Sl. No.	IIT Ropar List of Recent Publications with Abstract Coverage: July, 2024
A	**Book(s)**
1.	Proceedings of the international conference on fundamental and industrial research on materials **Rajiv Kumar, Neha Sardana, Pratik Kumar Ray, Abhishek Tewari** - Book, ISBN: 9789819745579, Springer, 2024 **Abstract:** The International Conference on Fundamental and Industrial Research on Materials (iConFIRM 2023) was held at IIT Ropar from 11-14 December 2023. The four-day extravaganza started with a workshop on damage modeling using cohesive zone and user subroutines (sponsored by Dassault System) and X-ray diffraction characterization technique for materials science (sponsored by Malvern Panalytical) on 11 December 2023, followed by three exciting days of research talks from 12-14 December 2023. The conference included exciting plenary talks from all over the world and promoted greater intellectual interactions between faculty, scientists, students, and industry. The conference also provided a common platform for a faculty/scientist in search of good graduate students/post-docs, a student in search of academic/industrial research jobs, and an industrialist on the lookout for talent to solve complex problems. Revolutionary approaches opened avenues for accelerated materials research, development, and manufacturing. This conference aims to bring together leading researchers, students, and industry under one umbrella to foster meaningful discussion and collaboration. The present volume of proceedings contains full research papers covering a wide spectrum of topics within the field of metallurgy. From novel extraction and recycling techniques to the development of advanced structural materials, from understanding corrosion/oxidation mechanisms to exploring the potential of functional materials, the contributions presented in the conference reflect the depth and breadth of worldwide research being conducted. These areas represent not only the core pillars of metallurgical research but also the driving forces behind innovation and sustainability in various industries. After receiving the full papers from various speakers, the papers were sent for a rigorous review process. About 19 research papers were accepted after a rigorous peer-review process. The accepted papers represent a set of high-quality research contributions in the field of materials. As editors of the conference proceedings, we extend our gratitude to all the authors who have contributed their work to this volume. We are immensely grateful to all the authors who contributed their research papers, posters, and presentations to the conference" iConFIRM 2023". We are also grateful to the reviewers whose dedication, expertise, and passion have enriched this volume. Additionally, we would like to thank the organizing committee, sponsors, and participants whose dedication and enthusiasm made the" iConFIRM 2023" conference a success.
B	**Book Chapter(s)**
2.	A comprehensive review of slaughterhouse wastewater treatment and concomitant resource recovery AR Choudhury, N Singh, V Kulkarni, **Vishal**… - Development in Wastewater Treatment Research and Processes: Book Chapter, 2024 **Abstract**: Due to the ever-rising demand for meat, the number of slaughterhouses and associated wastewater generation have significantly increased in the recent past. Processes such as lairage, sticking, washing, hide storage, and rendering require a huge volume of water. Tentatively, 82%–98% of the entire water consumed (~1100 L of freshwater/adult ruminant) for slaughtering and ancillary processes gets converted as wastewater. The typical ranges of the parameters that

	characterize slaughterhouse wastewater (SWW) are: pH: 6.2–7.9, TSS: 14,000–19,000 mg/L, TDS: 1200–350,000 mg/L, FOG: 12,000–37,000 mg/L, COD: 4200–120,000 mg/L, BOD: 1800–49,000 mg/L, TKN: 120–1105 mg/L, TP: 3–305 mg/L. Large variations and a severely high concentration of nutrients and FOG complicate the SWW treatment and recovery processes. Formerly, a combination of pretreatment (drum screen, settler, coagulation and flocculation) followed by physical treatment (dissolved air floatation) or biological treatment (upflow anaerobic sludge blanket reactor, activated sludge process) was practiced to treat SWW. But the process requires a long start-up, acclimatization period, and large area, yet lacks efficacy, especially in removing TP. So, in recent times, advanced pretreatment by electrocoagulation followed by secondary treatment using an anaerobic baffled reactor or anaerobic sequencing batch reactor is practiced. Further, the treated effluent is subjected to membrane bioreactor and reverse osmosis processes. Such a treatment strategy could lead to 90% efficiency or more. The treatment cost is approximately 0.12 USD/KL, which can be further lowered by facilitating energy recovery as methane-rich biogas from the anaerobic process (250 mLCH4 gVS−1 SWW). The treated wastewater can be rationally reused to partially compensate for the water demand for in-situ processes such as scalding, chilling, dehairing, slaughter-line rind treatment, carcass dressing, cutting, deboning, and fat plant.
3.	A comprehensive study of the governance of India's scientific, technological, and innovative endeavors M Kajal, **R Trikha**, K Singh - Science, Technology and Innovation Ecosystem: An Indian and Global Perspective: Book Chapter, 2024 **Abstract:** A robust governance and administrative framework are required to enable a good science, technology, and innovation (STI) ecosystem. It comprises decision-making and effective means of putting it into practice with regard to STIs. For STI, the structure for dynamic monitoring, assessment, and incentive needs to be reinforced. Studying the development of Indian STI governance from "The Scientific Policy Resolution" (1958) all the way up to the Science, Technology, and Innovation Policy (STIP 2020) is an intriguing topic of study. As a potential outcome of this, a number of institutions of higher education, including central and state universities, National Research Laboratories (NRLs), public and private organizations in numerous domains, etc., were established. The time has come for the correlation between STI and science policies in India, such as STIP, IPR policy, and other interdisciplinary causative linkages. The office of the "Principal Scientific Adviser" (PSA), "Ministry of Science and Technology," encompasses three key departments: the "Department of Science and Technology" (DST), the "Department of Scientific and Industrial Research" (DSIR), and the "Department of Biotechnology" (DBT); "NITI Aayog" and other ministries are included in a detailed examination of the key stakeholders in STI governance in India. STI governance is a set of defined institutional arrangements and associated policy positions that shape the ways in which research, technology, and innovation is governed within the larger socio-economic ecosystem. India's STI governance mechanism is primarily facilitated through the "Prime Minister's Science, Technology and Innovation Advisory Council" (PM-STIAC), "Empowered Technology Group" (ETG), and the recently announced "National Research Foundation" (NRF). The 2019 budget included a proposal for the "National Research Foundation" (NRF) to facilitate, encourage, and coordinate R&D efforts across industries. A study by the "National Science and Technology Management Information" (NSTMIS), DST, found that between 2008 and 2018, India's total R&D investment tripled, driven primarily by the government sector. This led to an increase in scientific publications. According to the NSF (National Science Foundation) database, the country is currently ranked third globally for the number of PhDs in science and engineering thanks to an increase in publications. Since 2000, there are now twice as many researchers per million people as before. Additionally, according to the WIPO's GII 2022 ranking, India is in the 40th position out of 132 countries. Certainly, there has been a significant improvement in this area, moving from 81st (2015) to the 40th position (2022). Despite being the most inventive

	country in South Asia and the middle-income countries, there is still much more to be done. And stakeholders are working to strengthen our STI governance framework in order to fully tap its enormous potential. It is possible to set up centralized coordination with decentralized functionality and cross-learning among key stakeholders. The need of the hour is for a national-level, cross-ministerial, STI governance mechanism. It is necessary to address recruitment in order to meet the need for human resources. The right working conditions must be offered. Furthermore, special attention should be paid to problems with coercion, mentor-mentee relationships, and work-life balance that are related to academic mental health. The current chapter will examine the present state of India's STI ecosystem, its evolution, and potential avenues for improvement so that it can contend with the current and future demands of the hour.
4.	Carbon foams derived from phenol and melamine formaldehyde thermosetting polymers: Preparation, properties, and applications **P Sreeram**, V Naikar, DA David, J Thomas… - Handbook of Thermosetting Foams, Aerogels, and Hydrogels: Book Chapter, 2024 **Abstract**: Carbon foams (CF) are excellent materials with a lightweight porous structure, exceptional properties, and low cost. CF synthesized from polymeric precursors has specific qualities that make them suitable for versatile applications in various industries, including electronics, aerospace, automotive, chemical processing, and health care. Their high surface area and porosity make CF attractive for energy storage applications as lightweight electrode materials in batteries, supercapacitors and fuel cells. The structural advantages of CF make them versatile materials with unique properties. During the recent COVID-19 pandemic, the application for CF in personal protective equipment (PPE) such as face masks, respirators, nose seals, and visors has been greatly appreciated. CF can improve the safety and comfort of health care workers by providing adequate protection against pathogens while remaining lightweight and breathable. The possibility that their structure and properties can be tailored for specific applications by carefully choosing the precursors and preparation techniques has revolutionized the research and development of CF. This chapter presents the preparation methods, specific properties, and applications of CFs from various thermosetting polymeric precursors like urea formaldehyde, melamine formaldehyde, phenol formaldehyde, other phenolic blends, epoxy, polyimides, lignin, and cellulosic polymers. Special foaming conditions and preparation techniques that make them suitable for crucial applications such as thermal management, energy storage, and electromagnetic interference (EMI) shielding are also explained.
5.	Carbon foams derived from thermosetting epoxy, polyimides and cellulosic polymers: Environmental and electrical or electrochemical applications **P Sreeram**, V Naiker, DA David,… - Handbook of Thermosetting Foams, Aerogels, and Hydrogels: Book Chapter, 2024 **Abstract**: Carbon foam (CF) is a porous, three-dimensional structural material having either closed or open cells connected with smooth skeletons called ligaments. These materials show good performance in traits like featherweight, physical and mechanical properties, high electronic and thermal conductivity, high microwave absorption capability, electron magnetic interference shielding properties, corrosion resistance, and exceptional surface area. Its synthesis and utilization have achieved significant advancements. Porosity and pore size can be tailored based on the precursor material and technique of manufacture. Among the various precursors used for CF synthesis, polymeric materials are of particular interest. CFs from polymer precursors offer advantages such as low density, thermal stability, tunable porosity, and ease of processing. They find applications in areas such as thermal insulation, lightweight structural components, energy storage devices (batteries and supercapacitors), catalyst supports, and more. They have a variety of applications due to the unique properties of the resulting CF, which vary based on the polymer precursor, carbon supply, processing conditions, and any posttreatment procedures used. This chapter presents the preparation methods, specific properties, and applications of CFs from

	various polymeric precursors such as epoxy, polyimide, lignin, and cellulosic polymers. Special foaming conditions and preparation techniques making them suitable for crucial applications such as energy storage, controlling thermal variations, and electromagnetic interference (EMI) shielding are also explained.
6.	Carbon foams derived from thermosetting polymers: Preparation, properties and applications V Naiker, **P Sreeram**…MS Manju - Handbook of Thermosetting Foams, Aerogels, and Hydrogels: Book Chapter, 2024 **Abstract**: Carbon foams (CF) represent a distinctive class of materials distinguished by their unique combinations of physical and chemical properties that are unachievable with any other material. With the ability to synthesize CFs from polymeric precursors with tailored characteristic attributes, it has become possible for CFs to enter into different areas of applications in various industries, namely electronics, batteries, aerospace, automotive, chemical processing, and healthcare. Their versatility and customizability for specific applications achieved through careful choice of the precursors and preparation techniques has revolutionized the landscape of research and development in the field of CF. This chapter encompasses the preparation methods, specific properties, and applications of CFs synthesized from different polymeric precursors including various epoxy derivatives and lignin extracted from different sources. The different techniques used to characterize these unique materials are also discussed.
7.	Environmental impact and recycling technologies of thermoset resin, foams, aerogels and hydrogels A Menon, A Vinod, **P Sreeram**… - Handbook of Thermosetting Foams, Aerogels, and Hydrogels: Book Chapter, 2024 **Abstract**: Polymers, their derivatives, and composites are widely used in innumerable applications such as energy storage, architecture, biomedical field, engineering devices, aerospace, and other industries. Thus, herein we comprehensively brief the domestic as well as industrial-scale environmental impacts of thermoset resins, foams, aerogels, and hydrogels. Despite their wide array of utilities to monitor environmental pollution, some of the conventionally derived materials are sluggish and are known to contain several hazardous materials such as phosphates and glycols, which poses a threat to nature and our human respiratory tract as well. This chapter reviews the environmental applications as well as hazards caused by these polymeric matrices. In a nutshell, it highlights their impact on humans, aquatic life, and agriculture and also describes the remedial measures to overcome the chaos after its shelf lives.
8.	Opportunities and versatile applications of thermoset foams, aerogels, and hydrogels: Current state of the art and anticipated developments L Ravindran, A Menon, A Pacheeri, **P Sreeram**… - Handbook of Thermosetting Foams, Aerogels, and Hydrogels: Book Chapter, 2024 **Abstract**: Thermoset foams have recently attracted a lot of attention due to their novel features, such as high self-ignition temperature, high heat/chemical/moisture resistance, highest FST, low cost, and easy processing. These foams are used in a variety of sectors, including thermal conductivity, acoustic applications, and fire safety. Because thermoset foams do not melt, they may be used in a wider range of temperatures than thermoplastic foams. Polyurethane, phenol-formaldehyde, melamine formaldehyde, urea formaldehyde, and epoxy are the most well-known thermoset foams. Among the thermoset foams, polyurethane is most popular due to its resilience, solvent resistance, and antibacterial properties. Thermoset foams are used for a variety of purposes, including insulating material, sandwich structure, reinforcement material, packaging, and furniture manufacturing. Like foams, aerogels and hydrogels are porous structures and are considered as super absorbents. They appear to be causal in reported rises in surface temperature and global climate changes due to superior absorption capabilities. Advantages associated with

	these unique materials are they can be tuned with desirable texture and surface properties. A number of various hydrogels/aerogels are now being created at the laboratory scale, and some of them have already been put into trial manufacturing. Thermoset aerogels/hydrogels expected to have excellent absorption efficiency, long shelf life than those made from natural resources. These can be tailored for targeted drug delivery, tissue engineering, biomedical applications, water treatments, energy storage, etc.The literature on this issue is growing, particularly in scientific fields of study. From an engineering standpoint, a number of research and technical studies dealing with these unique materials were reviewed in order to provide a holistic view of the new technologies of this rapidly expanding interdisciplinary field of study. This chapter provides an overview of different thermoset foams/aerogels/hydrogels. its current status, applications and future outlook.
9.	Phenolic resin: Preparation, structure, properties, and applications JK Joseph, V Naiker, **P Sreeram**… - Handbook of Thermosetting Foams, Aerogels, and Hydrogels: Book Chapter, 2024 **Abstract**: The development of phenolic resins that invigorated the polymer industry is considered to be the first synthetic resin developed and thus leaves an indelible mark in the field of polymer science. These thermoset resins are synthesized by the condensation polymerization of phenol or a mixture of phenols along with aldehyde. The chemical stability and the properties of the phenolic resins helms hope on the precursors used, i.e., an aldehyde along with the phenolic monomer and the reaction condition. Among the various phenolic resins, phenol-formaldehyde (PF) resin obtained the most attention of researchers, and it is synthesized by taking formaldehyde as the aldehyde monomer along with phenol. In the case of PF resin, depending on the ratio of formaldehyde to phenol and the pH of the reaction, PF resins are classified as Novolac and Resol resins, respectively, and both have their characteristic properties and stability. Looking into the trajectories of research done on phenolic resin, a myriad of researches have been conducted on the synthesis of PF resin from natural sources, an astonishing green approach toward resin synthesis, which can be taken as a substitute for the petroleum-derived monomers. Natural sources like hard and softwood, bark, residual lignin and cashew nut shell liquid (CNSL) have al emerged as potential sources of phenolics, out of which CNSL has gained the most attention because of its low cost and ease of use in synthesizing when compared to other sources. The current chapter gives insight into the synthesis of PF resins (Novolac and Resol resins) along with their characteristic properties and stability and also debates the synthesis of PF-resin from CNSL along with structure-property relations, properties, and applications.
10.	Polyurethane (PU): Structure, properties, and applications A Menon, **P Sreeram**, A Vinod, V Naiker,… - Handbook of Thermosetting Foams, Aerogels, and Hydrogels: Book Chapter, 2024 **Abstract**: Polyurethanes (PU) are an inevitable class of versatile polymeric material comprising carbamate (urethane) organic units links. Polyurethane polymers are formed by reacting polyol with a di- or tri-isocyanate. They comprise of two kinds of monomers, which polymerize one after the other, are categorized under the alternating copolymers. Both the types of monomers contain, at least two functional group per molecule. While most of the polyurethanes do not melt when temperature is applied (thermosetting polymers), recently thermoplastic polyurethanes are also prepared and are available. The versatility accounts due to the innumerable applications based on structure-property relationships. Its vast potential is reflected in the expected statistics of global PU market share for the year 2021, which forecasts an estimate of 26.47 million tons by volume production of PU products based on its utility. The research conducted in recent past about PU composites (thermoset, thermoplastic, and biobased PU with natural and synthetic fibers) used as reinforcement of polymers has amplified due to its durability, low cost, lightness, biodegradability, favored mechanical properties, etc. The unique chemical, mechanical, and thermal properties of PU can be designed based on the basic reaction between polyisocyanates

