste for recycling. A printed circuit board (PCB) is the core component of any EEE. Due to the heterogeneous material composition, recycling of metals from waste PCB is crucial and important. In this study, the bio-Fenton process has been applied in which glucose was oxidized by glucose oxidase enzyme to generate in-situ H_2O_2 . In addition, the effect of initial Fe^{2+} concentration was assessed on metal extraction using the bio-Fenton process. The results revealed an increase in metal extraction efficiency with an increase in initial Fe^{2+} concentration from 10 mM to 50 mM. The maximum metal extraction from the PCB sample was achieved by more than 90% for Cu, Zn, and 64% for Ni using the bio-Fenton process.

Keywords: E-waste; Printed circuit board; Metals; Circular economy; Metal recovery.

Long-Term Fate of Zinc Oxide Nanoparticles in the Presence of Nano-Iron Oxide through the Natural Sediment under different Environment Condition

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Presentation Type: Poster

The objective of this study is to evaluate the long-term fate of the $nZnO-nFe_xO_y$ mix nanoparticles through natural sediment in the presence of humic acid (HA) under varying pH. Column experiments were carried out where 50 mg/l of $nZnO-nFe_xO_y$ mix suspensions were injected for 5 pore volumes (PVs) in that porous media under varying pH (6 and 8) followed by flushing with deionized and/ groundwater for another 95 PVs under constant head condition. The outcome of the study suggests that the transport efficiency of retained Zn is high at higher pH (29.97% at pH 6 to 95.89% at pH 8). However, negligible Fe gets transported under all pH conditions. Release of retained Fe through porous media is less as

compared to release of Zn in the long-run. The presence of groundwater reduced the release of Zn and Fe through porous media, mainly due to the presence of co-ions.

Keywords: Co-transport; Emerging contaminants; Nanoparticles; Long-term fate; Groundwater.

A Comparison between different Saltwater Intrusion Simulation Models

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Presentation Type: Poster

Coastal aquifers are facing stress due to heavy and unmanaged pumping because of the massive demand for freshwater. This results in lowering of the water table, which results in polluted groundwater by seawater. Therefore, it is required to develop some management measures. The selection of a suitable management measure is dependent on simulated effects. There are mainly two different types of saltwater intrusion simulation models: the sharp interface model and density-dependent model. The sharp interface model considers saltwater and freshwater are two immiscible liquids, whereas mixing of saltwater and freshwater is considered in the density-dependent model. In this poster, a comparison study has been performed between the sharp interface model and density-dependent model. These models are applied to simulate the location of the saltwater in the Puri city aquifer. The comparison has been performed based on the time taken for simulation, the accuracy of the simulation, and drawbacks of the simulations.

Keywords: Saltwater intrusion; Sharp interface model; Density-dependent model.

Damage Detection in Truss Bridge using Vibration-based Techniques

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Presentation Type: Poster

Bridge deterioration causes catastrophes in the world. Therefore, the robustness and safety of bridges that exist throughout the world must be assured. A substantial amount of funds has been spent on maintaining existing bridges. Several bridges are now aging and do not satisfy current standards and reach the end of their design lifespan. The bridge's assessment is the need of the hour since the replacement of bridges has a high cost and environmental impact. In these circumstances, the bridge's structural health monitoring is an effective method to prolong the lifespan. In this study, a nonparametric damage detection method for truss bridges is presented, which uses bridge-free vibration response under real measurement conditions.

The analysis investigates the variation in modal properties with the reduction in strength of the member. It is established that the proposed technique produces positive results for identifying, locating, and relatively assessing the damage even under different end conditions.

Keywords: Steel truss bridge; Structural health monitoring; Damage detection; Free vibration response.

Variation of Swelling Pressure, Consolidation Characteristics and Hydraulic Conductivity of two Indian Bentonites due to Electrolyte Concentration

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Presentation Type: Poster

The hydro-mechanical properties of the buffer material play an important role in the design of deep geological repositories. This paper presents the effect of various electrolyte concentrations on swelling pressure, consolidation characteristics, and hydraulic conductivity of two different Indian bentonites. Constant volume swelling pressure tests on compacted bentonite specimens as well as consolidation tests on saturated bentonite specimens was carried out by supplying 0, 0.1, 0.5, and 1.0 N NaCl and CaCl₂ solutions. The change in morphology and microstructure of bentonite specimens were examined by Scanning Electron Microscope (SEM) and XRD analysis. The hydraulic conductivity was calculated based on consolidation test results. At a dry density of 1.4 Mg/m³ both swelling pressure and hydraulic conductivity of divalent bentonite were found to be approximately 2.9 and 7.3 times higher than that of monovalent bentonite when saturated with deionized water. The electrolyte solutions altered the morphology, microstructure, and hydro-mechanical properties of the monovalent bentonite significantly; however, the effect was found to be negligible for divalent bentonite. An empirical equation is proposed to predict the hydraulic conductivity of the bentonites. A good correlation between experimental and predicted hydraulic conductivity of bentonites is obtained. The divalent bentonite was found to be better suitable engineered barrier material in the electrolyte environment, whereas monovalent bentonite was found preferable at low salinity conditions.

Keywords: Bentonites; Swelling pressure; Hydraulic conductivity; SEM; XRD test.

Kinetic study for the Removal of Ibuprofen, Diclofenac and Carbamazepine from Aqueous Solution

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Presentation Type: Poster

Current demographic trends, the rise of chronic diseases, the accessibility of inexpensive generic treatments, and the emergence of “lifestyle” drugs have been the keys for increased pharmaceutical medicine use throughout the world. These pharmaceuticals are the group of emerging contaminants that is becoming a serious concern, given that the trace amount of those contaminants are detected in different component of environment such as surface water, groundwater, and soil. These emerging contaminants have significant impact on invertebrates, vertebrates and on the overall ecosystem. Bioremediation through green adsorbent has been explored widely to remove several of these contaminants which is cost-effective methods and efficient. The present study focused on the use of coconut derived activated carbon for the removal of above pharmaceuticals.

Keywords: Emerging contaminant; Bioremediation; Ibuprofen; Diclofenac; Carbamazepine.

Stability of Steel I-Section Beams Subjected to Extreme Fire

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Presentation Type: Poster

The steel beams' capacities are controlled by the slenderness ratio, modulus and strength properties of structural steels. Support conditions at the end, loading positions, and shape of the cross-section are equally important parameters for deciding the beams' capacities criteria. During extreme fire conditions, steel members go under substantial deformations. The stress development depends upon the degrees of freedom provided to the restraints. The critical buckling load for beams depends not only on slenderness and temperature but also on the duration of exposure to fire. This paper studies the performance of the steel beams under thermal loading. A numerical analysis is done on steel members using the finite element analysis method with a robust software tool ABAQUS. In a high-temperature gradient; plasticity of the steel material increases and strength and stiffness of steel member decreases significantly, causing the premature failure of the structural members.

Keywords: Buckling; Critical temperature; Fire loading; Steel beam; Stability.

Structural Performance of Thin-Walled Lipped Channel Flexural Members at Extreme Temperature

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Presentation Type: Oral (My research in 3 minutes)

Since the last decade, thin-walled cold-formed steel (*CFS*) members are gaining popularity among practicing structural engineers around the world. Cost-effectiveness, rapid construction, high strength to weight ratio, the economy of handling and transportation make these members an attractive choice of material over its hot-rolled alternative. High section factor (*ratio of fire-exposed area to volume*) makes *CFS* members vulnerable to failure under fire. This study reports FE simulation results on thin-walled lipped channel flexural members under simply supported boundary conditions at elevated temperatures. As findings of this research, it was concluded that the critical temperature of a beam is strongly affected by the loading and dimensionless slenderness (λ_{LT}) of the member. The critical temperature (θ_{cr}) limit of 350°C defined in Eurocode 3, Part 1.2 was found to be over-conservative for lateral-torsional buckling for members having higher slenderness, irrespective of loading, slenderness, or geometric parameters of the members considered.

Keywords: Cold-formed steel; Fire-safety; Flexural members; Numerical FE-Simulation; Steel Structures.

Development of Magnetic Biochar-Based Sand Filter for the Removal of Microplastics from Secondary-treated Wastewater Effluent

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Presentation Type: Oral (My research in 3 minutes)

Plastics have been deemed as evil polluters due to their indiscriminate littering and mismanagement amid increased plastic production, usage and waste generation. Microplastics (MPs) (plastic particles <5 mm) pollution is increasingly being recognized as pervasive in the environment and has recently been identified as a critical global challenge. A large proportion of MPs in the oceans originates from land-based sources such as the discharged effluent from sewage treatment plants (STPs), and urban runoff by passing through different aquatic channels. Despite high efficiency of the treatment chain in STPs, the quantity of MPs released is still of great concern due to their presence in significant volume of treated wastewater effluent on a daily basis. In this context, we aim to develop magnetic biochar-based sand filters as a potentially low-cost, eco-friendly, and low maintenance tertiary treatment option for augmenting in STPs to improve their efficiency for removing MPs from the secondary-treated effluent.

Keywords: Microplastics (MPs); Sewage treatment plants, Magnetic biochar; Sand filter; MPs immobilization.

Estimation of Hazen-Williams ‘C’ Value for Commercial Pipes through Physical Roughness Measurements

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Presentation Type: Oral (My research in 3 minutes)

This study deals with important issues of pipe flow analysis namely: estimation of Hazen-Williams ‘C’. The Hazen-Williams formula is frequently used for the design of pipelines, without regard for its limited range of applicability. This practice can have very detrimental effects on pipe design, and could potentially lead to litigation. Available evidence shows that the application of the formula is accurate only if the operation of the pipe is at a certain flow velocity. Most working ranges for water-supply pipes usually deviate from such conditions. Estimation of C from the physical roughness measurements is presented in the study.

Keywords: Pipe networks; Hazen-Williams ‘C’; physical roughness measurements.

Department of Computer Science & Engineering

About the Department

A journey to the global academic summit that touches every aspect of national life in its wake is the primary goal of the department. The department came into existence in 2008 with minuscule faculty strength and a minute undergraduate student body. This inadequacy was no deterrent to its bold decision to start the doctoral program right away.

The department has not looked back since then. It has witnessed a manifold raise in the size of the vibrant student body. Presently, all efforts are geared towards making this the first choice of aspiring undergraduates. This is being groomed to be the favored destination for research scholars brimming with ideas. Faculty strength is all set to multiply many times over with the planned addition of young and dynamic persons flashing enviable academic and research records.

The department boasts of generously equipped teaching and research laboratories. Doctoral candidates are liberally supported either by scholarships or by sponsored fellowships.

Sponsored research and developmental activities add muscle to the buzzing academics.

Future beckons this young department.

Total Number of Abstracts Received: 27

Posters: 24

My Research in 3 Minutes: 03

Routing of Delivery Trucks in a Battery Swapping System with Partial Delivery Option

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Presentation Type: Poster

We have considered a city map network with a Centralized Charging Station (CCS) and several Battery Swapping Stations (BSSs). The CCS owns a set of delivery trucks with limited capacity. Each BSS can demand some fully charged batteries from the CCS, which needs to figure out a routing strategy for each delivery truck. The strategy fulfills the demand of each BSS and, at the same time, optimizes the overall cost of delivery in terms of the distance travelled. A constrained programming-based approach has been proposed to obtain the delivery trucks' optimal routing considering the partial delivery of batteries.

Keywords: Applied Computing; Operation Research; Intelligent Transportation; Logistics.

Intelligent Scheduling of V2G, V2V, G2V Operations in a Smart Microgrid

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Presentation Type: Poster

We consider the problem of efficient scheduling of vehicle-to-grid (V2G), grid-to-vehicle (G2V), vehicle-to-vehicle (V2V) operations in a smart micro-grid equipped with renewable energy resources and multiple types of charging ports to cater to the requirements of Electric Vehicles (EVs) and essential loads of households. Our objective is to schedule the operations such that the total price paid to the utility-grid for the electrical energy is minimum. We propose a mixed integer linear programming (MILP) based formulation to obtain an optimal schedule of those operations. We also develop a heuristic approach to find a reasonable solution quickly.

Keywords: Micro-grid; Scheduling; V2G; G2V; V2V.

A Variational Approach to Image Despeckling under Varied Blur

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Presentation Type: Poster

Restoring blurred and speckle corrupted images have been a traditional problem in the area of image processing. This paper introduces a new variational Bayesian approach for deblurring and despeckling images corrupted by multilevel noise and different types of blur. We introduced an L^1 norm-based data-fidelity term and coupled it with Total Variational (TV) regularization filters in our optimization problem. As is evident through experimental results, such an approach is capable of retaining finer details in the image while producing a high-quality despeckled and deblurred image. Comparison with existing state-of-the-art shows high-quality visual and quantitative results, justifying the proposed approach's superiority.

Keywords: Deblurring, Despeckling, Total Variational filter.

Leveraging Structured Embedding Space in Attention Based DNN Model for Rumor Veracity Classification

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Presentation Type: Poster

Consequences of fake news and rumours have adversely affected social and political stability worldwide. Many such incidents have been reported which resulted in mass chaos with loss of lives and property. In response, many researchers have developed models for veracity detection of rumours on social media. The recent advances in veracity detection models incorporate the use of Deep Neural Networks (DNN) over statistical and classical machine learning based methods. Owing to better performance of DNN models over others, recent research relies much on huge auxiliary information and multiple tasks for achieving good performance. These models dependence on (1) auxiliary information and tasks limit the productivity and incur cost on resources. Moreover, (2) the structural constraints of these models puts a derogatory effect on model deliverance. These two shortcomings of the recent DNN models result in poor resource utilisation and unstructured feature extraction by these models. Resulting into a compromised output of the model. In this paper, we present an efficient ExMeX DNN model which mitigates the effects of poor utilization of resources and enhances the model performance using the same task without the aid of auxiliary information or tasks which incur huge manual efforts and costs. ExMeX is capable of utilizing the fine-granularity of implicit features for task identification. Unlike existing DNN models ExMeX is capable of achieving better performance over existing models by organised partitioning the feature space of the required task and identifying the features responsible for the task concerned. ExMeX reports a considerable performance improvement over state-of-art on standard benchmark metrics on two real world rumor datasets. It records a minimum of 17-11% improvement on Macro-F and Accuracy respectively.

Keywords: Veracity Classification; Deep neural network; Embedding space.

Detection of Alcoholism using EEG Signal and CNN-LSTM-ATTN Network

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Presentation Type: Poster

Alcoholism is a serious disorder that poses a problem for our society. Detection of alcoholism has no widely accepted standard tests or procedures. An electroencephalogram (EEG) is a method to measure the brain's electrical activity and can be used to detect alcoholism. Several previous works have tried to classify a subject as alcoholic or non-alcoholic based on these EEG signals. These works have mostly used machine learning or statistical techniques, along with handcrafted features. This paper proposes a deep learning architecture that uses a combination of Convolution Neural Network (CNN), Long Short Term Memory (LSTM), and a recently proposed attention mechanism for extracting Spatio-temporal features from multi-channel EEG signals. This proposed architecture can classify a subject as alcoholic or control with high accuracy by analyzing EEG signals and can be used for automating the task of alcoholism detection.

Keywords: Time Series; EEG; Alcoholism; FFT; Deep Learning.

BDmark: A Blockchain-Driven Approach to Big Data Watermarking

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Presentation Type: Poster

As a driving force to business growth, big data creates a new paradigm that encourages a large number of start-ups and less-known data brokers to adopt data monetization as their key role in the data marketplace. As a pitfall, such data-driven scenarios make big data prone to various threats, such as ownership claiming, illegal reselling, tampering, etc. Unfortunately, existing watermarking solutions are ill-suited to big data due to several challenging factors, such as V's of big data, multiple owners' involvement, incremental watermarking, large cover-size and limited watermark-capacity, non-interference, etc. This paper presents a novel approach BDmark that provides a transparent, immutable audit trail for data movement in big data monetizing scenarios by exploiting the power of both watermarking and blockchain technologies. To the best of our knowledge, this is the first proposal which deals with watermarking issues in the context of big data.

Keywords: Digital Watermarking; Big Data; Smart Contract; Blockchain.

Coordinated Scheduling of Residential Appliances and Heterogeneous Energy Sources in a Smart Microgrid

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Presentation Type: Poster

We propose a coordinated scheduling approach for controllable electrical appliances and the optimal usage of heterogeneous energy sources to minimize the energy drawn from the grid, thereby reducing electricity costs for the users. A mixed-integer linear programming (MILP) formulation for the problem is presented to produce the optimal solutions, and an efficient heuristic algorithm is proposed to obtain results efficiently.

Keywords: Smart Microgrid; Demand-side management; MILP.

AGD and Hessian for Saddles in Deep Neural Network

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Presentation Type: Poster

Minimizing non-convex functions posed a significant challenge in practice, as the loss landscape contains saddles, and plateaus, which affect optimizers' performance. First-order methods are often used to optimize the functions but fail to reach a second-order stationary point SSP. Second-order methods avoid saddles and arrive at SSP however are computationally expensive. We have addressed escaping saddles by establishing a trade-off between first and second-order methods without adding much overhead to calculating hessian. We give a theoretical analysis of our algorithm under the state of convexity and non-convexity. We show that minimal use of second-order derivatives increases the probability of convergence to an SSP. Furthermore, we test our algorithm on MNIST data sets. Numerical results demonstrate that our algorithm outperforms the classical version and previous variants of the algorithm

Keywords: AGD; Hessian; Saddles; First-order methods; Second-order methods.

A Fast and Efficient Way to Obtain the Optimal Number of Ports in Electric Vehicle Charging Stations

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Presentation Type: Poster

In this work, we address one of the many challenges of electric vehicles(EVs) that is the optimal placement of charging stations(locations) and allocating a certain number of charging ports(sizing) at these stations. We formulate a real-life problem in the form of a city network that accounts for the uncertainty in the arrival of EVs, mathematically represented in an optimization problem. The capacity of these locations is equivalent to the number of charging ports allotted to each of them. The uncertainty in EVs flow can be approximated in a statistical distribution with the mean representing the average expected demand and standard deviation denoting the uncertainty, which can be analyzed to determine the charging ports' optimal allocation. Experiments suggest that our approach performs better when compared using certain performance metrics with the existing research works.

Keywords: Electric Vehicles; Charging station localization; Station sizing.

Energy Trading Rank Algorithm for Truthful Auctions among EVs via Blockchain Analytics of Large Scale Transaction Graphs

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Presentation Type: Poster

There is a need for a highly secure and privacy-protected transaction environment in a decentralized vehicle-to-vehicle (V2V) energy trading among electric vehicles (EVs). In this work, we propose blockchain-based energy trading among EVs to enhance the security and privacy of the EV user's information. We introduce a new cryptocurrency, "ETcoin," for energy trading among EVs. The matched bids comprising traded energy units and ETcoins transferred are stored in a blockchain. The transaction graph formed by energy-trade can be analyzed as a large-scale graph processing. We propose an EnergyTradeRank algorithm for Blockchain analytics of large-scale transaction graphs. ETR algorithm considers both the edge and vertex properties of a graph to calculate the ETR Score for each EV during a traded period. Transaction graph analytics on energy trading acts as a proof-of-activity, and it also helps in incentivizing the EVs with maximum satisfiable participation in the blockchain environment.

Keywords: V2V; ETcoin; Blockchain; Electric Vehicle.

Ensemble Trees Learning based Improved Predictive Maintenance using IIoT for Turbofan Engines

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Presentation Type: Poster

The unprecedented growth of the industrial sector has led to an exponential increase in industrial IoT (IIoT) data sprouting increased interest in the data-driven predictive maintenance (PdM) of the industrial equipment(s). PdM is a prominent strategy that can help achieve increased reliability and safety while attaining reduced maintenance costs by estimating the current health status. However, the present schedule-based-maintenance ignores predicting faults in advance, leading to undue maintenance situations. This paper proposes a data-driven prognostic approach under multiple operating conditions to identify the most crucial attributes and critical relationship among the attributes for fault detection of individual equipment(s). Extensive experiments are performed on a widely used Prognostics and Health Management (PHM) C-MAPSS dataset. We observe that Gradient Boosted Trees (GBT) with an accuracy of 93.91% performs better over Random Forest (RF) with 91.78% accuracy. However, RF performed competitively with a much faster compute time in comparison to GBT.

Keywords: Predictive maintenance; Industrial internet of things (IIoT); Turbofan engines.

EnDeA: Ensemble based Decoupled Adversarial Learning for Identifying Infrastructure Damage during Disasters

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Presentation Type: Poster

Domain adaptation strategy is used to address the issue of unavailability of labeled data from emerging events to identify useful information during disasters. Techniques that retrieve both domain-specific and invariant information from both past and emerging events may help in mitigating this problem. We introduce an Ensemble learning approach with Decoupled Adversarial component(EnDeA), which leverages the feature extraction of newly emerged crises for both of its domain-invariant and specific feature spaces. The component models of EnDeA can efficiently identify the relevant information with a double coverage strategy and the aggregated result proves to be much promising for relevant task identification during the classification. Experimental results demonstrated that the proposed method

achieves improved performance on an average of 20\% in F1 measure with real-world datasets for identifying infrastructure damage tweets during disasters.

Keywords: Ensemble learning; Adversarial; Infrastructure damage; Disasters.

Minimizing Gas usage in Solidity Contracts

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Presentation Type: Poster

Solidity is a contract-oriented programming language native to Ethereum (blockchain platform), which differs from traditional programming languages in many ways. Being a popular blockchain platform, Ethereum mainnet is experiencing increasing economic activity in recent years. Interestingly, smart contract transactions on Ethereum are not free, and users need to pay gas, a unit of network cost paid exclusively by Ether. The present work deals with a gas optimization problem of solidity smart contracts. The problem considered is to optimize the solidity code such that the execution cost of its operations is minimized.

Keywords: Ethereum; Solidity; Optimization; Gas.

MAP³CN: Multi-Hop Anonymous and Privacy-Preserving Payment Channel Networks

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Presentation Type: Poster

Cryptocurrencies like Bitcoin and Ethereum suffer from scalability issues. The payment channel network (PCN) is the most prominent solution to resolve this layer of two scaling solutions. However, PCN does not have sufficient security and privacy protection. Most state-of-the-art payment schemes, such as MHTLC, CHTLC, and AMHL, leak information about the sender node along the payment route. We propose a simple but efficient, multi-hop, anonymous, and privacy-preserving PCN (MAP³CN) to achieve sender anonymity. To design the MAP³CN payment protocol, we use Elliptic curve cryptography (ECC). The Universal Composability (UC) framework is used to examine the security properties of PCN. It preserves the balance privacy, value privacy, sender and receiver anonymity, and resistance to wormhole attack. For an off-chain payment operation, MAP³CN can be performed with $(3n + 5)$ Elliptic curve scalar multiplication (ECSM) operations.

Keywords: Payment channel network (PCN); Hash time lock contract (HTLC); Wormhole attack; Privacy; Blockchain.

Machine Learning based Network Slicing and Resource Allocation for Electric Vehicles

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Presentation Type: Poster

Electric Vehicles brings out various challenges like deploying more charging stations, supportive infrastructure, and various resource requests. In order to maintain all the resource requests of the EVs, network slicing is used, which provides an efficient way to satisfy multiple use case demands of the EVs. In this work, we perform network slicing that partitions the physical network into three slices, infotainment, safety message slices that belong to downlink communication, and charge-state information slices that belong to uplink communication. Unsupervised machine learning is performed using local scaling, which handles multi-scale data with better clustering. We have proposed algorithms that efficiently perform resource allocation to EVs to increase the throughput with low latency. Slice leaders forward the resource requests made by the EVs of the respective clusters to the charging station through RSUs, and a slice block allocation is performed by giving higher preference to the critical message requests.

Keywords: Network slicing; Latency; Throughput; Uplink; Downlink; Machine learning.

A Deep Neural Network Based Multi-Task Learning Approach To Hate Speech Detection

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Presentation Type: Poster

The phenomenal growth of the internet, social media networks and messaging platforms provide plenty of opportunities for building intelligent systems, but these are also being heavily misused by certain groups who often disseminate offensive, racial, and hate speeches. Although a few benchmark datasets have emerged for hate speech detection, these are limited in volume and do not follow any uniform annotation schema. In this paper, a deep multi-task learning (MTL) framework is proposed to leverage useful information from multiple related classification tasks to improve the individual task's performance. The proposed multi-task model is based on the shared-private scheme that assigns shared and private layers to capture the shared- features and task-specific features from five classification tasks.

Experiments on the five datasets show that the proposed framework encourages performance in macro-F1 and weighted-F1.

Keywords: Multi-task learning; Hate speech detection; Shared features; Task-specific features; Macro-F1; Weighted-F1.

Rating Prediction with Review Network Feedback: A new Direction in Recommendation

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Presentation Type: Poster

In conjunction with customers' implicit or explicit feedback or both, recent research helps us learn customer-product latent features embedding. A customer buys products from her preferable zone. But when we want to predict her rating activity, we must understand her characteristics as a reviewer. Considering existing feedback, it is not sufficient to understand a customer's nature, influential power, and position as a reviewer in her network. To overcome this issue, we introduce a new class of feedback named Review Network Feedback. Review network feedback indicates the validation of a customer's posted review on purchased products and helps us understand the reviewer's characteristics and influential power in her network. Extensive experiments on Amazon.com online review dataset establishes that our model can be remarkably futuristic compared to other baseline approaches when considering review network feedback.

Keywords: Recommendation System; Review Network Feedback; Reliability; Clustering coefficient; Centrality; Matrix Factorization.

Syntax-Informed Interactive Neural Machine Translation

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Presentation Type: Poster

In interactive machine translation (MT), human translators correct errors in automatic translations in collaboration with the MT systems, which is an effective way to improve productivity gain in translation. Neural MT (NMT), an end-to-end learning approach to MT, represents the current state-of-the-art MT

research. The recent studies on interactive MT have indicated that NMT can significantly outperform PB-SMT. In this work, first, we investigate the possibility of integrating lexical syntactic descriptions in the form of supertags into the state-of-the-art NMT model, Transformer. Then, we explore whether the integration of supertags into transformers could reduce human efforts in translation in an interactive-predictive platform. From our investigation, we found that our syntax-aware interactive NMT (INMT) framework significantly reduces simulated human efforts in the French-to-English and Hindi-to-English translation tasks, achieving 2.65 points and 6.55 points absolute improvements, respectively, in terms of word prediction accuracy (WPA) over the respective baselines.

