Sl. No.	IIT Ropar List of Recent Publications with Abstract Coverage: October, 2022
1.	5 - State-of-the-art practices to upgrade biomass fast pyrolysis derived bio-oil KN Ansari, A Banerjee, M Danish, SZ Hassan… - Innovations in Thermochemical Technologies for Biofuel Processing, 2022 **Abstract:** The bio-oil derived from the biomass fast pyrolysis, after being upgraded on a suitable catalyst, can replace existing fossil fuel. However, catalytic upgrading of produced bio-oil is a complex process because of its multi-component nature, which results in a complicated, multi-step reaction network under the catalytic environment. Numerous theoretical researches have been performed to provide insights into catalytic upgrading of bio-oil, which cannot be elucidated using experiments. The chapter describes the newer theoretical approaches in the catalytic upgrading of bio-oil. The theoretical modeling tool, such as density functional theory (DFT) revealed crucial insights of bio-oil upgrading over a catalyst in terms of multiple reactions, kinetics, and energetics. The hydrodeoxygenation of bio-oil compounds using a catalyst is being appeared as one of the most promising routes to obtain oxygen-deficient and hydrocarbon-rich bio-oil, suitable to be matched with fossil fuel. The employment of machine learning approaches to facilitate and improve the biomass fast pyrolysis with particular emphasis on bio-oil is also addressed and briefly introduced in this chapter.
2.	A Bilevel Multi-Fidelity Polynomial Chaos Approach for the Uncertainty Quantification of MWCNT Interconnect Networks With Variable Imperfect Contact Resistances S Guglani, K Dimple, S Roy, R Sharma, BK Kaushik - IEEE Access, 2022 **Abstract:** With on-chip copper interconnects reaching their performance limits at 22 nanometer technology nodes, multi-walled carbon nanotube (MWCNT) interconnects are projected to replace them below this point. A major aspect of MWCNT interconnect design is to perform uncertainty quantification (UQ) in an efficient yet accurate manner. In this paper, a polynomial chaos (PC) based approach is developed for the UQ of MWCNT interconnect networks under the condition that some shells of each conductor of the network are perfectly contacted while others are imperfectly contacted. The key feature of the proposed approach is the development of a bilevel multi-fidelity algorithm where two different low-fidelity models are combined together. The main outcome of using this bilevel approach is to further reduce the computational time cost of state-of-the-art single level multi-fidelity algorithms, especially in the presence of variable imperfect contact resistances where single level multi-fidelity algorithms fail to provide much speedup over conventional PC approaches. The proposed approach adopts a SPICE hybrid model that combines the features of the equivalent single conductor (ESC) model and the rigorous multiconductor circuit (MCC) model of the MWCNT conductors. Then the low-fidelity ESC model, the intermediate-fidelity hybrid model, and the high-fidelity MCC model are exploited in a bilevel multi-fidelity algorithm for the recovery of the PC metamodel of the interconnect network. This proposed bilevel multi-fidelity algorithm is demonstrably 3-5x more numerically efficient than state-of-the-art single level multi-fidelity algorithms while being even more accurate. Once recovered, the PC metamodel is used to derive all statistical information of the network transient responses.
3.	A comprehensive review on solar pond research in India: Past, present and future R Das, S Ganguly - Solar Energy, 2022 **Abstract:** Solar pond is generally a shallow artificial pool of water in which considerable temperature can be established within its lower layers by suppression of convective transport. Generally, for prevention of convection, some suitable salt solution is used. In this paper, various aspects of solar pond, in terms of both simulation and experimental research advances, practical

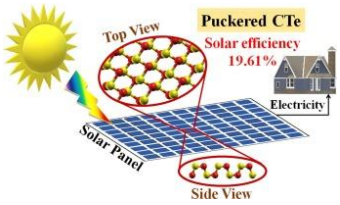
	applications, economic features, challenges faced and future prospects, particularly with respect to Indian context have been reviewed. In general, the importance and the position of India at global level in terms of solar energy harvesting potential have been discussed. Apart from conventional uses of solar ponds in process heating and salt production, their applications in water distillation and thermoelectric power generation are also highlighted. Besides, stability aspect and its importance are revisited from simulations and experimental observations. Important identified areas requiring future research and development to recognize more technically feasible solar pond-based systems include organic Rankine cycle for electrical power production, crop drying, building cooling and air-conditioning based on absorption systems, thermoelectric cooling, and integration of solar ponds with other renewable energy resources. The present literature is proposed to offer guidelines in policy making aimed at addressing various societal requirements in a sustainable and affordable manner by utilizing available natural resources.
4.	A Machine Learning Approach to the Smartwatch-based Epileptic Seizure Detection System G Gaurav, R Shukla, G Singh, AK Sahani - IETE Journal of Research, 2022 **Abstract:** Worldwide around 70 million people have epilepsy, and every year, more than 1 out of 1000 cases of epilepsy result in Sudden Unexpected Death in Epilepsy (SUDEP). Video – EEG is the standard clinical method for monitoring epilepsy and seizures. However, wearable systems are required to monitor epileptic activity in daily living due to the complexity of using EEG outside the laboratory. Also, to prevent SUDEP, early prediction of seizure onset is required. In this work, we propose a machine learning model to detect ictal and preictal conditions using an Empatica E4 smartwatch. The Empatica E4 records real-time photoplethysmography, electrodermal activity, accelerometry, and temperature. Clinical data were recorded from 11 patients with epilepsy (PWE) for 19 seizure onsets. Features from all the modalities were extracted by taking segments of the signal during the seizure (ictal), pre-seizure, and inter-ictal (non-seizure) conditions. These features were used on support vector machine (SVM-RBF), decision tree (DTC), and logistic regression (LRC)-based supervised training for ictal vs. non-ictal and pre-ictal vs. inter-ictal conditions. The highest accuracy of 99.40% was recorded for DTC-based seizure detection classifier during 10-fold cross-validation. Also, the highest accuracy of 95.42% was recorded for DTC-based pre-seizure onset detection classifier during 10-fold cross-validation.