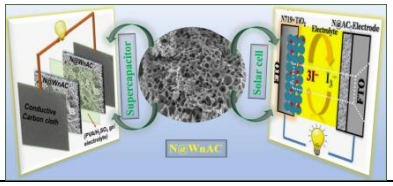
	and polyols, and hence the polyurethane industry is attracting the global market. Raw material modification and its production processes through appropriate methods has paved the way for the production of PU composites with desired properties. This chapter mainly focuses on the early PU synthesis, structural property relations of polyurethanes, prominent advanced methodologies, and newest green technologies concerning the production of ecological PU. This chapter also addresses the recent progress in overcoming and handling the major challenges that researchers face today in the development, management, and implementation of suitable recycling and recovering strategies that enhance the environmental friendliness and work-life of PU products. In a nutshell, this chapter aims to shed light on the various types, synthetic pathways, characteristic properties, applications, major green alternatives as raw materials, and the future of the polyurethane industry.
11.	Reinvigorating science, technology, and innovation in the country by factoring components of the innovation system A Chauhan, **R Trikha**, K Singh - Science, Technology and Innovation Ecosystem: An Indian and Global Perspective: Book Chapter, 2024 **Abstract**: Scientific and technological progress are crucial factors that drive economic growth. In highly developed economies, science, technology, and innovation are responsible for increasing productivity, resulting in the production of more goods and services. This, in turn, leads to a higher standard of living for citizens as they gain access to better quality products and services. However, achieving such progress requires a fully functional innovation system, which can be defined as a network of public and private institutions that initiate, import, modify, and diffuse new technologies. Collaboration, ideation, implementation, and value creation are the key elements of an innovation system, with actors and institutions being the main structural components. In India, the innovation system is classified into government, science-based, translational-based, industrial/user-based, and informal sector actors. The performance of these components directly influences the development, diffusion, and use of knowledge within the innovation ecosystem, which is critical for sustained economic growth and prosperity. Innovation not only drives economic growth but also improves well-being, communication, educational accessibility, and environmental sustainability. Moreover, it provides endless opportunities and new business models to generate competitive advantages and improve efficiency. Therefore, science, technology, and innovation are the key to a better world.
12.	Science, technology and innovation (STI) policy framework for socio-economic growth of the nations **R Trikha**, K Singh - Science, Technology and Innovation Ecosystem: An Indian and Global Perspective: Book Chapter, 2024 **Abstract:** Science, technology and innovation (STI) are one of the foremost and prevalent key drivers for the socio-economic spur of the nations worldwide. The socio-economic relevance and impact of STI are based on in depth understanding and exploration of the STI ecosystem with a focus on system interconnectedness between the STI actors and components. There is a need to reorient the STI ecosystem, with a special focus on the system interconnectedness required for strengthening it. The building of interconnection among actors in the STI ecosystem is one of the paramount requirements to reinvigorate the ecosystem as a whole. STI plays an essential role in utilising STI knowledge and technological advancements to derive sustainable solutions for the core challenges being faced at national, regional and global levels. Insights about how STI can address the Sustainable Development Goals of the United Nations should be highlighted. The future of science, in terms of emerging frontiers and strategic technologies, has to be brought forward. Emphasis is given to the policy directives and programme interventions backed by evidence to revamp the STI system by addressing the societal and economic needs of the country. The STI policy framework is focused on charting out the pathway for creating a knowledge-based economy with a focus on knowledge production and consumption by means of knowledge

	diffusion.
13.	Synthesis and characterization of ausformed nanostructured bainite **A Verma, K Rakha** - Proceedings of the International Conference on Fundamental and Industrial Research on Materials: Book Chapter, 2024 **Abstract:** The ausforming process of plastically deforming the austenite and then isothermally holding it at a bainitic temperature helps a lot in increasing the transformation kinetics and tailoring the microstructure and mechanical properties of the material. This study aims to evaluate the influence of thermomechanical treatment, followed by isothermal treatment on the mechanical properties and phase distribution characteristics. The optical and scanning electron microscopy of the bainite will be used to analyze the effects. The process involves the plastic deformation of austenite at a temperature of approximately near to the industrial coiling temperature followed by isothermal holding in the bainitic temperature range. A long isothermal holding time was used to allow the complete transformation of the plastically deformed parent austenite phase into the final nanostructured bainitic morphology consisting of bainitic ferrite with film austenite. The final microstructure obtained after long isothermal heating was studied and correlated with the hardness of the specimen thus obtained by applying different ausforming strains. Results showed that the arrangement of microstructural constituents leads to a decrease in the hardness.
14.	Thermodynamic study of novel Fe-Mn-Si alloys **S Chand, K Rakha, RM Prasad** - Proceedings of the International Conference on Fundamental and Industrial Research on Materials: Book Chapter, 2024 **Abstract:** With the emergence of advanced high-strength alloys for the automotive industry, the utilization of advanced high-strength alloys is considered for the replacement of existing alloy steels used in the automotive industries. To develop advanced high-strength alloys, there is a need to understand the thermodynamic behavior of the alloy systems. In this paper, the thermodynamic behavior (entropy, free energy, and enthalpy) of Fe-xMn-1Si (x = 3–5 wt.%) alloys are studied.
15.	Urea formaldehyde foams, aerogels and hydrogels: Preparation, properties and applications DA David, PS Owuor, KT Mohammed Kenz, **P Sreeram**… - Handbook of Thermosetting Foams, Aerogels, and Hydrogels: Book Chapter, 2024 **Abstract:** The development and usage of various resins are in development, and a myriad of research is in progress and in demand. Urea formaldehyde (UF) is one of the oldest thermosetting resin or polymers, which is a fruitful product obtained from the combination of urea, the first organic compound to be synthesized, along with an aldehyde, which is formaldehyde. The story of UF pivots around the centuries and leaves an ineradicable mark in the field of polymer science. UF were used for wide range of applications like adhesives, particle boards, finishes, etc., and UF were produced annually based on the requirements. The UF resins produced were used intact or converted to UF foams, aerogels, or hydrogels based on the application to be implemented such as UF foam insulation, electrocatalyst, etc., since UF were known for its astonishing properties. The tribulation in the release of formaldehyde into air from the UF based materials may jeopardize health on prolonged exposure. A mild concentration of formaldehyde may result in respiratory issues and other allergic reaction, but excess amounts of formaldehyde exposure may even become a risk factor for cancer. In this scenario, scientific steps are to be taken in order to make UF materials intact for longer time. The current chapter is a voyage through the preparation techniques and various extraordinary properties of the UF foam, aerogel, and hydrogel, which distinguish them from other resins or polymers along with some prevalent applications. The chapter also debates the factors that took the UF to face the knife-edge along with the trajectories of research done on UF.

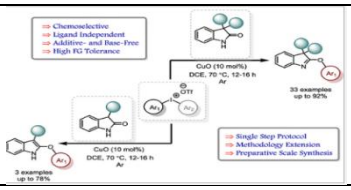
16.	Vacuum brazing of tungsten and fe-co-ni alloy along with micro-structural evaluation of joint interface using SEM **PD Kumar, N Sardana** - Proceedings of the International Conference on Fundamental and Industrial Research on Materials: Book Chapter, 2024 **Abstract:** In the present work, Fe-Co-Ni alloy and tungsten samples (sheet form) have been brazed using Oxygen-Free Electronic (OFE) copper (foil form) as brazing alloy under a vacuum of about 10^{-5} mbar and the interface has been characterized using scanning electron microscopy (SEM) & energy dispersive spectroscopy (EDS). To ensure proper alignment and uniform flow of brazing filler, uniform compressive force was applied using 25 g weight during brazing process. The joint interface was examined using SEM and is found to be thin, continuous and free from micro-cracks. The joint thickness varies between 25 µm to 40 µm. Further, compositional study using EDS along with Dot Mapping & Line Scan has been carried out across the joint interface and analyzed to correlate the diffusion of various elements across the joint. Micro-hardness variations across brazed interface have also been evaluated and the hardness was found to be lowest in filler region than parent materials which indicates the soundness of interfacial joint using this process. The joint strength has been assessed using Ram Tensile Test and the mean value of joint strength has been found to be 91.7 MPa.
C	**Conference Proceeding(s)**
17.	A closed network of RNA polymerase flow models for analyzing intracellular transport **A Jain, AK Gupta** - International Conference on Traffic and Granular Flow (TGF-2022), 2024 **Abstract:** We present a network of several RNA polymerase flow models (RPFM) interconnected through a finite pool of resources. We prove that the network always approaches a steady-state by using tools from the theory of cooperative systems having a first integral. Through theoretical framework and simulations, our analysis shows that increasing any of the forward (backward) rates in any of the RPFMs yields a local effect, an increase (decrease) in the output rate of this RPFM, and a global effect, the output rate of other RPFMs all increases or all decreases. Through simulation, we also show that sometimes increase in backward rates in an RPFM is related to an increase in the total output rate of the network. We believe that the network of RPFMs can provide deep insights into analyzing many natural and artificial systems.
18.	Conference proceedings of the IEEE magnetics society skyrmionic synapse implementation for pattern recognition using convolutional neural network S Gupta, V Vadde, B Muralidharan, **A Sharma** - 2024 IEEE International Magnetic Conference - Short papers (INTERMAG Short papers), 2024 **Abstract:** Conventional neuromorphic computing faces the foreseeable limit of computational and power resources that can be mitigated by using spintronic-based devices. In this digest, we propose a 4-bit (16-state) skyrmion-based synaptic device for application in Convolutional Neural Network(CNN) consuming 0.971 fJ energy per weight update. Our proposed device offers compactness and scalability to higher bits. The skyrmionic synapse device is simulated using a micromagnetic simulation package(OOMMF) integrated with a software-based ReLU Max Pooled function to implement CNN for neuromorphic computing applications. We attained an accuracy of 98.15 % for pattern recognition on the MNIST handwritten data set.
19.	Design considerations for DC-DC voltage regulators in distributed vertical power delivery systems S Krishnakumar, M Choi…**R Sharma**… - 2024 IEEE International Symposium on Circuits and Systems (ISCAS), 2024 **Abstract:** Modern high performance integrated systems demand high-power (>1 kW) to be

	delivered at high current density (>2 A/mm 2) from PCB to points-of-load (POLs) on-chip. Efficient delivery of high-quality power from PCB to POLs is a primary concern in modern high-power high-density integrated systems. With traditional power delivery approaches, high voltage is converted to high current on PCB, yielding prohibitively high power loss in horizontal packaging interconnect components. One approach to reduce this loss is with vertical power delivery (VPD), i.e., to deliver low current at high voltage horizontally and convert it to high current low voltage close to POLs. Voltage regulators (VRs) integrated within small footprint near POLs, however, exhibit high switching and inductor losses. As a result, state-of-the-art VPD systems still exhibit high IR voltage drops, power efficiency of less than 70%, and high thermal dissipation. Thus, the design of compact power efficient VRs is a primary concern with VPD approach. To enhance the overall performance of the PCB-to-POL power delivery system, distributed VPD is considered and architecture-specific design of VRs is investigated in this paper. The design methodology for determining optimal number and placement of VRs for a given power delivery architecture is also proposed. The approach has been demonstrated with on-interposer 12V/1V power converters, comprising Gallium Nitride (GaN) power devices and state-ofthe-art inductors and capacitors, yielding 85% power efficiency with 1-kA load at 2 A/mm 2 .
20.	Investigation of a radiant building heating system using inverse method **G Singh, R Das** - 2024 3rd International Conference on Artificial Intelligence For Internet of Things (AIIoT), 2024 **Abstract:** This article presents an inverse method aided by genetic algorithm (GA)-based inverse technique to predict necessary heating capacity along with acquired indoor relative humidity and temperatures when a radiant panel heating unit (RPHU) is provided for room heating. Due to absence of solar energy in winter, the RPHU was predominantly operated with biomass-based electricity and its waste thermal energy. Ambient temperature and relative humidity values under cold weather of Ropar, Punjab in India were taken from in-house experiments. From the acquired datasets, 144 samples were used for deriving suitable correlation between heating capacity and ambient conditions described by temperature and relative humidity. The GA-based inverse method is used to derive undetermined coefficients, and average capacity of the RPHU has been compared with the experimental data. Thereafter, for a single day, the GA was used to determine the response of indoor temperature and its relative humidity with time. Finally, the coefficients were used to forecast the indoor temperature for any day. It was found that the proposed inverse method could predict the average cooling capacity with above 99% accuracy, whereas the maximum errors in the predicted room temperature and relatively humidity were limited within 18.63 % and 5.72 %, respectively.
21.	Modified version of open TASEP with dynamic defects **N Bhatia, AK Gupta** - International Conference on Traffic and Granular Flow (TGF-2022), 2024 **Abstract:** We propose a modification to the study of site-wise dynamically disordered totally asymmetric simple exclusion process (TASEP). Motivated by the process of gene transcription, a study in ref. [39] introduced an extension of TASEP, where the defects (or obstacles) bind/un-bind dynamically to the sites of the lattice and the hopping of the particles on lattice faces a hindrance if the arrival site is occupied by an obstacle. In addition, the particle is only allowed to enter the lattice provided the first site is defect-free. In our study, we propose that the particle movement at the entry of the lattice must face an equal hindrance that is provided by the obstacles to the rest of the particles on the lattice. For open boundaries, the continuum mean-field equations are derived and solved numerically to obtain steady-state phase diagrams and density profiles. The presence of obstacles produces a shift in the phase boundaries obtained but the same three phases as obtained for the standard TASEP. Contrary to the model introduced in ref. [23], the idea to introduce the modification at the entrance shows that the limiting case $p_d \rightarrow 1$

	converges to the standard TASEP, where p_d refers to the affected hopping rate due to presence of obstacle. The mean-field solutions are validated using extensive Monte Carlo simulations.
22.	Performance optimization of a waste heat-operated tri-generation cycle under different energy situations **A Singh, R Das** - Proceedings of the 12th International Conference on Soft Computing for Problem Solving, 2024 **Abstract:** This research presents an integrated Goswami-absorption refrigeration cycle with twin absorber that can transform any leftover industrial waste heat into useful outputs like power generation, room cooling, and conditioning of eatables. The involvement of the above two sub-cycles in the current configuration offers the advantage of adjusting the cycle parameters to fulfill the energy requirements of either a residential or a cold storage building. The cycle is expected to produce a greater proportion of power and sensible/room cooling when its application is dedicated for residential sites, whereas higher latent cooling is anticipated for cold storage sites. To adjust the cycle for the above two applications, it is required to calculate: (a) the optimum value of the input parameters and (b) the performance of the cycle in the intended operating situation. This is achieved by using dragonfly optimization algorithm for the objective functions favoring either the residential or the storage-based applications. At the optimal input set for residential sites, the cycle delivers 24.33 kW of power, 5.79 kW of sensible/air cooling, and 13.52 kW of latent cooling/chilling. Similarly, the cycle produced 4.03 kW of power, 1.41 kW of sensible/air cooling, and 34.69 kW of latent cooling/chilling at the optimal input set for storage sites. The cycle is found to be 3.66 times more efficient while delivering the above output for residential application than for storage application. Also, the cycle shows 6.23 kW lesser overall exergy destruction while supplying the above output for residential building than for storage building.
D	**Editorial(s)**
23.	Introduction to photocatalytic materials for clean energy, renewable chemicals production, and sustainable catalysis R Ahuja, R Srivastava - Nanoscale Advances, 2024 **Abstract:** This editorial is part of a themed collection on Photocatalytic Materials, providing insights into the innovative design and synthesis of novel materials. It explores their wide-ranging applications in clean energy production, environmental remediation (including air and water purification); Renewable Chemicals production using sustainable energy sources; and Sustainable Catalysis.
E	**Journal Article(s)**
24.	An ERP study on the processing of subject-verb and object-verb gender agreement in Punjabi M Gulati, R Muralikrishnan, **KK Choudhary** - Journal of Psycholinguistic Research, 2024 **Abstract:** This study was conducted with the aim of exploring the general parsing mechanisms involved in processing different kinds of dependency relations, namely verb agreement with subjects versus objects in Punjabi, an SOV Indo-Aryan language. Event related brain potentials (ERPs) were recorded as twenty-five native Punjabi speakers read transitive sentences. Critical stimuli were either fully acceptable as regards verb agreement, or alternatively violated gender agreement with the subject or object. A linear mixed-models analysis confirmed a P600 effect at the position of the verb for all violations, regardless of whether subject or object agreement was violated. These results thus suggest that an identical mechanism is involved in gender agreement computation in Punjabi regardless of whether the agreement is with the subject or the object argument.
25.	Attaining promising efficiency through a Quasi-Solid-State symmetrical supercapacitor and Dye-