Keywords: Machine translation; Neural machine translation; Interactive neural machine translation.

A Platform for Event Extraction in Hindi

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Presentation Type: Poster

Event Extraction is an important task in the widespread field of Natural Language Processing (NLP). Though this task is adequately addressed in English with sufficient resources, we are unaware of any benchmark setup in Indian languages. Hindi is one of the most widely spoken languages in the world. This paper presents an Event Extraction framework for the Hindi language by creating an annotated resource for benchmarking and then developing deep learning-based models to set as the baselines. We crawl more than seventeen hundred disaster-related Hindi news articles from various news sources. We also develop deep learning-based models for Event Trigger Detection and Classification, Argument Detection and Classification, and Event-Argument Linking.

Keywords: Event Extraction; Event Trigger; Arguments; Event-Argument Linking.

Recognising Author's Trait using Social Media Data

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Presentation Type: Poster

Analysing the author's trait and its identity is known as authorship analysis. Its application area involves security, forensics, personalised recommender systems, etc. We have proposed different systems for the three different wings of authorship analysis. They are i) authorship verification, ii) authorship

identification and iii) author profiling. Other social media platforms such as Twitter, Facebook, Instagram, etc., are used regularly by the users for sharing their daily life activities. Moreover, users often post images and text on different social media platforms; thus, the usage of multi-modal information is widespread nowadays. Most of the works are based on traditional style-based features and tested on long documents. Hand-engineered features cost in terms of man-power, as well as efficiency too. Thus, it is the need-of-the-hour to develop deep learning-based systems to automatically analyze the author's traits. The current work aims to develop some deep learning-based authorship analysis systems.

Keywords: Authorship analysis; Forensics; Social media; Twitter.

A Multitask Framework to Detect Depression, Sentiment and Multi-Label Emotion from Suicide Notes

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Presentation Type: Poster

The significant rise in suicides is a major cause of concern in the public health domain. Depression plays a major role in increasing suicide ideation among individuals. This work focuses on learning three closely related tasks, *viz.* depression detection, sentiment classification, and emotion recognition, and investigates their impact in analyzing the victims' mental state. We extend the benchmark suicide notes CEASE dataset with additional 2539 sentences collected from 120 new notes. We annotate the consolidated corpus with appropriate depression labels and multi-label emotion classes. We further leverage weak supervision to annotate the corpus with sentiment labels. We propose a deep multitask framework that incorporates commonsense knowledge into the learning process. Evaluation results show that all our multitask models perform better than their single-task variants, indicating that the depression detection and sentiment classification tasks improve the emotion recognition task's performance when all tasks are learned jointly.

Keywords: Fine-grained Emotion Recognition; Sentiment Classification; Depression Detection; Deep Multitask Learning; Suicide notes.

Online Multi-Objective Subspace Clustering for Streaming Data

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Presentation Type: Poster

Subspace clustering is a technique where the subset of features used to represent a cluster is different for different clusters. A minimal number of subspace clustering algorithms are available for streaming data. Moreover, most of the streaming data clustering methods primarily optimize only a single objective function, limiting the model in capturing only a particular shape or property. The developed streaming subspace clustering method optimizes multiple objectives capturing cluster compactness and feature relevancy. In streaming data clustering, whenever a new stream of data arrives, the current model is updated accordingly and performs the clustering. Furthermore, the generated clusters in the proposed method may contain overlapping objects. To establish the superiority of using multiple objectives, the proposed method is evaluated on three real-life and three synthetic data sets. The comparative study shows the superiority of using numerous objectives in the proposed method.

Keywords: Multi-objective Optimization; Subspace Clustering; Streaming data; ICC-index and PBM-index.

COVIDRead: A Novel Framework for Question Answering on COVID-19

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Presentation Type: Poster

Extracting information related to COVID-19 is an essential need in this era of a pandemic that would help in acquaintance with this new pandemic and deadly infectious disease. This paper presents COVIDRead, to address the Question Answering (QA) problem on novel coronavirus. The dataset consists of Context-Answer-Question triples. Questions are created in a semi-automated way. This is a precious resource that could serve many purposes. We provide a baseline and proposed a few end-to-end neural network approaches also. Our baseline and the best proposed approach yielded an F1 of 32.03% and 37.19% respectively. We are the first to provide this kind of QA dataset. This dataset creates a new avenue of carrying out research on COVID-19 by providing a benchmark dataset and a baseline model. We also provide a fully human-annotated test set where questions are paraphrased that would help in testing the robustness of any QA system in any domain including COVID-19.

Keywords: Machine Reading Comprehension Dataset; Question Answering; Covid-19 Scholarly Articles; BERT; BioBERT; Automatic Article Peer Review System.

Aggregating Feature Representations with Orthogonality Constraints for Traffic Forecasting

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Presentation Type: Poster

Recent works on traffic volume prediction have made use of deep learning techniques to model the traffic between different regions of the cities using historical traffic data. These models include GCN, RNN, and ConvLSTM offer a better capacity to model the complex Spatio-temporal correlations. However, the variation of the extent of correlations over different time intervals makes direct application of these models challenging. In this paper, we introduce a model that learns the shared as well as distinct characteristics of the regions from the spatial as well as temporal data by a method of aggregating the spatial and temporal Feature Representations using Orthogonality Constraints (FROC). Experiments on real-world traffic data of two big cities outperform several state-of-art methods with an average RMSE reduction of at least 15% for both cities.

Keywords: Traffic prediction; Deep neural network; Spatio-temporal.

A Hindi Image Caption Generation Framework using Deep Learning

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Presentation Type: Poster

Image captioning is the process of generating a textual description of an image that aims to describe the salient parts of the given image. A lot of works have been done for image captioning for the English language. In this paper, we have developed a model for image captioning in the Hindi language. To the best of our knowledge, this is the first attempt to generate image captions in the Hindi language. A dataset is manually created by translating a well known MSCOCO dataset from English to Hindi. Finally, different types of attention based architectures are developed for image captioning in the Hindi language. These attention mechanisms are new for the Hindi language as those have never been used for the Hindi language. The obtained results of the proposed model are compared with several baselines in terms of BLEU scores, and the results show that our model performs better than others.

Keywords: Image Captioning, Hindi, Deep-learning, Attention

Privacy Preserving Decentralized Learning Framework for Healthcare System

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Presentation Type: Oral (My research in 3 minutes)

The health sector is an ever-growing research area that faces some unforeseen challenges and risks. One of the significant problems is the unavailability of contemporary data. Though the data is available with every individual, either the pact, compliances, or government rules are becoming the exchange barriers. Existing infrastructures collect the data and store it in a central or distributed repository accessible by them. However, it induces a high risk of analyzing sensitive information of contributors without their knowledge. Emerging technologies like Federated Learning (FL) and Blockchain are now being used across industries to solve these existing issues. Federated Learning brings a new concept of keeping data with the participants. This work proposes a Blockchain-based FL architecture with two layers of participation, which improves the global model accuracy and guarantees participants' privacy. It facilitates establishing decentralized trust between the participants and the gateways using the Blockchain, which only has honest participants.

Keywords: Healthcare system; Federated learning; Blockchain; Security; Privacy.

Abandoned Object Detection in Video Surveillance Systems

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Presentation Type: Oral (My research in 3 minutes)

Video surveillance is a crucial part of public safety and security systems. State-of-the-art techniques lack the ability to identify the owner of the abandoned objects. We provide a novel object association technique that very elegantly tackles this issue. We have developed a convolution neural network-based framework for abandoned luggage localization and owner identification in video surveillance systems that performs exceptionally well on publicly available datasets and our newly developed dataset. For testing the usability and robustness of these systems, an extensive set of test cases is a prerequisite. To this end, we provide an elaborate surveillance dataset covering many complex cases which are not available in existing datasets. Also, the developed dataset has been tested with various state-of-the-art techniques, showing the complexity and challenging nature of the cases. The developed system provides event detection along with the time of abandonment and ownership information which can help the further investigation and prevent unwanted incidents.

Keywords: Neural Networks; Surveillance; Back-tracing; Security.

Challenges Faced in Establishing EVs in the Indian Market

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Presentation Type: Oral (My research in 3 minutes)

In this work, we address one of the many challenges of electric vehicles(EVs) that is the optimal placement of charging stations(locations) and allocating a certain number of charging ports(sizing) at these stations. We formulate a real-life problem in the form of a city network that accounts for the uncertainty in the arrival of EVs, mathematically represented in the form of an optimization problem. The capacity of these locations is equivalent to the number of charging ports allotted to each of them. The uncertainty in the flow of EVs can be approximated in a statistical distribution with the mean representing the average expected demand and standard deviation denoting the uncertainty which can be analyzed to determine the optimal allocation of the charging ports. Experiments suggest that our approach performs better when compared using certain performance metrics with the existing research works.

Keywords: Electric Vehicles; Charging station localization; Station sizing.

Department of Electrical Engineering

About the Department

The Department of Electrical Engineering (EE) has been evolving since the inception of IIT Patna in the year 2008. The major objective of the department is to impart high quality education and to encourage the students, comprising B.Tech, M.Tech and PhD, in pursuing research. The department offers B. Tech in Electrical and Electronics Engineering, two M. Tech programs (1. Communication System Engineering, 2. VLSI and Embedded Systems) and Ph.D. program in various specialized areas of Electrical Engineering. The major research areas of the department include Communications, Optoelectronics, Signal Processing, Image and Video Processing, VLSI and Embedded System, RF and Microwave, Electric Drives, Solid state Devices, Power Systems and Power Electronics, Control Systems and Instrumentation. EE Department is executing research projects sponsored by external funding agencies.

The department is committed to engage in high quality research and pursuit of excellence in teaching. The faculty members of the department are actively involved in research and development in challenging areas of both theory and experiment. The labs established here have been well equipped with the latest equipment. The Department has online access to IEEE Explore digital library, IEL, Science Direct, Springer and other online journals. High End Computational Servers and Software like MATLAB, GAMS, CAD Tools are available with the Department in order to accelerate the research. Instructional laboratories for Basic Electronics, Analog Electronics and Digital Electronics are fully operational. Advanced laboratories like Communication, Digital Signal Processing, Embedded Systems, VLSI, Electrical Machines, Power Electronics and Power Systems are also fully operational with advanced technologies, hardware equipment and software. Department has a number of ongoing/approved projects of total amount 55.0 Crore. The Department undertakes a continuous process of setting up experimental and computational facilities for taking up research & development and consultancy activities in various fields as also to produce state-of-the-art research output.

Total Number of Abstracts Received: 11

Posters: 09

My Research in 3 Minutes: 02

Design and Testbed Implementation of Blind Parameter Estimated OFDM Receiver

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Presentation Type: Poster

Designing an intelligent transceiver system is becoming a promising technology for upcoming generations of wireless communication systems due to its adaptation, spectrum efficiency, and low latency characteristics. However, there is no work available till now that characterizes and demonstrates complete transformation in the physical layer of orthogonal frequency division multiplexing (OFDM) systems. This paper proposes and implements a blind wireless receiver for OFDM using a radio frequency (RF) testbed set up in a realistic scenario. It includes the estimation of OFDM signal parameters, synchronization parameters, and modulation over a frequency-selective fading channel. The parameter estimation has been carried out through a cyclic cumulant process. The modulation formats are classified by using normalized fourth-order cumulants in the frequency domain. The STO and CFO are estimated by using a proposed modified maximum likelihood algorithm. The performances of parameter estimation, modulation classification, and synchronization are measured through analytical, simulation, and measurement studies.

Keywords: Intelligent Transceiver; Modulation Classification; OFDM; RF Testbed.

Performance Improvement and Defects Analysis in Perovskite based Solar Cell

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Presentation Type: Poster

Comprehensive numerical modeling and analysis have been carried out for perovskite solar cells using device simulation software. Rigorous theoretical investigations have been performed for optimization of device parameters, more specifically absorber layer. We have obtained the optimum cell performance having PCE (η) = 21.5%, FF = 87.4, J_{sc} = 23.4 mA/cm², V_{oc} = 1.05 V. We have also studied the effect of recombination and trap densities on the performance of cell modules. This work will provide guidelines for reasonably selecting a material for high-efficiency perovskite solar cells.

Keywords: Perovskite Solar Cell; Defect Analysis.

Computational Investigation of Self-Heating Induced Performance Degradation in RingFET

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Presentation Type: Poster

In nanoscale FETs, the confined geometry and increased packaging density induce increased power density, translating into massive heat generation. The incessant scaling of transistor size demands a rigorous study on the impact of SHEs and ambient temperature variations on advanced MOSFET structures' electrical characteristics. Therefore, in this work, a comprehensive analysis of the electro-thermal (ET) behaviour of the nanoscale RingFET has been done using the Sentaurus TCAD device simulator. A comparative analysis of the device with and without SHEs has been presented via current-voltage and transconductance-voltage characteristics, which are further used to compute the ZTC (zero temperature coefficient) bias point. A detailed analysis of the device's electrical behaviour has also been presented.

Keywords: Ring Fet; Self-Heating; Zero temperature coefficient.

Detection of Leukemia in Microscopic Images of Human Blood Samples with the Help of Deep Learning

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Presentation Type: Poster

Today, deep learning techniques constitute a prominent part of the area of medical sciences. We obtained a novel dataset of 500 blood smear images containing normal, Acute Myeloid Leukemia and Acute Lymphoblastic Leukemia images. We have performed binary classification involving some state-of-the-art techniques based on machine learning and deep learning and achieved accuracy ranging from 83% to 92%. We hope that this work could provide a new experimental tool for medical and deep learning researchers.

Keywords: Acute lymphoblastic leukemia; Deep learning; Machine learning.

Modified Lyapunov Function based Control Strategy for Grid-Connected PV System

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Presentation Type: Poster

This study deals with the control of a single-phase two-stage grid-connected photovoltaic system with an LCL filter under the change in atmospheric conditions and system parameters. The finite-state predictive control technique is implemented in a boost converter to obtain the PV system's maximum power. A modified Lyapunov function-based control scheme is designed for an inverter to inject the quality current into the grid. The system's modeling and stability analysis is done by considering the DC-link capacitor's effect to achieve the system's global stability. The proper selection of controller gains and stability of the system is studied. Moreover, an active damping method considering capacitor voltage feedback loop is also implied to eliminate the effect of resonance and improve power quality. The proposed method's performance and analysis are validated on Simulink and the experimental environment under variation with solar irradiance.

Keywords: Finite-state predictive control; Lyapunov function; LCL-filter.

Tracking and Stabilization of Human Heart-rate using Pacemaker with Fuzzy FO-PID Controller

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Presentation Type: Poster

In this paper, we design and analyze a control system to mitigate the fluctuations and regulate the heart rate using a pacemaker. We use a Fuzzy Fractional Order-Proportional-Integral-Derivative (Fuzzy FO-PID) controller, which generates electric pulses to maintain the desired heart rate by minimizing unprecedented fluctuations of the beats. The proposed control model is compared with the pacemakers using Fractional Order-PID (FO-PID) and Fuzzy-PID (F-PID) controllers. The fuzzy FO-PID controller proves its superiority in performance over the existing controllers. Real-time tracking of heart-rate through the IoT network enables easy communication between patient and healthcare unit, possibly preventing a mishap. The maximum percentage of error is 0.72 for the Fuzzy FO-PID controller while the same is 3.14, 6.18, and 23.26 using FO-PID, F-PID, and PID controllers, respectively, in a male heart. For a female heart, the maximum error percentages are 1.55, 2.13, 11.25, and 24.38 using Fuzzy FO-PID, FO-PID, F-PID, and PID controllers, respectively.

Keywords: Controller; Fractional calculus; Fuzzy; Pacemaker.

Adaptive Mini-Batch Gradient Ascent based Localization for Indoor IoT Networks under Rayleigh Fading Conditions

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Presentation Type: Poster

Location estimation in an indoor Internet of Things (IoT) environment is challenging due to multipath signals and obstacles that cause shadowing and fading effects and vary the received signal power considerably. Most of the existing path loss-based localization methods assume only a lognormal shadowing model and ignore small-scale fading effects. This work considers a generic combined lognormal shadowing and Rayleigh fading model to localize smart devices in an IoT environment efficiently. The maximum likelihood estimate of the location, path loss exponent, and Cramer Rao Lower Bound is derived. The localization parameters are estimated using a novel adaptive mini-batch gradient ascent method with an appropriate batch size based on the convergence factor and addresses the challenge of an arbitrary selection of fixed batch size for a gradient ascent method. The localization results outperform state-of-the-art methods on simulation and real-time IoT testbed.

Keywords: Internet of Things; Mini-batch gradient ascent; Rayleigh fading; Smart device localization.

Novel Phasor Sequence-Based Wide-Area Backup Protection of Series-Compensated Line

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Presentation Type: Poster

For series-compensated lines, the distance relay finds its limitations during voltage inversion, current inversion, load encroachment, power swing, and balanced fault during the power swing. These limitations can be overcome by wide-area backup protection schemes. A novel fault detection technique is proposed utilizing the synchrophasor data of voltage and current signals at the system protection centre. The algorithm compares the phase angle difference between positive-sequence voltage phasor under system intact condition and real-time positive- or negative-sequence current phasor, which is computed from the synchronized data obtained from phasor data concentrator after identifying the

possible critical buses to which the faulted line is connected. Different cases of fault type, distance, and resistance have been considered to validate the proposed scheme with 3-generator, 9-bus western system coordinating council using MATLAB/Simulink platform.

Keywords: Wide area backup protection (WABP); Phasor data concentrator (PDC); System protection centre (SPC).

Power Grid Frequency And Phasor Estimation For Low Cost Synchrophasor Device Using Non-Linear Least Square Method

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Presentation Type: Poster

For synchrophasor technology, a wide range of PMU designs are available in literature but are very costly due to embedding a high-speed processor in it to run the complex algorithms. In this paper, an algorithm for synchrophasor and frequency estimation is proposed for processing platforms with low computational resources and is delineated extensively in respect of both accuracy and processing time. The proposed solution harnesses the main advantages of two well-known algorithms, i.e., the zero-crossing detection and the non-linear least-squares method. Both algorithms are incorporated in a computationally efficient manner to reduce processing time up to a lower extent while maintaining good accuracy in the standard IEEE testing conditions. The performance of the proposed algorithm has been evaluated through simulations as well as experimentally on the raspberry pi board. Test results provide clear evidence that the implemented design is suitable for PMU prototyping.

Keywords: Phasor measurement unit; Zero-crossing detection; Non-linear least error squares; Raspberry pi.

Fault-Tolerant Control of Five-Phase Induction Motor Drive for Industrial Applications

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Presentation Type: Oral (My research in 3 minutes)

Multi-phase (MM) drives are considered for high-power industrial applications due to their inherent advantages, such as low per-phase power, low torque pulsation, and fault-tolerant operation. MM drives are thus significantly preferable for safety-critical and reliable operations. Due to its simplicity and robustness against parameter variation, direct torque control (DTC) is particularly suitable for

fault-tolerant MM drive operation in high-power applications. This research's primary goal is to develop a fault-tolerant DTC scheme for a two-level and three-level NPC voltage source inverter-driven five-phase induction motor (FPIM) drive under an open-phase fault condition. In the proposed fault-tolerant DTC scheme, the virtual vector (VV) concept can cancel out the resultant voltage vector in the xy plane employing volt-second balancing and minimum copper loss criteria. The proposed controller is tested experimentally under steady-state and dynamic loading conditions, including the transition from pre-fault to post-fault operation.

Keywords: Fault-tolerant control; Direct torque control; Five-phase induction motor drive, Virtual vector.

Smart Device Localization In IoT Networks

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Presentation Type: Oral (My research in 3 minutes)

With the advent of the Internet of Things (IoT), location-based services assume significant importance in smart environments. Global Positioning System (GPS) based location services provide good accuracy in outdoor environments; however, they are not suitable for the indoor environment due to the weak signal strength. Hence, indoor localization utilizing the Received Signal Strength (RSS) of opportunistic signals such as Wi-Fi, Bluetooth, Geomagnetic, and Visible Light is gaining significant popularity. Location estimation in an indoor Internet of Things (IoT) environment is challenging due to multipath signals, device heterogeneity, and change of Access Points (APs). My research aims to propose localization methods using intelligent algorithms to address these challenges. The study suggests novel architectures and estimators for location estimation. In this presentation, I discuss a generic combined lognormal shadowing and Rayleigh fading model for efficient localization of smart devices and a multistage regression method for Gaussian Mixture Model (GMM) based localization.

Keywords: Internet of Things; Smart device localization; Device Heterogeneity.

Department of Humanities and Social Sciences

About the Department

The Humanities and Social Sciences Department incessantly tries to provide a humane perspective to the various technical branches at IIT Patna. It strives consistently to excel in its efforts day by day. Innovative and pertinent research is one such tool through which excellence can be aspired. The department envisions establishing itself as one of the best research platforms to young minds who have the undying thirst for knowledge. Past and ongoing researches in Economics, English language and literature, Linguistics, Management, Psychology, Public Health and Sociology not only try to answer useful inquiries but also try to use learning and imaginative actions as powerful tools to add to the enrichment and progress of human society. The uniqueness of the department will be realized by its successful and innovative research along with the various interdisciplinary and multidisciplinary collaborations both within and beyond the institute.

Total Number of Abstracts Received: 18

Posters: 15

My Research in 3 Minutes: 03

Antecedents and Outcome of Workplace loneliness: Does High Perceived Organizational Support Make the Consequences Better?

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Presentation Type: Poster

Drawing from the conservation of resources theory (Hobfoll, 1989), we test a model that examines work meaningfulness and psychological capital as the antecedents and creativity as an outcome of workplace loneliness in Indian business organizations. Additionally, we examine the moderating role of perceived organizational support on the relationship between workplace loneliness and creativity. Time-lagged field studies from two different studies (Study 1 = Banking industry, $n = 204$; Study 2 = Public Sector Undertakings, $n = 375$) provided support for our hypotheses. Work meaningfulness related significantly with workplace loneliness in study 1 but the linkage was insignificant in study 2. Psychological capital significantly predicted workplace loneliness in both studies. Consistent with the expectations, the effect of workplace loneliness on employee creativity was negative and the relationship was significantly moderated by perceived organizational support. Implications for theory and practice are discussed.

Keywords: Workplace loneliness; Work meaningfulness; Psychological capital; Perceived organizational support; Creativity.

Time-Varying Correlation between Business cycle and Financial cycle in India

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Presentation Type: Poster

The role of the financial sector in the business cycle has gained more attention after the U.S subprime loan crisis in 2008. The crisis, transmitted worldwide through international trade and financial linkages, necessitates relooking at the ‘real-financial’ nexus with a fresh perspective. The study examines the time-varying correlation between business and financial cycle using the DCC-GARCH model for India. Index of industrial production (IIP) data is used to measure economic growth, whereas a financial development index (FDI) is constructed by applying principal component analysis on several financial variables. The Cyclical components of both indexes are extracted by employing the Hodrick-Prescott filter. The result of the DCC-GARCH model demonstrates that the time-varying correlation between business and financial cycle in India can be distinguished in three phases. The correlation between the business cycle and financial cycle is found to be positive with some level of fluctuation and increasing in all three phases.

Keywords: DCC GARCH; Economic growth; Financial development.

Career Protection Strategies - Workplace Mobbing and Helping Behavior: The Role of Machiavellianism as a Moderator

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Presentation Type: Poster

Career success and its maintenance is a challenge for every individual. Given its importance, we examined the effect of career success dimensions (objective/subjective) on career protection strategies (workplace mobbing/helping behavior). We also explored the moderating role of Machiavellianism on the above relationship. Using a purposive sampling technique, data were collected from employees working in the academic (N=167) and insurance sectors (N=128) across India. The results showed that objective career success (OCS) positively predicted workplace mobbing, and negatively predicted helping behavior in both sectors. Further, a positive relationship was found between subjective career success (SCS) and helping behavior in academics but it failed to correlate with workplace mobbing in both sectors. Machiavellianism significantly moderated the relationship between OCS and workplace mobbing only in the insurance sector. Further, high levels of Machiavellianism instigated subjectively successful academicians and insurance officials to indulge in workplace mobbing. The findings carry significant implications for employees, managers, and policymakers of the Indian service sector in terms of how they structure their career success parameters to build a more congenial work environment.

Keywords: Objective career success; Subjective career success; Workplace mobbing; Helping behavior; Machiavellianism

Convergence analysis of health expenditure in Indian states: Do Political Factors Matter?

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Presentation Type: Poster

Economic theory argues that most often the extent and pattern of expenditure by government is politically driven. In India, in spite of poor health indicators, public spending on health is inadequate which encourages the study the impact of political factors on the nexus between per-capita GDP and public health expenditure for Indian states during 1980–2016. States are categorized into two converging groups which have been identified on the basis of Phillips and Sul convergence analysis. Bihar was the only state among the 20 states, which was non convergent. Each convergent group is further analysed

with panel corrected standard error model since traditional fixed or random effect models were found to have cross interdependence of errors. Political factors like centre-state political affiliation, party continuation and political unanimity are taken as explanatory variables for this analysis. Empirical findings suggest that political factors play major role in determining health expenditure in each category group but strength of impact differs across two groups.

Keywords: Political factors; PCSE Model; health expenditure; Phillips-Sul convergence analysis; ruling party

Poor on Move: Household Level Determinant of Migration from Rural India

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Presentation Type: Poster

Migration is an important livelihood diversification strategy to mitigate potential risks, such as crop failure, major illness, job loss etc., in rural areas. The literature dealing with migration in developing countries have devoted little attention to the particular group of ‘rural poor population’. Thus, objective of this study is to examine the determinants of migration decisions in ‘rural poor households’ in India considering households as a decision making unit. Here the Logit model has been used to model the binary outcome that is whether the ‘rural poor household’ has sent at least one migrant or not. The findings indicate migration as an important livelihood diversification strategy to tackle poverty for poor households in rural India. At household level debt, shocks, dependent members, small landholding etc. increases, while welfare benefits and presence of female elder heads are likely to dampen the probability of migration.

Keywords: Poor; Migration; Household; Diversification.