5.	A Multi-Level Converter for SRM Drive Based EV Applications with Auxiliary Load Driving Capability V Shah, S Payami - IEEE 2nd International Conference on Sustainable Energy and Future Electric Transportation (SeFeT), 2022 Abstract: This article proposes a multi-level converter topology (MLCT) for a four-phase switched reluctance machine (SRM) drive-based electric vehicle (EV) application with auxiliary load driving capability. The proposed MLCT employs the same number of devices as in the conventional three-level-asymmetrical half-bridge (CTL-AHB) converter. The DC-link in the proposed MLCT topology is connected in series with an active boosting source, i.e., battery, via a bi-directional DC-DC converter to achieve higher voltage levels. The higher voltage levels result in faster energization and de-energization of the phase currents, resulting in improved average torque output. The proposed MLCT provides continuous power to the auxiliary loads for EV applications via a series battery. Depending on the series battery voltage/state of charge, the operating modes of the converter allow its charging via three modes. Analysis of different operating modes under motoring and regeneration/ braking is discussed with the simulation and experimental validation of the same.
6.	A Novel Piezoelectric and Electromagnetic Energy Harvester as a High Pass Filter with a low cutoff frequency A Kumar, A Jaiswal, RS Joshi, J Singh - IEEE Sensors Journal, 2022

	Abstract: Battery-less wireless sensor networks (BL-WSNs) are an interesting and sustainable solution for Internet-of-Things (IoT) applications. The sensor nodes in the BL-WSNs are often powered by an energy harvester. Generally, these harvesters provide intermittent energy to the BL-WSNs. Hence, to cater to a variety of applications, the energy harvesters should work as a high pass filter, i.e., provide continuous energy to the BLWSNs. This paper proposes a novel design to harvest vibration energy using a coupled Dovetail-shaped Piezoelectric and Electromagnetic Energy Harvester (Dovetail-PEM-EH). Unlike earlier PEM-EH designs with either one or two vertical cantilevers, Dovetail-PEM-EH uses three bimorphs and one copper (fixed tip end) cantilever with magnets on the tips. Placing more than two cantilevers with tip magnets requires optimizing distances among cantilevers and selecting tip magnets in such a way that energy harvesting is increased and the design is stable i.e, cantilevers do not collide with each other. A low complexity binary search based algorithm is presented to achieve the same. By doing so, the magnetic attractive forces increase the vibration sensitivity of the proposed design, and it works as a high pass mechanical filter with a low cutoff frequency. The detailed simulation analysis performed in COMSOL shows that there is a minimum 2× increase in the voltage and six out of the nine tested models shows more than 3× the improvement in the harvested power as compared to the state-of-the-art. The hardware implementation of one of the models validates the simulation results with a slight variation.
7.	A Plug-in Type Integrated Rectenna Cell for Scalable RF Battery Using Wireless Energy Harvesting System M Kumar, S Kumar, S Jain, A Sharma - IEEE Microwave and Wireless Components Letters, 2022 **Abstract:** Microwave power transfer is employed for charging self-sustainable internet of things (IoT) devices by wireless energy harvesting (WEH) using rectenna (Rx) and dedicated RF shower (Tx). The challenges for this implementation are the diverse power requirements of different devices and polarization and orientation mismatch between Tx and Rx. Different demands need redesigning rectennas, which can be avoided by scalable designs. A novel integrated rectenna devised as a plug-in-type unit cell is proposed for scalable RF battery. The plug-in feature allows multishape assemblies for the WEH system using multiple rectenna cells. This enables multiobjective-like dynamic power harvesting and orientation-insensitive operation. The rectenna cell designed with integrated matching has a high-gain endfire radiation pattern, which avoids blocking of incident waves and mutual coupling between adjacent rectennas. To illustrate scalability, linear-stacking and cuboid-shaped assemblies are evaluated for WEH performance. The results prove that the proposed scaling scheme with rectenna cells easily adapts to the user requirements.
8.	A Review on the Effect of Fuel Additives and EGR on Knocking Behavior of Spark Ignition Engine P Gupta, MR Saxena, RK Maurya - SAE Technical Paper 2022-01-1004, 2022 **Abstract:** Engine design and selection of fuels for automotive applications are required to minimize noise and exhaust emissions without compromising fuel economy. The knocking combustion investigation is essential as it directly affects the performance and durability as well as the thermal efficiency of the engine. Several fuel additives were suggested in the previous studies to mitigate the knocking combustion in spark ignition (SI) engines. The present study reviews the effect of antiknock fuel additives such as ethanol, methanol, prenol, n-butanol, furan mixtures, etc., on knocking behavior in SI engines. Additionally, this paper aims to present a systematic review of the studies conducted to investigate the effect of EGR on the knocking in SI engines. The EGR is often considered an effective means to suppress knocking in SI engines. The thermal effect of EGR in controlling the knocking is well known as EGR affects the temperature and pressure history of the combustion chamber. The main constituting components

	of EGR are CO2, H2O, NO, and N2. It is found from the published studies that CO2 has a strong chemical effect on knocking through a chemical reaction between CO2 and hydrogen. CO2 also plays a significant role in the suppression of the temperature rise. The CO2 has a more substantial effect than H2O on laminar burning velocity. Nitric oxide (NO) present in the EGR also affects autoignition and knocking. It is demonstrated that knocking can be suppressed with NO addition, but the fuel must have a strong negative temperature coefficient in some specific conditions. Based on the literature review, future research directions are also proposed for further studies.