	Sensitized solar cell counter electrode utilizing bifunctional Nitrogen-Doped microporous activated carbon **A Husain**, M Kandasamy, **DK Mahajan**… - Inorganic Chemistry Communications, 2024 **Abstract:** This study addresses the imperative need for high-performance and sustainable energy storage and conversion technologies by leveraging the unique properties of nitrogen-doped porous carbon (N@WnAC) derived from the waste walnut shells (WnS). In the realm of supercapacitors, the N@WnAC demonstrates remarkable performance in a three-electrode system, showcasing a high specific capacitance value of 276.7 Fg^{-1} at 1 Ag^{-1}, outstanding stability (96.6 %, 5000 charge–discharge cycles) and favourable rate capability (68.8 % at 10 Ag^{-1}). Moreover, a quasi-solid-state symmetrical supercapacitor (N@WnAC//N@WnAC) is fabricated with PVA/H_2SO_4 gel electrolyte, underscores outstanding performance by delivering high capacitance (126.2 Fg^{-1} at 0.5 Ag^{-1}), promising rate capability (71.8 % at 5 Ag^{-1}), favourable long-term stability (93.3 %, 5000 charge–discharge cycles), and faster charge–discharge kinetics compared to conventional counterparts. At the same time, N@WnAC//N@WnAC delivers a high energy density (42.27 $Whkg^{-1}$ at 0.5 Ag^{-1}) that was retained up to 23.96 $Whkg^{-1}$ even at 5 Ag^{-1}. Simultaneously, the study explores the potential of N@WnAC as a counter-electrode (CE) in dye-sensitized solar cells (DSSC). The obtained results underscore that unique nitrogen doping enhances the electrocatalytic activity, leading to improved electron transfer kinetics and overall cell performance. Moreover, the N@WnAC CE-based DSSC delivers a promising overall solar-to-electrical conversion efficiency of 5.84 %. 
26.	Bistability and the emergence of oscillation in a multiple-loop traffic network **SN Chattopadhyay, AK Gupta** - Nonlinear Dynamics, 2024 **Abstract**: Mitigating traffic jams is a critical step for the betterment of the urban transportation system, which comprises a large number of interconnected routes to form an intricate network. To study the distinct features and complexities of vehicular flow, a network consisting of multiple-loops with a single intersection is considered a directed weighted graph. The governing equations for individual loop densities are derived using the principle of mass conservation, considering a data-driven flow-density relationship. Firstly, we examine the stability of a double-loop network and explore the traffic behavior using the macroscopic fundamental diagram (MFD) for different sets of parameters. Utilizing popular techniques of nonlinear dynamics, the existence of bistability, bifurcations, oscillations, and switching dynamics is demonstrated in the case of the triple-loop network. Further, bistability is characterized by plotting the basin of attraction diagram for the coexisting attractors. Our study reveals that an increase in the number of loop lines enriches the dynamical properties of vehicular traffic flow. It is observed that depending upon the initial density configuration, a loop network can show various phases, namely free flow, stop-and-go traffic jams, and loop congestion. Additionally, we show the presence of period-2 orbits in the case of the quadruple-loop system.
27.	Characterization of sputter-deposited hydrophobic chromium doped nickel alumnide coatings for mechanical and high-temperature oxidation-resistant applications SK Tiwari, AU Rao…**N Sardana**… - Journal of Materials Science, 2024 **Abstract:** Ni_3Al and Cr-Ni_3Al films were deposited on Inconel-718 using the DC magnetron sputtering at a substrate temperature of 400 °C. The evolution of phase, microstructure, surface topography, and mechanical properties of the deposited films have been characterized using XRD, FESEM, AFM, and nanoindentation, respectively. The results of nanoindentation showed

	that the hardness, modulus, and adhesive strength of the coatings increased with increase in Cr concentration in the host Ni_3Al matrix. The maximum hardness and modulus of 10.62 and 150.42 GPa respectively are shown by 5.7 at% of Cr-Ni_3Al films. The cyclic oxidation tests were performed at elevated temperatures of 900 °C, 1000 °C, and 1100 °C in the open-air environment to study the actual oxidation attack. The results of the test showed that the rate of oxidation in Ni_3Al and Cr-Ni_3Al films was low as compared to the uncoated substrate. Ni_3Al film doped with 5.7 at% of Cr-Ni_3Al has resulted in providing better protection to the substrate against oxidation attacks. The surface morphology and elemental composition of the oxidized samples were investigated using FESEM and EDS to elucidate the surface scale analysis and mechanism of oxidation due to the formation of different oxide layers.
28.	Comprehensive analysis of modified heavy metal pollution index and health risk assessment in the Yamuna river of Delhi, India: crucial study for environmental health management A Gani, **S Pathak**, A Hussain - Journal of Hazardous, Toxic, and Radioactive Waste, 2024 **Abstract:** The Yamuna River, vital for the sustenance of millions residing in Delhi, is heavily polluted with toxic heavy metals due to the effects of urbanization, industrialization, and untreated sewage discharge. Understanding the extent of heavy metal pollution and its associated health risks is crucial for effective environmental management. This study employs a comprehensive approach utilizing a modified Heavy Metal Pollution Index, Nemerrow Index, and health risk assessment to evaluate the pollution levels and potential health hazards in the Delhi stretch of the Yamuna River. Field observations, laboratory analyses, and statistical methods were employed during the research. Specifically, four sampling locations were selected, and 25 samples were collected from each site along a 22-km stretch in Delhi between March and June 2023. The findings reveal significant contamination of the Yamuna River in Delhi with heavy metals exceeding permissible limits set by regulatory bodies in Indian and International context. At the various sampling points, lead concentrations exhibited variability, with the highest concentration recorded at Wazirabad (2.332 mg/L) and the lowest at Okhla Barrage (1.092 mg/L). However, in terms of positive index (PI) and negative index (NI) values, Wazirabad registered the highest values of 2,639.97 and −0.02, respectively, while Okhla showed the lowest values of 31.21 for PI and −0.79 for NI. Conversely, at the Nizamuddin sampling site, the lowest PI and NI values were observed, standing at 31.21 and −0.79, respectively. Furthermore, the assessment of health risks related to heavy metal exposure involved metrics like the Hazard Quotient and carcinogenic risk models. The Total Hazard Index (THI) values ranged from 650 to 3,352 for infants, 341 to 1,843 for children, and 141 to 745 for adults. The THI values indicate that drinking water from the Yamuna River can result in various detrimental health conditions. This research enhances our understanding of the environmental health issues associated with heavy metal pollution in Delhi's Yamuna River. It underscores the importance of implementing holistic strategies for water quality management and pollution mitigation, stressing the integration of scientific assessments with policy actions and community engagement efforts.
29.	Copper-catalyzed chemoselective O-Arylation of Oxindoles: Access to cyclic aryl carboxyimidates PR Singh, M Lamba, **A Goswami** - The Journal of Organic Chemistry, 2024 **Abstract:** We have developed a highly efficient base- and additive-free chemoselective CuO-catalyzed strategy for the O-arylation of 2-oxindoles to synthesize 2-phenoxy-3H-indole and 2-phenoxy-1H-indole derivatives in the presence of diaryl iodonium salts. This method offers a variety of O-arylated oxindoles in good to excellent yields under relatively milder reaction conditions. Furthermore, this methodology was extended for the O-arylation of 2-pyridinone and isoindoline-1-one derivatives as well.



30.

[Copper nanoparticles anchored on the metal–organic framework as recyclable catalyst for CO2 fixation to high-value compounds]

PK Giri, V Parihar, S Kumar, CM Nagaraja - ACS Applied Nano Materials, 2024

Abstract: The capture and utilization of carbon dioxide (CO2) as a C1 source for valuable compounds and fuel production are essential in mitigating the escalating atmospheric carbon dioxide. In this context, the present study demonstrates rational integration of an efficient, highly recyclable, and noble-metal-free catalyst for effectively utilizing CO2 to prepare valuable commodity compounds and antibiotics. To achieve this, we anchored catalytically active, alkynophilic Cu(0) nanoparticles (Cu-NPs) with an average size of 10 nm in a high surface area (1079 m2/g), amine-functionalized MOF via the postsynthetic method. The resulting Cu NP-embedded MOF (Cu-NPs/MOF) demonstrates high CO2 uptake and superior catalytic performance for generating 2-oxazolidinones and α-alkylidene cyclic carbonates by CO2 coupling with propargylic amines and alcohols, respectively. More importantly, a facile one-pot preparation of 2-oxazolidinones, antibacterial agents, through a four-component reaction between readily accessible phenylacetylene, acetone, amine, and CO2 has also been accomplished using Cu-NPs/MOF as a catalyst. The high performance of the Cu-NPs/MOF is attributed to the synergistic participation of CO2-philic NH2 groups and catalytic Cu-NPs, rendering selective capture and utilization of carbon dioxide. Further, the Cu-NPs/MOF showed excellent recyclability over six cycles, retaining its catalytic performance and chemical stability. This work highlights the importance of CO2 utilization for one-pot synthesis of valuable 2-oxazolidinones by a four-component reaction involving C–H bond functionalization of phenyl acetylenes at mild conditions.

31.

[Design and analysis of 3D integrated folded ferro-capacitive crossbar array (FC2A) for brain-inspired computing system]

SA Thomas, S Kushwaha, R Sharma, DM Das - IEEE Journal on Emerging and Selected Topics in Circuits and Systems, 2024

Abstract: This paper presents a novel 3D folded capacitive synaptic crossbar array designed for in-memory computing architectures. In this architecture, the bitline is folded over the wordline to enhance the synaptic density. The proposed folded capacitive crossbar array (FC 2 A) architecture decreases the wordline interconnect length and physical crossbar area by 50%. Thus, it helps to reduce the crossbar-associated parasitics and optimize space utilization. The proposed folded capacitive synaptic crossbar is used for designing a brain-inspired computing system (BiCoS) to recognize different patterns using CMOS technology. The BiCoS systems are prone to various reliability issues caused by the crossbar's parasitics. Hence, the 3D folded capacitive crossbar's Q3D model is developed to investigate the crossbar-associated parasitics and its effect on the proposed system is analyzed. The impact of crossbar parasitics is investigated for two cases: Firstly, how the three different spiking patterns (regular spiking, fast-spiking, and

	chattering) of the Izhikevich neuron change for the different crossbar sizes. Secondly, the impact is analyzed on the pattern recognition rate, which gets reduced to 70%. Addressing these challenges is critical to ensure the correct and robust working of the proposed system. Therefore, we propose a solution to effectively overcome and resolve these adverse effects. The energy consumed to recognize each pattern is calculated, and the average energy needed is 0.25 nJ , which is significantly less when compared to the other state-of-the-art works. The circuit is implemented using 65nm standard CMOS technology.
32.	Design and fabrication of dual electrochromic device with broader color space **V Agrawal,** T Ghosh, R Kumar, **E Singla, PK Agnihotri** - Journal of Materials Science: Materials in Electronics, 2024 **Abstract:** Narrow color spectrum is a major limitation of the conventional electrochromic devices (ECDs) having a single electrochromic polymer (ECP) layer. Here, we report the design and fabrication of dual ECD capable of displaying a broader color spectrum at different voltages. The ECD color depends on the energy band gap of the ECP layer. Thus, it is possible to broaden the accessible color space by combining two (or more) ECPs in a single ECD. We have designed and fabricated dual ECD using two ECPs, polyaniline (PANI) and poly(3-hexyl thiophene) (P3HT). The dual ECDs show a wider color spectrum in comparison to the ECD prepared with either PANI or P3HT layer. Experimental measurements show that the complementary dual ECD (gel electrolyte is sandwiched between two ECPs) shows a much broader color range than hybrid dual ECD (both ECP layers on one side of gel electrolyte). The color space of complementary ECD is found to be a function of the viewing side. Moreover, the hybrid arrangement of ECP layers adds a new shade to the color spectrum accessible to complementary dual ECD. A combination of these ECDs may be used to design displays with varying color ranges and color intensity.
33.	Distributed independent sets in interval and segment intersection graphs B Gorain, **K Mondal**, S Pandit - International Journal of Foundations of Computer Science, 2021 **Abstract:** The Maximum Independent Set problem is well-studied in graph theory and related areas. An independent set of a graph is a subset of non-adjacent vertices of the graph. A maximum independent set is an independent set of maximum size. This paper studies the Maximum Independent Set problem in some classes of geometric intersection graphs in a distributed setting. More precisely, we study the Maximum Independent Set problem on two geometric intersection graphs, interval and axis-parallel segment intersection graphs, and present deterministic distributed algorithms in a model that is similar but a little weaker than the local communication model. We compute the maximum independent set on interval graphs in O (k) rounds and O (n) messages, where k is the size of the maximum independent set and n is the number of nodes in the graph. We provide a matching lower bound of Ω (k) on the number of rounds, whereas Ω (n) is a trivial lower bound on message complexity. Thus, our algorithm is both time and message-optimal. We also study the Maximum Independent Set problem in interval count l graphs, a special case of the interval graphs where the intervals have exactly l different lengths. We propose an 1 2 -approximation algorithm that runs in O (l) round. For axis-parallel segment intersection graphs, we design an 1 2 -approximation algorithm that obtains a solution in O (D) rounds. The results in this paper extend the results of Molla et al. [J. Parallel Distrib. Comput. 2019].
34.	Do firms' performance act as a catalyst of innovation: empirical evidence from innovative Indian manufacturing firms **P Chetia, SR Behera** - Indian Growth and Development Review, 2024 **Abstract:** Purpose: This paper aims to explore whether firms' performance determines innovation using a sample of Indian manufacturing firms. The impact of innovation on firms'

	performance across specific countries has been discussed in the literature. However, the effect of firms' performance on innovation output, especially for a developing country like India, remains an open question. Against this backdrop, this paper investigates whether firms' performance determines innovation in Indian manufacturing firms. Design/methodology/approach: The authors use patent filing information to instrument innovation and total factor productivity to instrument firms' performance. The patent data are collected from the Patent Search and Analysis Software database and firm-level data from the Centre for Monitoring Indian Economy's Prowess database. The study uses a sample of 309 Indian manufacturing firms from 2005 to 2021. Given the count nature of the data set used in this study coupled with over-dispersion issues, the authors have used the negative binomial regression to estimate the empirical specification of the models. There could be a possible problem of endogeneity due to the contemporary nature of innovation and firms' performance. Therefore, to address the possible issues of endogeneity in the model, the authors have used the Generalized Method of Moments (GMM) estimators for more robustness checks of the empirical results. Findings: The empirical results exhibit a positive and significant impact of firms' performance on the innovation output, validating that firms' performance determines innovation in Indian manufacturing firms. The posterior estimation results using GMM estimation also corroborate that firms' productivity is a determining factor for the innovation output of Indian manufacturing firms. Furthermore, empirical results exhibit that the ex ante innovativeness of the firms substantially affects the current innovation. This validates that the firms' prior experience, learning by doing and past innovative efforts are more likely to precipitate more innovation in the current period. Originality/value: This paper's main contribution is empirically estimating whether firms' performance determines innovation, which is hardly discussed in the existing innovation literature, specifically using Indian manufacturing industries. Further, it adds to the existing literature in two other prominent ways. First, this paper investigates whether firms require ex ante expertise to innovate or if a firm starting from scratch can innovate significantly without any hindrances. Second, it enriches the literature by instrumenting innovation in output terms with the patent application against input measures of innovation, such as research and development expenditures, acquisition of machinery and equipment, while discussing the relationship between firms' performance and innovation, specifically in the context of a developing economy like India.
35.	Domain wall and magnetic tunnel junction hybrid for on-chip learning in UNet architecture V Vadde, B Muralidharan, **A Sharma** - APL Machine Learning, 2024 **Abstract:** We present a spintronic device based hardware implementation of UNet for segmentation tasks. Our approach involves designing hardware for convolution, deconvolution, rectified activation function (ReLU), and max pooling layers of the UNet architecture. We designed the convolution and deconvolution layers of the network using the synaptic behavior of the domain wall MTJ. We also construct the ReLU and max pooling functions of the network utilizing the spin hall driven orthogonal current injected MTJ. To incorporate the diverse physics of spin-transport, magnetization dynamics, and CMOS elements in our UNet design, we employ a hybrid simulation setup that couples micromagnetic simulation, non-equilibrium Green's function, and SPICE simulation along with network implementation. We evaluate our UNet design on the CamVid dataset and achieve segmentation accuracies of 83.71% on test data, on par with the software implementation with 821 mJ of energy consumption for on-chip training over 150 epochs. We further demonstrate nearly one order of magnitude (10×) improvement in the energy requirement of the network using unstable ferromagnet ($\Delta = 4.58$) over the stable ferromagnet ($\Delta = 45$) based ReLU and max pooling functions while maintaining similar accuracy. The hybrid architecture comprising domain wall MTJ and unstable FM-based MTJ leads to an on-chip energy consumption of 85.79 mJ during training, with a testing energy cost of 1.55 µJ.
36.	Dynamic spillovers among equity, gold and oil markets during covid and Russia-Ukraine war:

	Evidence from India P Mukherjee, **S Bardhan** - Asia-Pacific Financial Markets, 2024 **Abstract:** The interactions among equity and commodity market prices and their volatility provide valuable information to market participants. This paper explores such dynamic interrelations in India, especially whether relationships have significantly changed with the onset of the COVID-19 pandemic and the Russia-Ukraine war of 2022. Based on a daily dataset from January 2017 to May 2022, VAR-MGARCH models and dynamic correlations are estimated with prices of gold, equity, and crude oil for spot and futures markets. Findings suggest that for gold, crude oil, and equity in spot and futures segments, there is evidence of significant persistence of volatility and spillover from past shocks. In general, volatility spillover is more pronounced in the spot than in the futures market. Evidence also indicates bi-directional spillovers between markets, but it is more prominent from the equity market to the crude oil and from crude oil to the gold market. However, the most notable finding of the study is that, like the period of the global financial crisis, the dynamic correlation between stock and crude oil markets has substantially increased during the COVID and war periods both in spot and futures markets. Also, during COVID, the property of gold acting as a hedge against stock has weakened.
37.	Effect of colored noise on precursors of thermoacoustic instability in model gas turbine combustors **N Vishnoi,** V Gupta**, A Saurabh, L Kabiraj** - International Journal of Spray and Combustion Dynamics, 2024 **Abstract**: In this work, we numerically investigate the dynamics of a prototypical thermoacoustic system, the generalized Van der Pol oscillator, in the presence of additive noise of varying color (correlation time) and intensity while the system undergoes supercritical and subcritical Hopf bifurcation. We specifically investigate the influence of noise color on trends in the coherence factor and the Hurst exponent in the subthreshold region to assess their reliability as instability precursors. The Hurst exponent is found reliable only for correlation times much larger than the time scale of the instability while the coherence factor is found to be reliable for the entire range of noise color investigated. These inferences are found to hold for both supercritical and subcritical bifurcation cases.
38.	Effect of employing carbon sequestration technologies while using electric arc furnace ash in cementitious binder **SK Saikia, AS Rajput, K Saini** - Journal of Building Engineering, 2024 **Abstract:** Electric arc furnace (EAF) ash is an industrial pulverized solid waste that consumes a large amount of land due to inefficient stacking at the site and pollutes water resources nearby. As sustainable construction practices have recently attracted significant attention globally, this paper attempted to utilize the EAF ash as a supplementary cementitious material (SCM) by utilizing CO2 mixing-CO2 curing sequestration technologies. A variety of tests were performed to evaluate the physical, chemical, mechanical, microstructural, and porosity-related properties of the specimens prepared using the various mixing-curing regimes. It was observed that employing consequent CO2 mixing and CO2 curing processes were able to realize a CO2 uptaking capacity of 17.63 %. This increase in CO2 capture also came with an enhancement in strength through the carbonate compound formation of calcium and ferrous elements, in addition to a reduction in the cumulative pore volume due to pore size-independent microstructural densification.
39.	Effects of multi-drivelines system on powertrain mounting design for vibration isolation in real vehicle operating conditions **J Singh, AK Sarna, N Kumar,** V Sharma - Journal of Vibration Engineering & Technologies, 2024 **Abstract:** Purpose: The existing powertrain mounting system (PMS) design principles only

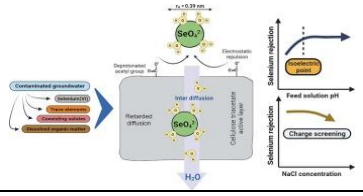
	assume uncoupled PMS as 6 degrees of freedom (DOF). This assumption ignores the dynamic interactions between PMS and other systems. To address this shortcoming, a coupled PMS and multi-driveline mounting system (MDMS) problem is formulated and investigated. Furthermore, design logic and simulation methods to optimize the PMS based on the vibration reduction contributed from the PMS in real vehicle operating conditions are proposed in this paper. Methods: Firstly, the key events that occur in real vehicle operating conditions are formulated and described along with eigenvalues and mode energy criteria. Secondly, a multi-body dynamics simulation model of a vehicle with 16 DOF and 22 DOF problems is taken into consideration to design the PMS. This simulation model is validated with experimentally measured vibrations on the powertrain mount. Thirdly, the influence of MDMS on PMS vibration performance is analytically evaluated in terms of eigensolutions and frequency responses. Finally, a novel systematic and procedural analysis approach is proposed. This new approach treats the PMS and MDMS as coupled 12 DOF systems, which are modeled by considering the powertrain mass and its bushing stiffness proprieties; along with the multi-driveline masses, joints kinematics, and its bushing stiffness proprieties. This coupled system with the vehicle model forms a 22 DOF system and is used for rigid body modes (RBM) optimization analysis. Result and Conclusions: The results demonstrate that the conventional approach achieves all design objectives during the early design stage as evident from the results of the 16 DOF case. However, the PMS isolation performance degrades when this model is applied to real vehicle operating events, as demonstrated by the 22 DOF case. The findings of the proposed optimized system demonstrate that under key real vehicle operating events, PMS vibration performance is enhanced by the better decoupling of the rigid body modes (RBM) parameters. This study's main contribution is the observation that by treating PMS and MDMS as a coupled system during PMS design, vehicle vibration behavior can be further improved. The approach of considering and formulating real vehicle events helps to reduce the gap between the theoretically predicted and practical measured vibration performance of PMS.
40.	Enhancing recycling potential: Exploring reduction and metal separation behavior of iron-rich slag in electric arc furnace smelting for a sustainable future **SS Chandel**, NS Randhawa, **PK Singh** - Journal of Sustainable Metallurgy, 2024 **Abstract:** The electric arc furnace steelmaking route is essential for sustainable steelmaking through hydrogen-based direct reduced iron. About 30% of the global steel production currently follows the scrap/direct reduced iron–electric arc furnace (DRI-EAF) route, which is bound to increase given decarburization efforts by the steel industry. We investigated DRI-EAF slag recycling simulated in laboratory EAF smelting tests to lower its environmental impact. Several aspects of process development were explored, such as process conditions, specific energy consumption, and the settling behavior of iron particles. Significant reductions occur in the first 15 min, ranging from 73.4% to 83.34%. About 97% iron was recovered under optimum conditions: basicity—1.2, carbon/oxygen ratio—1, and time—40 min. The settling velocities of iron particles decreased with increasing slag basicity, reaching values of $3.13 \times 10{-}5$ m/s, $1.95 \times 10{-}5$ m/s, and $0.89 \times 10{-}5$ m/s for basicities 0.9, 1.2, and 1.5, respectively. The effects of basicity on slag viscosity, phase formation, and energy consumption are critically discussed. Compared to 0.9, basicities of 1.2 and 1.5 increase power consumption by 17.6% and 23.5%, respectively. The findings potentially contribute to managing DRI-EAF-based slag, repositioning it as a potential resource, and reducing associated pollution.
41.	EpilConNet: A novel multi-class epileptic seizure classification model S Ghosh, Deepti, **S Gupta** - Inteligencia Artificial, 2024 **Abstract:** Epilepsy is a neurological disorder characterized by recurrent seizures, which can affect individuals of all age groups, but infants and older individuals are particularly vulnerable. Sudden epileptic attacks can pose significant risks and be life-threatening, impacting the overall quality of life of affected individuals. With the progress made in medical science,

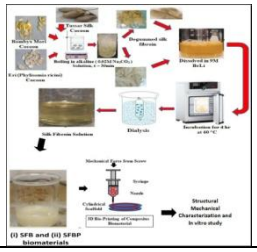
	Electroencephalography (EEG) has emerged as a valuable tool for diagnosing and predicting seizure occurrences. The availability of wearable EEG devices, including caps and helmets, has become increasingly prominent in the market. As a result, there has been a recent surge in the development of deep learning-based systems. These systems are helpful for diagnosis in hospital settings and for mobile applications that provide timely warnings and predictions regarding seizure onset. Most of the existing state-of-the-art (SOTA) approaches focus on distinguishing between healthy and epileptic patients. Some studies categorize individuals into three classes: healthy, experiencing the onset of a seizure, or currently having a seizure, specifically focusing on mobile applications. However, limited literature is available on the five-class problem, which is valuable for localization and diagnosis in hospitals and mobile applications. In this regard, we propose our novel model, named EpilConNet, and conduct extensive experiments on a real-world dataset to demonstrate its efficacy in all modes of classification. EpilConNet results in a significant increase of 4% in accuracy in five-class classification.
42.	Exchange bias and inhomogeneous spin states in La1.5×Sm0.5×NiMnO6 R Hissariya, N Tripathi, SK Mishra, **V Shukla**, T Brumme - Physical Review Materials, 2024 **Abstract:** The presence of antisite disorder in double perovskites manifests various intriguing properties like the spin-glass state, exchange bias, and memory effect. Here, we report the synthesis of a La1.5×Sm0.5×NiMnO6 compound that crystallizes in a monoclinic (P×2×1/n) structure. The presence of multiple oxidation states of Ni(Mn) cations induces competing (ferromagnetic and antiferromagnetic) exchange interactions that originate an inhomogeneous spin state, as evident from observed magnetic anomalies in temperature-dependent magnetization measurements. A spin-glass (SG) state is evolved that manifests field cooling (H×CF = 500 Oe) induced exchange bias (H×EB~×153 Oe) below spin-glass temperature T×SG (65 ± 1 K). The strength of the exchange bias is reduced after successive magnetization reversal cycles performed at 5 K. The reported magnetic training effect is explained within the frameworks of metastable magnetic disorder across frozen antiphase boundaries in the frustrated SG state. Measurements of frequency-dependent ac-susceptibility $\chi'_{f_0}(\omega)$ suggest critical slowing dynamics and memory effect in the proximity of T×SG, which is described using a critical slowing model resulting in relaxation exponent z×ν = 1.99 ± 0.04 and τ0 = 8.91 x 10−7×s. Employing first-principles calculations, we find the insulating ferromagnetic ground state of La1.5×Sm0.5×NiMnO6 in the ordered phase where Ni(Mn) appears to be in the 2×+(4+) state. Further, the presence of antisite disorder eventually results in lower magnetic moments per formula unit, which is well corroborated by experimental observations. Our findings provide a pathway for designing host materials with inhomogeneous spin-frustrated systems and variable electronic states.
43.	Experimental and numerical study on the fatigue behaviour of pre and post heat treated additively manufactured SS 316L specimens A Mishra, AK Tiwari, **SC Roy**, S Goyal - Engineering Failure Analysis, 2024 **Abstract:** The success of 3D printing relies on developing components with desired strength that heat treatment processes can further improve. While SS 316L is a widely used structural material for several industrial applications, the fatigue behaviour of its 3D-printed version is investigated herein. The low cycle fatigue (LCF) behaviour of heat-treated (HT) 3D-printed SS 316L specimens was carried out and compared with the without heat-treated (WHT) specimens thereof. The heat treatment considerably affected its LCF behaviour, which can be attributed to the microstructural changes post heat treatment. The cyclic softening is observed in both HT and WHT specimens. However, the degree of softening is lower (12.35 %) for HT compared to WHT specimens (25.30 %) and 62 % higher fatigue life for HT compared to WHT specimens. Further, the hardness values obtained are 176 and 169 HV for WHT and HT, respectively, while it is 238 and 223 HV for the same, before and after fatigue tests. Fractography revealed fewer pores and

	reduced fatigue striations in the HT specimens. Considering the Chaboche non-linear model, finite element modelling was employed to capture the specimens' fatigue behaviour. The proposed model is found to be suitable for predicting the cyclic behaviour of 3D-printed austenitic steels.
44.	Experimental study to understand the effects of deficit irrigation in maize S Sudesan, **I Sonkar**…CSP Ojha… - Journal of Water and Climate Change, 2024 **Abstract:** Given the challenges posed by climate change and the scarcity of water, it is essential to adopt sustainable irrigation practices that do not compromise crop yields. Research studies are crucial to determine the optimal deficit soil moisture levels to be maintained for cultivation in different soil types. This study examines the response of maize grown on loamy sand soil under different water deficit moisture contents by monitoring the variation of the crop growth in terms of the leaf area index, biomass weight, root depth and yield. The daily soil moisture is measured to understand the actual evapotranspiration from the study plots. From the experiments, the optimal moisture content identified is 13%, and the plot maintained at this moisture content has shown the highest evapotranspiration, yield and biomass. The yield response factor of the maize grown in water deficit conditions is also observed to be very close to the value reported by FAO. As expected, the yield response factor is found to be sensitive to water stress. The deficit irrigation at the optimal moisture content of 13% could be recommended for maize cultivation in loamy sand soil in North Indian climatic conditions. Such considerations will be vital for achieving sustainable irrigation goals.
45.	Factual analysis of factors influencing consumer cognitive thinking and automobile designing using fuzzy-AHP **J Singh, P Sarkar** - Journal of Visual Art and Design, 2024 **Abstract:** Consumer cognitive and emotional responses significantly impact consumers' affinity for both tangible and intangible products. Recent research underscores the heightened influence of consumer emotional and cognitive perceptions in product design, surpassing reliance on designers' instincts or experiences. This case study delved into the analysis of automobiles, using cars as focal product. While visual elements like curve lines, grill design, and color predominantly shape consumer perspectives, non-visual factors such as reliability, quality, and ergonomics play a pivotal role in purchasing decisions. Our investigation, involving six industrial experts and over 130 participants, explored non-visual factors affecting consumers' cognitive perceptions during car purchasing. Through a two-phase experimental approach, we developed a framework to understand the disparities in ranking assigned by consumers and designers to these non-visual factors, revealing perception gaps. Utilizing the rank value methodology, the Pareto principle, and Fuzzy-AHP analysis, we identified mileage/fuel efficiency, safety features, and reliability as dominant factors influencing consumer perceptions. Designers, on the other hand, prioritize safety features, reliability, and quality/warranty. Our findings emphasize the strategic significance for automobile companies to enhance their success rates by prioritizing these key factors, ultimately elevating brand value, profile, and overall financial prosperity.
46.	Flow dynamics and heat transfer in the wake of an rotary oscillating circular cylinder with an isothermal control plate A Haty, RK Ray, **HVR Mittal** - Numerical Heat Transfer, Part A: Applications, 2024 **Abstract:** This research explores the flow dynamics and heat transfer within the wake of a rotary oscillating circular cylinder in the presence of an isothermal control plate. Two-dimensional, unsteady, viscous and laminar flow of a Newtonian fluid is considered using the Higher Order Compact Scheme (HOC) to discretize the governing equations and the Bi-Conjugate Gradient Stabilized method to solve the resulting system. Simulations are performed for various gap ratios, maximum angular velocities, and frequency ratios of oscillation at Prandtl number 0.7 and