Differences in Efficiency in the Formal -Informal Dichotomy – A Study of Indian Firms

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Presentation Type: Poster

The unorganized manufacturing industries play a vital role in the process of industrial development of the Indian economy. Unlike other studies, this study examines differences in efficiency between formal and informal production manufacturing firms. The key novelty in this paper is the application of the technique of Blinder-Oaxaca decomposition to determine efficiency differences across formal and informal industries. Data for formal and informal firms are taken from the ASI and NSSO respectively for the years 2000, 2005, 2010, and 2015 for both sources. The evidence suggests that capital is a

positive and significant determinant of the output of efficient industries. Output gaps can be explained by coefficient, endowment, and interaction aspects of capital and capital productivity, while efficiency differences are explained by coefficient and interaction characteristics of emoluments and capital productivity. The results of kernel density plots show that informal firms are no longer functioning as a pool of surplus laborers.

Keywords: Formal sector; Informal sector; Productivity; Manufacturing Firms; Efficiency.

Voice Onset Time in Indian English

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Presentation Type: Poster

Voice Onset Time (VOT) can be used to determine whether a speech is accented or not to explain the acoustic features of accents in speakers. It is the duration of time between the release of a stop consonant and the onset of voicing. The focus of this study is to determine the possible differences in VOT in Indian English between the native speakers of Hindi and Bangla in a continuous speech context. A total of twenty informants, ten each of Bangla and Hindi, were recorded in an anechoic chamber. Informants were given a phonetically balanced passage to read for the recording. Using PRAAT, the sound files were analyzed using a combination of the waveform and spectrographic analysis. The result indicates that a reduced VOT is the characteristic of Indian English spoken by Bangla and Hindi native speakers.

Keywords: VOT; Indian English; Accent; Hindi; Bangla.

Metaphorizing Nonhuman Animals: A Purposive Study of Animal Metaphors in the Bengali Community

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Presentation Type: Poster

A common practice of humans can be observed in the frequent use of animal-metaphors in their daily discourses. This strategy can be employed to dehumanize or to raise the status of the addresses. However, after the seminal work of Lakoff and Johnson (1980) in cognitive linguistics, metaphors are realized beyond their rhetorical function but as a device to conceptualize reality. Therefore, to understand the reality of animals, this research attempts to examine the animal-metaphors with the help of Conceptual Metaphor Theory (Lakoff & Johnson, 1980). Animal-metaphors are collected from different existing Bengali speech corpora to understand their impact on the human cognition related to animals and the

subsequent behaviors towards them within the Bengali speech-community. Analysis indicates the destructive role of animal-metaphors in positioning animals in the community and also in threatening the lives of a few animals (vulture → ominous, fox → shrewd, crocodile → cunning) by compromising their scientific behaviors.

Keywords: Animal-metaphor; Discourse; Speech-community; Cognitive Linguistics; Conceptualization

Representation of Orality, Oral Tradition, and ‘Orature’ in Easterine Kire’s *Sky is My Father: A Naga Village Remembered*

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Presentation Type: Poster

Orality plays a pivotal role in indigenous culture to transmit, represent, and preserve the cultural and cultural identity of its people. The indigenous writers from Northeast India create a new kind of literature combining the oral and the written as they put cultural elements in the White’s form and language. Easterine Kire as one of the prominent voices from Northeast India deliberately uses oral techniques and oral tradition in her writings. Her novel *Sky is My Father: A Naga Village Remembered* (2018) deals with the cultural life and colonial history of the Angami community whose strong traditional cultural belief is affected by cultural imperialism and modernity. Deconstructing the binary between orality and literacy, this paper purports to investigate how in the novel Easterine Kire through her deliberate use of orality and oral tradition represents and preserves the culture and identity of the Angami community of Nagaland.

Keywords: Angami Community; Culture, Indigenous; Northeast India; Oral Tradition.

Provisions of Generic Drugs under Section 3(d) of Indian IP Act: What Data Reveals from the Backward States of India?

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Presentation Type: Poster

The provision of section 3(d) of the Indian Patent Act, 1970, was designed to promote and protect the manufacturing of low-cost generic medicine in the country. The provisions were set forth to secure the production of inexpensive generic drugs for easy accessibility at affordable prices across the states. But all those states whose per capita net state domestic product (NSDP) is lower than the per capita net national product (NNP), are not able to get the full benefit of inexpensive generic drugs. The section is

not guaranteeing the availability of price-effective generic drugs for the people of backward states. The paper has investigated the intra-molecular price variation of generic drugs and its impact on their affordability in backward states. The analysis is based on both, descriptive method as well as the analytical method with the help of relevant secondary data.

Keywords: Indian Patent Amendment Act, 2005; Section 3(d); Generic drugs; Affordable price; Backward states

Impact of Neighbourhood on Health of Children

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Presentation Type: Poster

The concerned study will draw from ongoing research on the neighborhood and its impacts on the health status of children. Neighborhood constitutes a built environment that plays a crucial role in developing both positive and negative influences on the health and lifestyle of children. A positive impact of the neighborhood is associated with the easy availability of healthy food stores and accessibility of open spaces for physical activities with a safe and supportive environment. While on the other, the negative influence of the neighborhood is related to insufficient space, lack of a safe and supportive environment, and unavailability of healthy food stores. These factors are associated with less physical activities and consumption of unhealthy food, which also develops the risk of chronic diseases among children. Understanding the influence of neighborhood on health and lifestyle of children becomes essential as it is during the formative years of their life where basic characteristics of health are formed and become established.

Keywords: Children; Neighbourhood; Health; Physical activities; Food pattern.

Tattle-traits: Investigating Personality Antecedents to Workplace Gossip

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Presentation Type: Poster

The present article aims to identify the personality dimensions such as dark traits, core self-evaluation, and self-monitoring that may possibly affect the underlying motivations and nature (positive or negative) of employees' gossip in a workplace. Drawing arguments from trait activation theory and social comparison theory, the study tests the proposed model on employees from various public and private firms across India through regression analysis. Empirical evidence from a sample of 419 employees

revealed that Machiavellianism and narcissism correlated with all four motives of gossip. Core self-evaluation correlated with information gathering and validation, negative influence, and group protection motives only, and individuals high on self-monitoring were found to indulge in workplace gossip for information gathering and validation and social enjoyment purposes. Furthermore, Machiavellianism, narcissism, and self-monitoring related to both positive and negative workplace gossip while core self-evaluation correlated solely with negative gossip at the workplace. Theoretical contributions and practical implications are discussed.

Keywords: Personality; Core self-evaluation; Self-monitoring; Gossip motives; Gossip nature.

Gig Economy and Informatory of Work in India: Case for Accessibility through Infrastructure

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Presentation Type: Poster

Sharing is an age-old concept that has triggered unprecedented prospects for collaborative consumption across the globe. Famous brands like Airbnb, BlaBaCar, Uber, eBay, and Lyft, etc., have transformed the business landscape on the fundamentals of ‘availability, accessibility, and affordability in a resource-constrained environment for the poor. But the potential socio-economic impact of sharing economy in revamping labor market informality and mitigating poverty has not gauged desired focus in India. The success of Indian start-ups like Oyo and Ola, amplified the debates over the conduciveness of the ‘Gig Economy’ for inclusive growth in India. So, the paper attempts to conceptually discuss the unexplored significance of infrastructure and Gig Economy in India, through exploratory content analysis and case studies retrieved from the reports of World Bank, PwC (PricewaterhouseCoopers), McKinsey & Company, etc.

Keywords: Gig economy; Conceptualisation; Informal economy; Infrastructure.

Technical Non-Tariff Measures (NTMs) and their Heterogeneous Impact on Trade: A Gravity Model Analysis

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Presentation Type: Poster

As global tariffs declined over the past decades, they have been replaced by a newer class of trade policy measures called non-tariff measures (NTMs). These measures, unlike tariffs, have a far more ambiguous

effect of trade than tariffs as they are highly heterogeneous. They encompass a wide range of measures that lead to wide-ranging trade effects. Some NTMs even have a trade enhancing effect. This requires examining the channels through which NTMs affect trading partners. This study seeks to examine that impact, using separate variables for each category of NTMs to examine the varying impact of each measure. The study takes into account technical NTMs only, as they are amongst the most universally applied category of NTMs. The data for the research is based on UNCTAD's classification, with products disaggregated at the HS6 level. The analysis applies the Gravity Model and the Poisson Pseudo-Maximum Likelihood Estimation technique.

Keywords: Non-tariff Measures; Trade Policy; Gravity Model.

Mapping Migrations: Diasporic Consciousness in Select Writings of Amitava Kumar

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Presentation Type: Poster

'Diaspora' refers to a group of communities living away from its homeland (Clifford 219, Safran 88, Brah 180, Cohen 6) while 'consciousness' has been elaborated as "the perception of what passes in a man's own mind" (Locke 87). Diasporic consciousness basically pertains to those sentimentalities that an individual experiences while living in a diaspora. Amitava Kumar, one of the foremost writers of diasporic literature in post millennia, vehemently presents *inter alia* the matrix of diasporic consciousness like alienation, loneliness, nostalgia, dissent, questioning, etc. in his literary works. The present poster delves into these elements through employing the textual analysis methodology and highlights Kumar's concerns for nation, religion, and spaces in his acclaimed collection of select literary works.

Keywords: Diaspora; Diasporic consciousness; Nationalism; Religion; Spaces.

Non-linearity in India's Monetary Policy Response Function

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Presentation Type: Oral (My research in 3 minutes)

The Taylor (1993) rule has become the most popular tool in determining the monetary policy rate in the early 1990s. The rule is essential due to its ability to predict central bank behavior in altering the policy rate. The present work investigates the central bank's monetary policy asymmetries using quarterly time-series data from 2000 Q4 to 2019 Q4. The nonlinear model, namely the smooth transition regression (STR) model, is used for empirical analysis. We found asymmetry in monetary policy response function

and, therefore, non-linearity in augmented Taylor rule. Result suggests that monetary authority reacts aggressively towards the inflation gap and exchange rate in the inflationary regime while the reaction of RBI during the non-inflationary period is towards the output gap. Today, many developing countries are facing high inflation due to covid-19. They need to adopt the policy of price stability, and the Taylor rule may help determine its policy rate.

Keywords: Monetary policy; Smooth transition regression; Taylor rule.

Sanzari Boro Grammatical Sketch

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Presentation Type: Oral (My research in 3 minutes)

This research is an attempt to provide a grammatical sketch of Sanzari Boro (SB). SB is a variety of the Boro language and is primarily spoken in Assam, India. The research follows the Basic Linguistic Theory (Dixon, 2010) in which collected data are used to form rules. For this research data have been gathered through an interview method from native SB speakers of Nagaon district, Assam. After analyzing the data, it has been observed that SB has 22 consonant phonemes, 6 vowel phonemes, and 8 diphthongs. SB is rich in affixation, classifier, and reduplication. It follows agglutinating nature in which a single word may consist of several morphemes but these morphemes can be easily separated. The basic word order of SB is Subject-Object-Verb but due to the presence of a case-marking system, the order can be interchanged without changing the meaning.

Keywords: Sanzari Boro; Agglutinating; Reduplication; Case; Word order.

Impact of Workplace Spirituality on Workplace Incivility: Evidence from Indian Workplace

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Presentation Type: Oral (My research in 3 minutes)

The objectives of the present research were to explore if and how spirituality at the workplace curb employees' uncivil behaviors at the workplace. Taking cues from the conservation of resources theory (Hobfoll, 1989) and cognitive appraisal theory (Lazarus & Folkman, 1984) we proposed and tested the direct and indirect effect of workplace spirituality on workplace incivility through prosociality. Using a time-lagged study design; we tested our model in two studies. Study one included 338 employees working in the Indian hotel industry whereas study two incorporated 228 participants from Indian

Information Technology firms. Results were analyzed using regression analysis in PROCESS Macro for SPSS version 24. Findings of both the studies revealed that workplace spirituality correlates negatively to workplace incivility. Furthermore, prosociality partially mediated the association between spirituality at work and employee uncivil behaviors. The findings of this study contribute to theory, research, and practice.

Keywords: Workplace Spirituality; Incivility; Prosociality.

Department of Mathematics

About the Department

Welcome to the Department of Mathematics at IIT Patna established in August, 2008. The Department of Mathematics is committed to impart high quality education in Mathematics at Undergraduate and Postgraduate levels.

The young and dynamic faculty members of the department have versatile experience both in teaching and research in various areas of Mathematics and Statistics. Currently the faculty members of the department are actively engaged in research areas such as Bayesian Statistics, Data Mining, Fuzzy Optimization, Geometric Topology and Topological Graph Theory, Mathematical Control theory, Multi-objective Programming, Non-linear Optimization, Number Theory, Optimal control, Statistical Decision Theory, Statistical Inference, Stochastic Differential Equation, Support Vector Machines, Fuzzy logic and its application, Rings & Modules, Associated Prime Rings, Mathematical Modeling in Ecology and Epidemiology, Applications of Differential Equations in Biology, Stability and Bifurcation, Mathematical Modeling of HIV dynamics: in vivo, Wireless communications and signal processing, estimation and detection, time and frequency domain signal analysis, blind signal parameters estimation, blind signal classification, blind wireless receiver design, estimation includes carrier frequency, symbol rate, symbol timing offset, carrier frequency offset, blind OFDM signal parameter estimation and synchronization, cooperative communications, MIMO, OFDM , cognitive radio and UWB systems, implementation of a universal blind receiver estimation algorithm on National Instrument (NI) hardware, experiment and measurement.

The department is currently running the M.Sc., M.Tech (Mathematics and Computing), and PhD programmes. Our M.Tech students are collaborating with several industrial and research agencies. The department has developed a computational research lab to encourage research areas which require high computing facilities.

Total Number of Abstracts Received: 10

Posters: 07

My Research in 3 Minutes: 03

Taylor Series Solution of ODE

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Presentation Type: Poster

We consider the class of singular boundary value problems. To find the approximate solution we use the Taylor series method. Our proposed method is very simple but effective. We provide some Mathematica codes corresponding to IVP, BVP, a system of IVP, and a system of BVP which give Taylor series solutions within a couple of seconds.

Keyword: Taylor series method; Singular boundary value problem; Approximation method.

Solutions Approximation of a Class of Fractional Order Nonlinear Volterra Integro-Differential Equations of First Kind and their Convergence Analysis

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Presentation Type: Poster

In this work we consider a class of fractional order Volterra integrodifferential equations of first kind where the fractional derivative is considered in the Caputo sense. Here, we consider the initial value problem and the boundary value problem separately. For simplicity of the analysis, we reduce each of these problems to the fractional order Volterra integro-differential equation of second kind by using Leibniz's rule. We have obtained sufficient conditions for the existence and uniqueness of the solutions of initial and the boundary value problems. An operator based method has been considered to approximate their solutions. In addition, we provide a convergence analysis of the adopted approach. Several numerical experiments are presented to support the theoretical results.

Keywords: Fractional differential equation; Integral equation of first kind; Convergence analysis.

A Direct Construction of q-ary 2-D Z-Complementary Array Pair based on Generalized Boolean Functions

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Presentation Type: Poster

Two-dimensional (2-D) Z-complementary array pair (ZCAP) is a pair of 2-D arrays or matrices, whose 2-D auto-correlation sum gives zero value at all time shifts in a zone around the (0,0) time shift, except the (0,0) time shift itself. The zone is called the zero correlation zone (ZCZ). 2-D ZCAP has found applications in wireless communication technology such as 2-D synchronization, phased array antenna, ultra wide band (UWB) systems and so on. To the best of authors' knowledge, most of the constructions of 2-D ZCAPs in the existing literature need special sequences at its initial stage. In this paper, for the first time, we propose a direct construction of 2-D ZCAPs of non-power-of-two sizes, which does not require any special sequence at the initial stage. The construction is based on generalized Boolean functions (GBFs) and thus facilitates rapid generation for use in several fields.

Keywords: Generalized Boolean function (GBF); Z-complementary array pair (ZCAP); Zero correlation zone (ZCZ); Auto-correlation; Wireless communication.

Skew Cyclic Codes Over

$$\frac{F_q[u,v,w]}{\langle u^2 - 1, v^2 - 1, w^2 - 1, uv - vu, vw - wv, wu - uw \rangle}$$

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Presentation Type: Poster

In this paper, we study skew cyclic codes over the ring $\mathcal{R} = \frac{F_q[u,v,w]}{\langle u^2 - 1, v^2 - 1, w^2 - 1, uv - vu, vw - wv, wu - uw \rangle}$ where $q=p^m$; p is an odd prime. Here, the structural properties, generating polynomials and idempotent

generators of the skew cyclic codes are obtained. Also, we show that the Gray images of skew cyclic codes of length n over \mathcal{R} are skew 8-quasi-cyclic codes of length $8n$.

Keywords: Skew polynomial ring; Cyclic codes; Skew cyclic codes; Gray map; Generating polynomial; Idempotent generator.

Modeling the Effect of Delayed Information and Incubation Period in Infectious Disease

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Presentation Type: Poster

This study focuses to explore the nonlinear behavior of infectious disease dynamics of an SIRS epidemic model incorporated with incubation delay. Also, a separate rate equation is considered to study the dynamics of information with delay effect. We found that basic reproduction no. (R_0) plays a key role for disease persistence. When $R_0 < 1$, disease will die out and disease will survive when $R_0 > 1$. It is found that delay has no effect on the stability of disease free equilibrium point, but it affects stability of endemic equilibrium point. Threshold values of delays are investigated at which stability nature of endemic equilibrium point alters due to occurrence of Hopf bifurcation. For this, the existence of periodic oscillations in the population are observed. Numerically we show that disease transmission rate and treatment rate have significant effects on disease infection level.

Keywords: Information; delay; Hopf – bifurcation; Stability switches.

On Functional Observers for Descriptor Systems

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Presentation Type: Poster

This paper addresses the problem of functional observer design for a class of LTI continuous-time descriptor systems. We consider the case where the descriptor systems need not be necessarily regular. Sufficient conditions for the existence of observers are proved. These conditions are less restrictive than existing ones. Two numerical examples are presented to illustrate the approach.

Keywords: Descriptor systems (DAEs), Observer design for linear systems, Functional observers.

Monotone Iterative Technique for a Class of Four Point BVPs with Reversed Ordered Upper and Lower Solutions

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Presentation Type: Poster

Consider the class of four point nonlinear BVPs

$$\begin{aligned} -w''(x) &= f(x, w, w'), \quad 0 < x < 1, \\ w'(0) &= 0, \quad w(1) = \delta_1 w(\eta_1) + \delta_2 w(\eta_2) \end{aligned}$$

Where $f \in (I \times \mathbb{R} \times \mathbb{R}) : \rightarrow \mathbb{R}$ is continuous, $I=[0,1]$, $0 < \eta_1 \leq \eta_2 < 1$, and $\delta_1, \delta_2 \geq 0$. In this paper we demonstrate an iterative technique which we deduce by using quasilinearization. then we consider upper-lower solutions in well ordered and reverse ordered cases and prove existence of solutions under some sufficient conditions. We show that under certain conditions generated sequences are monotone, uniformly convergent and converges to the solution of the above problem. We also provide examples which validate that all the conditions derived in this paper are realistic and can be satisfied. We have also plotted upper and lower solutions for the test examples and show that under the conditions derived upper and lower solutions are monotonic in nature.

Keywords: Four point BVPs; Monotone iterative technique; Nagumo condition; Upper solution; Lower solution.

A Proximal Neurodynamic Model for Solving Mixed Variational Inequalities Involving -Monotone Proximal Operator

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Presentation Type: Oral (My research in 3 minutes)

In this article, we propose a proximal neurodynamic model for solving mixed variational inequality involving α -monotone proximal operator. We have shown that for a Lipschitz continuous proximal operator the proximal neurodynamic model has a unique solution. Moreover, we derive the stability of the proximal neurodynamic model for Lipschitz continuous and α -monotone proximal operators. Furthermore, we discuss some numerical examples to justify the validity of the proximal neurodynamic model.

Keywords: Proximal Neurodynamic Model; Mixed Variational Inequality; -Monotone operator.

Linear Canonical Wavelet Transform

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Presentation Type: Oral (My research in 3 minutes)

We propose a new time-frequency analyzing tool namely linear canonical wavelet transform (LCWT). We will discuss the time frequency analysis and the constant Q-property associated with this transform as a result we will see that the proposed transform is better than the windowed linear canonical transform. We will also discuss the Lieb uncertainty principle and obtain the lower bound of the measure of essential support of the LCWT.

Keywords: Linear canonical wavelet transform; Time-frequency analysis; Uncertainty principle.

Double Circulant LCD Codes Over $\mathbb{F}_q + u\mathbb{F}_q + v\mathbb{F}_q$

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Presentation Type: Oral (My research in 3 minutes)

Let $q = p^m$ and \mathbb{F}_q be a finite field, where p is an odd prime and m is a positive integer. In this work, we present some results on double circulant LCD codes over $R = \mathbb{F}_q + u\mathbb{F}_q + v\mathbb{F}_q$, where $u^2 = u$, $v^2 = v$ and $uv = vu = 0$. We first obtain necessary and sufficient condition for these codes to be LCD and then enumerate LCD double circulant codes over R . We show that the family of Gray images of LCD double circulant codes over R is good enough. Finally, the importance of our work is shown by presenting the applications of LCD codes.

Keywords: Linear code; Double circulant code; Gray map; LCD code.

Department of Mechanical Engineering

About the Department

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

Since its inception in 2008, the department has grown its leaps and bounds. The department at present offers Bachelor of Technology degree in Mechanical Engineering and Master of Technology degree in Thermal and Fluids, Manufacturing, and Mechatronics streams of Mechanical Engineering. In addition, the Department has a successful Ph.D. program with over fifty scholars performing research in various contemporary fields of Mechanical Engineering. .

The personnel in the Department venture in diverse multidisciplinary fields including surface engineering, soft-tissue mechanics, non-traditional manufacturing, laser material processing, condition monitoring, biomedical robotics, biomedical bone drilling, computational mechanics, fracture, finite element modelling, composites, fire, micro- and nano-scale heat transfer, boiling, condensation, two-phase flows, refrigeration and air-conditioning, computational fluid dynamics, colloids and interfacial science, soft computing, and microgravity, among others. Such activities are aptly supported by 16 state-of-the-art research cum teaching laboratories. Significant numbers of patents and publications in various top multidisciplinary journals is an evidence of the flourishing research environment in the department. Department has received more than 5.0 crores of funding support in terms of sponsored projects and consultancy works from various Government and Industry agencies including Aeronautics Research Development Board (ARDB), Board of Research in Nuclear Science (BRNS), Defence Research Development Organization (DRDO), Department of Electronics and Information Technology (DeITY), Department of Science and Technology (DST), and Indian Space Research Organization (ISRO), among others.

Total Number of Abstracts Received: 19

Posters: 15

My Research in 3 Minutes: 04

Deep Learning the Sound of Boiling for Advance Prediction of Boiling Crisis

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Presentation Type: Poster

Advance prediction of the boiling crisis is critical to the safety and economy of many thermal systems. Here we perform steady-state near-saturated boiling experiments on a plain copper surface and acquire the acoustic emissions (AE) in natural convection, nucleate, and transition boiling regimes. We use the corresponding AE spectrograms to train a convolutional neural network which shows a validation accuracy of 99.92% against the ground truth. We next evaluate the trained network on unseen experiments with water and aqueous solutions of ionic liquid and surfactant on plain and nanostructured copper surfaces with time varying heat inputs. Despite the variations in boiling surfaces, working fluids, and the heating strategy between the training and the evaluation datasets, the network accurately predicts the respective boiling regimes. We finally use the insights to perform advance prediction of the boiling crisis for mitigating thermal runaway induced accidents in boiling-based systems.

Keywords: Boiling; Acoustic Emissions; Spectrograms; Deep Learning; Advance Prediction.

Design and Development of an Orientation and Gravity Independent Passive Two-phase Wickless Heat-spreader

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Presentation Type: Poster

Hotspots from electronic components present significant thermal management challenges in defense, space, and commercial applications. To mitigate hotspots evaporation/boiling based two-phase heat spreaders are used that can quickly spread heat from a smaller area to a larger area. However, performance of these devices is sensitive to component orientation and gravity. Here we design, develop, and evaluate the thermal performance of a novel wickless two-phase heat spreader wherein an aqueous solution of ionic liquid is completely filled within a thin form factor metallic hollow chamber. Unlike typical two-phase passive devices in literature, our device does not rely on gravity or wicks for fluid

recirculation. Our device demonstrates orientation independent and near-isothermal performance from 0.5 – 1.1 MW/m² in two-phase regime. Further, quick transient response and relatively lower surface temperature of present heat spreader in comparison to metallic pads suggest prospective applications in hotspot mitigation of components with orientation and gravity independent operations.

Keywords: Heat Spreader; Wickless; Orientation; Gravity; Isothermal; Ionic Liquid.

Design and Analysis of a Magnetorheometer

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Presentation Type: Poster

This work presents the numerical simulation of magnetostatic, laminar fluid flow, and thermal field distribution of a plate-plate magnetorheometer using the finite element method. We analyzed the magnetic field distribution and magnitude of the magnetic field along the radius of the plates. We obtained a better uniform magnetic field along the radius of plates, with an enhanced magnetic field at a particular applied current compared to the other existing design of the rheometer. The heat generated due to the electromagnetic coil and slippage heating between the plates and the maximum temperature generated due to the combined effect of the electromagnetic coil and slippage is about 318K after 40 minutes of working. Here we enhanced the magnetic field density profile and magnitude of magnetic flux density along the working radius of the plate and minimized the effects of resistive coil heating in the MR fluid region.

Keywords: Magnetic field; Magnetorheology; shear stress; Heat Transfer.

Robust Superhydrophobic Copper Surfaces for Efficient Heat Exchange

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Presentation Type: Poster

Dust deposition, frosting, and filmwise condensation on heat exchanger units are the critical challenges in various industries ranging from desalination plants, HVAC systems, cryogenic units, process industries, among others. In this regard, superhydrophobic surfaces (SHS) have shown potential in alleviating such

bottleneck issues. However, very few surface fabrication techniques in literature show their viability in large-scale industrial applications due to poor stability and robustness. Moreover, the reliance of per-fluorinated compounds (PFCs) as functionalization materials is another bottleneck in food and water applications. In this work, we demonstrate environmentally friendly, and PFC free fabrication of copper SHS via electrodeposition, and subsequent lauric acid modification. The prepared SHS exhibit excellent thermal stability, mechanical robustness, underwater stability, and chemical stability under aqueous acidic and basic medium. Moreover, excellent self-cleaning, anti-icing, and dropwise condensation abilities promise these surfaces as a potential candidate in a broad spectrum of engineering applications.