9.	A Study on Ultrasonic Vibration and Laser-Assisted Turning of Aluminum Alloy N Deswal, R Kant - Advances in Forming, Machining and Automation - Lecture Notes in Mechanical Engineering, 2023 **Abstract:** Ultrasonic vibration-assisted turning (UVAT) and laser-assisted turning (LAT) are widely used advanced machining processes. In this study, a new machining method of ultrasonic vibration and laser-assisted turning (UVLAT) is proposed by simultaneous interaction of UVAT and LAT processes. Experimental analysis is carried out to explore the machinability of the aluminum alloy during conventional turning (CT), UVAT, LAT, and UVLAT. The effect of laser power on machining performance is analyzed for UVLAT and compared with CT, UVAT, and LAT in terms of machining forces and surface roughness. Lower cutting, radial, and feed forces are observed for UVLAT compared to CT, UVAT, and LAT. However, higher surface roughness is obtained for UVAT and UVLAT compared with CT and LAT. Results showed that the UVLAT could be an excellent process to enhance the machinability of aluminum alloys if the vibration is applied in the appropriate direction and will be better than CT, UVAT, and LAT.
10.	A Tilted-Orthogonal Receiver Coil Antenna to Improve Misalignment Tolerance in WPT systems A Bharadwaj, VK Srivastava, A Sharma, CC Reddy - IEEE Transactions on Antennas and Propagation, 2022 **Abstract:** This article proposes a novel receiver coil antenna to mitigate the lateral misalignment problem in resonant wireless power transfer (R-WPT) systems. The proposed design comprising two receiver coils is analytically optimized by parametric sweeping the tilt angle (θ). Consequently, the resultant structure is designated as a tilted-orthogonal receiver coil antenna with stable mutual inductance in the receiver active region. Therefore, regardless of the receiver misalignment, power transfer efficiency (PTE), realized using the circuit parameters, maintains its consistency. The analytical results of the proposed receiver coil antenna are experimentally verified. The misalignment tolerance of the proposed tilted-orthogonal receiver coil antenna is improved by 120.18% in terms of PTE compared with the conventional planar receiver coil antenna.
11.	A Transformer Based Approach for Activity Detection G Sharma, A Dhall, R Subramanian - Proceedings of the 30th ACM International Conference on Multimedia, 2022 **Abstract:** Non-invasive physiological sensors allow for the collection of user-specific data in realistic environments. In this paper, using physiological data, we investigate the effectiveness of Convolutional Neural Network (CNN) based feature embeddings and Transformer architecture for the human activity recognition task. 1D-CNN representation is used for the heart rate, and 2D-CNN is used for short-term Fourier transformation of the accelerometer data. Post fusion, the feature is input into a transformer. The experiments are performed on the harAGE dataset. The findings indicate the discriminative ability of the feature-fusion on transformer-based architecture, and the method outperforms the harAGE baseline by an absolute 3.7%.
12.	An Assessment of Cyclic Variations in the Air-Fuel Ratio for RCCI Engine MR Saxena, S Suman, RK Maurya - SAE Powertrains, Fuels & Lubricants Conference &

	Exhibition, 2022 **Abstract:** The potential for simultaneous reduction of soot and NOx emissions and higher fuel conversion efficiency has already been demonstrated for reactivity-controlled compression ignition (RCCI) engines. The RCCI engine has a relatively higher peak pressure rise rate (PPRR) and cyclic variations compared to the conventional diesel engine. The upper and lower operating load boundaries of the RCCI engine are restricted by higher PPRR and cyclic variations, respectively. The cyclic variations in the air-fuel ratio are one of the main factors which govern the variations in combustion parameters. The cyclic variations in combustion need to be controlled for stable engine operation. The present study estimates the cyclic air-fuel ratio from the measured in-cylinder pressure data for the RCCI engine. The RCCI experiments are performed on a modified single-cylinder compression ignition (CI) engine equipped with a development ECU. In this study, the engine was operated in RCCI combustion mode with port injection of gasoline and direct injection of diesel fuels. The port and direct fuel injection events are controlled through the development ECU. The in-cylinder pressure signals are measured using a piezoelectric pressure transducer installed on the engine head. A crank angle encoder of 0.1 CAD resolution is used to determine the crank angle position for recording in-cylinder pressure data. In this study, 1000 consecutive engine cycles are recorded, and the air-fuel ratio is estimated for each cycle. The pressure moment method is used to estimate the cyclic air-fuel ratio at a particular engine operating condition. Furthermore, statistical methods (coefficient of variation and standard deviation in the parameter) and Wavelet Transform (WT) are used to analyze the cyclic variations in the air-fuel ratio. Correlation between cyclic variations of air-fuel ratio and cyclic variation of combustion parameters is also estimated, and a good relationship is found in some of the engine operating conditions. Results indicate that in conventional dual-fuel operation, only low-periodicity high-frequency variations in the air-fuel ratio are present. Whereas in the case of RCCI combustion, high-frequency and low-frequency variations in the air-fuel ratio are present.
13.	An Adaptive Digital Frequency Locked Loop with quarter cycle update for distorted single phase grid M Satyanarayana, AVR Teja - 2022 IEEE 2nd International Conference on Sustainable Energy and Future Electric Transportation (SeFeT), 2022 **Abstract:** This paper proposes a quarter cycle update digital frequency locked loop for adverse single-phase grid systems. The proposed frequency locked loop is designed to obtain the grid estimates with-in a quarter cycle time of fundamental grid voltage input. It uses second order generalized integrator as a filter and orthogonal signal generator. Further a frequency locking stage is designed to estimate the frequency and phase angle using zero crossing detectors and digital counters. The proposed digital frequency locking stage works based on zero crossing instants of both in-phase and orthogonal phase of the input grid voltage corresponding to a two zero crossing and peak instant of the in-phase grid voltage to estimate the grid frequency and phase angle for every quarter cycle. The implementation of the proposed FLL is simple and has less computational overhead. The ability of the proposed FLL to track the frequency and phase under various steady-state (dc-offset and harmonics) and transient (frequency drift) grid disturbances is tested in simulation using MATLAB/SIMULINK, and the results are reported. The improved performance of the proposed method is verified by comparing it with the results of SOGI-FLL.