	Reynolds number 150 using an in-house code. Results show a significant increase in heat transmission for d/R0=0.5 and f/f0=0.5 for all αm. Drag and lift coefficients are also analyzed, with the maximum peak of the drag coefficient decreasing by 9.88% for d/R0=3. This research offers valuable insights for advancing and optimizing aerodynamic forces and heat transfer processes, particularly in the field of fluid dynamics. The study focuses on enhancing the efficiency of heat transfer mechanisms around rotary oscillating circular cylinders, contributing to the development of cutting-edge technologies in aerodynamics and thermal management.
47.	From defense to dysfunction: Autophagy's dual role in disease pathophysiology **JA Malik, MA Zafar**, S Singh, **S Nanda…T Lamba**, **MA Khan**…**JN Agrewala** - European Journal of Pharmacology, 2024 **Abstract:** Autophagy is a fundamental pillar of cellular resilience, indispensable for maintaining cellular health and vitality. It coordinates the meticulous breakdown of cytoplasmic macromolecules as a guardian of cell metabolism, genomic integrity, and survival. In the complex play of biological warfare, autophagy emerges as a firm defender, bravely confronting various pathogenic, infectious, and cancerous adversaries. Nevertheless, its role transcends mere defense, wielding both protective and harmful effects in the complex landscape of disease pathogenesis. From the onslaught of infectious outbreaks to the devious progression of chronic lifestyle disorders, autophagy emerges as a central protagonist, convolutedly shaping the trajectory of cellular health and disease progression. In this article, we embark on a journey into the complicated web of molecular and immunological mechanisms that govern autophagy's profound influence over disease. Our focus sharpens on dissecting the impact of various autophagy-associated proteins on the kaleidoscope of immune responses, spanning the spectrum from infectious outbreaks to chronic lifestyle ailments. Through this voyage of discovery, we unveil the vast potential of autophagy as a therapeutic linchpin, offering tantalizing prospects for targeted interventions and innovative treatment modalities that promise to transform the landscape of disease management.
48.	Heterogeneous photocatalytic valorization of lignocellulose biomass for chemical and fuel production via reductive pathways **R Ghalta, A Chauhan, R Srivastava** - Sustainable Energy and Fuels, 2024 **Abstract:** Biomass, an abundant and renewable resource, particularly lignocellulosic biomass derived from agricultural and forestry waste, presents substantial potential for sustainable chemical and fuel production. It serves as a renewable source for synthesizing variety of valuable chemicals and fuels. Historically, biomass upcycling has relied on high-temperature thermal and chemical processes, contributing to environmental concerns. In response to these challenges, the emerging field of photocatalysis utilizes light energy to propel chemical reactions, offering a more environmentally friendly alternative. Though relatively recent, the application of photocatalysis in biomass valorization exhibits promising potential for revolutionizing processes toward sustainability. This review primarily explores the photocatalytic valorization of lignocellulosic biomass, encompassing reductive pathways. While oxidative processes have received considerable attention, the reductive aspect remains relatively unexplored, gaining increased interest in recent years. The reductive pathway yields a diverse array of value-added products from cellulosic and lignin components, establishing it as a pivotal avenue for producing fuel additives and industrial synthetic intermediates. Providing a comprehensive exploration of the current knowledge landscape, this review emphasizes photocatalysts and their synthesis and characterization, elucidating reaction mechanisms, and discusses potential applications in reductive photocatalytic biomass upgrading.
49.	Incomplete fusion reactions for 19 F + 169 Tm : Measurement of recoil range distributions M Shuaib, MS Asnain, **PP Singh**… - Physical Review C, 2024

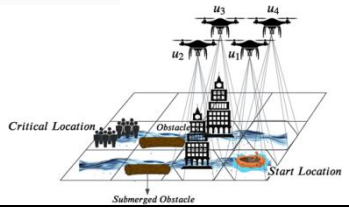
	Abstract: This present study explores the role of incomplete fusion in heavy-ion reactions alongside complete fusion, examining recoil ranges of populated residues. An attempt has been made to distinguish between complete and incomplete fusion contributions by analyzing linear momentum transfer from the projectile to the target nucleus. Employing the recoil-catcher activation technique, forward recoil range distributions for the 19 F + 169 Tm system at energies around 96 and 106 MeV have been measured. Analysis of these recoil range distributions reveals characteristics of complete and incomplete fusion processes. Complete fusion reactions show larger recoil ranges, signifying comprehensive linear momentum transfer. On the other hand, residues exhibiting smaller recoil ranges result from partial linear momentum transfer due to incomplete fusion of the projectile. The forward recoil range distributions indicate an admixture of full and partial linear momentum transfer components in reactions with α particles in the exit channels. This behavior suggests projectile breakup caused by the Coulomb effect, offering valuable insights into fusion process dynamics.
50.	Influence of effective stiffness on seismic response of RC frame building with shear walls **KKK Reddy, P Haldar** - Journal of Vibration Engineering & Technologies, 2024 **Abstract:** Purpose: This article aims to explore the implication of effective stiffness modifiers of structural elements on the seismic performance of high-rise RC frame buildings with shear walls. Contribution and method: Effective stiffness of structural elements i.e., beams, columns, shear walls etc. plays a pivotal role in the seismic evaluation of Reinforced Concrete (RC) shear wall buildings which are predominantly considered through the use of stiffness modifiers in Indian design standards like various national design standards worldwide. The reduction in stiffness of the structural members is mainly due to crack formation in members due to shrinkage, creep, bond-slip of the reinforcement, etc. which further aggravates due to large inelastic deformation caused by seismic events. stiffness modifiers for various structural members i.e., beams and columns have been recommended in revised Indian seismic standards (BIS inIS 1893 (Part 1)—2016 Indian Standard criteria for earthquake resistant design of structures, part 1: general provisions and buildings (fifth revision). Bureau of Indian Standards, New Delhi, 2016), however specific guidelines for the same are missing for RC shear walls. This paper presents a comprehensive review of the available effective stiffness recommendation by various national seismic design standards viz., ASCE (ASCE-41 in ASCE/SEI 41-17, seismic evaluation and retrofit of existing buildings. American Society of Civil Engineers, Reston, 2017), Eurocode (Design of structures for earthquake resistance—part 1: general rules, seismic actions, and rules for buildings, 2005), New Zealand code (NZS in NZS 3101:2006 New Zealand Standard Concrete Structures Standard, 2006) and assess the influence of effective stiffness on seismic evaluation of high-rise RC shear wall buildings. It is observed that a significant difference in peak strength is observed with variation in stiffness modifiers of beam and column, whereas their peak strength is not significantly sensitive to the effective stiffness of shear walls due to the higher stiffness of shear walls compared to other structural elements. Conclusion: It has been observed that the choice of stiffness modifiers of structural elements influences the seismic performance of RC shear wall buildings in terms of strength, stiffness and plastic deformation capability. Indian seismic design standard BIS (2016) does not prescribe any reduction in gross stiffness to get effective stiffness of shear walls and it is evident from the parametric study that the influence of effective stiffness of the shear wall on the seismic performance of the RC shear wall building is negligible whereas the effective stiffness of beams and columns has a profound effect on seismic behaviour of such buildings.
51.	Investigation of forward osmosis process for selenium mitigation from environmentally-relevant groundwater systems **M Verma, VA Loganathan** - Journal of Water Process Engineering, 2024 **Abstract:** Selenium (Se) is a groundwater contaminant that needs to be regulated in drinking water to avoid health hazards. In this study, the underlying mechanisms of forward osmosis (FO)

	process for selenium mitigation from contaminated groundwater, under environmentally-relevant conditions has been identified using glucose as a draw solution. Firstly, aqueous speciation modelling of selenium was performed incorporating field hydrogeochemical conditions of Se-contaminated regions of Punjab, India. Further, laboratory experiments with aqueous solution containing selenium were performed under varied pH, draw solution concentration, feed ionic strength, and including various co-solutes. Moreover, FO experiments were conducted using Se-contaminated field groundwater obtained from Chetah, Nawanshahr district of Punjab, India to probe the long-term viability of selenium removal in a complex water matrix. Our results indicated that Se rejection was high when the feed pH stayed above the isoelectric point (i.e. pH 4.65) of the membrane. About 97.17 % of Se rejection was observed, primarily attributable to charge-based interactions between membrane and dominant Se complex. Our study illustrated that the presence of co-solutes viz. calcium, magnesium, nitrate, and sulphate reduced selenium rejection. No uptake onto the membrane surface has been observed in the pH range between 4.0 and 10.0. The Se concentration in the draw solution was well within Bureau of Indian Standards (BIS) drinking water acceptable value of 10 µg of Se L−1 in contaminated field groundwater during a nine-day long-term study suggesting that the diluted draw solution (glucose) from the FO process could be used directly as a nutrient without the need for regeneration. 
52.	Isolated single-photon emitters with low Huang–Rhys factor in hexagonal boron nitride at room temperature **A Bhunia**, P Joshi, **N Singh**…**R V Nair**… - Journal of Physics D: Applied Physics, 2024 **Abstract**: The development of stable room-temperature bright single-photon emitters using atomic defects in hexagonal boron nitride flakes (h-BN) provides significant promise for quantum technologies. However, an outstanding challenge in h-BN is the creation and detection of isolated, stable single-photon emitters with high emission rates and with very low Huang–Rhys (HR) factor. Here, we discuss the quantum photonic properties of a single, isolated, stable quantum emitter that emits single photons with a high emission rate and a low HR value of 0.6 ± 0.2 at room temperature. A scanning confocal image confirms the presence of a deserted, single-quantum emitter with a prominent zero-phonon line at ∼578 nm with a well-separated phonon sideband at 626 nm. The second-order intensity-intensity correlation measurement shows an anti-bunching dip of ∼0.25 with an emission lifetime of 2.46 ± 0.1 ns, reinforcing distinct features of the single-photon emitter. The importance of low-energy electron beam irradiation and subsequent annealing is emphasized to achieve stable, reproducible single-photon emitters.
53.	Iterative spectral correlation based multispectral image demosaicking V Rathi, **K Rana, P Goyal** - Signal, Image and Video Processing, 2024 **Abstract:** Multispectral imaging systems with a multispectral filter array (MSFA) provide an affordable and portable way to capture multispectral images (MSIs) that have a variety of applications in different fields. These systems generate raw images initially and require an effective multispectral image demosaicking technique for reconstructing the MSI from the raw data. These demosaicking methods require proper usage of the spectral correlation available between the bands of MSI to generate high quality MSI. However, the existing demosaicking methods only partially utilize this spectral correlation, as they use spectral correlation only in the initial estimation of MSI. In this work, we utilize the spectral correlation between bands iteratively and finally enhance the quality of the generated image using median filtering based image enhancement. The exploratory results on the two standard datasets publicise the quality of

	the presented method on the various metrics.
54.	Local resetting in a bidirectional transport system **N Bhatia, AK Gupta** - Journal of Statistical Physics, 2024 **Abstract:** Inspired by different stochastic mechanisms, such as the two-sided motion of ribosomes seen during the initiation of mRNA translation, which is backed by their decay, we investigate a totally asymmetric simple exclusion process with open boundaries in a bidirectional setting where two oppositely charged species of particles move opposite to each other and locally reset to the respective entry site. The steady-state characteristics, such as density profiles and phase diagrams, are investigated theoretically under the mean-field framework. The introduction of resetting into the system produces non-trivial effects in the form of two novel asymmetric phases that appear in the phase diagram. The system possesses several different combinations of symmetric phases as well as asymmetric phases for different resetting rates. A rich behavior is observed in the system, emphasizing the occurrence of spontaneous symmetry-breaking phenomena even in the small resetting regime. Moreover, the significance of the resetting rate is analyzed on the domain wall, and it is found that one of the stationary phases with a localized domain wall vanishes for a substantial resetting rate. Due to the interaction of both species at the boundaries, the consequences of the resetting dynamics on the boundary densities are also investigated. All the findings, including finite-system size, are thoroughly validated by the Monte Carlo simulations.
55.	Mechanical and in vitro study of 3D printed silk fibroin and bone-based composites biomaterials for bone implant application AI Ansari, NA Sheikh, **N Kumar** - Proceedings of the Institution of Mechanical Engineers, Part H: Journal of Engineering in Medicine, 2024 **Abstract**: When treating orthopaedic damage or illness and accidental fracture, bone grafting remains the gold standard of treatment. In cases where this approach doesn't seem achievable, bone tissue engineering can offer scaffolding as a substitute. Defective and fractured bone tissue is extracted and substituted with porous scaffold structures to aid in the process of tissue regeneration. 3D bioprinting has demonstrated enormous promise in recent years for producing scaffold structures with the necessary capabilities. In order to create composite biomaterial inks for 3D bioprinting, three different materials were combined such as silk fibroin, bone particles, and synthetic biopolymer poly (ε-caprolactone) (PCL). These biomaterials were used to fabricate the two composites scaffolds such as: silk fibroin + bovine bone (SFB) and silk fibroin + bovine bone + Polycaprolactone (SFBP). The biomechanical, structural, and biological elements of the manufactured composite scaffolds were characterized in order to determine their suitability as a possible biomaterial for the production of bone tissue. The in vitro bioactivity of the two composite scaffolds was assessed in the simulated body fluids, and the swelling and degradation characteristics of the two developed scaffolds were analyzed separately over time. The results showed that the mechanical durability of the composite scaffolds was enhanced by the bovine bone particles, up to a specific concentration in the silk fibroin matrix. Furthermore, the incorporation of bone particles improved the bioactive composite scaffolds' capacity to generate hydroxyapatite in vitro. The combined findings show that the two 3D printed bio-composites scaffolds have the required mechanical strength and may be applied to regeneration of bone tissue and restoration, since they resemble the characteristics of native bone. 

56.	Memory switching versus threshold memory switching: Finding a promising synaptic device for brain-inspired artificial learning systems **MS Yadav, K Varshney, B Rawat** - ACS Applied Engineering Materials, 2024 **Abstract**: The integration of a selector layer with resistive switching devices has emerged as a promising strategy for developing large-scale cross-point memory by mitigating sneak path currents. However, their performance benefits in obtaining tunable states for emulating the synapses have remained unexplored. In this context, we investigate the device-to-cross-point array (CPA)-level performance of the NbO2–HfOx-based threshold selector-memory switching (TS-MS) device and explore the performance advantages over the HfOx-based memory switching (MS) device for artificial synapses using a fully calibrated multiscale modeling framework. Our findings reveal that the TS-MS device offers highly linear and symmetric long-term potentiation (LTP) and long-term depression (LTD) over the HfOx-based MS device. The NbO2–HfOx-based TS-MS device demonstrates more linear conductance modulation and well-separated multilevel-state operations, which result in a 1.7× reduction in reading inaccuracy and a 4.6× improvement in power efficiency (PE) compared to the MS device, particularly in a 64 × 64 cross-point array under worst-case scenarios. Furthermore, the application of the TS-MS-based bioinspired learning system, with a 15 × 6 cross-point array (CPA), reveals enhanced recognition accuracy and power efficiency over the MS-based cell for a 5 × 3 pixel grayscale image, even in the presence of high noise percentages and intercell wire resistance. Notably, the TS-MS-based CPA demonstrates around 3× reduction in average energy consumption compared to the MS-based CPA for recognizing digital digits. The comprehensive analysis presented in this study suggests that the TS-MS device stands out as a more viable candidate for hardware implementations of brain-inspired artificial learning systems.
57.	Modeling and tuning the electronic, mechanical and optical properties of recently synthesized 2D polyaramids: A first principles study M Singh, **SP Kaur**, B Chakraborty - Physical Chemistry Chemical Physics, 2024 **Abstract:** This work delves into a methodology of modeling 2D materials, considering an example of a recently synthesized 2D Polyaramids (2DPA-1) and its structural engineering with hole and electron doping. A bottom-up approach similar to experimental techniques is implemented for modeling, and then its electronic structures, phonon spectrum, and quadratic nature of flexural phonon are analyzed. Further, electron- and hole-doping, modeled by substituting the carbon atom of the amide group of 2DPA-1 with Boron and Nitrogen, and their effect on the electronic, phononic spectrum and mechanical properties compared with pristine one using density functional theory calculations. The ab initio molecular dynamics (AIMD) simulations validate the thermal stability of our system at high temperatures. The spin-polarized electronic structures reveal the transformation of pristine 2DPA-1 from semiconductors to half-metallic and magnetism with nitrogen substitution. Finally, validation of our methodology is confirmed as computed Young's modulus (11.26-11.76 GPa) matching excellently with the experimental values (12.7±3.8 GPa). Also, constraining the quadratic nature of flexural phonons using the Born-Huang criteria significantly enhances the phonon spectra, leading to more accurate and reliable simulations. For modulated 2DPA-1, the elastic modulus varies between 17-27 N/m, and the absorption peaks shift from ~3.57 eV to 0.67 eV, opening the application of polymeric 2D nanomaterial in photocatalysts and sensors where light absorption in near-infrared is important. Overall, this study reveals the modeling of newly synthesized polymeric 2D material and tuning its properties with smaller bandgaps, half-metallic and magnetic properties.
58.	Modulating electrolyte solvation for high-performance aqueous zinc–sulfur batteries **TS Thomas, AP Sinha, D Mandal** - Journal of Materials Chemistry A, 2024 **Abstract**: Rechargeable aqueous zinc/sulfur (Zn/S) batteries are promising candidates for large-scale energy storage applications owing to their high specific capacity and energy density with