Keywords: Superhydrophobicity; Electrodeposition; Lauric acid; Condensation; Anti-icing.

Thermal and Multiphase Flow Simulations of PTFE-grease and Characterisation Study of Magnetorheological Grease

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Presentation Type: Poster

This work presents a numerical model for predicting flow behaviour and temperature distribution of PTFE grease in a roller-bearing configuration. Laminar flow multiphase mixture model is used to predict the flow patterns and volume fraction distribution of thickener in a rectangular channel with cylindrical rollers rotating at constant angular speeds. The rotation affects local distribution of thickener as well as the rate of homogenisation. Most of the channel portion is thermally unaffected due to heat dissipation up to 5 W. Rheological characterisations reveal that the yield stress of PTFE-based Magnetorheological grease (MRG) increases with temperature and magnetic field. Formation of PTFE-particle clusters which decrease localized heat dissipation has been explained to be the reason for this. With increasing magnetic field strength, shear stress and apparent viscosity show an increasing trend. On-state storage and loss moduli are presented to show the effect of temperature and magnetic field on the viscoelasticity of PTFE-based MRG.

Keywords: CFD; Non-newtonian Fluids; Grease; Multiphase flow.

Effect of Flat Probe on Local Heat Generation in Friction Stir Welding of 6061-T6 Aluminium Alloy

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Presentation Type: Poster

A 3-D coupled thermo-mechanical modelling using COMSOL Multiphysics software is used to investigate the effect of the number of flats on the material flow and the local heat generation at the tool/workpiece interface. It has been shown that the optimum number of flats that can be machined from a cylindrical surface tool is four. The larger contact length will offer a larger frictional heating area and hence causing the greater amount of the local thermal softening of the workpiece material. The growth of the built-up-edge provides the local disturbance in the material flow causing the additional flow paths and torque. The torque ratio is the highest with four numbers of flats which is an important indicator of local heat generation.

Keywords: Friction stir welding; Numerical analysis; Tool design; Material flow; Local heat generation.

Healing of Fatigue Crack in Steel with the Application of Pulsed Electric Current

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Presentation type: Poster

This study aims at the fatigue crack healing in a steel specimen by the application of pulsed electric current. The initial crack in the specimen is introduced by means of a notch fatigue test. Electron backscatter diffraction and scanning electron microscopy are used to observe and quantify the change in microstructure before and after the electro-pulsing treatment. The study indicates that with suitable electro-pulsing parameters, complete crack healing could be achieved. The region reasonably far away from the crack shows no impact of electro-pulsing on microstructure. The possible reasons behind fatigue crack healing could be Joule heating, thermal compressive stress, and micro-welding.

Keywords: Electro-pulsing; Crack healing; Fatigue crack; Micro-welding.

Characterisation of Cu-Al alloy Lap Joint using TIG Welding

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Presentation Type: Poster

It is difficult to join dissimilar material which has different thermal and mechanical properties using conventional arc welding, which is prone towards the formation of the intermetallic compound. In the present work pure Copper (Cu) and Aluminium (Al) alloy (Al-6061) is a lap joined by conventional TIG Welding. At optimal operating condition, successful weld is achieved as observed from mechanical testing. The metallurgical properties of joints are investigated by BSE (Back Scattered Electron) image, spot EDS (Energy Dispersive X-ray Spectroscopy) and line EDS. Intermetallic compound layers formed have 100 μ m thickness and 1.017 mm bead width. Two layers of intermetallic compounds (IMCs) formed at joints fail near the copper plate. The mechanical property is investigated by tensile shear test, and the average maximum load-carrying capacity found 1726.92N, which is comparable to other non-conventional welding processes.

Keywords: Cu-Al; Lap joint, Dissimilar; TIG Welding; Microstructure; Shear Strength.

Experimental Characterization and Modelling of a Desiccant Cooling System for Perishables

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Presentation Type: Poster

The agricultural sector, since times immemorial, has made significant contributions (\approx 17-18% GDP) to the Indian economy. Despite a good harvest, a decent income to farmers is not often guaranteed due to limited access associated with post-harvest storage facilities. Further, the conventional storage units incorporate interdependent sensible and latent load, their independent control is required to avoid designing a separate storage for each perishable item. Hence, engineering interventions are required to make an energy efficient versatile climate controlled unit. In this regard, biomass gasification based desiccant cooling systems are considered efficient and promising techniques. Here, we present a steady-state model based on mass and energy balance to analyze the performance of a desiccant-cooling based climate control unit. We estimate the room temperature and specific humidity for various values of input loads. We propose to validate these results through experiments using a suitable desiccant cooling system.

Keywords: Perishables; Climate control unit; Biomass gasification; Desiccant dehumidifier; Steady state modeling.

On the Local Deformation Behavior of Similar and Dissimilar Friction Stir Weld

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Presentation Type: Poster

The joints produced by the friction stir welding (FSW) have heterogeneous microstructure along the transverse direction, which resulted in a variable resistance to deformation during the uniaxial tensile loading. This variable resistance to deformation leads to non-uniform elongation in a tensile specimen of FSW joints. The conventional contact-based extensometers are inadequate in computing this non-uniformity in the deformation. However, the digital image correlation (DIC) which measures strain field over a deforming surface can be applied to measure this non-uniformity accurately. In the present work, local strain variation of similar AA6061-AA6061 FSW joint and dissimilar AA6061-AA7075 FSW joint (FSW-67) in the transverse direction of welding has been measured using DIC. The local strain in a similar joint gets concentrated in a heat-affected zone (HAZ) on both sides. However, local strain in dissimilar joints gets concentrated in the HAZ of AA6061-T6 side due to the difference in tensile strength of AA6061-T6 and AA7075-T6.

Keywords: Friction stir welding; Digital image correlation; Strain localization; Microstructure.

Micro-Friction Stir Welding (μ FSW) of Dissimilar Aluminum Alloys Sheets - Study of the Effect of Process Parameters

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Presentation Type: Poster

The inherent advantages of solid-state process (friction stir welding-FSW) over fusion processes have made it a preferred choice to join dissimilar aluminum alloys. Obtaining a sound dissimilar joint is difficult and even more challenging for sheet thickness $\leq 1000 \mu\text{m}$ (μ FSW). In dissimilar μ FSW, these challenges are an amalgamation of challenges in dissimilar FSW and that in μ FSW, hence a new knowledge base is essential. With narrower process parameters window and its increased sensitivity to joint strength, the difficulty is to obtain its optimal set. Dissimilar FSW of 500 μm thin AA 6061-T6 and

ALCLAD 2024-T3 sheets have been performed. For the selected set of process parameters, with the increase in ω/V ratio, weld tensile strength first increases and decreases, having a joint efficiency of 63.43%. However, poor joint ductility (elongation of 1.02%) was obtained, which may be due to rapid heat dissipation and material inhomogeneity at the weld zone.

Keywords: Dissimilar Micro-Friction Stir Welding (Dissimilar μ FSW); Aluminium Alloys; Thin; Process Parameters; Joint Strength.

Effect of Soft and Hard Inclusions in Tensile Deformation and Damage Mechanism of Aluminium: A Molecular Dynamics Study

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Presentation type: Poster

Abstract: The investigation under uniaxial tensile deformation and damage mechanism in single-crystal Aluminium (Al) is performed in the presence of soft and hard inclusions. The shape of inclusion is spherical and added in Al single crystal. Mg is considered as soft inclusion, and Ti is considered as hard inclusion. Alteration in mechanical properties is noted due to the inclusions. Softening is observed in the presence of Mg while hardening in the presence of Ti. The small Young modulus of Mg and lack of dislocation activity in the Al+Mg system causes higher stress concentration at the interface, less deformation, and early void nucleation. In contrast, the large Young modulus of Ti inclusion and substantial dislocation activity in the Al+Ti system prevails the large deformation, lower stress concentration at the interface, and slow fracture in the Al+Ti system. The study evokes the mechanism of fracture influenced by the inclusions.

Keywords: Inclusions; Stress and Strain distribution; Dislocation; Void; Molecular dynamics simulation.

Fretting Wear Evolution of Partially Compatible Zircaloy-4/Inconel-600 System

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Presentation Type: Poster

Fretting wear test of partially compatible Zircaloy-4/Inconel-600 system for different test duration was conducted at room temperature. The effects of test duration on the coefficient of friction and mechanism of the wear were analyzed. Worn surface morphologies were investigated with optical microscopy, scanning electron microscopy, and energy dispersive spectroscopy. The results indicated that fretting

duration had a strong effect on wear behavior. With an increase in fretting duration, the fretting regime gradually transformed from fully-stick to mixed stick-slip to gross-slip regime. Correspondingly, the wear mechanism transformed from local adhesive damage to the combined damage of oxidation, adhesion surface cracking, and delamination wear. Microcracks in the wear scar were strongly dependent on fretting wear regime. In the mixed stick-slip regime central stick region was free from cracks. However, in slip region, microcracks were formed due to low cycle fatigue. After the transition, complete wear surface was covered with the oxides.

Keywords: Fretting; Adhesion; Stick-Slip; Wear.

Numerical study on Thermo-fluid Behavior of the Berforated Micro Pin Fin

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Presentation Type: Poster

The heat sink's cooling capability is essential for the miniaturized microprocessors with the increasing electrical power consumptions. Literature reveals that perforations have great potentials for better thermal management. In this study, 3D CFD simulations have been done to study heat transfer in a square-shaped perforated micro pin fin heat sink mounted on a CPU to explore the designed thermos-fluid behavior micro-pin-fin heat sink. Air cooling methods are used for heat extraction. This numerical work considers the effects of inlet turbulence intensity (TI) and fin diameter (D) of the micro-pin-fin on the heat sink's performance. A turbulent SST model is applied to capture the turbulence regime in the system. The heat transfer and pressure coefficient have been found at different Reynolds numbers (Re) (i.e., different inlet velocities). Preliminary found results show that an increase in turbulent intensity is enhancing the temperature drop and thermal layer thickness. Nusselt number (Nu) increases with an increase in airflow velocity, improving the processors' heat extraction.

Keywords: Secondary flow; Perforated micro pin fin; Thermal performance; SST Model; Turbulent forced convection.

Deep Learning the Sound of Boiling for Advance Prediction of Boiling Crisis

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Presentation Type: Oral (My research in 3 minutes)

We utilize a deep learning algorithm to classify the various regimes and capture the key transition points during boiling. We use acoustic emissions during pool boiling experiments to train a convolutional neural network. The network trained on steady-state data is used for real-time prediction of boiling regimes and boiling crisis during slow and fast transient experiments. The network further exhibits good generalizability by predicting the boiling behavior on nanostructured copper surface and with aqueous surfactant solution as the boiling fluid. The high accuracy with which we predict the previously unseen data of transient heating, nanostructured heater surface, and aqueous surfactant solution, demonstrates the ability of the model to capture the fundamental bubble behavior during boiling. This strategy promises novel solutions for monitoring the health, efficiency, and economy of boilers in industrial applications.

Keywords: Boiling; Acoustic Emissions; Deep Learning; Advance Prediction; Boiling Crisis.

The Biomass Gasification Powered Off-the-Grid Solutions for Storage and Processing of Perishable Items

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Presentation Type: Oral (My research in 3 minutes) / Poster

Food waste is a far-reaching problem with tremendous financial, ethical, and environmental costs in developing countries such as India. Despite being the 2nd largest producer of fruits and vegetables, India holds 102nd rank in Global Hunger Index primarily due to insufficient cold storage facilities at farm-level. Here, we propose to develop an agricultural residue gasification powered storage and processing unit to enhance shelf life of perishable items. Proposed versatile unit will serve two purposes: first, it will provide the apt food storage conditions via maintaining a wide range of temperature (5- 70°C) and relative humidity (5- 95%), second, it will also harness the huge available energy (2.5 EJ/year) in crop residues thereby alleviating the crop burning issue, which is a severe threat to environment and health. Thermal systems of this kind will also empower the economy of the country.

Keywords: crop residue, perishables, climate control unit, drying.

Effect of Groove Profile on Magnetorheological Fluid Flow in Radial Shear Gap Clutch: Numerical and Experimental Study

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Presentation Type: Oral (My research in 3 minutes)

The magnetorheological (MR) fluid is a kind of smart material. It is used in the MR brake, MR clutch, and MR damper. The MR fluid domain is modelled using a technique that can be applied for any driving and driven disc's wall texture. An MR clutch with three different discs, i.e., plane, radial groove, circular groove disc, and an MR transmission test-bed, has been built to verify the numerical findings. The influence of groove profile on the transmission torque of MR fluids has been investigated on the test-bed. The results are presented to obtain the relationships among torque performance, disc radius, rotational speed, and magnetic field. Numerical results show good agreement of torque transmission for the different groove profiles with experiments. Finally, three groove-based MR clutches' temperature distribution patterns and the radial groove profile optimization have been analyzed numerically.

Keywords: Magnetorheological clutch; Magnetorheological fluid; Magnetic field; Texture; Torque.

A New Methodology for Energy-Efficient Machining of Ductile Materials

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Presentation Type: Oral (My research in 3 minutes)

Machining a ductile material has always been an issue mainly because of high chip thickness which results in high power consumption and poor surface finish. In situ machining experiments together with image analysis reveals that severe sliding contact between tool rake face and chip is responsible for Instantaneous dead metal zone (IDMZ) formation at the tool tip and stick-slip motion of the chip. Where, IDMZ is responsible for high chip thickness, stick-slip results in poor surface finish. In this work, A novel tool is designed to provide rolling motion at the tool-chip interface to prevent the aforementioned problem and facilitates easy chip flow on the rake surface. The novel tool is further compared with a conventional tool having the same tool geometry as well as with the one having a sharp cutting edge. Power consumption is reduced to half and fifteen times less roughness is measured.

Keywords: Rolling cutting edge, machining, ductile materials, in-situ analysis, power consumption, surface finish.

Department of Metallurgical and Materials Engineering

About the Department

The strong dependence of our society on metals and alloys makes metallurgy an important branch of modern engineering. Metallurgical and materials engineering involves design, innovate and improve the process; to transform minerals and metals to useful products we use every day in our life. It is a discipline that enables both the creation and application of materials in society. Also, Materials engineers develop materials for new applications, improve existing materials to enhance performance and evaluate ways in which different materials can be used together. The Department of Materials Science and Engineering was established in the year 2012 and was renamed as Department of Metallurgical and Materials Engineering in 2018. The department focuses on the fundamental and engineering aspects of conventional metallurgy, materials and advanced materials. The department faculty specializes in the areas of physical and mechanical metallurgy, phase transformations, thermomechanical processing, electron microscopy, materials chemistry, nanomaterials, thin films and coatings, ceramic and metal matrix composites, tribology, thermal spraying, polymer science and technology, fillers, composites, ultra-high temperature ceramics and phase field modeling. Apart from the regular teaching activities, the department aims to train students with the fundamentals and expertise of design, synthesis, characterize, testing and production of various materials and also with the knowledge of new technologies in production and processing of new and advanced engineering materials. Ongoing research projects in the department are supported both by government (funding agencies include, SERB-DST, NRB, ISRO etc.) and industry (e.g., Tata Steel Limited, MRF Tyres, Carborundum Universal Limited etc.). The department continues to strive for excellence and develop continuously through progress and improvement to establish itself as one of the leading departments of education and research.

Total Number of Abstracts Received: 09

Posters: 07

My Research in 3 Minutes: 02

Structure-Property Co-relationship for a Phase-pure, Nanograined Tetragonal Zirconia Ceramic Stabilized with Minimum CaO doping

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Presentation Type: Poster

Dense (~97%) CaO-stabilized ZrO₂ ceramic was stabilized with minimum (3 mol%) doping (reported to date) and processed via conventional sintering at a low temperature (~1200°C); compositional analysis via X-ray fluorescence confirmed the CaO doping accuracy. Phase-pure tetragonal structure (characterized via both X-ray diffraction and Raman spectroscopy) along with uniform nanograins (90 nm) of the ceramic ensured the evolution of no monoclinic phase even after vigorous low-temperature degradation experiments (both thermal and hydrothermal aging for 80-100 h). The sintered ceramic recorded a high hardness (~15 GPa); the indentation toughness value was also comparable to a 3 mol% yttria-stabilized zirconia system. The remarkable structure–property correlations in the 3 mol% CaO-stabilized ZrO₂ ceramic suggests that the same may be worth examining for suitable future applications (e.g., in dental ceramics).

Keywords: CaO-stabilized ZrO₂; Ceramics; Hardness; Powder processing; Toughness.

The investigation of ZnO dopant on flash sintering of 3YSZ: Grain growth with electrochemical reactions

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Presentation Type: Poster

Conventional sintering of Zirconia ceramics typically requires a high temperature and long soaking hours. Recently, Flash Sintering (FS), one of the new methods of field-assisted sintering has shown tremendous promise in reducing the sintering time and the temperature. FS also has attracted much attention due to its tailorability to a wide range of materials and simplicity in the setup design. Yttria Stabilized Zirconia (3YSZ) is one of the most studied flash sintered materials owing to its wide-ranging application. However, FS till now is only successful for small-sized samples, and significant heterogeneity in densification was observed in the FSed sample. In this work, we investigated and compared the microstructural heterogeneity in FSed 3YSZ in the presence and absence of ZnO as a dopant. Heterogeneity in grain size and reduction of 3YSZ into non-stoichiometric zirconia is observed with grain growth in the sample.

Keywords: Flash sintering; Zirconia; ZnO; Sintering additive, Electrochemical reaction.

Unique Compatibilized Thermoplastic Elastomer with High Strength and Remarkable Ductility: Effect of Multiple Point Interactions within a Rubber-Plastic Blend

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Presentation Type: Poster

In the case of thermoplastic elastomers (TPEs) based on nonpolar polypropylene (PP) and polar rubbers, a small quantity of a third component (compatibilizer) is added to maximize the compatibility between the incompatible blend components. Till today, there are no reports in literature, which examine the effect of a compatibilizer that can have multifaceted interactions with the incompatible blend components for the development of TPEs. Accordingly, here, ethylene-acrylicester-maleicanhydride terpolymer (E-AE-MA-TP) has been used as the compatibilizer for the preparation of TPEs based on polypropylene (i-PP) and polar epichlorohydrin rubber (ECR). The E-AE-MA-TP compatibilizer contains ethylene groups, acrylic groups and anhydride groups along its backbone, which act as the sites for establishing multifaceted interactions with both i-PP and ECR. The unique properties of TPEs based on i-PP and ECR in the presence of E-AE-MA-TP compatibilizer is attributed to the efficacy of the E-AE-MA-TP to establish multifaceted interactions with both i-PP and ECR.

Keywords: Polymer blend; compatibilizer; polypropylene; epichlorohydrin rubber; thermoplastic elastomers.

Friction Surfacing: A Tool to Repair Surface Cracks

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Presentation Type: Poster

In the present work, it is demonstrated that friction surfacing can be used as a tool to repair surface cracks on engineering components. The repaired component can be put to service once again with enhanced service life. Crack repair was performed by depositing coating of Inconel 718 on a self-mating substrate. The artificial crack, made on Inconel 718 surface, was completely filled and the coating exhibited sound bonding with the substrate. Process parameters were optimized in accordance with crack dimensions for complete filling of the crack. Microstructure characterization showed equiaxed fine grains with an average grain size of 1-3µm and significant amount (>78%) of HAGBs in the coating microstructure. The microstructure development in the coating is attributed to occurrence of dynamic recrystallization due to

the combination of high strain rate and high temperature during friction surfacing. The method shows high value of applicability as it promotes reuse, over replacement of components.

Keywords: Friction Surfacing, Inconel 718, Microstructure.

Can a Shape Factor in Bulk Ceramics Mitigate Unwanted Phase Transformations?

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Presentation Type: Poster

The present work introduces the concept of ‘shape strain’ to illustrate its beneficial effect to control/avoid any undesired phase transition via consolidation/densification of ceramics; low (4 mole%)-doped ZrO₂ ceramics with various dopants have been used for investigation. With ionic radii size difference (of dopant ion and Zr⁴⁺) above 30%, CaO-doped zirconia ceramics showed the effect most prominently. The effect was also dependent on the grain boundary mobility of dopants. Controlling final phase evolutions in ceramics is difficult and this effect may serve as a remedy if tried with different size fractions of starting powders.

Keywords: Powder Consolidation; Sintering; Ceramics; Nanostructured Materials; Phase transformations.

Flash sintering of Lead Zirconate Titanate

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Presentation Type: Poster

Piezoelectric materials are enormously important for numerous applications in diverse fields. It includes household items like gas lighters, to ultrasound imaging in medical applications, sensor, actuator, energy harvester etc. However, there are certain challenges involved in producing PZT. Being a ceramic material, powder processing followed by high-temperature heat treatments (sintering) for a few hours is required to densify them and achieve satisfactory mechanical and piezoelectric properties. The volatility of PbO during sintering stage of PZT is a major concern as lead accumulates in the environments and causes damage to living organisms including humans. There are efforts being made by scientific communities to gradually replace the Lead based piezoelectric by Lead-free piezoelectric. Flash

Sintering (FS), is a novel technique of achieving ultrafast densification in ceramics. Here, the green sample is heated to specific furnace temperature, and an electric field is applied to the sample.

Keywords: Sintering; PZT; Lead loss; Flash sintering.

Structure-Property relations for a Phase-pure, Nanograined Tetragonal Zirconia Ceramic Stabilized with Minimum CaO doping

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Presentation Type: Oral (My research in 3 minutes)

Dense (~97%) CaO-stabilized ZrO_2 ceramic was stabilized with minimum (3 mol%) doping (reported to date) and processed via conventional sintering at a low temperature (~1200°C); compositional analysis via X-ray fluorescence confirmed the CaO doping accuracy. Phase-pure tetragonal structure (characterized via both X-ray diffraction and Raman spectroscopy) along with uniform nanograins (90 nm) of the ceramic ensured the evolution of no monoclinic phase even after vigorous low-temperature degradation experiments (both thermal and hydrothermal aging for 80-100 h). The sintered ceramic recorded a high hardness (~15 GPa); the indentation toughness value was also comparable to a 3 mol% yttria-stabilized zirconia system. The remarkable structure–property correlations in the 3 mol% CaO-stabilized ZrO_2 ceramic suggests that the same may be worth examining for suitable future applications (e.g., in dental ceramics).

Keywords: CaO-stabilized ZrO_2 ; Ceramics; Hardness; Powder processing; Toughness.

Flash Sintering: A novel technique to sinter ceramics

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Presentation Type: Oral (My research in 3 minutes)

Ceramic materials such as porcelain, bricks, clay-pots, and white-ware ceramics are made from powders by the process of sintering. Sintering is carried out at high temperatures and it takes a few hours to achieve good density. Flash sintering is a recently developed novel technique to sinter the ceramic samples at very low furnace temperatures and in a few seconds by applying an electric field across the sample. Ultrafast densification kinetics gives no time for grain growth which results in 30% smaller

grains compared to the conventionally sintered samples, hence, better mechanical properties. A variety of materials including; semiconductor, ionic conductor, electronic conductor, insulator, complex oxides, and composites have been flash sintered in the recent past. The short sintering times and low furnace temperatures has opened a new way of rapid manufacturing of ceramics. The mechanism for the ultrarapid densification during flash sintering is not fully understood yet.

Keywords: Flash Sintering; Ceramics; microstructure-property correlation.

Fire Retardant Materials: Investigation on Mechanistic & Thermo-physical Properties & Synthesis Process

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Presentation Type: Oral (My research in 3 minutes)

Agni (fire) is one of the pancha bhoota (5 basic elements for life) which is often called as sarvashresth. But an uncontrolled fire can also become destructive (e.g. forest fires, industrial and household fire accidents etc.). This brings the need of fire extinguishers and retarding materials to control fire. Though there are plenty of materials and ways to extinguish fire, the study of the fire intensities and their gradation was still needs to be explored and that is the motivation of my project. It mainly comprises of synthesis of different eco-friendly fire retardant materials and grade them according to their degradation temperatures, intensity of fire and the by-product they release such as water vapour or carbon dioxide or char etc.

Keywords: Fire Retardant; Extinguisher; Eco-friendly.

Department of Physics

About the Department

The department of Physics at IIT Patna was established and started its activity in August 2008 to train undergraduate engineering students. In July 2009, the department initiated a Ph.D. program in various frontier fields of Physics. The M.Tech program in Nanoscience and Nanotechnology has been started since July 2012. The department is also offering a 2 year M.Sc. program in Physics from July 2016.

The department is committed to engage in high quality research and pursuit of excellence in teaching. The faculty members of the department are actively involved in research and development in challenging areas of both theory and experiment. Currently, the main research emphasis of the department comprises Condensed Matter Physics, Optics, Biophysics, and Atomic & Molecular Physics.

Total Number of Abstracts Received: 32

Posters: 29

My Research in 3 Minutes: 03

Role of Soft Magnetic Phase (CuFe_2O_4) in $\text{BaFe}_{12}\text{O}_{19} + \text{CuFe}_2\text{O}_4$ Composite

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Presentation Type: Poster

The composites of $\text{BaFe}_{12}\text{O}_{19}$ (BHF) + (x) CuFe_2O_4 (CuFeO) ($x=1, 2$, and 4) have been synthesized by the one pot sol-gel method. The allowed Bragg's peaks for both crystal phases of BHF and CuFeO have been observed in the XRD patterns. It reveals the intermixing of BHF and CuFeO without any major chemical reaction between them. Hence, the role of soft magnetic phase (copper ferrite) on magnetic parameters and interaction are explored by measuring M-H hysteresis loop of composites. Magnetic interactions (Exchange interaction and dipolar interaction) have been studied with the help of "Henkel plot". The "Law of approach to saturation" has been employed to obtain the Magnetocrystalline anisotropy constant. The coercivity and saturation magnetization decrease with the increase in CuFeO in the composite. The magnetic parameters such as saturation magnetization, magnetocrystalline anisotropy constant and $(\text{BH})_{\text{max}}$ increases with the decrease in measuring temperatures, whereas coercive fields decrease with decrease in temperature.

Keywords: Composite; Magnetic material; Henkel plot; Law of Approach to Saturation.

Mapping Deep Learning to Renormalization Group: An Enquiry

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Presentation Type: Poster

As physicists, our fascination with Artificial Intelligence and Machine-Learning revolves around the mechanism behind the process of 'learning' itself. The underlying mathematical structure of a neural-net will not only help us in understanding the scientific/epistemological meaning of 'Learning' but also the mechanism that governs our minds.