14.	An Audio-Seismic Fusion Framework for Human Activity Recognition in an Outdoor Environment P Choudhary, P Kumari, N Goel, M Saini - IEEE Sensors Journal, 2022 **Abstract:** Human activity recognition has a significant impact on people's daily lives. The need

	to infer human activities is prominent in many human-centric applications, such as healthcare and individual assistance. In this paper, we introduce a non-invasive human activity recognition system that utilizes footstep-induced vibration and sound in an outdoor environment with the aim of achieving improved performance over a single source of information. We employ one-dimensional convolutional neural networks for automated feature extraction, fusion, and activity recognition on a nine-class classification problem. The proposed framework reports an average F1 score of 92%, which corresponds to a 5.74% improvement over the best-performing state-of-the-art. Confusion matrix-based analysis demonstrates that audio-seismic fusion not only reduces misclassifications but also reduces the impact of background noise on model performance. In addition, we demonstrate that a model trained on a balanced dataset has a higher F1 score than one trained on an imbalanced dataset. Activity-wise performance is reported to show the efficacy of the proposed fusion-based framework. We also contribute an audio-seismic dataset for human activity recognition in an outdoor environment. The dataset is collected in a variety of challenging environments, such as varying grass length, soil moisture content, and the passing of unwanted vehicles.
15.	An Experimental Study of Forced Cooling in Single-Scan Laser Bending R Yadav, DK Goyal, R Kant - Advances in Forming, Machining and Automation - Lecture Notes in Mechanical Engineering, 2023 **Abstract:** Laser bending offers a controlled deformation of sheets and generates a small and precise bend angle. In this paper, experimental study of laser bending of duplex stainless steel at forced and natural cooling conditions has been carried out. The forced cooling is applied at the opposite surface to the laser beam irradiation throughout the width simultaneously. Bend angle is analyzed by varying laser power, scanning speed, and line energy during both cooling conditions. An increase in laser power results in the increase of bend angle in the beginning and then remains approximately constant, whereas it continuously increases with line energy and decreases with scanning speed. At most of the parametric conditions, it is observed that the bend angle decreases with the application of forced cooling.
16.	An Integrated Charger with High Efficiency Over Wide Range of Input Voltage with G2V, V2G, and Direct V2V capabilities for SRM Drive V Shah, G Kumawat, S Payami - IEEE IAS Global Conference on Emerging Technologies (GlobConET), 2022 **Abstract:** Single-phase AC level-1 on-board charging module (OBCM) integrated with electric vehicle (EV) drive-train facilitates battery charging via a standard residential socket. However, level-1 OBCMs are slow chargers due to their space, weight, and cost constraints. To address these problems, level-1 charging is realized via integrated converters (ICs). The article proposes an IC with drive and charge ability. For faster grid-to-vehicle (G2V) charging, i.e., single-phase AC level-2 charging, a bridgeless buck-boost power factor correction (BBB-PFC) rectifier configuration is integrated with the IC. For operating over a wide range of input voltage with high efficiency, the BBB-PFC configuration operates in buck, boost and/or buck-boost mode. The proposed IC allows the battery to connect and charge/discharge via emerging vehicle-to-vehicle (V2V) charging technology, dc microgrids of voltage rating higher or lower than the EV battery voltage. Thus, allowing fast battery charging via AC (single-phase) and DC sources. The proposed IC implementation does not require any hardware or phase winding modification and/or an external mechanical brake to assist a standstill rotor. Implementation of the proposed IC is presented with simulation and experimental validation for the same.
17.	Analyses of lattice hydrodynamic area occupancy model for heterogeneous disorder traffic D Kaur, S Sharma, AK Gupta - Physica A: Statistical Mechanics and its Applications, 2022 **Abstract:** In developing countries, traffic not only consists of a wide range of vehicles, including automobiles, trucks, buses, motorbikes, etc. but is also disordered. Controlling and managing

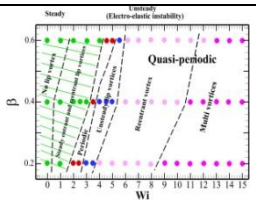
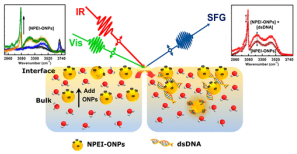
	increasingly complex transport networks depend heavily on modeling the mechanics of mixed (heterogeneous) traffic. In heterogeneous disordered traffic, every vehicle has its size and speed, and even they are different from each other in the case of occupying the area on the road, so these can affect the overall movement of vehicular flow. Therefore, a new lattice model is designed by considering the area occupancy of different vehicles in a heterogeneous disorder traffic system with a variable proportion of slow-moving to fast-moving automobiles. In addition, stability analysis is done to investigate the ability of a heterogeneous traffic model. The mixed traffic phase diagrams show a link between traffic stability and the fraction of vehicles. Moreover, a reduction perturbation approach is used to explore the behavior of the disordered traffic, and the mKdV equation is achieved near the critical point. Furthermore, numerical simulations are performed to verify the consistency of theoretical analysis. Results portray that a higher fraction of small vehicles is beneficial for stabilizing the traffic flow.