	additional advantages of zinc and sulfur being abundant and cost-effective. However, practical application is impeded by the poor reversibility of the sulfur cathode and parasitic reactions at the Zn anode, limiting their capacity and cycling life. To address these challenges, an aqueous hybrid electrolyte comprising dimethylacetamide (DMA) as a high-donor number organic cosolvent and ZnI2 as an additive was developed. The designed hybrid electrolyte helps in facile sulfur conversion and efficiently suppresses the HER and corrosion by reconstructing the solvation shell of zinc ions, thereby facilitating uniform Zn deposition. The designed Zn/S battery exhibits improved electrode reversibility with a specific capacity of 1453 mA h g−1 at 0.1 A g−1 and 72% capacity retention at 5 A g−1 over 300 cycles. The DMA-modified electrolyte presents a novel approach for utilizing high donor-number solvents to mitigate water-induced side reactions in other aqueous metal–sulfur batteries.
59.	Molecular dynamics simulation of salt diffusion in constituting phosphazene-based polymer electrolyte **S Kaur**, S Swayamjyoti, **V Taneja**, **SS Padhee**…**KC Jena** - Journal of Physics: Condensed Matter, 2024 Abstract: A growing demand to visualize polymer models in liquid poses a computational challenge in molecular dynamics (MD) simulation, as this requires emerging models under suitable force fields to capture the underlying molecular behaviour accurately. In our present study, we have employed TIP3P potential on water and all atomistic optimized potentials for liquid simulations force fields to study the liquid electrolyte behavior of phosphazene-based polymer by considering its potential use in lithium-ion polymer batteries. We have explored the polymer's local structure, chain packing, wettability, and hydrophobic tendencies against the silicon surface using a combination of a pseudocontinuum model in MD simulation, and surface-sensitive sum frequency generation (SFG) vibrational spectroscopy. The finding yields invaluable insights into the molecular architecture of phosphazene. This approach identifies the importance of hydrophobic interactions with air and hydrophilic units with water molecules in understanding the behavior and properties of phosphazene-based polymers at interfaces, contributing to its advancements in materials science. The MD study uniquely captures traces of the polymer-ion linkage, which is observed to become more pronounced with the increase in polymer weight fraction. The theoretical observation of this linkage's influence on lithium-ion diffusion motion offers valuable insights into the fundamental physics governing the behavior of atoms and molecules within phosphazene-based polymer electrolytes in aqueous environments. Further these predictions are corroborated in the molecular-level depiction at the air-aqueous interface, as evidenced from the OH-oscillator strength variation measured by the SFG spectroscopy. The fundamental findings from this study open new avenues for utilizing MD simulation as a versatile methodology to gain profound insights into intermolecular interactions of polymer. It could be useful in the application of biomedical and energy-related research, such as polymer lithium-ion batteries, fuel cells, and organic solar cells.
60.	Multi-objective GA to schedule task graphs on heterogeneous voltage frequency islands Sanchit, N Singh, **J Singh** - Concurrency and Computation: Practice and Experience, 2024 **Abstract:** Energy consumption of multiprocessor's system is increasing day by day. The capability of multiprocessor systems and high compute-intensive tasks play a major role in increasing energy consumption. Voltage frequency island (VFI) architecture partitioned the cores into groups for which voltage/frequency can be controlled by a single switch. VFI plays a major role in optimizing the energy consumption. We have generated the initial population by using the slot technique to VFI architecture. The genetic algorithm studied by many researchers to solve scheduling problems. So we combined the genetic algorithm with the VFI-enabled architecture and slot approach called VFIGen. Then apply the VFIGen algorithm to optimize the energy consumption. When comparing the results of the proposed one with the existing state-of-art we achieved the performance gain by to 28% to 39%.

61.	Multifaceted role of mTOR (mammalian target of rapamycin) signaling pathway in human health and disease V Panwar, A Singh, **M Bhatt**… - Signal Transduction and Targeted Therapy, 2023 **Abstract:** The mammalian target of rapamycin (mTOR) is a protein kinase that controls cellular metabolism, catabolism, immune responses, autophagy, survival, proliferation, and migration, to maintain cellular homeostasis. The mTOR signaling cascade consists of two distinct multi-subunit complexes named mTOR complex 1/2 (mTORC1/2). mTOR catalyzes the phosphorylation of several critical proteins like AKT, protein kinase C, insulin growth factor receptor (IGF-1R), 4E binding protein 1 (4E-BP1), ribosomal protein S6 kinase (S6K), transcription factor EB (TFEB), sterol-responsive element-binding proteins (SREBPs), Lipin-1, and Unc-51-like autophagy-activating kinases. mTOR signaling plays a central role in regulating translation, lipid synthesis, nucleotide synthesis, biogenesis of lysosomes, nutrient sensing, and growth factor signaling. The emerging pieces of evidence have revealed that the constitutive activation of the mTOR pathway due to mutations/amplification/deletion in either mTOR and its complexes (mTORC1 and mTORC2) or upstream targets is responsible for aging, neurological diseases, and human malignancies. Here, we provide the detailed structure of mTOR, its complexes, and the comprehensive role of upstream regulators, as well as downstream effectors of mTOR signaling cascades in the metabolism, biogenesis of biomolecules, immune responses, and autophagy. Additionally, we summarize the potential of long noncoding RNAs (lncRNAs) as an important modulator of mTOR signaling. Importantly, we have highlighted the potential of mTOR signaling in aging, neurological disorders, human cancers, cancer stem cells, and drug resistance. Here, we discuss the developments for the therapeutic targeting of mTOR signaling with improved anticancer efficacy for the benefit of cancer patients in clinics.
62.	Multi-UAV assisted flood navigation of waterborne vehicles using deep reinforcement learning **A Garg, SS Jha** - Journal of Computing and Information Science in Engineering, 2024 **Abstract:** During disasters, such as floods, it is crucial to get real-time ground information for planning rescue and response operations. With the advent of technology, unmanned aerial vehicles (UAVs) are being deployed for real-time path planning to provide support to evacuation teams. However, their dependency on expert human pilots for command and control limits their operational capacity to the line-of-sight range. In this article, we utilize a deep reinforcement learning algorithm to autonomously control multiple UAVs for area coverage. The objective is to identify serviceable paths for safe navigation of waterborne evacuation vehicles (WBVs) to reach critical location(s) during floods. The UAVs are tasked to capture the obstacle-related data and identify shallow water regions for unrestricted motion of the WBV(s). The data gathered by UAVs is used by the minimum expansion A* (MEA*) algorithm for path planning to assist WBV(s). MEA* addresses the node expansion issue with the standard A* algorithm, by pruning the unserviceable nodes/locations based on the captured information, hence expediting the path planning process. The proposed approach, MEA*MADDPG, is compared with other prevalent techniques from the literature over simulated flood environments with moving obstacles. The results highlight the significance of the proposed model as it outperforms other techniques when compared over various performance metrics. 
63.	Nanoscale spin rectifiers for harvesting ambient radiofrequency energy **R Sharma**, T Ngo, E Raimondo… - Nature Electronics, 2024

	Abstract: Radiofrequency harvesting using ambient wireless energy could be used to reduce the carbon footprint of electronic devices. However, ambient radiofrequency energy is weak (less than −20 dBm), and the performance of state-of-the-art radiofrequency rectifiers is restricted by thermodynamic limits and high-frequency parasitic impedance. Nanoscale spin rectifiers based on magnetic tunnel junctions have recently demonstrated high sensitivity, but suffer from a low a.c.-to-d.c. conversion efficiency (less than 1%). Here we report a sensitive spin rectifier rectenna that can harvest ambient radiofrequency signals between −62 and −20 dBm. We also develop an on-chip co-planar-waveguide-based spin rectifier array with a large zero-bias sensitivity (around 34,500 mV mW−1) and high efficiency (7.81%). The performance of our spin rectifier array relies on self-parametric excitation, driven by voltage-controlled magnetic anisotropy. We show that these spin rectifiers can be used to wirelessly power a sensor at a radiofrequency power of −27 dBm.
64.	On-resin synthesis of Lanreotide epimers and studies of their structure–activity relationships **A Chowdhury, NM Tripathi**, …**A Bandyopadhyay** - RSC Medicinal Chemistry, 2024 **Abstract:** Peptide drugs often accompany epimeric impurities (isomers). Therefore, efficient chemical synthesis of epimers is critical to identify them correctly and investigate their biological activities. Here, we report the rapid synthesis and structure–activity relationship (SAR) studies of eight possible epimers of a somatostatin synthetic analog (SSA), lanreotide (LAN). SPPS and the subsequent on-resin rapid disulfide closure method offered >90% conversion yield for all epimers (P1–P8). Further, we developed an analytical method to separate these epimers, which enabled the profiling of five epimeric impurities in the API, purchased for Somatuline generic formulations. In SAR studies, most LAN epimers revealed compromised antiproliferative activity, while the P7 epimer retained antiproliferative activity similar to LAN API, as supported by in silico SAR studies in detail. Additionally, P7 showed serum stability nearly identical to LAN, suggesting that drug epimers could be a potential API. Current studies will further encourage the development of novel SSA scaffolds.
65.	Onset and growth of viscous fingering in miscible annular ring JS Hong, **L Palodhi, M Mishra**, MC Kim - Physics of Fluids, 2024 **Abstract:** We investigate the onset and growth of viscous fingering (VF) of miscible annulus in a radial Hele-Shaw cell. Systematic numerical study on a finite annulus domain is performed by employing finite element method solver in COMSOL Multiphysics software. We justify that concentration field analysis is not a good choice for dynamic study in radial flows. Instead, velocity magnitude is a better tool to understand the dynamics. Therefore, we propose velocity field analysis to better differentiate the stable and unstable states and present a new stability criterion using the velocity field method. Most interestingly, using the velocity field analysis and the new stability criterion, we show a restabilization of the VF at a critical time when the system becomes diffusion dominant and able to provide both the onset time, τon (time at which instability develops), and the time at which the interface returns to the stable state, τd. Furthermore, the study successfully suggests the critical values for several dimensionless parameters, the Péclet number (Pe), log-viscosity ratio (R), and volumetric ratio (ra) and time (τ), to induce instability. When Pe is higher than 103, the evolution of VF instability is no longer enhanced by Pe, and Rc converges to a certain value. In particular, for the transiently unstable system of low Pe, the restabilization of VF instability is identified even though R is higher than Rc. The unstable system returns to the stable state as injection time increases further. Moreover, we obtained a critical value of the volumetric ratio (r c , a).
66.	Optimizing location and power of chargers to reduce interference in battery-less WSNs A Kumar, **J Singh** - IEEE Sensors Journal, 2024 **Abstract:** Battery-free wirelessly powered sensor networks (WPSNs) are an important step for Internet of Things (IoT) applications mainly towards achieving an infinite lifetime of sensing

	infrastructure. The nodes in battery-less WPSNs harvests and store energy in super-capacitors from RF signals that are periodically transmitted by power beacons or chargers. However, the sensor nodes covered by multiple power beacons become unreliable due to overlapping signals from chargers. In this paper, we minimize the number of power beacons keeping a focus on the unreliability because of the interference of signals in the heterogeneous battery-less wireless sensor networks (BL-WSN). We propose algorithms to first optimally place the power beacons (OPBL) and then to adapt the power of the chargers with an integer linear program (OPA-ILP) such that interfering nodes and data transmission time (DTT) can be reduced. Comprehensive simulation results show our proposed algorithms minimize the interfering nodes in 60% and 90% of cases respectively. The DTT is reduced by 30% in 36% of cases by OPBL and 50% in 72% of cases by OPA-ILP in comparison to the state-of-art.
67.	Optimizing power beacon deployment in battery-less wireless sensor networks for transforming e-commerce A Jaiswal, A Kumar, A Hazra, N Mazumdar, **J Singh** - IEEE Transactions on Consumer Electronics, 2024 **Abstract:** Integrating Internet of Things (IoT) and Wireless sensor networks (WSN) in E-commerce enhances supply chain visibility and ensures product quality through real-time tracking, revolutionizing inventory management system. IoT devices (IoTDs) gather extensive consumer data, enriching E-commerce databases. Using advanced analytics and machine learning, platforms create personalized recommendations, targeted ads, and customized promotions, enhancing customer engagement and loyalty. While IoT and WSN devices provide valuable insights for E-commerce applications, it's imperative to address their energy limitations to uphold quality of service. This article explores battery-less IoTDs powered by wireless Power Beacons (PBs). To address this challenge, we employed both omni-directional PBs and directional PBs for powering IoTDs. We have proposed a novel scheme for the optimal number of power beacons (ONPB) which is based on set cover problem. The Omni Directional Cliques (ODC) and Directional Cliques (DC) algorithms are employed to cover the IoTDs, followed by the optimization of PBs placement using the ONPB algorithm, leveraging both omni and directional PBs features.
68.	Oxidative Cleavage of α-O-4, β-O-4, and 4-O-5 Linkages in Lignin Model Compounds over P, N Co-doped Carbon Catalyst: A Metal-free Approach **A Chauhan, DR Kanchan, A Banerjee, R Srivastava** - ChemSusChem , 2024 **Abstract:** Developing efficient metal-free catalysts for lignin valorization is essential but challenging. In this study, a cost-effective strategy is employed to synthesize a P, N co-doped carbon catalyst through hydrothermal and carbonization processes. This catalyst effectively cleaved α-O-4, β-O-4, and 4-O-5 lignin linkages, as demonstrated with model compounds. Various catalysts were prepared at different carbonization temperatures and thoroughly characterized using techniques such as XRD, RAMAN, FTIR, XPS, NH3-TPD, and HRTEM. Attributed to higher acidity, the P5NC-500 catalyst exhibited the best catalytic activity, employing H2O2 as the oxidant in water. Additionally, this metal-free technique efficiently converted simulated lignin bio-oil, containing all three linkages, into valuable monomers. Density Functional Theory calculations provided insight into the reaction mechanism, suggesting substrate and oxidant activation by P-O-H sites in the P5NC-500, and by N-C-O-H in the CN catalyst. Moreover, the catalyst's recyclability and water utilization enhance its environmental compatibility, offering a highly sustainable approach to lignin valorization with potential applications in various industries.
69.	Ozone nanobubble technology as a novel AOPs for pollutants degradation under high salinity conditions **P Koundle, N Nirmalkar**, M Momotko, G Boczkaj - Water Research, 2024