The subtle parallels between the Renormalization Group (RG) and Deep Learning are quite interesting. Deep learning subdues the high-dimensionality of data to a low-dimensional space, extracting prominent features from the dataset. Similarly, renormalization through coarse-graining averages out short-range coupling, resulting in long-range interactions and fewer degrees of freedom. Recent research indicating a mapping between the RG and deep learning looks promising. Putting these claims through a series of tests, we will prepare various neural-networks having the same number of layers, neurons and activation-function(s). They will be trained using different techniques and the results will be compared.

Keywords: Renormalization Group; Deep Learning; Auto-Encoders; Transfer Learning; Ising model.

Enhancement of Electromagnetically Induced Transparency and Absorption Signals in ^{85}Rb Atomic Vapor Medium by using a Small External Magnetic field

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Presentation Type: Poster

In the present work, a theoretical and experimental study to enhance electromagnetically induced transparency (EIT) and electromagnetically induced absorption (EIA) signals in an ^{85}Rb atomic vapor medium at room temperature is conducted. Also, switching from EIT to EIA signal at a particular value of the magnetic field is observed. Further, by using circularly polarized coupling light, the dispersion profile of the linearly polarized probe signal is investigated theoretically and experimentally. The nine-level system of ^{85}Rb D2 transition in a ladder-type configuration is fully solved by using the density matrix theory. The simulated results are found in good qualitative agreement with experimental observations. Hence, an experimental setup is developed for (1) achieving enhanced EIT and EIA signal, (2) switching from EIT to EIA, and (3) dispersion measurement. These observations have potential applications towards measurement of the group velocity of light, quantum memory, quantum information, and optical switching.

Keywords: EIT; EIA; Quantum Memory; Dispersion.

Magneto-Structural and Magnetocaloric Effect in $(\text{Mn}_{0.6}\text{Fe}_{0.4})(\text{Ni}_{0.4}\text{Co}_{0.6})\text{Si}$ Alloy

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Presentation Type: Poster

The presence of combined magnetic and structural transition (Magneto-structural transition: MST) at a single temperature and, first order nature of the transition in $(\text{Mn}_{0.6}\text{Fe}_{0.4})(\text{Ni}_{0.4}\text{Co}_{0.6})\text{Si}$ alloy were investigated from the temperature-dependent magnetization measurement. The present alloy exhibits the phase transition from ferromagnetic TiNiSi-type orthorhombic structure to paramagnetic Ni₂In-type hexagonal structure nearly at room temperature. It shows a large isothermal magnetic entropy change of $3.45 \text{ J kg}^{-1}\text{K}^{-1}$ and large Refrigerant Capacity (RC) of 120 J kg^{-1} for a low field change of 30 kOe. This rare earth free, cost effective and non-toxic material can be a potential refrigerant for the solid state cooling industry due to their large isothermal entropy change and large refrigerant capacity around room temperature.

Keywords: Magneto-structural Transition; Magnetocaloric Effect; Refrigerant Capacity.

Enhanced Electrocaloric Effect in Sr-Doped BaTiO₃

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Presentation Type: Poster

Nowadays, Solid-state Refrigeration gets so much attention by the researchers which is environment friendly, low cost, easy to fabricate, etc. For this purpose, here energy storage performance and electrocaloric effect on Sr modified BaTiO₃ (Ba_{1-x} Sr_xTiO₃, x=0.10) have been observed. The effect of Sr modified on BaTiO₃ has been studied on its structural, dielectric, and electrocaloric properties. The temperature variation PE-loops indicates that the material undergoes a transition from ferroelectric to Relaxor ferroelectric due to the formation of short-range ordered Polar Nano Regions (PNRs). The large electrocaloric parameter has been found on Sr =0.10 i.e. isothermal entropy change (ΔS)=1.108J/kgK at 360C by the application of 30kV/cm field. Also, this material shows high energy storage efficiency. Hence, this modified material can be applicable in the energy storage industry as well as in the cooling industry.

Keywords: Ferroelectric; Electrocaloric effect; Polar Nano Regions(PNRs).

Photo-physics of Carbon Dots in the Nonionic Micellar Medium

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Presentation Type: Poster

Carbon Dots (CDs), a new generation of fluorescent material of the carbon family, have novel photophysical properties and have promising applications in many disciplines of science and engineering. Due to complexity in its structure, deciphering the photo-physics at an electronic and molecular level becomes even more challenging. Recent investigations on different modes of interactions of CDs in its immediate local micro environment or in confined media indicate some very interesting outcomes, as the medium can moderate the diffusion and spin dynamics of different photo-induced transients. This report focuses on the optoelectronic behavior of CDs in the non-ionic brij-35 micelle medium and their photo dynamics in the presence of menadione, for electron and proton transfer. Since CDs have both electron donating and accepting capacity with apposite neighboring molecules, the Stern-Volmer analysis of their photoluminescence has been studied with gradual addition of menadione (Vitamin K3) within the neutral micellar media.

Keywords: Carbon Dots, Micelles, Photo-physics.

High Temperature Ordering in a 2D Spin Lattice

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Presentation Type: Poster

A wide range of layered 2D compounds have been studied over the last decade but the majority of them are nonmagnetic. However, some recent experiments showed the existence of magnetism in several 2D monolayers such as $\text{Cr}_2\text{Ge}_2\text{Te}_6$ and CrI_3 etc. In this work, First-principles based calculations combined with Monte-Carlo simulation are used to investigate the behavior of $\text{Cr}_2\text{Ge}_2\text{Se}_6$ (CGS). The monolayer CGS is predicted to be a semiconductor along with a critical temperature (T_c) of 149K, which can be increased to a value of 885K under the application of 11% biaxial strain and the further enhancement in T_c is due to the combined effect of strain and electric field. Under the application of external stimuli, the materials show rapid enhancement in T_c , suggesting the existence of high temperature ordering above the room temperature. The coexistence of high spin polarization and enhanced magnetic moment make CGS more suitable for spintronics applications.

Keywords: 2D magnet, Ferromagnetism, Spintronics.

Whispering Gallery Modes of Hollow and Solid Core-Shell Microspheres Illuminated by Plane Wave and Gaussian Beam: A Theoretical Study

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Presentation Type: Poster

Dielectric microspheres have attracted researchers' attention due to their applications in photonics, such as the generation of photonic nanojets, enhancement of Raman scattering, and detection of biomolecules using different types of microspheres in the form of whispering gallery mode (WGM) microresonators. Here, we report some theoretical simulations for studying optical properties of hollow and solid core-shell microspheres made up of dielectric materials. These simulations use the analytical theory, which is based on Bromwich formalism. The scattering efficiency of hollow and solid microspheres is studied in detail. Effect of core and shell radii of the microspheres and thickness of the shell on the scattering efficiency is shown. Apart from the effect of the microspheres' size, the effect of the refractive index of the microspheres on the scattering efficiency is also shown. Also, the distribution of electric field enhancement due to a plane wave and a focused Gaussian beam is also shown.

Keywords: Whispering gallery mode; Dielectric microsphere; Electric field enhancement; Scattering efficiency; Bromwich formalism.

Narrowing of Electromagnetically Induced Transparency by using Structured Coupling Light in ^{85}Rb Atomic Vapor Medium

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Presentation Type: Poster

In this present study we observed narrowing of electromagnetically induced transparency (EIT) spectrum width. Superposition of two Laguerre-Gaussian (LG) modes which has a petal like structure is used for coupling light. Narrow EIT spectrum has a potential application towards slow light generation which in turn has application in quantum storage devices. The superposed LG modes have opposite circular polarization (RCP-LCP). Theoretical modelling is developed on the basis of a semiclassical approach which agrees qualitatively with experimental results. We observed that as the azimuthal quantum index ' l ' increases, the EIT width decreases.

Keywords: Electromagnetically induced transparency; Structured light; Slow light.

Low-light Quantitative Phase Imaging using Transport of Intensity Equation

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Presentation Type: Poster

Phase changes carry important information about an object's shape and refractive index and are important in surface profiling, adaptive optics and particularly biomedical visualization, where samples are often transparent. Imaging in low light has been a challenging task due to receiving a low number of photons at the image sensor. The functioning of the electronic cameras and how the properties can be exploited to optimize image quality under low-light conditions has been studied. In situations where the light source is weak the detection signal-to-noise ratio is limited, the imaging performance is mostly degraded due to noise. In this work, we demonstrate a transport of intensity equation based technique that uses photon-counting phase imaging. The effectiveness of the proposed method has been illustrated through simulation and experimental results using a partially coherent light source.

Keywords: Low-light imaging; Quantitative phase imaging; Transport of intensity equation; LED light source; Micro-lens.

Measurement of Dispersion of Multi-Window Electromagnetically Induced Transparency Signal

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Presentation Type: Poster

In this letter, we have measured the dispersive profile of the multi window Electromagnetically Induced Transparency (EIT) signals in Rubidium (Rb) atomic medium at room temperature. Weak probe laser light and strong coupling light in counter propagating direction are used to excite the atomic medium via ladder type configuration of ^{87}Rb D2 line to obtain multiple EIT peaks. The uniqueness of our work is in the experimental setup which is used for the measurement of dispersion. We have used a transmissive Spatial Light Modulator(SLM) in one arm of the Mach-Zehnder(M-Z) interferometer to obtain the desired phase shift between two interfering arms for the measurement of dispersive properties of multi window EIT in Rb vapor medium. One can easily obtain the phase shift without disturbing the alignment of the M-Z interferometer by using this setup.

Keywords: Electromagnetically Induced Transparency; Dispersion; Mach-Zehnder Interferometer.

Biosensing using Graphene and hexagonal boron nitride based single electron transistor

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Presentation Type: Poster

Two dimensional materials have attracted huge attention in the field of Nano-electronics, photovoltaics, and optoelectronics due to their tunable mechanical, electronic, and optical properties. The combination of two single layered materials forms the Van der Waals heterostructure, which can offer structural versatility and engineered functionality of the constituent layers. On the other hand, rapid detection and sequencing of various DNA/RNA nucleobases is a very promising challenge of modern-day. In this work, we have investigated the behaviour of Graphene and h-BN heterostructure based single electron transistors for the sensing/detection of such nucleobases. Ab-initio based DFT-NEGF was used for calculating the electrostatic, adsorption and transport behaviour of the system. The presence of a specific molecule within the SET can be identified from respective line scans of the charge stability diagram. The current observations offer a novel detection methodology for various nucleobases, which is very energy efficient and offers superior detection sensitivity.

Keywords: Nano-electronics; Sequencing; Heterostructure.

Engineered Cluster of Coherent States to Produce Intense Fock State

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Presentation Type: Poster

Coherent State (CS), first introduced by Erwin Schrödinger in 1926, is known as a non-decaying wave-packet that is almost classical in the quantum regime. Although CS behaves most classically, a generalized Schrödinger cat state shows non-classical properties like sub-Poissonian distribution, photon antibunching, Quadrature squeezing, etc.

Here, we consider a generalized superposition of N -coherent states of photons situated on a circle of radius given by the CS-parameter with an equal consecutive phase difference. We derive an expression for the Photon Number Distribution of the generalized-CS, which reveals that under certain conditions, all the coherent photons accumulate in a single Fock state. The obtained state practically signifies a dynamical condensation of photons in a particular number state, paving the feasibility of experimental implementation. When tested for a deviation from circular geometry, we never obtain a pure Fock state, signifying the conformity of our prediction.

Keywords: Coherent state, Fock State, Non classical state, Photon number distribution.

Theoretical Investigation on Surface Enhanced Ultraviolet Fluorescence Using Indium Nanoparticles

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Presentation Type: Poster

Recently, surface enhanced fluorescence (SEF) has become an efficient tool for single protein molecule detection and protein dynamics visualization as well as for studying protein-protein interactions. These will help in early disease detection and to understand protein functions and networks in living cells. Mostly, Au and Ag nanoparticles have been used for SEF applications. Unfortunately, the plasmon band of these nanoparticles primarily lies in the visible region. Thus, these nanoparticles can enhance the fluorescence of a limited number of fluorescent labels. Herein, we propose a method to enhance the ultraviolet (UV) fluorescence using Indium nanoparticles, and some theoretical simulations related to surface enhanced UV fluorescence are reported. We believe that the present study will enable the research community to use several UV fluorescent labels for the applications mentioned above.

Keywords: LSPR; UV plasmons; Electric field enhancement; Nanospheres.

Chemical Exfoliation Synthesis of Boron Nitride and Molybdenum Disulphide 2D sheets via modified Hummer's method

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Presentation Type: Poster

To realize long-cherished dreams of employing inorganic graphene cousins such as boron nitride (BN) and molybdenum disulfide (MoS_2) for large area coating applications, scalable synthesis pathways are presently being hunted with unprecedented curiosity to obtain large-scale 2D exfoliated sheets. Modified Hummer's method provides an apt alternative and has already been established for graphene. However, it currently faces limitations in scalable production of BN and MoS_2 as the nature of binding in their crystallographic lattice as well as their interactions with the solvents are different in these materials' vis-a-vis graphene. Therefore, intensely focussed efforts are needed to optimize synthesis parameters to produce scalable quantities of these advanced materials at an economical cost. In this report, we present a facile synthesis of BN and MoS_2 via modified Hummer's synthesis. While the modified Hummer's synthesis will inspire future generations of devices and sensors with novel functionalities, it is believed.

Keywords: 2D material, Boron Nitride, Molybdenum Disulphide, Chemical Exfoliation .

Effect of Defect Density Control and Intrinsic Layer on Efficiency Enhancement in an Optimized SnS Absorber based Solar Cells Configuration

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Presentation Type: Poster

In this study, we attempted to address the primary issue of low experimental efficiency of SnS/CdS solar cells by pinpointed consideration of a major recombination pathway to control and limit the undesirable bulk defect density by passivation of the absorber layer. Interface recombination effects were controlled by insertion of an intrinsic layer between absorber and buffer layers. Bulk defect density passivation in the absorber layer enhances JSC and efficiency by bringing the bulk recombination under control. The next level of simulation for FF improvement by intrinsic layer insertion at SnS/CdS interface to improve the absorber/buffer junction. This approach, in fact, enhanced fill factor to 62% from 54% for benchmarked and open circuit voltage (VOC) to 0.89 V from its prior report ~0.32 V. The two levels of optimization yielded an efficiency ~15.69% for the optimal device structure which is ~5 times higher than that of the initial benchmarked device structure, i.e.; 3.16%.

Keywords: SnS solar cell; Recombination; Defects density; Intrinsic layer; Optimization.

Microwave Synthesis of Hematene

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Presentation Type: Poster

2D oxides in general are lucrative due to their ferromagnetic, electronic, and catalytic behaviour. Amongst 2D oxides, hematene ($\alpha\text{-Fe}_2\text{O}_3$) has emerged as an important material due to emerging applications it attracts and also due to structural stability at elevated thermal conditions. Enhanced sensitivity to strain other than its excellent anchoring capability makes it further interesting. We report the single-step and scalable synthesis of hematene. Ferric chloride dispersed in dimethylformamide (DMF) solvent, immediately converted into the hematene upon microwave irradiation. While AFM and HRTEM establish its 2D character and structural evolution respectively, Raman spectroscopy verifies chemical phase purity. Further, vibrating sample magnetometer reveals the room temperature ferromagnetic ordering of hematene with saturation magnetization 0.24 emu/g (at 300 K) and 1.08 emu/g (at 60K). Field-cooled (FC) and zero-field cooled (ZFC) measurements demonstrate enhanced Curie temperature of \sim 376 K. This synthesis route permits a simple, inexpensive, efficient, and scalable production of hematene.

Keywords: Hematene. Microwave, Ferromagnetic.

Electronic Structure of H@C₆₀: Contrasting Study of Hard Vs Smooth Potential

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The electronic structure properties of H endohedrally confined by fullerene C₆₀ are investigated employing two model potentials 1) an annular square well potential (ASW) and 2) a Gaussian annular square well potential (GASW). As the strength of the confined potential is increased, the energy levels display phenomena called “avoided crossing” between two different levels of symmetry. The sensitivity of avoided crossing to different model potentials in the case of H and He are studied in this work.

The Shannon entropy of the normalized one electron density gives quantitative information about the spatial delocalization of the electronic cloud. Variation of the Shannon entropy of electrons of H under external confinement using different model potentials also studies in this work. Information regarding the delocalization of electrons as the confinement varies is studied in endohedral atomic systems.

Keywords: ASW; GASW; Avoided Crossing; Shannon Entropy.

Survey of Relativistic Effects on the ns Dipole Angular Distribution Asymmetry Parameter (β_{ns}) of Heavy Atoms

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Presentation Type: Poster

Angular distribution asymmetry parameter (β) for closed subshell atoms is 2.0 non-relativistically. It is well known that the β is deviated from its non-relativistic value upon inclusion of relativistic effects, especially at the location of Cooper minimum. This hints that the effect of spin-orbit coupling on the angular distribution is very important. The present work aims to investigate the deviation of β_{ns} in the energy region where Cooper minimum is not present. A systematic study of deviation of β from 2.0 is studied as a function of Z. We considered the beta of $6s$ subshell of Hg(Z=80), Rn(Z=86), Ra(Z=88), No(Z=102), Cn(Z=112), Og(Z=118) and of $7s$ subshell Ra, No, Cn and Og. The present work concludes that the spin-orbit interaction induces dipole phase shift difference, which plays a major role in deviating the β value from its non-relativistic one.

Keywords: Angular distribution asymmetry parameter; Cooper minimum; spin-orbit coupling; phase shift difference.

Interaction of DNA with Anionic Triphenylene-cationic Surfactant Complex Monolayer at Interfaces

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Presentation Type: Poster

We report the interaction of DNA with a system consisting of anionic triphenylene and cationic ammonium surfactants (TPC) at air-water and air-solid interfaces. This pure TPC system forms a stable monolayer on the water surface with reversible collapse. Upon addition of DNA into subphase, a highly

condensed monolayer is formed compared to a pure TPC monolayer. With increasing concentration of DNA in subphase, collapse pressure of complex monolayer increases indicating enhanced stability. The pure TPC system forms a trilayer at collapse whereas the TPC-DNA complex system forms bilayer domains on monolayer at collapse. DNA interaction with the TPC system facilitates multilayer formation on solid substrates with enhanced transfer efficiency compared to the pure TPC system showing the potential for device application. AFM study and UV-Vis absorption spectroscopy confirmed the transfer of DNA onto TPC-DNA complex film. The transferred DNA-based molecular assemblies on solid substrates could find applications in functional materials.

Keywords: Monolayer; DNA; Self-assembly; Interactions; Interface.

High Spin Filtering Capability in Magnetic Phosphorene

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Presentation Type: Poster

2D materials are a family of single layer materials, which have excellent properties such as high carrier mobility and large conductivity, long spin diffusion length for spintronic applications with high mechanical strength. These materials are emerging with a great potential for next-generation miniaturized electronics, optoelectronics, and spintronic devices. Graphene is the first member of the 2D material family with no band gap. From the spintronic perspective, graphene has high spin communication capabilities. Similar to graphene, phosphorene also manifests promising for spin devices with significant gate controllable spin currents, which is also a member of the 2D material family. A single layer of phosphorene is a semiconductor. Its direct bandgap is between 0.98 – 1.45 eV (experimentally reported). In this work, we have induced magnetization in the phosphorene layer by replacing phosphorous atom with transition metal atom in various concentrations of (a) 2.77%, (b) 5.55%, and (c) 11.1%. From the DFT based calculation, we have observed a high magnetization value with perfect spin filtering capability in the transition metal substituted phosphorene layer.

Keywords: Transition Metal atom; Phosphorene; Magnetization.

Simulation of Short-term Memory Behavior in Atomic Switch Network

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Presentation Type: Poster

In the current days' technology, good old Moore's law and Von Neumann architecture are saturated, while the internet of things, cloud computing, unstructured data etc. has increased the data access exponentially. Neuromorphic computing is one of the solutions that can bridge this gap. Atomic switch, a promising candidate for the same, exhibits special behaviors like Spike timing dependent plasticity, sensory memory, short term memory, long term memory etc. which established its application as synthetic synapse. Research groups have also claimed the neural network-like behaviors of the network built with atomic switches. Though explored through experiments by several groups, the system simulation of atomic switch is done by a few. In our work we propose compact modeling of atomic switch networks in LTSpice, by modification of Yakopcic Model. This will help to implement an atomic switch as a circuit element and understand its physical behaviors with great degree of accuracy.

Keywords: Memristor; Atomic Switch; Artificial Synapse; Neuromorphic Computing.

Interfacial Charge Transfer between Amine doped Carbon Dots and Nucleosides in Bio-mimicking Environment

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Presentation Type: Poster

Purine and pyrimidine nucleobases are the building blocks DNA and RNA. Herein, we report the electron transfer (ET) among amine-doped carbon dots (ACDs) with the five nucleosides (NS) adenosine (ANS), guanosine (GNS), cytidine (CNS), thymidine (TNS) and uridine (UNS) using absorption, steady-state and time-resolved fluorescence. To bio-mimic the environmental conditions, we have performed these experiments in anionic (sodium dodecyl sulfate, SDS), cationic (cetyl trimethyl ammonium bromide, CTAB) and non-ionic (brij 35) micellar media along with the aqueous one (water-ethanol mixture). The effects of charged interface on ET rate between ACDs and these NS are investigated. In water-ethanol and SDS medium, the ET rate is found to be the minimum, while in other medium like CTAB and brij 35, a similar order analogous to electron affinities of NS is observed for ET rate is detected, UNS>TNS>GNS>CNS~ANS, due to the analogous order of electron affinities of the individual NS.

Keywords: Charge transfer; Nucleosides; Micelles; Amine doped carbon dots.

Pulsed Voltage Induced Resistive Switching Behaviour of Copper Iodide and $\text{La}_{0.7}\text{Sr}_{0.3}\text{MnO}_3$ Nanocomposites

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Presentation Type: Poster

In this study, we explored the presence of resistive switching in copper iodide and $\text{La}_{0.7}\text{Sr}_{0.3}\text{MnO}_3$ nanocomposites. To evaluate the resistive switching behaviour of the nanocomposites, we enacted two different methods. In the first method, we performed hysteretic pulse current-voltage (I-V) measurement for 100 cycles where frequency of the pulse was 50 Hz (pulse width = 0.01 s and pulse period = 0.02 s). The fitting of various regions of the 1st cycle of the hysteretic pulse I-V curve pointed towards Schottky emission and Poole-Frenkel effect to be the dominant conduction mechanisms in lower bias region and higher bias region respectively. In the second method, we tried to gauge the robustness of the resistive switching behaviour of the samples in practical scenario by using 1000 square electrical pulse trains of frequency of 125Hz (pulse period 2 ms and pulse width 100 μs) and 250 Hz (pulse period 1 ms and pulse width 50 μs).

Keywords: Resistive switching; Copper iodide; Schottky emission; Poole-Frenkel effect.

Study of Surface Enhanced Raman Scattering of IR-780 Iodide Molecules using Au-Ag Bimetallic Nanostructures with Blunt and Sharp Sprouts

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Presentation Type: Poster

Au-Ag bimetallic nanostructures with blunt and sharp sprouts are synthesized using a high yield one step synthesis process. The Raman probe (IR-780 Iodide) molecules are dispersed on the surface of plasmon-active substrates by drop-casting 10 μl of dye solution of concentration ranging from 1 μM to 1 picomolar (pM) on the substrates. After recording the SERS spectra of each concentration, the nanostructures with blunt sprouts are found useful only up to 100 pM. However, this limitation is brought down to 1 pM using nanostructures with sharp sprouts. The normal Raman scattering spectra of molecules and microcrystals are also recorded and compared with the SERS spectra of molecules. The experimental enhancement factor (EF) is found around 1×10^9 for the Raman probe solution with 1 pM concentration. Finite Element Method (FEM) simulations are also performed for estimating the possible single molecule SERS enhancement. It is calculated as 4.5×10^{14} .

Keywords: Single-molecule SERS; Surface enhanced Raman scattering; IR-780 Iodide; Localized surface plasmons; Au-Ag bimetallic nanostructures.

Self-assembly of Heterocoronene based Discotic Liquid Crystal Molecules

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Presentation Type: Poster

Heterocoronene based discotic liquid crystal molecules are known to exhibit the highest anisotropic conductivity among the family of liquid crystals. To explore its potential applications in organic electronics, it is important to make stable and uniform thin films on solid supports. Here, we report the formation of self-assembled monolayer of a novel heterocoronene based discotic liquid crystal molecule at air-water and air-solid interfaces. The properties of the monolayer were studied using surface manometry, Brewster angle microscopy (BAM) and atomic force microscopy (AFM). Due to the strong core-core pi-stacking interaction, it forms a compact and uniform monolayer film in edge-on configuration at air-water interface. This film, when transferred onto solid supports, exhibited a thickness of about 4 nm indicating that the molecular packing is preserved during transfer onto the air-solid interface. The edge-on assembly is helpful for directional charge transport which makes it particularly important for designing advanced molecular FETs.

Keywords: Self-assembly; Discotic liquid crystals; Organic monolayer

Optical encryption using arbitrary vector beams

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Presentation Type: Poster

We demonstrate an encoding and encryption scheme using vector light fields that have spatially variable polarization. In this scheme, multiple-input images are modulated into one of the binary polarization components, while keeping other components unmodulated. This creates a vector field that simplifies the decoding process because of intensity-based measurements. Using this principle, an encryption scheme with a high level of security has been proposed. Both experiments and simulations have been performed to verify the feasibility of the proposed scheme.

Keywords:Polarization, structured light beams, optical encryption, and information optics .

Electrical Properties of Lithium Cobalt Oxide

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Presentation Type: Poster

We report electrical properties of Lithium Cobalt Oxide (LiCoO_2) using dielectric spectroscopy in the temperature range 10 to 200 °C and frequency range 0.1 Hz to 1 MHz. The solid-state method has been used for the preparation of LiCoO_2 . The analysis of X-ray diffraction, Raman spectra, and FTIR spectra confirms the phase formation. The variation of dielectric constant with frequency shows a lossy dielectric-type behavior and temperature-dependent electrical phase transition has been observed in conductivity spectra within the measured temperature range.

Keywords: LiCoO_2 , dielectric spectroscopy, electrical conductivity.