18.	Carbon-based monochalcogenides for efficient solar and heat energy harvesting AK Bhojani, HK Kagdada, R Ahuja, DK Singh - Applied Surface Science, 2022 **Abstract**: A new generation of two-dimensional (2D) material has captivated significant attention in the energy conversion field owing to their promising optoelectronics and thermoelectric applications. The present work involves the systematic investigation of fundamental properties of single-layered 2D carbon-based monochalcogenides (CS, CSe, CTe) with planar, buckled and puckered geometry within the framework of density functional theory (DFT). The structural and lattice dynamics analysis disclose that puckered and buckled configurations are energetically and dynamically stable whereas planar structures depict instability. The anisotropic group velocity of longitudinal acoustic (LA) and transverse acoustic (TA) phonon modes in puckered systems may render the characteristics thermal transport properties. Additionally, for the first time, we scrutinized the thermoelectric and optical properties of these materials. At room temperature, the electron carrier mobilities are 174.698 and 160.830m2V-1s-1 of puckered and buckled CS systems, respectively are highest among all structures. The computed Seebeck coefficient, electrical conductivity and power factor manifests the high thermoelectric transport properties of puckered CS material. Further, the calculated solar parameters demonstrate an exceptionally high-power conversion efficiency of 19.61 % for puckered CTe. Present work indicates that puckered phase of CS and CTe show their potential for the heat and solar energy harvesting devices, respectively. **Graphical Abstract:** 
19.	Compelling Cyclic Peptide Scaffolds for Antitubercular Action: An Account (2011-21) of the Natural Source A Chowdhury, A Bandyopadhyay - Current Protein & Peptide Science, 2022 **Abstract:** Natural cyclic peptide scaffolds are indispensable in medicinal chemistry, chemical biology, and drug discovery platforms due to their chemical diversity, structural integrity, proteolytic stability and biocompatibility. Historically, their isolation and profound understanding of target engagement have been identified as lead pharmacophore discovery. Natural cyclic peptides are the largest class of pharmacologically active scaffold, in which most show activity against drug-resistant Mycobacterium tuberculosis (Mtb). Nevertheless, eight recently discovered cyclic peptide scaffolds exhibit promising antitubercular activity among

	numerous naturally occurring antitubercular peptides, and they are amenable scaffolds to drug development. We examined their biological origin, scaffolds, isolations, chemical synthesis, and reasons for biological actions against Mtb. Understanding these peptide scaffold details will further allow synthetic and medicinal chemists to develop novel peptide therapeutics against tuberculosis-infected deadly diseases. This review emphasizes these cyclic peptides' in vitro and in vivo activity profiles, including their structural and chemical features.
20.	Coupled diffusion-mechanics framework for simulating hydrogen assisted deformation and failure behavior of metals V Singh, R Kumar, Y Charles, DK Mahajan - International Journal of Plasticity, 2022 **Abstract:** Understanding of years-old multifaceted hydrogen-assisted damage evolution necessitates efforts to model the coupled diffusion-mechanics response in metallic materials. Informed by the dislocation-hydrogen interactions, understood earlier via experiments and/or multi-scale modeling techniques, this work presents a dislocation density-based crystal plasticity model coupled with a hydrogen diffusion/trapping model to simulate the hydrogen-assisted deformation and failure under the HELP mechanism of hydrogen embrittlement. The important role of hydrogen on dislocation multiplication, annihilation and dislocation interaction weakening are included in the presented framework. Two possible scenarios under HELP mechanism, leading to H-induced macroscopic softening or hardening as a result of trade-off between the hydrogen-induced weakening of dislocation interactions and hydrogen-induced increased dislocation density emerges from the simulation studies. These finding points towards the inevitable role of HELP mechanism to cause early failure in metals either working independently or in support with additional mechanisms.
21.	COVID-19: Lesson Learnt from Diagnostics to Therapeutics PK Panda, VP Chavda, K Neve, S Mishra, SK Verma…R Ahuja – A book chapter of Microbial Engineering for Therapeutics, 2022 **Abstract:** Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) causes Coronavirus Disease 2019 (COVID-19) that first appeared in December 2019 in Wuhan, Hubei Province, China. COVID-19 gradually spread to virtually all regions of the world and was declared a global pandemic by WHO. It has been the greatest tragedy befalling mankind since World War II. While the mortality rate is higher than that of influenza, it seems to vary by region, perhaps indicating variations in the immune status of individuals and the response of local health authorities to tackle the challenge of new infectious disease. Drugs are desperately required for both prophylaxis and care of severely ill patients. Although there are few approved treatment options, several drugs approved for other diseases earlier are being tested and used after emergency use authorization for mitigation and treatment of COVID-19 patients. However, data from appropriately designed clinical trials are lacking to show the effectiveness of these drugs. The result from WHO solidarity trials for four drug types are not encouraging. There is definite relief and hope due to the emergence of many vaccine candidates in the market; however, the virus is adapting fast and has started mutating as seen in many countries like Africa and the UK. There is a need for a cogent diagnostic and vaccine for controlling this outbreak. The need for corona-appropriate behavior like masking, sanitization, quarantine, and containment will play a decisive role until an effective treatment regime is worked out. While the pandemic has adversely affected most spheres of human activities, it has also been a great learning experience for scientists, healthcare professionals, and mankind. In this chapter, an attempt is made for understanding the lessons that have been learned so far and how they will benefit in reducing the impact of COVID-19 and the current picture of diagnostic and therapeutic development for COVID-19.
22.	Crank Angle Based Exergy Analysis of Syngas Fuelled Homogeneous Charge Compression Ignition Engine MR Saxena, V Ranjane, RK Maurya – SAE Technical Papers, 2022

	Abstract: Homogeneous charged compression ignition (HCCI) engine is a low-temperature combustion (LTC) strategy with higher thermal efficiency and ultra-low NOx and particulate matter emission. Syngas is a renewable and clean alternative fuel that has gained researchers' interest, and it is one of the alternatives to fossil fuels. Syngas can be a suitable fuel for HCCI Engines due to their characteristics of high flame speed, lower flammability limits, and low auto-ignition temperatures. This paper presents the crank angle-based exergy analysis of syngas fuelled HCCI engines. Energy and exergy analysis is essential for the better performance and utilization of the HCCI engine. The syngas HCCI engine is numerically simulated in this study using a stochastic reactor model (SRM). In SRM models, physical parameters are described by a probability density function (PDF), and these parameters do not vary within the combustion chamber. Thus, the spatial distribution (due to local inhomogeneity) of the charge is represented by PDF. The SRM-based approach simplifies many aspects of CFD processes while retaining the predictive capability similar to 3-D CFD codes. A detailed syngas combustion reaction mechanism (having 32 species and 173 reactions) is used to simulate the HCCI Engine. Numerically simulated combustion pressure is validated with experimental results published in the previous study at different inlet valve closing temperature (T_{ivc}) and equivalence ratio (ϕ). The simulation is performed for different T_{ivc}, engine speed (N), ϕ, and syngas composition. The effect of engine operating parameters on the conversion of fuel energy into work exergy output, exergy transfers due to heat transfer, exergy lost to the exhaust in the form of thermo-mechanical exergy and unburned fuel; and exergy destruction due to combustion has been discussed in this study. Results indicate that exergy destruction due to combustion and the heat transfer to the cylinder walls increases with an increase in T_{ivc} and decreases with a decrease in ϕ and increase in N. The Physical exergy lost to the exhaust gases increases at higher engine speed.