	Abstract: Conventional water treatment systems frequently exhibit diminished efficiency at high salinity - a significant issue especially for real industrial effluents - mostly due to the creation of intricate structures between pollutants and salts. One of the primary obstacles associated with high salinity conditions is the generation of by-products that pose additional hurdles for treatment. In this work, we have investigated the novel advanced oxidation process a so-called ozone nanobubble technology for degradation of the pollutants at high salinity conditions. The mass transfer is often the rate-limiting step in gas-liquid process and the poor rate of mass transfer diminishes the overall efficacy. One of the primary disadvantages associated with ozone is its restricted solubility and instability when dissolved in an aqueous solution. These characteristics impose limitations on its potential applications and need the use of specialized systems to facilitate gas-liquid interaction. In this work, we have also suggested enhancing the ozonation process through the utilization of ozone nanobubbles. The findings of our experiment and subsequent analysis indicate that the presence of nanobubbles enhances the process of ozonation through three key mechanisms: (i) an increased mass transfer coefficient, (ii) a higher rate of reactive oxygen species (ROS) generation attributed to the charged interface, and (iii) the nanobubble interface serving as an active surface for chemical reactions. The predicted mass transfer coefficients were found to range from 3 to 3.5 min−1, a value that is notably greater than that seen for microbubbles. The study showcased the degradation of methylene blue dye through the utilization of ozone nanobubbles, which exhibited a much higher rate of dye degradation compared to ozone microbubbles. The confirmation of the radical degradation mechanism was achieved by the utilization of electron spin resonance (ESR) measurements. The developed process has high potential for application in industrial scale textile wastewater treatment.
70.	PA-RDFKNet: Unifying plant age estimation through rgb-depth fusion and knowledge distillation **S Bansal, M Singh, S Barda, N Goel, M Saini** - IEEE Transactions on AgriFood Electronics, 2024 **Abstract:** Agriculture is facing bigger challenges in the 21st century due to the scarcity of resources. Artificial intelligence is being integrated with agriculture to cater to people's needs, unlocking fresh avenues for sustainability and innovation. One of the crucial agricultural practices is plant growth monitoring to detect plant stress at an early stage. In the past, there have been preliminary attempts at plant growth monitoring using red–green–blue (RGB) and depth images. The major challenge of this approach is the unavailability of the depth camera at the farmers' end. In this work, we have developed a transformer-based plant age RGB-depth fusion knowledge distillation network (PA-RDFKNet), a multi-to-single modal teacher–student network, that exploits the combined knowledge of RGB-depth pairs at the training time to infer the growth using RGB images alone during test time. The model uses a distillation loss that combines response-based, feature-based, and relation-based knowledge distillation techniques in the offline scheme. The proposed knowledge distillation improves the mean squared error for RGB images from 2 to 0.14 weeks. The results are validated on three different datasets.
71.	Performance evaluation of neonatal anti-pressure ulcer bed using a novel force-sensing array **A Mallick, B Basumatary, M Kumar**, K Arora, **D Pal, A Sahani** - Journal of Medical Devices, 2024. **Abstract:** Pressure ulcer (PU) is a serious issue among newborns, particularly those who are premature and have medical conditions that require hospitalization. Existing conventional beds require modifications that can reduce the chance of PU and the extra effort of nursing staff. In this work, a force-sensing resistor array (FSRA) mattress is implemented that detects high-pressure points. The microcontroller processes the data that are collected from the FSRA using an electronic circuit based on the principle of voltage divider circuits. The multiplexer identifies the pixels of high-pressure points and plots the heat maps using matlab. The results of the FSRA mattress use an alternately inflating and deflating pressure channel bed to act as an anti-PU bed

	and compare it with the currently deployed bed. The demonstrated work was validated using the finite element modeling framework. This anti-PU bed is effective in detecting high-pressure points; based on that, chances of PUs in neonates can be prevented. The performance evaluation of the designed and tested anti-PU bed with more accuracy and automatically varies the contact position to reduce the efforts made by the nursing staff. This innovation significantly improves the quality of life as compared to the conventional methods to avoid PUs for neonatal intensive care units (NICUs).
72.	Polystyrene nanofibrous membrane infused with TiO2 nanoparticles by a one-step electrospinning process for effective oil–water separation K Thota, R Araga, **M Sabapathy**, M Kakunuri - Industrial & Engineering Chemistry Research, 2024 **Abstract:** The challenge of oil pollution presents a substantial threat to both the environment and the economy. It is imperative to tackle this issue by creating innovative materials that can efficiently separate oil and water. In this study, we have successfully prepared a novel nanofibrous composite membrane by single-step electrospinning utilizing a polystyrene precursor embedded with titanium dioxide for the effective separation of water-in-oil emulsion. We analyze the morphology, water contact angle, absorption capacity, and oil permeating flux of the prepared composite membrane and compare the results with those of the pristine polystyrene nanofibrous membrane. The membrane embedded with TiO2 nanoparticles exhibited a high-water contact angle of ∼155 ± 1.5°, surpassing that of the pristine polystyrene nanofibrous membrane. We assessed the oil absorption capacity of the prepared membranes across five different oil–water mixtures, with the highest recorded absorption capacity reaching approximately 103 g of oil/g of the membrane. Furthermore, in separating W/O emulsion, the composite membrane attains a permeate flux of ∼1543 ± 59 L/m2h.
73.	Predicting the electrophoretic mobility of charged particles in an aqueous medium **V Kumar, N Kumar,** U Ghosh, **SK Sinha** - Langmuir, 2024 **Abstract**: Electrophoresis of charged particles has important applications in biochemical separation processes. The mobility of these particles depends on the surrounding electric double layer (EDL), which is impacted by solvent restructuring because of hydration interactions. Nevertheless, most theoretical estimates ignore such interactions during computation of the electrophoretic mobility. Here, we employ a complementary blend of mean-field analysis and molecular dynamics simulations performed for a peptide–G-quadruplex complex to assess how hydration interactions alter the mobility of a charged particle in an aqueous medium. These interactions are seen to stabilize the EDL, resulting in more significant localized counterion concentrations while strengthening the ensuing electrokinetic flow. The ordering of ions near the particle surface is obtained only upon including hydration interaction, revealing that the hydration water molecules act as a glue for forming a stable EDL, a key finding of this work. Conversely, the observed microstructure of ions near the charged surface as obtained from our theory establishes a bridge link between the micro and continuum model. The presence of larger counter ions enhances the drag on the particle, thus restricting its mobility. The mobility also becomes dependent on size, which may be useful for isolating a wide array of biomolecules. The impact of hydration interactions intensifies with increases in particle size, surface charge density, and bulk ion concentration.
74.	Semi-analytical study of reduction of wave impact on an elastic plate in the presence of a vertical porous structure **G Sahoo, SC Martha** - Acta Mechanica, 2024 **Abstract:** Based on the small-amplitude water wave theory, the usefulness of a vertical porous structure extending from top to bottom of finite width to reduce the wave-induced

	hydrodynamics responses of an elastic plate that is floating freely on the free surface is studied. The fluid flow inside the porous structure is based on Sollitt and Cross model, and the elastic plate is modeled using the thin plate theory. A generalized code based on the eigenfunction expansion method is developed for solving the boundary value problem. Scattering coefficients and various hydrodynamic parameters related to the wave scattering, such as wave forces on the porous structure, free surface elevation, elastic plate deflection, shear force, and strain, are analyzed for various waves and structural parameters of porous structure and elastic plate. It is found that the values of the scattering coefficients are less with progressively increasing width and frictional coefficient of the porous structure. As more wave is dissipated by the porous structure with an increase in frictional coefficient, as a result, the free surface elevation, plate deflection, shear force, and strain decrease with an increase in frictional coefficient. Moreover, with the distance between the porous structure and the elastic plate, the scattering coefficients and forces on the porous structure follow a periodic and oscillatory pattern. This model is expected to be of great help in protecting different coastal assets.
75.	SHIELD: A secure heuristic integrated environment for load distribution in rural-AI **A Kaushal**, O Almurshed, O Almoghamis…**N Auluck**… - Future Generation Computer Systems, 2024 **Abstract**: The increasing adoption of edge computing in rural areas is leading to a substantial rise in data generation, necessitating the need for development of advanced load balancing algorithms. This is particularly important in applications that utilise existing, though limited, computational and data communication infrastructures. Furthermore, rural communities have growing concerns regarding the privacy, security, and ownership of the data produced within their agricultural fields. Load distribution in rural edge devices can enhance agricultural practices by improving resource usage, decision-making, and addressing network connectivity challenges. Managing resource utilisation in this way also improves economic investments made in managing and deploying edge devices in rural environments. In this work, we propose SHIELD, a security-aware load balancing framework, primarily designed for edge-based systems in rural areas. For handling environments with limited connectivity, SHIELD efficiently manages tasks and computational resources by categorising them into restricted, public and private, shared respectively. It also allocates tasks considering key performance factors such as completion time, resource utilisation, failure rate, and security. The framework is evaluated on a weed detection scenario in precision agriculture, using three federated learning (FL) variants (local model training, global model aggregation, and model prediction) with the ResNet-50 model trained on the DeepWeeds image classification dataset. The proposed framework also integrates encryption and task replication techniques for data confidentiality, integrity, and availability. Experimental results show that SHIELD demonstrates an average of 23% (using Parsl), 29% (using OpenWhisk) improvement in failure rate and 18 s (Parsl), 13 s (OpenWhisk) average improvement in makespan compared to other task allocation approaches, such as secure variants of random, round robin, and least loaded.
76.	Shielding against breast tumor relapse with an autologous chemo-photo-immune active Nano–Micro-Sera based fibrin implant M Mimansa, **MA Zafar**, DK Verma, R Das, **JN Agrewala**,… - Nanoscale, 2024 **Abstract**: Local recurrence post-surgery in early-stage triple-negative breast cancer is a major challenge. To control the regrowth of a residual tumor, we have developed an autologous therapeutic hybrid fibrin glue for intra-operative implantation. Using autologous serum proteins as stabilizers, we have optimized high drug-loaded lapatinib-NanoSera (Lap-NS; ~66% L.C.) and imiquimod-MicroSera (IMQ-MS; ~92% L.C). Additionally, plasmonic nanosera (PNS) with an ~67% photothermal conversion efficiency under 980 nm laser irradiation was also developed. While localized monotherapy with either Lap-NS or PNS reduced the tumor regrowth rate, their combination with IMQ-MS amplified the effect of immunogenic cell death with a high level of

	tumor infiltration by immune cells at the surgical site. The localized combination immunotherapy with a Nano–MicroSera based hybrid fibrin implant showed superior tumor inhibition and survival with significant promise for clinical translation.
77.	SpiMAM: CMOS implementation of bio-inspired spiking multidirectional associative memory featuring in-situ learning **SK Vohra, M Sakare**, AP James, **DM Das** - IEEE Transactions on Circuits and Systems I: Regular Papers, 2024 **Abstract**: Associative memory (AM) robustly retrieves information from given partial data. Compared to artificial neural network (ANN)-based AM, spiking neural network (SNN)-based AM offers greater bio-plausibility, sparsity, and message storage capacity. Recently, an ANN-based multidirectional associative memory neural network (MAMNN) for handling multiple associations was implemented by extending an ANN-based bidirectional associative memory (BAM) neural network. In comparison, this study implements SpiMAM, a more bio-plausible MAMNN based on SNN with a winner-take-all mechanism. The circuit design of spiking MAMNN (SpiMAM) employing in-situ synaptic training was proposed for the first time. Instead of a memristor device or memristor model, a CMOS circuit of a memristive synapse featuring spike-timing-dependent-plasticity (STDP) is used to incorporate the CMOS integrated circuit challenges. The synaptic weights in the crossbar for storage and association of patterns were trained on-chip without requiring additional computing platforms and digital circuitry attached to the synapse. The entire circuit of the spiking MAMNN was implemented at the transistor-level in 180 nm standard CMOS technology to demonstrate pattern recognition applications. The robustness of the proposed circuit of SpiMAM was evaluated through post-layout simulations for PVT, mismatch variation, pixel flip, hard faults, memristive drifts, and Gaussian noise. Compared to the previous work, this work uses 86 % fewer synapses and 70 % fewer neurons for the pattern recognition of nine binary images of 5 × 3 pixel size.
78.	Staggered band alignment of n-Er2O3/p-Si heterostructure for the fabrication of a high-performance broadband photodetector A Ghosh, **R Wadhwa, Shivani**, S Deswal…**M Kumar** - Nano Express, 2024 **Abstract**: The low responsivity of conventional Silicon photodiodes in ultraviolet and near-infrared regimes restricts their utility as broadband photodetectors (BBPDs). Despite ongoing investigations into various p-n heterostructures for Silicon-based BBPDs, challenges such as high dark current (Idark), low collection efficiency, low detectivity, and compatibility issues with large-scale Silicon-based devices persist. In this context, we have fabricated relatively unexplored n-Er2O3/p-Si heterojunction-based BBPDs. Polycrystalline Er2O3 thin films (∼110 nm) were deposited on p-Si 〈100〉 substrates by radio frequency magnetron sputtering. Although this process induces a microstrain of approximately 0.022 and a dislocation density of about 0.00303/nm2, the presence of optically active defects is minimal, indicated by a low Urbach energy (∼0.35 eV). X-ray photoelectron spectroscopy (XPS) analysis confirms staggered band alignment at the heterointerface, facilitating efficient charge carrier separation and transport. Consequently, the In/p-Si/n-Er2O3/In device demonstrated significant BBPD properties– low Idark ∼0.15 μA (at +5 V), photo-to-dark current ratio (PDCR) ∼6.5 (at +5 V, 700 nm) with a maximum photoresponsivity ∼22.3 A W−1, and impressive detectivity (∼1013 Jones) even in UV-C region where traditional silicon-based photodetectors respond feebly. The device also demonstrates transient photo-response across an ultrawide spectrum (254 nm–1200 nm) with a fast rise time/fall time ∼79 ms/∼86 ms (at −5 V for 600 nm illumination). This work establishes a straightforward and reliable method for proper material engineering, surface texturing, staggered heterojunction formation, and high-performance BBPD fabrication with prominent broad-spectrum responsivity, sizeable detectivity, and fast response. The integration of these BBPDs with Silicon opens possibilities for their use in electronic devices containing optical

	switches for communications and broadband image sensors, enhancing their utility in various applications.
79.	Sustainable local seismic culture in vernacular buildings of the Indian Himalayas: Field observations, knowledge dissemination, and recommendations **D Baldev, T Modgil, M Surana, P Haldar**… - International Journal of Disaster Risk Reduction, 2024 **Abstract**: Vernacular buildings are the classic examples of sociocultural development, centuries of experience, and empirical knowledge gained from past earthquakes to construct climate-cum-earthquake resistant indigenous buildings in seismic-prone regions across the globe. Vernacular buildings are constructed using re-usable or re-cyclable materials with a low carbon footprint and are thus sustainable, and these buildings also follow local seismic culture in their building attributes. Elaborate field investigations are conducted in the Indian Himalayas to investigate the local seismic culture in prevalent vernacular building systems, namely, Kath-Kunni, Thathara, Taq, Dhajji-Dewari, Ikra, and Rammed-earth. Based on field observations, these building systems are rated to understand their relative merits/de-merits for earthquake-resiliency and construction sustainability attributes. Simple, ready-to-use sketches are developed to disseminate the construction process of vernacular buildings. Further, recommendations are made to overcome deficits and promote vernacular buildings for earthquake-resilient sustainable development in the Indian Himalayas.
80.	Sustainable production of powder feedstock from machining waste using modulation-assisted drilling **M Singh**, S Dhiman, **H Singh**… - The International Journal of Advanced Manufacturing Technology, 2024 **Abstract:** High-quality metal and alloy powder feedstock for powder metallurgy (PM) and additive manufacturing (AM) is typically expensive due to stringent physical and chemical requirements. The increasing demand for such powders drives innovation toward more sustainable and cost-effective production methods. In this study, we demonstrate the generation of discrete machining chips (MCs) with controlled characteristics during modulation-assisted drilling of Inconel-718 nickel superalloy. To achieve this, a full factorial experimental design, varying modulation frequency (fm) and amplitude (2A) (two factors: fm and 2A, multi-level: 7 and 5, respectively) was used to define discrete and continuous cutting regimes. Furthermore, the effect of individual modulation (fm and 2A) and machining parameters (drill tool diameter, D, and feed rate, h) on the characteristics of MCs was investigated systematically. The findings reveal direct linear relationships between the investigated parameters, i.e., D, fm, and 2A, on chip characteristics: length, width, and thickness, respectively. Specifically, the average chip length was 10–40% smaller than the length of each cutting edge of the drill tool; the average chip width reduces by 17 % when fm increases from 184 to 251 Hz. Similarly, the average chip thickness increases to 80% when 2A increases from 3.6 to 27.5 μm, confirming the generation of MCs having controllable characteristics. As established using a comprehensive comparative analysis, generated MCs (size range: 100–1200 μm) can be used as feedstock directly in press-and-sinter PM and solid-state friction-stir AM technologies. Additionally, the reusability of these MCs can be further enhanced by converting them into finer powder with a well-defined size distribution via ball milling (average particle size < 100 μm having angular morphology, in the present case), promoting a circular economy by repurposing high-value industrial machining waste into useful products.
81.	The multifaceted roles of circular RNAs in cancer hallmarks: From mechanisms to clinical implications **I Kundu, S Varshney**, S Karnati**, S Naidu** - Molecular Therapy-Nucleic Acids, 2024