Electrocaloric Effect- The Path towards Solid State Refrigeration

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Presentation Type: Oral (My research in 3 minutes)

Nowadays, Solid-state Refrigeration gets so much attention by the researchers which is environment friendly, low cost, easy to fabricate, etc. For this purpose, here energy storage performance and electrocaloric effect on Sr modified BaTiO_3 ($\text{Ba}_{1-x} \text{Sr}_x \text{TiO}_3$, $x=0.10$) have been observed. The effect of Sr modified on BaTiO_3 has been studied on its structural, dielectric, and electrocaloric properties. The temperature variation PE-loops indicates that the material undergoes a transition from ferroelectric to Relaxor ferroelectric due to the formation of short-range ordered Polar Nano Regions (PNRs). The large electrocaloric parameter has been found on $\text{Sr}=0.10$ i.e. isothermal entropy change (ΔS) = 1.108J/kgK at 36°C by the application of 30kV/cm field. Also, this material shows high energy storage efficiency. Hence, this modified material can be applicable in the energy storage industry as well as in the cooling industry.

Keywords: Ferroelectric ; Electrocaloric effect ; Polar Nano Regions(PNRs).

Information Encoding and Encryption Using Vector Light Fields

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Presentation Type: Oral (My research in 3 minutes)

We demonstrate an encoding and encryption scheme using vector fields of light which have spatially variable polarization. In this scheme, multiple-input images are modulated into one of the binary polarization components, while keeping other components unmodulated. This creates a vector field that

simplifies the decoding process because of intensity-based measurements. Using this principle, an encryption scheme with a high level of security has been proposed. Both simulation and experiment have been performed to verify the feasibility of the proposed scheme.

Keywords: Polarization, structured light beams, optical encryption, and information optics.

Research Scholars Graduated in 2020-21

Chemistry:

- Mukta Shaw (1521CH02)
- Sonam Kumari (1621CH02)
- Arif Chowdhury (1621CH07)
- Yogesh Jaiswal (1521CH10)

Civil & Environmental Engineering:

- Kumari Sweta (1421CE1)

Computer Science & Engineering:

- Sweta (1421CS09)
- Rakesh Kumar Sanodiya (1621CS04)
- Debajyoti Banik (1421CS04)
- Md. Shad Akhtar (1521CS01)
- Jaishree Mayank (1321CS01)
- Sayantan Mitra (1521CS09)
- Sumit Kumar Teterave (1221CS04)
- Naveen Saini (1621CS12)
- Roshni Chakraborty (1521CS02)
- Deepak Kumar Gupta (1621CS08)

Electrical Engineering:

- Chandan Kumar Jha (1521EE06)
- Subhradeep Pal (1421EE01)
- Sumit Kumar (1321EE05)
- Akash Agarwal (1521EE09)
- Rakesh Palisetty (1421EE03)
- Bhamidi Lokeshgupta (1621EE11)
- Amit Kumar Panda (1421EE02)
- Rahul Gupta (1521EE14)
- Nibedita Nandan (1521EE10)

- Mohammad Junaid Akhtar (1321EE01)
- Arun Kumar (1621EE01)
- Sushant Kumar (1521EE15)
- Vinay Kumar Trivedi (1421EE07)
- Deba Prasad Dash (1521EE01)
- Deepti Gola (1621EE14)

Humanities & Social Sciences:

- Sadeqa Ghazal (1321HS02)
- Srishti (1521HS03)
- Anuja Akhouri (1621HS05)
- Kumar Gaurav (1321HS01)
- Anupama Singh (1421HS03)
- Nusrat Begum (1621HS13)
- Sandeep Kumar Sharma (1621HS02)
- Shamsher Alam (1621HS08)

Mathematics:

- Tushar Bag (1621MA07)
- Sushma Singh (1221MA03)
- Shibsankar Das (1521MA08)
- Palash Sarkar (1521MA07)

Mechanical Engineering:

- Pankaj Kumar (1321ME04)
- Durga Prasad Ghosh (1521ME11)
- Pintu Kumar (1421ME04)
- Dilshad Ahmad (1421ME14)
- Deepak Kumar Prajapati (1421ME06)
- Sumit Raj (1521ME02)
- Shuja Ahmed (1421ME01)
- Ashwani Pratap (1521ME13)
- Bimal Das (1621ME14)

Metallurgical and Materials Engineering:

- Asiq Rahman O.S. (1521MS06)
- Kundan Kumar (1521MS05)
- Singh Swarnima Premkumar (1521MS02)

Physics:

- Rabichandra Pandey (1421PH06)
- Atul Kumar (1421PH05)
- Jayanta Bera (1421PH07)

Publications and Awards of the Year 2020-21

Department of Chemical and Biochemical Engineering

List of Publications

1. Roy, A., Behera, S., Mazire, P. H., Kumari, B., Mandal, A., Purkait, B., ... & Das, P. (2021). The HIV-1 protease inhibitor Amprenavir targets Leishmania donovani topoisomerase I and induces oxidative stress-mediated programmed cell death. *Parasitology International*, 82, 102287.
2. Mandal, S., Pal, J., Subramanian, R., & Das, P. (2020). Amplified fluorescence of Mg²⁺ selective red-light emitting carbon dot in water and direct evaluation of creatine kinase activity. *Nano Research*, 13(10), 2770-2776.
3. Mishra, S., Kumar, P., & Samanta, S. K. (2020). Microwave Catalytic Degradation of Antibiotic Molecules by 2D Sheets of Spinel Nickel Ferrite. *Industrial & Engineering Chemistry Research*, 59(36), 15839-15847.
4. Verma, P., Samanta, S. K., & Mishra, S. (2020). Photon-independent NaOH/H₂O₂-based degradation of rhodamine-B dye in aqueous medium: Kinetics, and impacts of various inorganic salts, antioxidants, and urea. *Journal of Environmental Chemical Engineering*, 8(4), 103851.
5. Sreenath, P. R., Mandal, S., Panigrahi, H., Das, P., & Kumar, K. D. (2020). Carbon dots: Fluorescence active, covalently conjugated and strong reinforcing nanofiller for polymer latex. *Nano-Structures & Nano-Objects*, 23, 100477.
6. Nayak, S., Prasad, S. R., Mandal, D., & Das, P. (2020). Carbon dot cross-linked polyvinylpyrrolidone hybrid hydrogel for simultaneous dye adsorption, photodegradation and bacterial elimination from waste water. *Journal of hazardous materials*, 392, 122287.
7. Mandal, S., & Das, P. (2020). Ultrasensitive visual detection of mycotoxin citrinin with yellow-light emitting carbon dot and Congo red. *Food chemistry*, 312, 126076.
8. Kumari, S. & Kumar, S. (2020). 1D study on microwave assisted warming of human blood with varied ceramic and composite supports. *Journal of the Indian Chemical Society*. 97. 379-383.
9. Verma, P. (2020). UV-C/NaOH based degradation of ciprofloxacin antibiotic in aqueous medium: A negative emission water treatment technology. *Journal of the Indian Chemical Society*. 97. 389-395.
10. Jaiswal, Y., Mandal, S., Das, P., & Kumar, A. (2020). One-Pot Synthesis of Orange-Red Fluorescent Dimeric 2 H-Pyrrolo [2, 3-c] isoquinoline-2, 5 (3 H)-diones from Benzamides and Maleimides via Ru (II)-Catalyzed Sequential C–C/C–N/C–C Bond Formation. *Organic letters*, 22(4), 1605-1610.
11. Sreenath, P. R., Mandal, S., Singh, S., Panigrahi, H., Das, P., Bhowmick, A. K., & Kumar, K. D. (2020). Unique approach to debundle carbon nanotubes in polymer matrix using carbon dots for enhanced properties. *European Polymer Journal*, 123, 109454.

12. Shukla, G., & Chaturvedi, N. D. (2020). A Pinch Analysis approach for minimizing compression energy and capital investment in gas allocation network. *Clean Technologies and Environmental Policy*, 1-14.
13. Shukla, G., & Chaturvedi, N. D. (2020). Simultaneous Minimization of Cost and Energy in Gas Allocation Network. *Chemical Engineering Transactions*, 81, 1093-1098.
14. Sinha, R. K., & Chaturvedi, N. D. (2020). A Goal Programming Approach to Reduce Plastic Waste for Sustainable Packaging Design. *Chemical Engineering Transactions*, 81, 1009-1014.
15. Kumawat, P. K., & Chaturvedi , N. D. (2020). Robust Targeting of Resource Requirement in a Continuous Water Network. *Chemical Engineering Transactions*, 81, 1003-1008.
16. Chaturvedi, N. D. (2020). Cost Optimal Sizing of Hybrid Power Systems: A Pinch Analysis Approach. *Chemical Engineering Transactions*, 81, 973-978.
17. Nayak, S., Prasad, S. R., Mandal, D., & Das, P. (2020). Hybrid DNA–Carbon Dot–Poly(vinylpyrrolidone) Hydrogel with Self-Healing and Shape Memory Properties for Simultaneous Trackable Drug Delivery and Visible-Light-Induced Antimicrobial Photodynamic Inactivation. *ACS Applied Bio Materials*, 3(11), 7865-78

Department of Chemistry:

Journal/conference:

1. Dubey, K. A., Srikanth, K., Rao, T. R., & Jose, J. (2020). Effects of anisotropy on the resonant scattering of Hydrogen atom from the fullerene C₆₀. *Journal of Physics Communications*, 4(7), 075016.
2. Goswami, S., Sahoo, J., Paul, S. K., Rao, T. R., & Mahapatra, S. (2020). Effect of Reagent Vibration and Rotation on the State-to-State Dynamics of the Hydrogen Exchange Reaction, H+ H₂ → H₂+ H. *The Journal of Physical Chemistry A*, 124(45), 9343-9359.
3. Kumar, A., Rao, T. R., & Sarkar, R. (2021). An unbiased confirmation of the participating isomers of C₂B₅⁻ in the formation of its photo-detachment spectra: a theoretical study. *Physical Chemistry Chemical Physics*, 23(4), 3160-3175.
4. Jaiswal, Y., Mandal, S., Das, P., & Kumar, A. (2020). One-Pot Synthesis of Orange-Red Fluorescent Dimeric 2-H-Pyrrolo [2, 3-c] isoquinoline-2, 5 (3 H)-diones from Benzamides and Maleimides via Ru (II)-Catalyzed Sequential C-C/C-N/C-C Bond Formation. *Organic letters*, 22(4), 1605-1610.
5. Baghel, A. S., Jaiswal, Y., & Kumar, A. (2020). Pd (II)-Catalyzed One-Pot Multiple C-C Bond Formation: En Route Synthesis of Succinimide-Fused Unsymmetrical 9, 10-Dihydrophenanthrenes from Aryl Iodides and Maleimides. *Organic letters*, 22(5), 1908-1913.
6. Molla, M. R., Das, P., Guleria, K., Subramanian, R., Kumar, A., & Thakur, R. (2020). Cyanomethyl Ether as an Orthogonal Participating Group for Stereoselective Synthesis of 1, 2-trans-β-O-Glycosides. *The Journal of Organic Chemistry*, 85(15), 9955-9968.
7. Alam, N., & Sarma, D. (2020). Tunable metallogels based on bifunctional ligands: precursor metallogels, spinel oxides, dye and CO₂ adsorption. *ACS omega*, 5(28), 17356-17366.
8. Alam, N., & Sarma, D. (2020). A thixotropic supramolecular metallogel with a 2D sheet morphology: iodine sequestration and column based dye separation. *Soft Matter*, 16(47), 10620-10627.
9. Mahata, A., Bhaumick, P., Panday, A. K., Yadav, R., Parvin, T., & Choudhury, L. H. (2020). Multicomponent synthesis of diphenyl-1, 3-thiazole-barbituric acid hybrids and their fluorescence property studies. *New Journal of Chemistry*, 44(12), 4798-4811.
10. Jana, A., Bhaumick, P., & Choudhury, L. H. (2020). Microwave assisted synthesis of β-keto thioethers and furan derivatives by thiol directed multicomponent reactions. *New Journal of Chemistry*, 44(20), 8442-8453.
11. Parvin, T., Yadav, R., & Choudhury, L. H. (2020). Recent applications of thiourea-based organocatalysts in asymmetric multicomponent reactions (AMCRs). *Organic & Biomolecular Chemistry*, 18(29), 5513-5532.
12. Panday, A. K., Ali, D., & Choudhury, L. H. (2020). Cs₂CO₃-Mediated Rapid Room-Temperature Synthesis of 3-Amino-2-aryl Benzofurans and Their Copper-Catalyzed N-Arylation Reactions. *ACS omega*, 5(7), 3646-3660.
13. Dwivedi, R., Singh, S., Chauhan, B. S., Srikrishna, S., Panday, A. K., Choudhury, L. H., & Singh, V. P. (2020). Aroyl hydrazone with large Stokes shift as a fluorescent probe for detection of Cu²⁺ in pure aqueous medium and in vivo studies. *Journal of Photochemistry and Photobiology A: Chemistry*, 395, 112501.

14. Panday, A. K., Ali, D., & Choudhury, L. H. (2020). One-pot synthesis of pyrimidine linked naphthoquinone-fused pyrroles by iodine-mediated multicomponent reactions. *Organic & biomolecular chemistry*, 18(26), 4997-5007.
15. Panday, A. K., Ali, D., & Choudhury, L. H. (2020). One-pot synthesis of pyrimidine linked naphthoquinone-fused pyrroles by iodine-mediated multicomponent reactions. *Organic & biomolecular chemistry*, 18(26), 4997-5007.
16. Bhaumick, P., Jana, A., & Choudhury, L. H. (2021). Synthesis of novel coumarin containing conjugated fluorescent polymers by Suzuki cross-coupling reactions and their chemosensing studies for iron and mercury ions. *Polymer*, 218, 123415.
17. Hassan, A., Goswami, S., Alam, A., Bera, R., & Das, N. (2021). Triptycene based and nitrogen rich hyper cross linked polymers (TNHCPs) as efficient CO₂ and iodine adsorbent. *Separation and Purification Technology*, 257, 117923.
18. Alam, A., Hassan, A., Bera, R., & Das, N. (2020). Silsesquioxane-based and triptycene-linked nanoporous polymers (STNPs) with a high surface area for CO₂ uptake and efficient dye removal applications. *Materials Advances*, 1(9), 3406-3416.
19. Alam, A., Hassan, A., Bera, R., & Das, N. (2020). Silsesquioxane-based and triptycene-linked nanoporous polymers (STNPs) with a high surface area for CO₂ uptake and efficient dye removal applications. *Materials Advances*, 1(9), 3406-3416.
20. Shetty, S., Baig, N., Hassan, A., Al-Mousawi, S., Das, N., & Alameddine, B. (2020). Polyphenylene networks containing triptycene units: Promising porous materials for CO₂, CH₄, and H₂ adsorption. *Microporous and Mesoporous Materials*, 303, 110256.
21. Mohan, B., Choudhary, M., Kumar, G., Muhammad, S., Das, N., Singh, K., ... & Kumar, S. (2020). An experimental and computational study of pyrimidine based bis-uracil derivatives as efficient candidates for optical, nonlinear optical, and drug discovery applications. *Synthetic Communications*, 50(14), 2199-2225.
22. Ansari, M., Alam, A., Bera, R., Hassan, A., Goswami, S., & Das, N. (2020). Synthesis, characterization and adsorption studies of a novel triptycene based hydroxyl azo-nanoporous polymer for environmental remediation. *Journal of Environmental Chemical Engineering*, 8(2), 103558.
23. Kumar, S., Bera, R., Das, N., & Koh, J. (2020). Chitosan-based zeolite-Y and ZSM-5 porous biocomposites for H₂ and CO₂ storage. *Carbohydrate polymers*, 232, 115808.
24. Alam, A., Mishra, S., Hassan, A., Bera, R., Dutta, S., Das Saha, K., & Das, N. (2020). Triptycene-Based and Schiff-Base-Linked Porous Networks: Efficient Gas Uptake, High CO₂/N₂ Selectivity, and Excellent Antiproliferative Activity. *ACS omega*, 5(8), 4250-4260.
25. Noorussabah, N., Choudhary, M., Das, N., Mohan, B., Singh, K., Singh, R. K., ... & Kumar, S. (2020). Copper (II) and nickel (II) complexes of tridentate hydrazide and schiff base ligands containing phenyl and naphthalyl groups: synthesis, structural, molecular docking and density functional study. *Journal of Inorganic and Organometallic Polymers and Materials*, 30, 4426-4440.
26. Mohan, B., Choudhary, M., Muhammad, S., Das, N., Singh, K., Jana, A., ... & Kumar, S. (2020). Synthesis, characterizations, crystal structures, and theoretical studies of copper (II) and nickel (II) coordination complexes. *Journal of Coordination Chemistry*, 73(8), 1256-1279.
27. Ansari, M., Hassan, A., Alam, A., Jana, A., & Das, N. (2020). Triptycene based fluorescent polymers with azo motif pendants: Effect of alkyl chain on fluorescence, morphology and picric acid sensing. *Reactive and Functional Polymers*, 146, 104408.

28. Nayak, S., Prasad, S. R., Mandal, D., & Das, P. (2020). Carbon dot cross-linked polyvinylpyrrolidone hybrid hydrogel for simultaneous dye adsorption, photodegradation and bacterial elimination from waste water. *Journal of hazardous materials*, 392, 122287.
29. Jaiswal, Y., Mandal, S., Das, P., & Kumar, A. (2020). One-Pot Synthesis of Orange-Red Fluorescent Dimeric 2 H-Pyrrolo [2, 3-c] isoquinoline-2, 5 (3 H)-diones from Benzamides and Maleimides via Ru (II)-Catalyzed Sequential C–C/C–N/C–C Bond Formation. *Organic letters*, 22(4), 1605-1610.
30. Sreenath, P. R., Mandal, S., Panigrahi, H., Das, P., & Kumar, K. D. (2020). Carbon dots: Fluorescence active, covalently conjugated and strong reinforcing nanofiller for polymer latex. *Nano-Structures & Nano-Objects*, 23, 100477.
31. Mandal, S., & Das, P. (2020). Ultrasensitive visual detection of mycotoxin citrinin with yellow-light emitting carbon dot and Congo red. *Food chemistry*, 312, 126076.
32. Sreenath, P. R., Mandal, S., Singh, S., Panigrahi, H., Das, P., Bhowmick, A. K., & Kumar, K. D. (2020). Unique approach to debundle carbon nanotubes in polymer matrix using carbon dots for enhanced properties. *European Polymer Journal*, 123, 109454.
33. Prasanna, P., Kumar, P., Mandal, S., Patyal, T., Kumar, S., Das, P., & Ravichandiran, V. (2020). Synthesis of 7, 8-dihydroxyflavone functionalized gold nanoparticles and its mechanism of action against Leishmania donovani.
34. Nayak, S., Prasad, S. R., Mandal, D., & Das, P. (2020). Hybrid DNA–Carbon Dot–Poly (vinylpyrrolidone) Hydrogel with Self-Healing and Shape Memory Properties for Simultaneous Trackable Drug Delivery and Visible-Light-Induced Antimicrobial Photodynamic Inactivation. *ACS Applied Bio Materials*, 3(11), 7865-7875.
35. Mandal, S., Pal, J., Subramanian, R., & Das, P. (2020). Amplified fluorescence of Mg²⁺ selective red-light emitting carbon dot in water and direct evaluation of creatine kinase activity. *Nano Research*, 13(10), 2770-2776.
36. Indra, S., Subramanian, R., & Daschakraborty, S. (2021). Interaction of volatile organic compounds acetone and toluene with room temperature ionic liquid at the bulk and the liquid-vacuum interface. *Journal of Molecular Liquids*, 115608.
37. Maiti, A., & Daschakraborty, S. (2021). Effect of TMAO on the Structure and Phase Transition of Lipid Membranes: Potential Role of TMAO in Stabilizing Cell Membranes under Osmotic Stress. *The Journal of Physical Chemistry B*, 125(4), 1167-1180.
38. Dubey, V., & Daschakraborty, S. (2020). Breakdown of the Stokes–Einstein Relation in Supercooled Water/Methanol Binary Mixtures: Explanation Using the Translational Jump-Diffusion Approach. *The Journal of Physical Chemistry B*, 124(46), 10398-10408.
39. Dubey, V., Maiti, A., & Daschakraborty, S. (2020). Predicting the solvation structure and vehicular diffusion of hydroxide ion in an anion exchange membrane using nonreactive molecular dynamics simulation. *Chemical Physics Letters*, 755, 137802.
40. Erimban, S., & Daschakraborty, S. (2020). Cryostabilization of the Cell Membrane of a Psychrotolerant Bacteria via Homeoviscous Adaptation. *The Journal of Physical Chemistry Letters*, 11(18), 7709-7716.
41. Erimban, S., & Daschakraborty, S. (2020). Translocation of a hydroxyl functionalized carbon dot across a lipid bilayer: an all-atom molecular dynamics simulation study. *Physical Chemistry Chemical Physics*, 22(11), 6335-6350.
42. Chowdhury, A., Kumari, S., Khan, A. A., Chandra, M. R., & Hussain, S. (2021). Activated carbon loaded with Ni-Co-S nanoparticle for superior adsorption capacity of antibiotics and dye from

- wastewater: kinetics and isotherms. *Colloids and Surfaces A: Physicochemical and Engineering Aspects*, 611, 125868.
- 43. Rao, M. S., & Hussain, S. (2021). LUDOX HS-40 Catalyzed Pot, Atom and Step Economic (PASE) Synthesis of Pyran Annulated Heterocyclic Scaffolds. *Polycyclic Aromatic Compounds*, 1-12.
 - 44. Khan, A. A., Chowdhury, A., Kumari, S., & Hussain, S. (2020). The facile soft-template-morphology-controlled (STMC) synthesis of ZnIn₂S₄ nanostructures and their excellent morphology-dependent adsorption properties. *Journal of Materials Chemistry A*, 8(4), 1986-2000.
 - 45. Kumari, S., Khan, A. A., Chowdhury, A., Bhakta, A. K., Mekhalif, Z., & Hussain, S. (2020). Efficient and highly selective adsorption of cationic dyes and removal of ciprofloxacin antibiotic by surface modified nickel sulfide nanomaterials: Kinetics, isotherm and adsorption mechanism. *Colloids and Surfaces A: Physicochemical and Engineering Aspects*, 586, 124264.
 - 46. Chowdhury, A., Kumari, S., Khan, A. A., & Hussain, S. (2020). Selective removal of anionic dyes with exceptionally high adsorption capacity and removal of dichromate (CrO₇²⁻) anion using Ni-Co-S/CTAB nanocomposites and its adsorption mechanism. *Journal of hazardous materials*, 385, 121602.
 - 47. Kumar, B., Rao, M. S., Kumar, P., Hussain, S., & Das, S. (2020). Spectrophotometric investigation of 5-nitroso-6-aminouracil and its methyl derivative in methanol by selective complexation with bivalent metal ions. *Journal of Molecular Structure*, 1221, 128827.
 - 48. Bhakta, A. K., Kumari, S., Hussain, S., Mascarenhas, R. J., Martis, P., Delhalle, J., & Mekhalif, Z. (2020). Lanthanum Hydroxide Nanoparticles/Multi-Wall Carbon Nanotubes Nanocomposites. In *Advanced Materials for Defense* (pp. 25-34). Springer, Cham.
 - 49. Bomzon, B., Khunger, Y., & Subramanian, R. (2020). A dielectric and spectrophotometric study of the tautomerization of 2-hydroxypyridine and 2-mercaptopypyridine in water. *RSC Advances*, 10(4), 2389-2395.
 - 50. Mandal, S., Pal, J., Subramanian, R., & Das, P. (2020). Amplified fluorescence of Mg²⁺ selective red-light emitting carbon dot in water and direct evaluation of creatine kinase activity. *Nano Research*, 13(10), 2770-2776.
 - 51. Molla, M. R., Das, P., Guleria, K., Subramanian, R., Kumar, A., & Thakur, R. (2020). Cyanomethyl Ether as an Orthogonal Participating Group for Stereoselective Synthesis of 1, 2-trans-β-O-Glycosides. *The Journal of Organic Chemistry*, 85(15), 9955-9968.
 - 52. Pal, J., Teja, P. S., & Subramanian, R. (2020). Sodium and lithium ions in aerosol: thermodynamic and rayleigh light scattering properties. *Theoretical Chemistry Accounts*, 139(11), 1-14.
 - 53. Pal, J., Patla, A., & Subramanian, R. (2021). Thermodynamic properties of forming methanol-water and ethanol-water clusters at various temperatures and pressures and implications for atmospheric chemistry: A DFT study. *Chemosphere*, 272, 129846.
 - 54. Avais, M., & Chattopadhyay, S. (2021). Hierarchical Porous Polymers via a Microgel Intermediate: Green Synthesis and Applications toward the Removal of Pollutants. *ACS Applied Polymer Materials*, 3(2), 789-800.
 - 55. Bapli, A., & Seth, D. (2020). The photophysics of a hydrophilic molecule in the presence of graphene oxide. *Journal of Luminescence*, 217, 116816.
 - 56. Bapli, A., Gautam, R. K., Seth, S., Jana, R., Pandit, S., & Seth, D. (2020). Graphene Oxide as an Enhancer of Fluorescence. *Chemistry–An Asian Journal*, 15(8), 1296-1300.

57. Jana, R., Bapli, A., Gautam, R. K., Pandit, S., Bahadur, P., & Seth, D. (2021). Photophysics of a red emitting dye in the presence of pluronic block copolymers. *Journal of Photochemistry and Photobiology A: Chemistry*, 407, 113051.
58. Bapli, A., Chatterjee, A., Gautam, R. K., Pandit, S., Jana, R., & Seth, D. (2021). Interaction of a hydrophilic molecule with bovine serum albumin: A combined multi-spectroscopic, microscopic and isothermal calorimetric study in the presence of graphene oxide. *Journal of Molecular Liquids*, 323, 114618.
59. Gautam, R. K., Bapli, A., Jana, R., & Seth, D. (2020). Photophysics and rotational dynamics of Nile red in room temperature ionic liquid (RTIL) and RTIL-cosolvents binary mixtures. *Journal of Photochemistry and Photobiology A: Chemistry*, 399, 112550.
60. Jana, R., Maity, B., & Seth, D. (2020). Structural transition dynamics of biologically active flavins in alkylglucoside surfactants aggregates. *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy*, 224, 117346.