23.	Current status of the ISRO's SCATSAT-1 mission, products, utilisation and future enhancements S Singh, RK Tiwari, V Sood, S Prashar - AIP Conference Proceedings, 2022 **Abstract:** A scatterometer is an active microwave sensor that acquires the earth's surface information in one of the microwave bands, i.e., C-band at 4-8 GHz and Ku-band at 12-18 GHz. Recently (26th September 2016), the Indian Space Research Organisation (ISRO) launched a scatterometer satellite (SCATSAT-1) which operates through the Ku-band (frequency = 13.5 GHz and wavelength = ∼2 cm). SCATSAT-1 is an improved version of the ocean scatterometer (OSCAT) with numerous system and onboard processor improvements. SCATSAT is specially designed to provide the measurements over the ocean and land applications which are helpful in weather forecasting, cyclone prediction, early- snow melt, sea-ice extent estimation, and agriculture. Moreover, SCATSAT-1 provides day and night monitoring, penetration through the clouds, daily data delivery, and global coverage. In this work, the SCATSAT-1 technical details, product development, and utilisation in various emerging scientific domains, e.g., cryosphere, land hydrology, and soil moisture, have been explored with future recommendations. This study is vital for near real-time monitoring of natural hazards, management of natural resources, forecasting of early snow-melt, and flood prediction.
24.	Design, Synthesis and Anticancer potential evaluation of Novel Naphthoic Acid linked Imidazo[2,1-b][1,3,4]thiadiazoles S Singh, DD Bhandari, M Gupta, J Singh – Research Journal of Pharmacy and Technology, 2022 **Abstract:** A total of 18 derivatives S(1-18) of naphthoic acid linked Imidazo[2,1-b][1,3,4]thiadiazole were synthesized and tested for their anticancer potential at human cancer cell line A – 549. The interaction of the proposed derivatives with the colchicine binding domains of the receptor was also performed using Maestro 10.5 program (Schrodinger Inc. USA). Molecular docking study was performed for synthesized compounds displaying a significant inhibitory activity in order to validate their binding mode to active site. All the 18 inhibitors were docked into the active site of the receptor in two poses. The G-scores and binding

	energy for compound S4, S10, S12, S13 and S16 were observed to be comparable to the standard Colchicine. The compound S1, S5, S10, S12 and S16 exhibited prominent inhibition of cancer cell line.
25.	Digitally controlled multimode laser for high-resolution and robust beam shaping S Mahler, C Tradonsky, V Pal, AA Friesem, N Davidson - Proceedings Volume 12218, Laser Beam Shaping XXII, 2022 **Abstract:** Laser beams can be shaped by controlling either the intensity or phase or coherence distribution separately. With typical laser configurations, the intensity and phase controls are relatively slow and cannot yield high-resolution arbitrarily shaped beams and the coherence control suffers from high power loss. By resorting to a degenerate cavity laser that incorporates an intra-cavity digital spatial light modulator and an intra-cavity spatial Fourier filter, it is possible to exploit a very large number (about 100,000) of independent lasing spatial modes in order to control the properties of the laser output. We have adapted this configuration to develop a novel, rapid and efficient method to generate high resolution laser beams with arbitrary intensity, phase and coherence distributions.
26.	Directed Explorations During Flood Disasters Using Multi-UAV System A Garg, SS Jha - IEEE 18th International Conference on Automation Science and Engineering (CASE), 2022 **Abstract:** The disaster relief operations during floods require time critical information of the flooded area to save lives. Finding critical regions of the disaster struck area in a limited time frame is crucial for effective relief planning. In this paper, we propose a multi-UAV based system with directed explorations of flooded area to gather time-critical ground information using deep reinforcement learning based controls. We learn an exploration policy for the multi-UAV system with limited battery for autonomous coverage of the flooded region. Further, we integrate D8 flow algorithm that approximates the water flow direction based on image pixel information of a sub-region in the UAVs' exploration strategy. The results show that our proposed method for multi-UAV exploration of flooded area outperforms other methods from the literature. Moreover, the learnt multi-UAV exploration policy is able to generalize to unseen flooded regions without any retraining.
27.	Effect of crumb rubber addition on the deformation and fracture behavior of ductile epoxy matrix SN Tiwari, PK Agnihotri - Journal of Applied Polymer Science, 2022 **Abstract:** A strategy is demonstrated to utilize the waste crumb rubber in ductile epoxy for low-strength structural applications. The crosslink density is reduced to improve the ductility of epoxy by increasing the hardener concentration more than its stoichiometric composition. The ductile epoxy (Ep) is blended with 5, 10, and 20 wt% of crumb rubber particles. The rubber/epoxy (EpR) composites are characterized through quasi-static and dynamic testing to quantify the effect of crumb rubber addition in a ductile epoxy matrix. Quasi-static compression results show that energy absorption is enhanced after adding 5–10 wt% of crumb rubber in epoxy. Furthermore, it is found that crumb rubber modification markedly increased the energy of fracture. Crumb rubber inclusion also improves the storage modulus ($$ {E}^{\prime } $$) and glass transition temperature (T_g) of Ep. While crumb rubber particles do not enhance the compressive response of Ep under high strain rate loading, their addition significantly reduces the intensity of the transmitted wave. Subsequently, it suggests dual advantages, that is, Ep can be effectively toughened with 5–10 wt% of crumb rubber, and the resulting EpR may be used as an interlayer/backing plate in impact-resistant panels to mitigate adverse effects of the transmitted stress waves.