	Abstract: Circular RNAs (circRNAs) represent a distinct class of covalently closed RNA species lacking conventional 5' to 3' polarity. Derived predominantly from pre-mRNA transcripts of protein-coding genes, circRNAs arise through back-splicing events of exon-exon or exon-intron junctions. They exhibit tissue- and cell-specific expression patterns and play crucial roles in regulating fundamental cellular processes such as cell cycle dynamics, proliferation, apoptosis, and differentiation. CircRNAs modulate gene expression through a plethora of mechanisms at epigenetic, transcriptional, and post-transcriptional levels, and some can even undergo translation into functional proteins. Recently, aberrant expression of circRNAs has emerged as a significant molecular aberration within the intricate regulatory networks governing hallmarks of cancer. The tumor-specific expression patterns and remarkable stability of circRNAs have profound implications for cancer diagnosis, prognosis, and therapy. This review comprehensively explores the multifaceted roles of circRNAs across cancer hallmarks in various tumor types, underscoring their growing significance in cancer diagnosis and therapeutic interventions. It also details strategies for leveraging circRNA-based therapies and discusses the challenges in utilizing circRNAs for cancer management, emphasizing the need for further research to overcome these obstacles.
82.	The power-law fluids staggered circular cylinders in laminar forced convection: An optimization study **KK Agarwal, N Dutt, P Suri, SA Patel** - Journal of Fluid Flow, Heat and Mass Transfer, 2024 **Abstract**: In this study, for power-law fluids, a two-dimensional heat transfer analysis was performed in a circular cylinder to determine the ideal distance between cylinders in equilateral triangle configurations for forced convection in free stream crossflow. The cylinder array is in contact with a free stream of a specific temperature and velocity while occupying a set volume. The optimal cylinder-to-cylinder spacing is determined by maximizing the overall thermal conductance between all the cylinders and the free stream. The numerical study was conducted to maximize the heat transfer rate over the range of Reynolds number, $40 \leq Re \leq 200$; power-law index, $0.2 \leq n \leq 1.3$; Prandtl number, $1 \leq Pr \leq 100$; and geometries with spacing from cylinder-to cylinder, $0.5 \leq S/D \leq 2$. The governing equations have been solved for the steady state flow over the range of parameters by employing finite-element numerical scheme. The flow and thermal field by using hot cylinder arranged in triangular array is analysed by plotting the streamlines and isotherms. The thermal heat conductance increases for the shear thinning fluids as Reynolds number increases and on further increasing the Prandtl number. The relation for thermal heat conductance with Prandtl number for extreme values of Reynolds number is also shown for different values of power-law index.
83.	The synergy of alloyed Pd and Ni over H-NbOx: Enhancing hydrogenation of lignin derivatives and lignin bio-oil into cyclic hydrocarbons and alcohols **G S More**, R Bal, **R Srivastava** - ACS Sustainable Chemistry & Engineering, 2024 **Abstract:** The study aims to investigate the hydrogenation of lignin-derived bio-oil (known as lignin bio-oil) and β-O-4 linkages, which are representative lignin model compounds. The hydrogenation of these molecules produces cyclic hydrocarbons and aromatic platform chemicals. H-NbOx was synthesized using a hydrothermal method, followed by an acid treatment of Nb2O5. Three wt % Pd and 3 wt % Ni were deposited over H-NbOx to form an alloyed PdNi/H-NbOx catalyst. XPS, NH3-TPD, and O2-TPD revealed intrinsic active sites, metal–support interactions, and modified oxygen vacancies, making it highly efficient for the hydrogenation of 2-phenoxy-1-phenylethanol (PPE-OL) in dodecane using 3 MPa hydrogen. The hydrogenation of PPE-OL yielded >98% cyclic hydrocarbons (cyclohexane and ethyl cyclohexane). In contrast, 3Pd/H-NbOx and 3Ni/H-NbOx showed varied selectivity, producing a mixture of ethylbenzene, phenol, ethyl cyclohexane, and cyclohexanol. Notably, catalytic transfer hydrogenation (CTH) resulted in the formation of >99% aromatics (phenol and ethylbenzene) in isopropanol. Expanding the investigation from model compounds, PdNi/H-NbOx was utilized to

	hydrogenate lignin bio-oil derived from wheat straw, yielding saturated cyclic alcohols with a high yield at 250 °C in isopropanol. It underscores the potential of the developed protocol to effectively meet energy demands by generating aromatics via catalytic transfer hydrogenation and cyclic hydrocarbons via hydrogenation.
84.	Thermal convection of viscoelastic fluids in concentric rotating cylinders: Elastic turbulence and kinetic energy budget analysis **A Chauhan, C Sasmal** - Physical Review Fluids, 2024 **Abstract:** The introduction of solid polymers into a Newtonian solvent induces significant modifications in the flow behavior and heat transfer characteristics of resulting viscoelastic fluids. This study performs a comprehensive numerical investigation of thermal convection within a system comprising two concentric horizontal cylinders filled with viscoelastic fluids, with the inner cylinder rotating. The analysis encompasses all three modes of thermal convection, namely, forced, free, and mixed convection, over a range of Weissenberg numbers up to 20 and three values of the Richardson number, namely, 0, 1.429, and ∞, representing forced, mixed, and free convection modes of heat transfer, respectively. In forced convection, the flow field remains stable, while in free and mixed convection, an increase in the Weissenberg number leads to a transition from steady to unsteady periodic, quasiperiodic, and, finally, an aperiodic and chaotic behavior. This transition arises due to the presence of elastic instability and the subsequent appearance of elastic turbulence in viscoelastic fluids with the increasing Weissenberg number. Furthermore, our findings indicate that fluid viscoelasticity has minimal influence on heat transfer rates in the cases of forced and free convection. Conversely, heat transfer rates in mixed convection decrease initially with the Weissenberg number, and then it remains almost constant on further increasing its value. We conduct a detailed analysis of the viscoelastic kinetic energy budget to elucidate this deterioration in the heat transfer rate for viscoelastic fluids. We show that this diminished heat transfer results from kinetic energy transfer from the flow structure to polymer molecules, leading to decreased bulk motion within the system and, eventually, lesser heat transfer rates.
85.	Tipping points, multistability, and stochasticity in a two-dimensional traffic network dynamics **SN Chattopadhyay, AK Gupta** - Chaos: An Interdisciplinary Journal of Nonlinear Science, 2024 **Abstract:** Mitigating traffic jams is a critical step for the betterment of the urban transportation system, which comprises a large number of interconnected routes to form an intricate network. To understand distinct features of vehicular traffic flow on a network, a macroscopic two-dimensional traffic network model is proposed incorporating intra-nodal and inter-nodal vehicular interaction. Utilizing the popular techniques of nonlinear dynamics, we investigate the impact of different parameters like occupancy, entry rates, and exit rates of vehicles. The existence of saddle-node, Hopf, homoclinic, Bogdanov–Takens, and cusp bifurcations have been shown using single or biparametric bifurcation diagrams. The occurrences of different multistability (bistability/tristability) phenomena, stochastic switching, and critical transitions are explored in detail. Further, we calculate the possibility of achieving each alternative state using the basin stability metric to characterize multistability. In addition, critical transitions from free flow to congestion are identified at different magnitudes of stochastic fluctuations. The applicability of critical slowing down based generic indicators, e.g., variance, lag-1 autocorrelation, skewness, kurtosis, and conditional heteroskedasticity are investigated to forewarn the critical transition from free flow to traffic congestion. It is demonstrated through the use of simulated data that not all of the measures exhibit sensitivity to rapid phase transitions in traffic flow. Our study reveals that traffic congestion emerges because of either bifurcation or stochasticity. The result provided in this study may serve as a paradigm to understand the qualitative behavior of traffic jams and to explore the tipping mechanisms occurring in transport

	phenomena.
86.	Towards a sustainable blockchain: A peer-to-peer federated learning based approach **V Agarwal, S Mishra, S Pal** - ACM Transactions on Internet Technology, 2024 **Abstract:** In the rapidly evolving digital world, blockchain technology is becoming the foundation for numerous applications, ranging from financial services to supply chain management. As the usage of blockchain is becoming more prevalent, the energy-intensive nature of this technology has raised concerns about its long-term sustainability and environmental footprint. To address this challenge, we explore the potential of Peer-to-Peer Federated Learning (P2P-FL), a distributed machine learning approach that allows multiple nodes to collaborate without sharing raw data. We present a novel integration of P2P-FL with blockchain technology, aimed at enhancing the sustainability and efficiency of blockchain networks. The basic idea of our approach is the use of distributed learning mechanisms to find the optimal performance parameters of blockchain without relying on centralized control. These parameters are then used by a load-balancing mechanism that prioritizes energy efficiency to distribute loads on different blockchains. Furthermore, we formulate a non-cooperative game theory model to align the individual node strategies with the collective objective of energy optimization, ensuring a balance between self-interest and overall network performance. Our work is exemplified through a case study in the renewable energy sector, demonstrating the application of our model in creating an efficient marketplace for energy trading. The experimentation and results indicate a significant improvement in the execution times and energy consumption of blockchain networks. Therefore, the overall sustainability of the network is enhanced, making our framework practical and applicable in real-world scenarios.
87.	Traces of Poincaré series at square discriminants and Fourier coefficients of mock modular forms **V Kalia, B Kumar** - Acta Arithmetica, 2024 **Abstract:** Jeon, Kang and Kim (2013) proved that the Fourier coefficients b(d,D) of mock modular form Gd of weight 3/2 for Γ0(4) can be interpreted in terms of the Hurwitz–Kronecker class number and modified traces of cycle integrals of a sesqui-harmonic Maass form Jˆ1 of weight 0 for SL2(Z). The function Jˆ1 is related to Klein's j-function via its image under hyperbolic Laplacian. Their result applies to the coefficients b(d,D) for which dD is not a square. In this paper, we define modified traces for square discriminants and express the coefficients b(d,D) with dD a square in terms of the Hurwitz–Kronecker class number and modified traces of cycle integrals of Jˆ1. Furthermore, we prove that the coefficient b(d,D) is the regularized inner product of weakly holomorphic modular forms of weight 1/2 for Γ0(4). As an application, we express the modified trace of Jˆ1 at a square discriminant in terms of the central critical value of the (non-existent) L-series of harmonic Maass form of 'dual' weight. The summands that emerge in the expression of the central critical value are linked to a classical expression of the Rademacher–Petersson type formula.
88.	U(VI) mitigation via forward osmosis: Elucidation of retention mechanisms and co-ion effects **M Verma, VA Loganathan** - Chemosphere, 2024 **Abstract:** Uranium (U) is a chemical and radioactive toxic contaminant affecting many groundwater systems. The focus of this study was to evaluate the suitability of forward osmosis (FO) for uranium rejection from contaminated groundwater under field-relevant conditions. Laboratory experiments with aqueous solution containing uranium were performed with FO membrane to understand the uranium rejection mechanism under varied pH, draw solution concentration, and presence of co-ions. Further, experiments were performed with U-contaminated field groundwater. Results of the hydrogeochemcial modelling using PHREEQC indicated that the rejection mechanism of uranium was highly dependent on aqueous speciation. Uranium rejection was maximum at alkaline pH with ca. 99% rejection due to charge-based

	interactions between membrane and dominant uranyl complexes. The results of the co-ion study indicated that nitrate and phosphate ions decrease uranium rejection. Whereas, bicarbonates, calcium, and magnesium ions concentrated uranium in feed solution. Further, the uranium adsorption onto the membrane surface primarily depended on pH of the aqueous solution with maximum adsorption at pH 5.5. Our results show that the World Health Organization's drinking water guideline value of 30 μgL−1 for U could be achieved via FO process in field groundwater containing low dissolved solids.
89.	Unique approach of modern automotive exhaust system mountings design for NVH improvement **AK Sarna, J Singh, N Kumar, V Sharma** - SAE International Journal of Commercial Vehicles, 2024 **Abstract**: Minimizing vibration transmitted from the exhaust system to the vehicle's passenger compartment is the primary goal of this article. With the introduction of regulatory norms on NVH behavior and emissions targets, it has become necessary to address these issues scientifically. Stringent emissions regulations increased the complexity of the exhaust system resulting in increased size and weight. Exhaust system vibration attenuation is essential not only from the vehicle NVH aspects but also for the optimized functionality of the subsystems installed on it. Based on earlier studies, this work adopts a more thorough strategy to reduce vehicle vibration caused by the exhaust system by adjusting it to actual operating conditions. To achieve this, a complete vehicle model of 22 DOF is considered, which consists of a powertrain, exhaust system, chassis frame, and suspension system. A method for evaluating static and dynamic vibration response is proposed. Through the use of the vehicle's rigid body modes and actual field events, design indicators are carefully analyzed and validated. Based on actual operating conditions, the two main load cases that are taken into consideration are idling and the sweet spot operating zone. To define the sweet spot zone of the dominant vehicle/engine-operating scenario, the vehicle duty cycle is monitored experimentally. The baseline 22 DOF model results show a degradation in exhaust vibration performance in both load cases as its yaw and bounce modes are falling into the resonance region of the idle and sweet spot operating zone load cases, respectively. The acceleration reduction of nearly 10–20 dB in static events, and nearly 10 dB in dynamic events can be evident in the proposed model. The proposed system's outcomes demonstrate an improvement in the eigenvalues of the yaw and bounce modes, which in turn enhances the vehicle's overall NVH performance in both static and dynamic load cases. Thus, the study suggests that designers should consider the real field events' load cases for modern exhaust system-mounting optimization to achieve improvement in NVH behavior, fuel efficiency, emissions performance, and durability aspects of the vehicle.
90.	Unraveling the dynamics of HfO2-based NW-CTT as an artificial synapse **A Goel,** MHR Ansari, **B Rawat**... - IEEE Transactions on Electron Devices, 2024 **Abstract:** In this work, we investigate the synaptic characteristics of HfO2-based nanowire-charge trap transistor (NW-CTT) using a fully calibrated 3-D technology computer-aided design (TCAD) simulation, based on self-consistent solutions of 3-D Poisson's equation, Boltzmann transport equation, and self-heating equation with interface traps charge correction terms. The results indicate that the Si NW-CTT exhibits excellent nonvolatile memory characteristics with the modulation of threshold voltage around 1 V between program and erase pulses when interface trap charge density (Nit)=1×1017cm−3 present in the HfO2 layer. In addition, almost linear conductance modulation in long-term potentiation (LTP) and long-term depression (LTD) with NW-CTT synapse promises the recognition accuracy of around 94.7% and write energy efficiency of around 2.3 mJ in the 784×100×10 neural network for handwritten MNIST dataset. Our analysis highlights the critical role of optimal nanowire diameter, thickness of the charge trapping HfO2 layer, gate length, and metal gate work function in enhancing short- and long-term memory characteristics, while concurrently preserving recognition accuracy and energy efficiency. Overall, our results provide valuable insights into the synaptic behavior of

	conventional NW-CTTs and offer guidance for further harnessing their weight-update capabilities in neuromorphic computing applications.
91.	Visible-light responsive ionic columnar self-assemblies exhibiting fast photothermal energy conversion at room-temperature **M Gupta, A Krishna KM, S Sony**, S Dhingra - Advanced Functional Materials, 2024 **Abstract:** A visible-light responsive ionic liquid crystalline (LC) system based on gallic ester and tetra-ortho-substituted azobenzene is designed and synthesized. All the prepared derivatives exhibit columnar hexagonal mesophases at room temperature either in their pristine form or on cooling from isotropic states. The strategic design of these molecules allows for rapid photoisomerization, which is further aided by the dynamic LC phase. These systems attains photostationary states (PSSs) within 5 min of charging and discharging. The maximum Z conversion on charging in the solid-state at room-temperature is ≈80% with a highest temperature rise of 9.1 °C on discharging. This new molecular design enables the efficient working of solar thermal fuels (STFs) even in low sunlight intensity conditions, potentially promoting widespread adoption for mitigating global energy demands.

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