Awards

1. Dr. Snehasis Daschakraborty won the young scientist award awarded by INSA, 2020-2021.
2. Shakkira Erimban won the Professor Santi RanjanPalitMemorial Award in the 57th Annual Convention of Chemists, 2021.
3. Vikas Dubey won the Association of Kineticists Award in the 57th Annual Convention of Chemists 2021.
4. Shakkira became second runner up of RSD 2020 "Research in 3 minutes" contest organised by IIT patna.
5. Vikas Dubey won Third prize for best oral presentation in ICFAC organised by Mahatma Gandhi Central University Motihari Bihar, 2020.
6. Saptarshi Mandal Awarded with Newton Bhabha PhD placement program fellowship to work at the University of Hull.

Department of Civil and Environmental Engineering

List of publications:

1. Das, A., Chakraborty, P., & Popescu, R. (2021). Assessment of lumped particles effect on dynamic behaviour of fine and medium grained sands. *Bulletin of Earthquake Engineering*, 19(2), 745-766.
2. Chakraborty, P., Nilay, N., & Das, A. (2020). Effect of silt content on liquefaction susceptibility of fine saturated river bed sands. *International Journal of Civil Engineering*, 1-13.
3. Chakraborty, P., Roshan, A. R., & Das, A. (2020). Evaluation of dynamic properties of partially saturated sands using cyclic triaxial tests. *Indian Geotechnical Journal*, 50, 948-962.
4. Das, A., & Chakraborty, P. (2020). Influence of motion energy and soil characteristics on seismic ground response of layered soil. *International Journal of Civil Engineering*, 18(7), 763-782.
5. Gupta, N., Trivedi, A., & Hait, S. (2021). Material composition and associated toxicological impact assessment of mobile phones. *Journal of Environmental Chemical Engineering*, 9(1), 104603.
6. Venkateswarlu, H., & Hegde, A. (2020). Effect of infill materials on vibration isolation efficacy of geocell-reinforced soil beds. *Canadian Geotechnical Journal*, 57(9), 1304-1319.
7. Venkateswarlu, H., & Hegde, A. (2020). Isolation prospects of geosynthetics reinforced soil beds subjected to vibration loading: experimental and analytical studies. *Geotechnical and Geological Engineering*, 38(6), 6447-6465.
8. Venkateswarlu, H., & Hegde, A. (2020). Effect of influencing parameters on the vibration isolation efficacy of geocell reinforced soil beds. *International Journal of Geosynthetics and Ground Engineering*, 6, 1-17.
9. Venkateswarlu, H., & Hegde, A. (2020, February). Factors Influencing Dynamic Response of Geocell Reinforced Soil Beds. In *Geo-Congress 2020: Engineering, Monitoring, and Management of Geotechnical Infrastructure* (pp. 569-578). Reston, VA: American Society of Civil Engineers.
10. Jadda K., & Ramakrishna B. (2020). Variation of swelling pressure, consolidation characteristics and hydraulic conductivity of two Indian bentonites due to electrolyte concentration. *Engineering Geology*, 272, 105637.
11. Tripathy, D., Meghwal, P., & Singhal, V. (2020). Strengthening of Lime Mortar Masonry Wallettes Using Fiber-Reinforced Cementitious Matrix. *Journal of Composites for Construction*, 24(6), 04020075.
12. Tripathy, D., & Singhal, V. (2021). Strengthening of weak masonry assemblages using wire reinforced cementitious matrix (WRCM) for shear and flexure loads. *Construction and Building Materials*, 277, 122223.
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16. Kumar, H., & Varma, S. (2021). A review on utilization of steel slag in hot mix asphalt. *International Journal of Pavement Research and Technology*, 14(2), 232-242.
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18. Dibyanshu and Raychoudhury, T. (2020). Transport behavior of different metal-based nanoparticles through natural sediment in the presence of humic acid and under the groundwater condition. *Journal of Earth System Science* 129, 145. <https://doi.org/10.1007/s12040-020-01411-2>.
19. Gundavaram, D., Hussaini, SKK. (2020). Performance evaluation of polyurethane-stabilized railroad ballast under direct shear conditions. *Construction and Building Materials* 255, 119304.

Book Chapters:

1. Bag, R., & Jadda, K. (2021). The Effect of Sand Ratio on Suction and Swelling Pressure of Two Bentonite–Sand Mixtures. In *Proceedings of the 1st Indo-China Research Series in Geotechnical and Geoenvironmental Engineering* (pp. 103-112). Springer, Singapore
2. Chakrabortty, P., & Das, A. (2021). Free Field Ground Vibration Due to Ground Improvement Induced Vibration. In International Conference of the *International Association for Computer Methods and Advances in Geomechanics* (pp. 786-793). Springer, Cham.
3. Chakrabortty, P., & Das, A. (2021). Effect of Soil Grain Size on Liquefaction Strength of Sandy Soil. In *Geohazards* (pp. 539-554). Springer, Singapore.
4. Jadda, K., & Bag, R. (2020). The Effect of Saline Fluid on Hydraulic Properties of Clays. In *Advances in Computer Methods and Geomechanics* (pp. 41-54). Springer, Singapore.
5. Trivedi A., Kanaujia, K., Upvan K., Hait, S. Fungal Biotechnology for Recovery of Critical Metals from E-waste: Current Research Trends and Prospects. In *Paradigm Shift in E-waste Management: Vision for Future*. CRC Press (Review completed).
6. Bhavini, Kanaujia, K., Trivedi, A., & Hait, S. (2020). Applicability of Vermifiltration for Wastewater Treatment and Recycling. In *Earthworm Assisted Remediation of Effluents and Wastes* (pp. 3-17). Springer, Singapore.
7. Venkateswarlu, H., & Hegde, A. M. (2020). Performance Evaluation of Geocell Reinforced Machine Foundation Beds. In *Geocells* (pp. 199-223). Springer, Singapore.

Conferences

1. Das, and P. Chakrabortty, “Simple Statistical Models to Predict the Cyclic Behaviour of Cohesionless Soil in Quaternary Alluvium”, 3rd Conference of the Arabian Journal of Geosciences (CAJG 2020), Sousse, Tunisia.
2. Chakrabortty, P. and A. Das, “Free Field Ground Vibration due to Ground Improvement Induced Vibration”, 16th Conference on Computer Methods and Advances in Geomechanics (IACMAG-2020), Torino, Italy.
3. Hegde, A. and Venkateswarlu, H. (2020). FLAC3D modeling of geocell reinforced foundation beds. *Proceedings of Fifth International Itasca Symposium*, 17–20 February 2020, Vienna, Austria, Paper ID 16-05 (CD-ROM).
4. Bandyopadhyay, T. S., Chakrabortty, P., and Hegde, A. (2020) “Shake Table Studies to Assess the Effect of Reinforced Backfill Parameters on Dynamic Response of MSE Walls.” 7th International Conference on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics, 13-16 July 2020, IISc Bangalore, India.

5. Mandal, M., & Bag, R. (2020). Effect of pile and heat exchanger properties on total heat extraction of an energy pile-A numerical study. In *E3S Web of Conferences* (Vol. 205, p. 05024). EDP Sciences
6. Tripathy, D., & Singhal, V. (2020). Strengthening of mud masonry assemblages using wire reinforced cementitious matrix (WRCM). Proc., 17th World Conference on Earthquake Engineering, Sendai, Japan, 3f-0048.
7. Singhal, V., Tripathy, D., & Meghwal, P. (2020). Shear and flexure behaviour of historical lime masonry strengthened with fibre reinforced cementitious matrix. Proc., 17th World Conference on Earthquake Engineering, Sendai, Japan, 3d-0027.
8. Singhal, V., Tripathy, D., & Kaushik, H.B. (2020). Seismic strengthening of heritage masonry building: a case study. Proc., 17th World Conference on Earthquake Engineering, Sendai, Japan, 3g-0029.
9. Gundavaram, D., Hussaini, SKK. (2020). Effect of Coal Fouling on Railroad Ballast Under Direct Shear Loading Conditions. In *Joint Rail Conference*, April 20–22, 2020 St. Louis, Missouri, USA.

Achievements

1. The research paper entitled "Effect of Infill Materials on Vibration Isolation Efficacy of Geocell Reinforced Soil Beds" authored by Hasthi Venkateswarlu and Dr. Amarnath Hegde has been adjudged as the best paper on "Soil Dynamics and Earthquake Engineering" by Indian Geotechnical Society. Mr. Hasthi Venkateswarlu has conferred IGS-Guwahati Chapter Young Geotechnical Engineer Award.
2. Angshuman Das got iGrip doctoral research award at IIT Gandhinagar in March 2020.

ASCE Geotechnical special publication

1. Venkateswarlu, H., & Hegde, A. (2020, February). Factors Influencing Dynamic Response of Geocell Reinforced Soil Beds. In *Geo-Congress 2020: Engineering, Monitoring, and Management of Geotechnical Infrastructure* (pp. 569-578). Reston, VA: American Society of Civil Engineers.

Department of Computer Science and Technology:

List of Publications:

1. N. Saini, S. Saha, P. Bhattacharyya (2020). *Microblog Summarization using Self-adaptive Multi-objective Binary Differential Evolution*. Applied Intelligence (impact factor: 3.325, h5-index: 42) (accepted).
2. Ghosh, S., Ekbal, A., & Bhattacharyya, P. (2021). A Multitask Framework to Detect Depression, Sentiment and Multi-label Emotion from Suicide Notes. *Cognitive Computation*, 1-20.
3. S. Mishra, R. Dhir, S. Saha, P. Bhattacharyya (2020). *A Hindi Image Caption Generation Framework using Deep Learning*. ACM Transactions on Asian and Low-Resource Language Information Processing (accepted).
4. Jha, K., & Saha, S. (2021). Incorporation of multimodal multiobjective optimization in designing a filter based feature selection technique. *Applied Soft Computing*, 98, 106823.

5. Jha, K., & Saha, S. (2020). Amalgamation of 3D structure and sequence information for protein–protein interaction prediction. *Scientific Reports*, 10(1), 1-14.
6. Suman, C., Reddy, S. M., Saha, S., & Bhattacharyya, P. (2021). Why pay more? A simple and efficient named entity recognition system for tweets. *Expert Systems with Applications*, 167, 114101.
7. Suman, C., Saha, S., Bhattacharyya, P., & Chaudhari, R. S. (2020). Emoji helps! a multi-modal siamese architecture for tweet user verification. *Cognitive Computation*, 1-16.
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10. Kapil, P., & Ekbal, A. (2020). A deep neural network based multi-task learning approach to hate speech detection. *Knowledge-Based Systems*, 210, 106458.
11. Santosh Mishra, Rijul Dhir, Sriparna Saha, Pushpak Bhattacharyya, Amit Singh. *Image Captioning in Hindi Language using Transformer Networks*. Computers & Electrical Engineering (impact factor: 2.663) journal.
12. Giri, S. J., Dutta, P., Halani, P., & Saha, S. (2020). MultiPredGO: Deep Multi-Modal Protein Function Prediction by Amalgamating Protein Structure, Sequence, and Interaction. *IEEE Journal of Biomedical and Health Informatics*.
13. Saha, T., Saha, S., & Bhattacharyya, P. (2020). Towards Sentiment-Aware Multi-Modal Dialogue Policy Learning. *Cognitive Computation*, 1-15.
14. Firdaus, M., Chauhan, H., Ekbal, A., & Bhattacharyya, P. (2020). EmoSen: Generating Sentiment and Emotion Controlled Responses in a Multimodal Dialogue System. *IEEE Transactions on Affective Computing*.
15. Dutta, P., Mishra, P., & Saha, S. (2020). Incomplete multi-view gene clustering with data regeneration using Shape Boltzmann Machine. *Computers in Biology and Medicine*, 125, 103965.
16. Salgotra, R., Singh, U., Saha, S., & Gandomi, A. H. (2021). Self adaptive cuckoo search: Analysis and experimentation. *Swarm and Evolutionary Computation*, 60, 100751.
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24. Saha, T., Gupta, D., Saha, S., & Bhattacharyya, P. (2020). Towards integrated dialogue policy learning for multiple domains and intents using Hierarchical Deep Reinforcement Learning. *Expert Systems with Applications*, 162, 113650.
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30. Akhtar, M. S., Ekbal, A., & Cambria, E. (2020). How intense are you? Predicting intensities of emotions and sentiments using stacked ensemble [application notes]. *IEEE Computational Intelligence Magazine*, 15(1), 64-75.
31. Paul, D., Saha, S., & Mathew, J. (2020). Improved subspace clustering algorithm using multi-objective framework and subspace optimization. *Expert Systems with Applications*, 158, 113487.
32. Paul, D., Saha, S., & Kumar, A. (2021). Evolutionary Multi-objective Optimization based Overlapping Subspace Clustering. *Pattern Recognition Letters*.
33. Dipanjyoti Paul, Rahul Kumar, Sriparna Saha, Jimson Mathew. (2021). Multi-objective Cuckoo Search based Streaming Feature Selection for Multi-label Data set, In ACM Transactions on Knowledge Discovery from Data.
34. Saha, T., Gupta, D., Saha, S., & Bhattacharyya, P. (2020). Emotion aided dialogue act classification for task-independent conversations in a multi-modal framework. *Cognitive Computation*, 1-13.
35. Bhanu, M., Mendes-Moreira, J., & Chandra, J. (2020). Embedding Traffic Network Characteristics Using Tensor for Improved Traffic Prediction. *IEEE Transactions on Intelligent Transportation Systems*.
36. Mandal, S., & Maiti, A. (2020). Explicit feedback meet with implicit feedback in GPMF: a generalized probabilistic matrix factorization model for recommendation. *Applied Intelligence*, 1-24.
37. Supriyo Mandal, Abyayananda Maiti. *Deep Collaborative Filtering with Social Promoter Score-based User-Item Interaction: A New Perspective in Recommendation*. accepted in Applied Intelligence - Springer [SCI, Impact Factor:3.325].
38. Tetarave, S., Tripathy, S., & Ghosh, R. (2020). Enhancing quality of experience using peer-to-peer overlay on device-to-device communications. *International Journal of Communication Systems*, 33(15), e4546.

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42. Banerjee, S., Misra, R., Prasad, M., Elmroth, E., & Bhuyan, M. H. (2020, November). Multi-diseases Classification from Chest-X-ray: A Federated Deep Learning Approach. In *Australasian Joint Conference on Artificial Intelligence* (pp. 3-15). Springer, Cham.
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44. Patel, Y. S., Page, A., Nagdev, M., Choubey, A., Misra, R., & Das, S. K. (2020). On demand clock synchronization for live VM migration in distributed cloud data centers. *Journal of Parallel and Distributed Computing*, 138, 15-31.
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Conference:

1. M. Firdaus, H. Chauhan, A. Ekbal and P. Bhattacharyya (2020). *More the Merrier: Towards Multi-Emotion and Intensity Controllable Response Generation*. In Proceedings of AAAI 2020 (Accepted).
2. Gupta, D., Chauhan, H., Akella, R. T., Ekbal, A., & Bhattacharyya, P. (2020, December). Reinforced Multi-task Approach for Multi-hop Question Generation. In *Proceedings of the 28th International Conference on Computational Linguistics* (pp. 2760-2775).
3. Firdaus, M., Chauhan, H., Ekbal, A., & Bhattacharyya, P. (2020, December). MEISD: A Multimodal Multi-Label Emotion, Intensity and Sentiment Dialogue Dataset for Emotion Recognition and Sentiment Analysis in Conversations. In *Proceedings of the 28th International Conference on Computational Linguistics* (pp. 4441-4453).
4. Gupta, D., Ekbal, A., & Bhattacharyya, P. (2020, November). A Semi-supervised Approach to Generate the Code-Mixed Text using Pre-trained Encoder and Transfer Learning. In *Proceedings of the 2020 Conference on Empirical Methods in Natural Language Processing: Findings* (pp. 2267-2280).
5. Sundararaman, M. N., Ahmad, Z., Ekbal, A., & Bhattacharyya, P. (2020, December). Unsupervised Aspect-Level Sentiment Controllable Style Transfer. In *Proceedings of the 1st Conference of the Asia-Pacific Chapter of the Association for Computational Linguistics and the 10th International Joint Conference on Natural Language Processing* (pp. 303-312).

6. Gupta, D., Lenka, P., Ekbal, A., & Bhattacharyya, P. (2020, December). A Unified Framework for Multilingual and Code-Mixed Visual Question Answering. In *Proceedings of the 1st Conference of the Asia-Pacific Chapter of the Association for Computational Linguistics and the 10th International Joint Conference on Natural Language Processing* (pp. 900-913).
7. Chauhan, D. S., Dhanush, S. R., Ekbal, A., & Bhattacharyya, P. (2020, December). All-in-One: A Deep Attentive Multi-task Learning Framework for Humour, Sarcasm, Offensive, Motivation, and Sentiment on Memes. In *Proceedings of the 1st Conference of the Asia-Pacific Chapter of the Association for Computational Linguistics and the 10th International Joint Conference on Natural Language Processing* (pp. 281-290).
8. Ahmad, Z., Ekbal, A., Sengupta, S., Mitra, A., Rammani, R., & Bhattacharyya, P. (2020, November). Active Learning Based Relation Classification for Knowledge Graph Construction from Conversation Data. In *International Conference on Neural Information Processing* (pp. 617-625). Springer, Cham.
9. Saikh, T., De, A., Bandyopadhyay, D., Gain, B., & Ekbal, A. (2020, November). A Neural Framework for English-Hindi Cross-Lingual Natural Language Inference. In *International Conference on Neural Information Processing* (pp. 655-667). Springer, Cham.
10. Jha, K., Saha, S., & Khushi, M. (2020, November). Protein-Protein Interactions Prediction Based on Bi-directional Gated Recurrent Unit and Multimodal Representation. In *International Conference on Neural Information Processing* (pp. 164-171). Springer, Cham.
11. Saha, T., Chopra, S., Saha, S., & Bhattacharyya, P. (2020, November). Reinforcement Learning Based Personalized Neural Dialogue Generation. In *International Conference on Neural Information Processing* (pp. 709-716). Springer, Cham.
12. Paul, D., Saha, S., & Mathew, J. (2020, November). Online Multi-objective Subspace Clustering for Streaming Data. In *International Conference on Neural Information Processing* (pp. 95-103). Springer, Cham.
13. N. Saini, S. Mansoori, S. Saha , P. Bhattacharyya (2020). *Multi-tweet Summarization using Fusion of Two Neural Networks*. International Conference on Neural Information Processing (ICONIP) 2020, 18-22 November, 2020 (accepted). (Category A).
14. Gupta, K. K., Haque, R., Ekbal, A., Bhattacharyya, P., & Way, A. (2020). Modelling source-and target-language syntactic Information as conditional context in interactive neural machine translation.
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16. NAVINE SAINI, SUSHIL KUMAR, Sriparna Saha, Pushpak Bhattacharyya. *Exploring Graph-based Feature for Scientific Document Summarization using Evolutionary Framework*.IEEE International Conference on Pattern Recognition (h5-index 38/ h5-median: 56).
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19. Giri, S. J., & Saha, S. (2020, July). Multi-view gene clustering using gene ontology and expression-based similarities. In *2020 IEEE Congress on Evolutionary Computation (CEC)* (pp. 1-8). IEEE.

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24. Firdaus, M., Thangavelu, N., Ekba, A., & Bhattacharyya, P. (2020, July). Persona aware Response Generation with Emotions. In *2020 International Joint Conference on Neural Networks (IJCNN)* (pp. 1-8). IEEE.
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26. Ahmad, Z., Mukuntha, N. S., Ekbal, A., & Bhattacharyya, P. (2020, July). Tweet to News Conversion: An Investigation into Unsupervised Controllable Text Generation. In *2020 International Joint Conference on Neural Networks (IJCNN)* (pp. 1-8). IEEE.
27. Gupta, K. K., Haque, R., Ekbal, A., Bhattacharyya, P., & Way, A. (2020, July). Syntax-Informed Interactive Neural Machine Translation. In *2020 International Joint Conference on Neural Networks (IJCNN)* (pp. 1-8). IEEE.
28. Tanik Saikh, Haripriya B, Asif Ekbal and Pushpak Bhattacharyya (2020). *A Deep Transfer Learning Approach for Fake News Detection*. IJCNN 2020.
29. Kanani, C. S., Saha, S., & Bhattacharyya, P. (2020, July). Improving Diversity and Reducing Redundancy in Paragraph Captions. In *2020 International Joint Conference on Neural Networks (IJCNN)* (pp. 1-8). IEEE.
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34. Ghosh, S., Ekbal, A., & Bhattacharyya, P. (2020, May). CEASE, a Corpus of Emotion Annotated Suicide notes in English. In *Proceedings of The 12th Language Resources and Evaluation Conference* (pp. 1618-1626).

35. Sahoo, S. K., Saha, S., Ekbal, A., & Bhattacharyya, P. (2020, May). A Platform for Event Extraction in Hindi. In *Proceedings of The 12th Language Resources and Evaluation Conference* (pp. 2241-2250).
36. Tanik Saikh, Asif Ekbal and Pushpak Bhattacharyya (2020). *Dataset for Machine Reading Comprehension on Scholarly Articles*. LREC 2020.
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41. Singh, N., Kasyap, H., & Tripathy, S. (2020, September). Collaborative Learning Based Effective Malware Detection System. In *Joint European Conference on Machine Learning and Knowledge Discovery in Databases* (pp. 205-219). Springer, Cham.
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43. Tripathy, S., & Mohanty, S. K. (2020, February). Mappcn: Multi-hop anonymous and privacy-preserving payment channel network. In *International Conference on Financial Cryptography and Data Security* (pp. 481-495). Springer, Cham.
44. Patel, Y. S., Banerjee, S., Misra, R., & Das, S. K. (2020, January). Low-latency energy-efficient cyber-physical disaster system using edge deep learning. In *Proceedings of the 21st International Conference on Distributed Computing and Networking* (pp. 1-6).
45. Patel, Y. S., Mishra, M. K., Mishra, B. S. P., & Misra, R. (2021). Cloud of Things Assimilation with Cyber Physical System: A Review. *Internet of Things: Enabling Technologies, Security and Social Implications*, 93-110.
46. Chanchal Suman, Aditya Gupta, Sriparna Saha, Pushpak Bhattacharyya.(2020) A Multi-modal Personality Prediction System. ICON.
47. Chanchal Suman, Jeetu Kumar, Sriparna Saha, Pushpak Bhattacharyya. (2020). D-Coref: A Fast and Lightweight Coreference Resolution Model using DistilBERT
48. Paul, D., Saha, S., & Mathew, J. (2020, November). Online Multi-objective Subspace Clustering for Streaming Data. In *International Conference on Neural Information Processing* (pp. 95-103). Springer, Cham.
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Department of Electrical Engineering

Patent granted:

1. Pratik Kumar Parmar and Kailash Chandra Ray; SoC Lab; Invention entitled: "AUTOMATIC BOOKLET SCANNING MACHINE AND ITS METHOD OF WORKING"; Indian Patent
2. Ranjan Kumar Behera, Mohammad Junaid Akhtar and Sanjoy Kumar Parida; Advance Electrical Lab; Invention entitled: "AN IMPROVED SQUIRREL CAGE INDUCTION MOTOR WITH ENHANCED EFFICIENCY AND WIDE RANGE OF OPERATING SPEED FOR APPLICATION IN ELECTRIC VEHICLE"; Indian Patent

Journal/conference:

1. Panda, A. K., Palisetty, R., & Ray, K. C. (2020). High-Speed Area-Efficient VLSI Architecture of Three-Operand Binary Adder. *IEEE Transactions on Circuits and Systems I: Regular Papers*, 67(11), 3944-3953.
2. Palisetty, R., Panda, A. K., & Ray, K. C. (2020). ASIC Implementation of Low PAPR Multi-Device Variable Rate Architecture for IEEE 802.11 ah. *IEEE Transactions on Instrumentation and Measurement*.
3. Srivastava, A., & Parida, S. K. (2020). Adaptive Protection Strategy in a Microgrid Under Disparate Operating Modes. *Electric Power Components and Systems*, 48(8), 781-798.
4. Chikondra, B., Muduli, U. R., & Behera, R. K. (2020). An improved open-phase fault-tolerant dtc technique for five-phase induction motor drive based on virtual vectors assessment. *IEEE Transactions on Industrial Electronics*.
5. Chikondra, B., Muduli, U. R., & Behera, R. K. (2020). Performance Comparison of Five-Phase Three-Level NPC to Five-Phase Two-Level VSI. *IEEE Transactions on Industry Applications*, 56(4), 3767-3775.
6. Muduli, U. R., and Behera, R. K, Advanced Power Electronics Lab, 2020. Open-Phase Fault-Tolerant Direct Torque Control for Five-Phase Three-Level NPC VSI fed Induction Motor Drive. IEEE Conference on Power Electronics, Drives and Energy Systems (PEDES-2020).
7. Trivedi, V. K., & Kumar, P. (2020). Low complexity joint equalization and interference compensation in fractional Fourier domain for DCT-OFDM system with CFO. *Digital Signal Processing*, 107, 102863.
8. Trivedi, V. K., & Kumar, P. (2020). Fractional Fourier domain equalization for DCT based OFDM system with CFO. *Digital Signal Processing*, 100, 102687.
9. Trivedi, V. K., & Kumar, P. (2020). Low complexity interference compensation for DFRFT-based OFDM system with CFO. *IET Communications*, 14(14), 2270-2281.
10. Singh, A. K., Trivedi, V. K., and Kumar, P. Wireless Communication Research Lab. Discrete Fractional Fourier Transform based OFDM for 5G Mobile Communication. International Symposium on 5G & Beyond for Rural Upliftment, Dhanbad, India.
11. Kumar, R. R., Pandey, S. K., & Pandey, S. K. (2021). Experimental investigation and comparative analysis of electron beam evaporated ZnO/MgxZn_{1-x}O/CdxZn_{1-x}O thin films for photodiode applications. *Superlattices and Microstructures*, 150, 106787.
12. Trivedi, V. K, Kumar, P., and Prasad, R. Wireless Communication Research Lab. DFRFT based OFDM system for Future Wireless Mobile Communication. IEEE River Publishers.