28.	Effect of geometric disorder on chaotic viscoelastic porous media flows A Chauhan, S Gupta, C Sasmala - Physics of Fluids, 2022

	Abstract: Many practical applications, such as enhanced oil recovery or groundwater remediation, encounter the flow of viscoelastic fluids in porous media. Once the flow rate exceeds a critical value in such flows, an elastic instability with a fluctuating flow field is observed, which ultimately transits to a more chaotic and turbulence-like flow structure as the flow rate further increases. In this study, we present an extensive numerical investigation of the viscoelastic fluid flows in a model porous media consisting of a microchannel with many micropillars placed in it by considering both their initial staggered and aligned configurations. Within the present range of conditions encompassed in this study, we find that the geometric disorder always increases the chaotic fluctuations irrespective of the initial arrangement of micropillars. We propose that it is due to the formation of preferential paths or lanes and the formation of highly curved streamlines, which results in the local stretching of polymer molecules and, hence, significant origin in the local elastic stresses. We further show that this chaotic flow behavior strongly depends on the competitive influence between the strain-hardening and shear-thinning behaviors of a viscoelastic fluid, which again strongly depends on the polymer extensibility parameter, polymer viscosity ratio, and geometric disorder parameter. In particular, we show that the strain-hardening behavior of a viscoelastic fluid promotes these chaotic fluctuations, whereas the shear-thinning behavior tends to suppress these. Therefore, it is not a general phenomenon that can always be seen in the flows of a viscoelastic fluid in porous media.
29.	Electro-elastic instability in electroosmotic flows of viscoelastic fluids through a model porous system MB Khan, C Sasmal - European Journal of Mechanics-B/Fluids, 2022 **Abstract:** Electrokinetic transport phenomena in porous media are encountered in many practical applications such as electro-chromatography, micro-pumping, chemical remediation of contaminated soil, etc. These applications often deal with various complex viscoelastic fluids (such as polymers, emulsions, suspensions, different kinds of biofluids, etc.) along with simple Newtonian ones. This study presents a detailed numerical investigation on this electrokinetic transport of both Newtonian and viscoelastic fluids in a model porous system consisting of a long micropore with step expansion and contraction. Over the whole range of conditions encompassed in this study, a steady and symmetric flow field is observed for a Newtonian fluid. However, for a viscoelastic fluid, we observe a transition in the flow field from steady and symmetric to unsteady and asymmetric once the Weissenberg number (ratio of the elastic to that of the viscous forces) exceeds a critical value. We show that this transition is caused due to the onset of an electro-elastic instability in the system. The critical value of this Weissenberg number (at which this transition occurs) depends on various factors. In particular, we find that this value increases with the polymer viscosity ratio and expansion and contraction lengths of the micropore. At fixed values of the electric field strength, polymer viscosity ratio, contraction and expansion lengths of the micropore, we observe the existence of different vortex dynamics within this model porous system as the Weissenberg number gradually increases, such as the emergence of the entrant and re-entrant lip vortices, oscillating lip vortices, multi vortices, etc. Therefore, the electrokinetic flow dynamics of viscoelastic fluids in a porous system is much more complex than that of simple Newtonian fluids. We hope this study for a model porous system would facilitate a better understanding of the electrokinetic transport phenomena of viscoelastic fluids in an actual porous media. Furthermore, we show how this model system of a long micropore with step expansion and contraction could also be successfully utilized for other practical applications such as mixing two viscoelastic fluids. **Graphical Abstract:**

	
30.	Elucidating the Molecular Structure of Hydrophobically Modified Polyethylenimine Nanoparticles and Its Potential Implications for DNA Binding H Kaur, M Verma, S Kaur, B Rana, N Singh, KC Jena - Langmuir, 2022 Abstract: The structural properties of the polyethylenimine (PEI) polymer are generally tuned and selectively modified to reinforce its potential in a broad spectrum of applied domains of medicine, healthcare, material design, sensing, and electronic optimization. The selective modification of the polymer brings about changes in its interfacial characteristics and behavior. The current work involves the synthesis of naphthalimide conjugated polyethylenimine organic nanoparticles (NPEI-ONPs). The interfacial molecular structure of NPEI-ONPs is explored in an aqueous medium at pH 7.4 using surface tensiometry and sum-frequency generation vibrational spectroscopy (SFG-VS). The hydrophobic functionalization rendered a concentration-dependent surface coverage of NPEI-ONPs, where the SFG-VS analysis exhibited the molecular rearrangement of its hydrophobic groups at the interface. The interaction of NPEI-ONPs with double-stranded DNA (dsDNA) is carried out to observe the relevance of the synthesized nanocomposites in the biomedical domain. The bulk-specific studies (i.e., thermal denaturation, viscometry, zeta (ζ) potential, and ATR-FTIR) reveal the condensation of dsDNA in the presence of NPEI-ONPs, making its structure more compact. The interface-sensitive SFG-VS showcased the impact of the dsDNA and NPEI-ONP interaction on the interfacial molecular behavior of NPEI-ONPs at the air–aqueous interface. Our results exhibit the potential of such hydrophobically functionalized ONPs as promising candidates for developing biomedical sealants, substrate coatings, and other biomedical domains. 
31.	Evidence for prolate-oblate shape coexistence in the odd-$A^{73}_{35}Br_{38}$ nucleus S Bhattacharya, T Trivedi, A Mukherjee, D Negi…D Choudhury - Physical Review C, 2022 **Abstract:** The excited states in ^{73}Br nucleus have been investigated through the fusion evaporation reaction ^{50}Cr(^{28}Si, αp)^{73}Br at a beam energy of 90 MeV using the Indian National Gamma Array. The γ−γ coincidence technique has been used to add eight new γ-ray transitions in the level scheme. The mixing ratio of ΔI=0 (mixed with E2 and M1) transitions have been determined using angular distribution and RDCO-polarization measurement. The half-life of the 9/2+ isomeric state has been measured to be $\tau_{1/2}$=52(2) ns from the variation in the intensity of delayed γ-ray transition as a function of coincidence time window. The two state mixing model calculations were performed to obtain the mixing amplitude, and mixing interaction of two different configurations of ^{73}Br. The calculated mixing amplitudes along with the deformations of two different configurations provide the monopole transition strength ρ^2(E0) for Se, Br, and Kr isotopes in a semiempirical approach. These results support a prolate-oblate shape coexistence in the odd-A^{73}Br nucleus. The observed structural properties have been discussed in terms of projected shell model calculations.