13. Kumar, R. R., Sekhar, M. R., Laha, R., & Pandey, S. K. (2020). Comparative studies of ZnO thin films grown by electron beam evaporation, pulsed laser and RF sputtering technique for optoelectronics applications. *Applied Physics A*, 126(11), 1-10.
14. Hasan, M. A., & Parida, S. K. (2020). Adaptive modulation index-based controller for suppression of circulating current in parallel inverters of autonomous microgrid. *International Transactions on Electrical Energy Systems*, e12701.
15. Gandhi, G. A. S., Prakash, R., & Sivasubramani, S. (2020, December). Optimal Allocation of DG for Minimization of Power Loss and Total Investment Cost using an Analytical Approach. In *2020 21st National Power Systems Conference (NPSC)* (pp. 1-6). IEEE.
16. Pandey, A., Tiwary, P., Kumar, S., & Das, S. K. (2020). Adaptive Mini-Batch Gradient Ascent based Localization for Indoor IoT Networks under Rayleigh Fading Conditions. *IEEE Internet of Things Journal*.
17. Khan, P., Reddy, B. S. K., Pandey, A., Kumar, S., & Youssef, M. (2020). Differential Channel-State-Information-Based Human Activity Recognition in IoT Networks. *IEEE Internet of Things Journal*, 7(11), 11290-11302.
18. Pandey, A., Sequeria, R., Kumar, P., & Kumar, S. (2019). A multistage deep residual network for biomedical cyber-physical systems. *IEEE Systems Journal*, 14(2), 1953-1962.
19. Tiwary, P., Pandey, A., & Kumar, S. (2021, January). Differential d-Vectors for RSS based Localization in Dynamic IoT Networks. In *2021 International Conference on COMmunication Systems & NETworkS (COMSNETS)* (pp. 82-85). IEEE.
20. Pandey, P., Tiwary, P., Kumar, S., & Das, S. K. (2020, August). Residual Neural Networks for Heterogeneous Smart Device Localization in IoT Networks. In *2020 29th International Conference on Computer Communications and Networks (ICCCN)* (pp. 1-9). IEEE.
21. Khan, P., Reddy, B. S. K., Pandey, A., Kumar, S., & Youssef, M. (2020). Differential Channel-State-Information-Based Human Activity Recognition in IoT Networks. *IEEE Internet of Things Journal*, 7(11), 11290-11302.
22. Khan, P., Khan, Y., & Kumar, S. (2020, January). Tracking and Stabilization of Heart-Rate using Pacemaker with FOF-PID Controller in Secured Medical Cyber-Physical System. In *2020 International Conference on COMmunication Systems & NETworkS (COMSNETS)* (pp. 658-661). IEEE.

Department of Humanities and Social Sciences

List of Publications

1. Mandal, S., & Singh, S. (2020). Stor(y)ing the Reality: (Con)Textualization of myth in Easterine Kire's son of the thundercloud. *IUP Journal of English Studies*, 15(4), 1-9.
2. Gosh, S. & Smriti, S. (2020). Finding nature in the cities: An ecocritical study of Sarah Ladipo Manyika's Like a Mule Bringing Ice Cream to the Sun. *Literary Oracle*. 3(1 and 2), 93-102.
3. Saha, S. & Singh, S. (2020). Effectiveness of language games in enrichment and retention of vocabulary in ESL classroom. *Fortell*, 41, 60-73.
4. Bisai, S. & Singh, S. (2020). Towards a holistic and inclusive pedagogy for students from diverse linguistic backgrounds. *TEFLIN*, 31(1), 139-161.
5. Kumar, C., & Bharti, N. (2020). Why NTM is a Challenge in Trade Relations? Evidence from India–Africa Agricultural Trade. *Insight on Africa*, 12(2), 79-103.
6. Kumari, M., & Bharti, N. (2020). What Drive Trade Costs? South Asia and Beyond. *South Asia Economic Journal*, 21(2), 258-280.
7. Kumari, M., & Bharti, N. (2020). Does bureaucracy affect the outcome of logistics performance? Empirical evidence from South Asia. *American Journal of Business*.
8. Kumar, C., & Bharti, N. (2021). Post-SAFTA NTMs for Agricultural Trade: Revelations from the India–South Asia Approach. *Foreign Trade Review*, 56(1), 117-135.
9. Kumari, M., & Bharti, N. (2021). Linkages Between Trade Facilitation and Governance: Relevance for Post-COVID-19 Trade Strategy. *Millennial Asia*, 0976399620972346
10. Tripathi, P., & Das, C. (2020). Social Distancing and Sex Workers in India. *Mental Health and Migrant Workers*, 55(31), 21.
11. Tripathi, P. & Kumar, U. (2020). Translated in English Rajinder Singh Bedi's short story "Quarantine". *Indian Literature*, 317 (Sahitya Akademi).
12. Biswas, S. K., & Tripathi, P. (2020). 'Cartographies of struggle': Remapping the plight of Bengali women in/after the 1971 war in Kamila Shamsie's Kartography. *Journal of Gender Studies*, 29(8), 937-948.
13. Biswas, S. K., & Tripathi, P. (2019). History and/through Oral Narratives: Relocating Women of the 1971 War of Bangladesh in Neelima Ibrahim's A War Heroine, I Speak. *Journal of International Women's Studies*, 20(7), 154-164.
14. Dwivedi, P. S., & Tripathi, P. (2020). Understanding the Gender Biases in Modern and Pre-modern Times through Mr̄cchakaṭika and Utsav. *Rupkatha Journal of Interdisciplinary Studies in Humanities*, 12(4), 1-8.
15. Das, C., & Tripathi, P. (2020). Decoding the Postcolonial Geo-Linguistic Sangam in Allahabad: A Study of Neelum Saran Gour's Requiem in Raga Janki. *IUP Journal of English Studies*, 15(3), 71-79.
16. Das, C. and Tripathi, P. (2020). Re-contextualizing the lives of Courtesans' in Neelum Saran Gour's *Requiem in Raga Janki* and Vikram Sampath's *My Name is Gauhar Jaan*. *Indian Literature*, 315 (Sahitya Akademi).
17. Das, C., & Tripathi, P. (2020). Experiencing the Riverscape: An Eco-Spiritual Decoding of Gangetic 'Triveni-Sangam'in select writings of Neelum Saran Gour. *Open Cultural Studies*, 4(1), 96-106.

18. Kumar, K. & Paramanik, R.N. (2020). Nexus between Indian economic growth and financial development: A non-linear ARDL approach. *The Journal of Asian Finance, Economics and Business*, 7(6), 109-116.
19. Paramanik, R.N. & Singhal, V. (2020). Sentiment Analysis of Indian Stock Market Volatility. *Procedia Computer Science*, 176, 330-338.
20. Youkta, K., & Paramanik, R. N. (2020). Convergence analysis of health expenditure in Indian states: Do Political Factors Matter? *GeoJournal*, 1-10.
21. Youkta, K., & Paramanik, R. N. Epidemiological model for India's COVID-19 pandemic. *Journal of Public Affairs*, e2639.
22. Lata, M., & Chaudhary, R. (2020). Workplace spirituality and experienced incivility at work: Modeling Dark Triad as a moderator. *Journal of Business Ethics*, 1-23.
23. Lata, M., & Chaudhary, R. (2020). Dark Triad and instigated incivility: The moderating role of workplace spirituality. *Personality and Individual Differences*, 166, 110090.
24. Chaudhary, R. (2020). Corporate Social Responsibility and Employee Performance: A study amongst Indian Business Executives. *The International Journal of Human Resource Management*, 31(21), 2761-2784.
25. Chaudhary, R. (2020). Deconstructing work meaningfulness: sources and mechanisms. *Current Psychology*, 1-14.
26. Chaudhary, R. (2020). Authentic leadership and meaningfulness at work. *Management Decision*.
27. Chaudhary, R. (2020). Green Human Resource Management and Employee Green Behavior: An Empirical Analysis. *Corporate Social Responsibility and Environment Management*, 27(2), 630-641.
28. Chaudhary, R. and Kumar, C. (2020). Determinants of diffusion of environmental sustainability innovations in hospitals of Bihar state in India. *Journal of Global Responsibility*, 12(1), 76-99.
29. Firoz, M., Chaudhary, R., and Khan, A. (2020). Desolated milieu: exploring the trajectory of workplace loneliness (2006-2019). *Management Research Review*.
30. Dutta, M. (2020). Does Informality Hold the Key to Growth and Stability? *Applied Economics Quarterly (formerly: Konjunkturpolitik)*, 66(1), 29-45.
31. Dutta, M. (2020). Gendered Migration - Does the Better World Exist? *Economic and Political Weekly*.

Conference:

1. Firoz, M. & Chaudhary, R. (2020). Workplace Loneliness, Quality of Interpersonal relationship, and Work-Family Conflict: Moderating Influence of Psychological Capital. 36th EGOS European Group of Organizational Studies Colloquium, Hamburg, Germany.
2. Lata, M., & Chaudhary, R. (2020). Does spiritual work environment reduce workplace incivility? The mediating role of prosociality, Academy of Management Proceedings 2020. 80th Annual Meeting of Academy of Management (held virtually) from 7-11 August 2020, Vancouver, British Columbia, Canada.
3. Das, C. and Tripathi, P. (2021). "Where the 'Street' Connects Spatial, Cultural and Subjective Realities: Textualizing the Chronotopic Representation of 'Streetscape' in Neelum Saran Gour's *Invisible Ink*," in the conference "Spaces and Places: 2nd Global Interdisciplinary Conference," organized by Progressive Connexions (Lisbon), 20th -21st March, 2021. (Accepted)

4. Das, C. and Tripathi, P. (2021). “*Parityakta Naari*: Rereading Motherhood in Select Fiction of Neelum Saran Gour,” in the NeMLA’s 52nd and 1st ever Virtual Convention’2021, 11th -14th March, 2021. (Accepted)
5. Das, C. and Tripathi, P. (2021). “Beyond Geographical Contours: ‘Allahabad’ in Neelum Saran Gour’s *Invisible Ink*,” in the IACLALS Annual International Conference 2020, Jadavpur University, Kolkata.
6. Das, C. and Tripathi, P. (2020). “Decoding the Postcolonial Geo-Linguistic *Sangam*: A Study of Neelum Saran Gour’s *Requiem in Raga Janki*”, in the International Conference on “Languaging and Translating: Within and Beyond,” Indian Institute of Technology Patna.
7. Vijay, F. & Tripathi, P. (2020). *Localising the Global: A Study on Linguistic Experiments in Indian Crime Fiction* [Paper Presentation]. International Conference on Languaging and Translating: Within and Beyond, Patna, India.
8. Dandapat, S. & Tripathi, P. (2020). *Shift of Language in the Digital Age: 'Power up' or 'Threat'*? International Conference on Languaging and Translating: Within and Beyond, Patna, India.
9. Kashyap, S. and Tripathi, P. (2021). *Practising the Humanities: Female Fertility, Artificial Reproductive Technology and Contemporary Indian Women's Writing*. (2021). Contemporary Women's Writing and the Medical Humanities, The Institute of Modern Languages Research, School of Advanced Study, London. Online.
10. Kumar, K., Ansari, Z. N., & Paramanik, R. N. (2020) “Nexus Between Financial Cycle and Business Cycle in India.” BITS Pilani K K Birla Goa Campus.
11. Kumar, K., &Paramanik, R. N. (2020).“Time-Varying Correlation between Business cycle and Financial cycle in India.” 22nd Malaysian Finance Association Conference 2020 (MFAC 2020). Online.
12. Khan, A. & Chaudhary, R. (2021). Do whispers whisk uncivil workplace? Investigating the impact of workplace gossip on incivility. 32nd International Congress of Psychology (18-23 July, 2021), Prague, Czech Republic.
13. Mandal, S. (2020). Orality, Oral Tradition, and Naga Culture: A Critical Study [Conference Presentation]. Three-Day International Conference on Indigenous Studies, Cape Comorin Trust, India.

Department of Mathematics

List of publications:

1. Verma, A. K., Urus, N., & Singh, M. (2020). Monotone iterative technique for a class of four point BVPs with reversed ordered upper and lower solutions. *International Journal of Computational Methods*, 17(09), 1950066.
2. Verma, A. K., Pandit, B., & Agarwal, R. P. (2020). On approximate stationary radial solutions for a class of boundary value problems arising in epitaxial growth theory. *Journal of Applied and Computational Mechanics*, 6(4), 713-734.
3. Verma, A. K., Singh, M., & Agarwal, R. P. (2020). Regions of existence for a class of nonlinear diffusion type problems. *Applicable Analysis and Discrete Mathematics*, 14(1), 106-121.
4. Verma, A. K., Kayenat, S., & Jha, G. J. (2020). A note on the convergence of fuzzy transformed finite difference methods. *Journal of Applied Mathematics and Computing*, 63(1), 143-170.

5. Verma, A. K., Pandit, B., & Escudero, C. (2020). Numerical solutions for a class of singular boundary value problems arising in the theory of epitaxial growth. *Engineering Computations*.
6. Singh, K., Verma, A. K., & Singh, M. (2020). Higher order Emden–Fowler type equations via uniform Haar Wavelet resolution technique. *Journal of Computational and Applied Mathematics*, 376, 112836.
7. Filippov, A. N., Koroleva, Y. O., & Verma, A. K. (2020). Cell Model of a Fibrous Medium (Membrane). Comparison between Two Different Approaches to Varying Liquid Viscosity. *Membranes and Membrane Technologies*, 2(4), 230-243.
8. Verma, A. K., Kumar, N., & Tiwari, D. (2020). Haar wavelets collocation method for a system of nonlinear singular differential equations. *Engineering Computations*. (Emerald), Accepted, <https://doi.org/10.1108/EC-04-2020-0181>.
9. Verma, A. K., Pandit, B., Verma, L., & Agarwal, R. P. (2020). A review on a class of second order nonlinear singular BVPs. *Mathematics*, 8(7), 1045.
10. Verma, A. K., & Kayenat, S. (2020). Applications of modified Mickens-type NSFD schemes to Lane–Emden equations. *Computational and Applied Mathematics*, 39(3), 1-25.
11. Verma, A. K., Rawani, M. K., & Agarwal, R. P. (2020). A High-Order Weakly L-Stable Time Integration Scheme with an Application to Burgers' Equation. *Computation*, 8(3), 72.
12. Verma, A. K., & Kayenat, S. (2020). An efficient Mickens' type NSFD scheme for the generalized Burgers Huxley equation. *Journal of Difference Equations and Applications*, 26(9-10), 1213-1246..
13. Verma, A. K., Pandit, B., & Agarwal, R. P. (2020). Existence and nonexistence results for a class of fourth-order coupled singular boundary value problems arising in the theory of epitaxial growth. *Mathematical Methods in the Applied Sciences*. Verma, A. K., Pandit, B., & Agarwal, R. P. (2020). Existence and nonexistence results for a class of fourth-order coupled singular boundary value problems arising in the theory of epitaxial growth. *Mathematical Methods in the Applied Sciences*.
14. Verma, A. K., Pandit, B., & Agarwal, R. P. (2020). Existence and nonexistence results for a class of fourth-order coupled singular boundary value problems arising in the theory of epitaxial growth. *Mathematical Methods in the Applied Sciences*. (Wiley), Accepted.
15. Verma, A. K., Pandit, B., & Agarwal, R. P. (2020). An effective numerical technique to solve Lane-Emden type equations based on the Galerkin finite element method, *Advances in Mathematical Sciences and Applications*, Accepted.
16. Verma, A. K., Rawani, M. K., & Agarwal, R. P. (2020). A novel approach to compute the numerical solution of variable coefficient fractional Burgers' equation with delay, *Journal of Applied and Computational Mechanics*, Accepted.
17. Kumar, K., Chakrabarty, P. P., Das, P., Ramos, H. (2021). A graded mesh refinement approach for boundary layer originated singularly perturbed time-delayed parabolic convection diffusion problems, *Mathematical Methods in the Applied Sciences*, Accepted, Wiley,, ISSN No: 0170-4214.
18. Das, P., Rana, S., (2021) Theoretical Prospects of the Solutions of Fractional Order Weakly Singular Volterra Integro Differential Equations and their Approximations with Convergence Analysis, *Mathematical Methods in the Applied Sciences*, Accepted, Wiley, ISSN No: 0170-4214.
19. Shakti, D., Mohapatra, J., Das, P., & Vigo-Aguiar, J. (2020). A moving mesh refinement based optimal accurate uniformly convergent computational method for a parabolic system of boundary layer originated reaction–diffusion problems with arbitrary small diffusion terms. *Journal of Computational and Applied Mathematics*, 113167.

20. Das, P., Rana, S., & Ramos, H. (2020). On the approximate solutions of a class of fractional order nonlinear Volterra integro-differential initial value problems and boundary value problems of first kind and their convergence analysis. *Journal of Computational and Applied Mathematics*, 113116.
21. Das, P., Rana, S., & Vigo-Aguiar, J. (2020). Higher order accurate approximations on equidistributed meshes for boundary layer originated mixed type reaction diffusion systems with multiple scale nature. *Applied numerical mathematics*, 148, 79-97.
22. Das, P. (2019). An a posteriori based convergence analysis for a nonlinear singularly perturbed system of delay differential equations on an adaptive mesh. *Numerical Algorithms*, 81(2), 465-487.
23. Das, P., Rana, S., & Ramos, H. (2020). A perturbation-based approach for solving fractional-order Volterra–Fredholm integro differential equations and its convergence analysis. *International Journal of Computer Mathematics*, 97(10), 1994-2014.
24. Wang, L., Tripathi, Y. M., & Lodhi, C. (2020). Inference for Weibull competing risks model with partially observed failure causes under generalized progressive hybrid censoring. *Journal of Computational and Applied Mathematics*, 368, 112537.
25. Kayal, T., Tripathi, Y. M., Dey, S., & Wu, S. J. (2020). On estimating the reliability in a multicomponent stress-strength model based on Chen distribution. *Communications in Statistics-Theory and Methods*, 49(10), 2429-2447.
26. Wang, L., Dey, S., Tripathi, Y. M., & Wu, S. J. (2020). Reliability inference for a multicomponent stress–strength model based on Kumaraswamy distribution. *Journal of Computational and Applied Mathematics*, 376, 112823..
27. Jha, M. K., Dey, S., & Tripathi, Y. M. (2019). Reliability estimation in a multicomponent stress–strength based on unit-Gompertz distribution. *International Journal of Quality & Reliability Management*.
28. Maurya, R. K., & Tripathi, Y. M. (2020). Reliability estimation in a multicomponent stress-strength model for Burr XII distribution under progressive censoring. *Brazilian Journal of Probability and Statistics*, 34(2), 345-369.
29. Wang, L., Tripathi, Y. M., Wu, S. J., & Zhang, M. (2020). Inference for confidence sets of the generalized inverted exponential distribution under k-record values. *Journal of Computational and Applied Mathematics*, 380, 112969.
30. Lodhi, C., & Tripathi, Y. M. (2020). Inference on a progressive type I interval-censored truncated normal distribution. *Journal of Applied Statistics*, 47(8), 1402-1422.
31. Wang, L., Zuo, X., Tripathi, Y. M., & Wang, J. (2020). Reliability analysis for stress-strength model from a general family of truncated distributions under censored data. *Communications in Statistics-Theory and Methods*, 49(15), 3589-3608.
32. Mani Tripathi, Y., Petropoulos, C., & Sen, T. (2020). Quantile estimation for a progressively censored exponential distribution. *Communications in Statistics-Theory and Methods*, 49(16), 3919-3932.
33. Alotaibi, R. M., Tripathi, Y. M., Dey, S., & Rezk, H. R. (2020). Bayesian and non-Bayesian reliability estimation of multicomponent stress–strength model for unit Weibull distribution. *Journal of Taibah University for Science*, 14(1), 1164-1181.
34. Mahto, A. K., Tripathi, Y. M., & Kızılaslan, F. (2020). Estimation of Reliability in a Multicomponent Stress–Strength Model for a General Class of Inverted Exponentiated Distributions Under Progressive Censoring. *Journal of Statistical Theory and Practice*, 14(4), 1-35.

35. Mahto, A. K., & Tripathi, Y. M. (2020). Estimation of reliability in a multicomponent stress-strength model for inverted exponentiated Rayleigh distribution under progressive censoring. *OPSEARCH*, 57, 1043-1069.
36. Sen, T., Bhattacharya, R., Tripathi, Y. M., & Pradhan, B. (2020). Inference and optimum life testing plans based on Type-II progressive hybrid censored generalized exponential data. *Communications in Statistics-Simulation and Computation*, 49(12), 3254-3282..
37. Mahto, A. K., Tripathi, Y. M., & Wu, S. J. (2021). Statistical inference based on progressively type-II censored data from the Burr X distribution under progressive-stress accelerated life test. *Journal of Statistical Computation and Simulation*, 91(2), 368-382.
38. Sen, T., Bhattacharya, R., Pradhan, B., & Tripathi, Y. M. (2021). Statistical inference and Bayesian optimal life-testing plans under Type-II unified hybrid censoring scheme. *Quality and Reliability Engineering International*, 37(1), 78-89.
39. Shilpa Yadav, Habibul Islam, Om Prakash and Patrick Sole (2021). Self-dual and LCD double circulant and double negacirculant codes over $F_q + uF_q + vF_q$, *J. Appl. Math. Comput.* <https://doi.org/10.1007/s12190-021-01499-9>.
40. Habibul Islam and Om Prakash (2021). New \mathbb{Z}_4 codes from constacyclic codes over a non-chain ring, *Comput. Appl. Math.*, 40(12) <https://doi.org/10.1007/s40314-020-01398-y>
41. A. Alahmadi, H. Islam, Om Prakash, P. Sole, A. Alkenani, N. Muthana and R. Hijazi (2021). New quantum codes from constacyclic codes over a non-chain ring, *Quantum Inf. Process.* DOI: <https://doi.org/10.1007/s11128-020-02825-z>.
42. Habibul Islam and Om Prakash (2020). New quantum codes from constacyclic and additive constacyclic codes, *Quantum Inf. Process.* 19(9), 1-17.
43. Habibul Islam, Om Prakash and R. K. Verma (2020). New quantum codes from constacyclic codes over the ring $R_{k,m}$, *Adv. Math. Commun.* doi:10.3934/amc.2020097.
44. Habibul Islam, Om Prakash and Patrick Solè (2020). On \mathbb{Z}_4 $\mathbb{Z}_4[u]$ -additive cyclic and constacyclic codes, *Adv. Math. Commun.* doi: 10.3934/amc.2020094.
45. Shikha Patel and Om Prakash (2020). Skew Repeated-root bidimensional (μ,ν) -constacyclic codes of length $4pt^2r$, *Int. J. Inf. Coding Theory* 5(3-4), 266-289.
46. Habibul Islam and Om Prakash, Construction of reversible cyclic codes over Z_{pk} , *J. Discrete Math. Sci. Cryptogr.* (Accepted May 2020).
47. Arindam Ghosh and Om Prakash (2020). Jordan left $\{g, h\}$ -derivation over some algebras, *Indian J. Pure Appl. Math.* 51(4).
48. Om Prakash, Sushma Singh and K. P. Shum (2020). On Almost Armendariz Rings, *Algebra Colloq.* 27(2), 199-212.
49. Habibul Islam, Ram Krishna Verma and Om Prakash (2020). A family of constacyclic codes over $Fpm[v,w]/<v^2-1, w^2-1, vw-wv>$, *Int. J. Infor. Coding Theory* 5(3-4), 198-210.
50. Sushma Singh and Om Prakash, Armendariz Property with weakly semicommutative, *Southeast Asian Bull. Math.* 44(2) (2020), 278-296.

Achievements:

1. The following talks are delivered by Amit K. Verma
 - Delivered a talk on “Mathematics, Mathematicians and Some Unsolved Problems, on 22nd December 2020, Department of Applied Science & Humanities, Invertis University, Bareilly.

- Delivered a talk on 4th December 2020 on Numerical study of Stokes-Brinkman systems with varying liquid viscosity web conference “Membrane process modeling” in celebration of the 60th birth anniversary of Professor A.N. Filippov, Gubkin University, Russia.
- Delivered an invited talk on 1st December 2020 on “Non-standard finite difference techniques” on the foundation day of MMMUT, Gorakhpur.
- Delivered an invited talk on “Mathematica” on 22 September 2020, for the Faculty Development Program (21 September - 25 September) at Department of Mathematics and Scientific Computing, Madan Mohan Malaviya University of Technology,Gorakhpur, TEQIP-III sponsored, On Mathematical Tools and Recent Advances in Mathematics (MTAM-2020).
- Delivered webinar on “Teaching and learning Mathematics with Mathematica” at RMLU Ayodhya on 11th September 2020.
- Delivered an invited talk on “Modeling with Mathematica” on 31st July 2020, for the Faculty Development Program (28 July - 2 Aug) at Invertis University, Bareilly.
- Delivered a lecture on Modeling of Heat conduction in the human mind, during National Webinar “Covid 19: A mathematical approach to opportunities and challenges” organized by Pandit Deen Dayal Upadhyay Girls PG College, on 30th June 2020.

Department of Mechanical Engineering

List of Publications

1. Das, B., & Singh, A. (2020). Influence of hydrogen on the low cycle fatigue performance of P91 steel. *International Journal of Hydrogen Energy*, 45(11), 7151-7168.
2. Das,B., Singh,A., Paul,SK., Arora KS., Shome M.,(2020) Developing a correlation between bend fatigue and cornering fatigue life of wheel disc. *Fatigue and Fracture of Engineering materials and Structures*. pp.1-12. <https://doi.org/10.1016/j.ijfatigue.2020.105799>
3. Das, B., Paul, S. K., Singh, A., Arora, K. S., & Shome, M. (2020). The effect of thickness variation and pre-strain on the cornering fatigue life prediction of a DP600 steel wheel disc. *International Journal of Fatigue*, 139, 105799. (<https://doi.org/10.1016/j.ijfatigue.2020.105799>)
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Department of Physics

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Awards

1. Dr. Naveen K. Nishchal appeared in World's Top 2% Scientists List in Optics by Stanford University, USA (PLOS Biology, Oct. 2020).
2. Dr. Naveen K. Nishchal, Associate Editor; Optical Engineering, SPIE, USA.
3. Dr. Naveen K. Nishchal , Member; Executive Council, Optical Society of India, Kolkata.

The Team RSD'21



Glimpses 2020



Imagination is more important than knowledge. Knowledge is limited. Imagination encircles the world.

~ Albert Einstein

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