32.	Federated learning-based air quality prediction for smart cities using BGRU model

	S Dey, S Pal - Proceedings of the 28th Annual International Conference on Mobile Computing And Networking, 2022 **Abstract:** Nowadays, Internet of Things (IoT) has become very popular due to its applications in various fields such as industry, commerce, and education. Cities become smart cities by utilizing lots of applications and services of IoT. However, these intelligent applications and services significantly threaten the environment regarding air pollution. Therefore, high accuracy in air pollution monitoring and future air quality predictions have become our primary concern to save human beings from health issues coming from air pollution. In general, deep learning (DL) and federated learning (FL) techniques are suitable for solving various forecasting problems and dealing with the high volatile air components in heterogeneous big data scenarios. This ambiance of DL and FL motivates us to exploit the DL-based Bidirectional Gated Recurrent Unit (BGRU) method for future air quality prediction using big data and federated learning (FL) to train our model in a distributed, decentral, and secure ways. This paper proposes a novel distributed and decentralized FL-based BGRU model to accurately predict air quality using the smart city's big data. The effectiveness of the FL-based BGRU Model is estimated with other machine learning (ML) models by using various evaluation metrics.
33.	Generating asymmetric aberration laser beams with controlled intensity distribution S Singh, V Dev, V Pal - Journal of Optics, 2022 **Abstract:** We present generation of asymmetric aberration laser beams (aALBs) with controlled intensity distribution, using a diffractive optical element (DOE) involving phase asymmetry. The asymmetry in the phase distribution is introduced by shifting the coordinates in a complex plane. The results show that autofocusing properties of aALBs remain invariant with respect to the asymmetry parameters. However, a controlled variation in the phase asymmetry allows to control the spatial intensity distribution of aALBs. In an ideal ALB containing equal intensity bright lobes, by introducing asymmetry most of the intensity can be transferred to any one of single bright lobe, and forms a high-power density lobe. For a given beam parameter m, the precise spatial position of high-power density lobe can be controlled by the asymmetry parameter β, and we have determined the empirical relations for them. We have found that for the specific values of β, the intensity in the high-power density lobe can be enhanced by several times the intensity in other lobes. The experimental results show a good agreement with the numerical simulations. The findings can be suitable for applications such as in optical trapping and manipulation as well as material processing.
34.	Graph-based Group Modelling for Backchannel Detection G Sharma, K Stefanov, A Dhall, J Cai - Proceedings of the 30th ACM International Conference on Multimedia, 2022 **Abstract:** The brief responses given by listeners in group conversations are known as backchannels rendering the task of backchannel detection an essential facet of group interaction analysis. Most of the current backchannel detection studies explore various audio-visual cues for individuals. However, analysing all group members is of utmost importance for backchannel detection, like any group interaction. This study uses a graph neural network to model group interaction through all members' implicit and explicit behaviours. The proposed method achieves the best and second best performance on agreement estimation and backchannel detection tasks, respectively, of the 2022 MultiMediate: Multi-modal Group Behaviour Analysis for Artificial Mediation challenge.
35.	Identify and Understand the Physical Characteristics that Responsible for the Masculine Nature of a Car J Singh, P Sarkar - Recent Trends in Product Design and Intelligent Manufacturing Systems - Lecture Notes in Mechanical Engineering, 2023

	Abstract: Today's car market is limited not only to the passenger as well as sports car segments. Although, people start liking cars with big engines, large front grill sizes, sharp corners, etc. The main aim of this research study is to find the physical features of a vehicle that were responsible for its masculine nature. This study uses the average value method among the twelve cars, and the survey is conducted among thirty respondents. It enables the study of the relationship between the feeling of masculine nature of the vehicle and their physical factor, which leads toward their masculine nature. By this method, a large wheelbase, ample ground clearance, and front grills play a substantial part in the masculine nature of the car. Outcomes of this study can aid the designers in understanding the consumer's likability or perceptions when they purchase a vehicle. If designers involve this consent while designing any SUVs, it will increase the company's profit.
36.	Improvising limitations of DNN based ultrasound image reconstruction Balendra, RS Halder, A Sahani - Physical and Engineering Sciences in Medicine, 2022 **Abstract:** Ultrasound modalities are cost-effective and radiation-free technology for real-time medical imaging. These modalities require image reconstruction to obtain the actual ultrasound images from ultrasound raw data. The ultrasound raw data is obtained in the form of echo after scanning an imaging plane through ultrasound waves. The most commonly used image reconstruction beamforming technique is Delay and Sum (DAS). Other sophisticated beamforming techniques are Delay Multiply and Sum (DMAS) and Minimum Variance Distortionless Response (MVDR). DAS has limited image quality, and the employment of sophisticated techniques increases the computational complexity and computational time with improvement in image quality. To overcome these problems, various DNN (Deep Neural Networks) based techniques have been proposed which can reconstruct ultrasound images directly from ultrasound raw data. But DNN implementation has two limitations: accuracy of reconstruction and generalizability of the model. To overcome these limitations, we are proposing methodologies with a DNN model which was able to reduce these limitations. Firstly, we generated the datasets which include multiple shapes such as line, circle, ellipse, and parabola. After that, we have implemented a CNN-DNN (Convolution Neural Network and Deep Neural Network) hybrid model which has significantly improved computational time as well as image quality. We have trained our model with different sets of data to validate the reconstruction of the image matrix. We achieved a significant improvement in computational time of around 100 times (from around 0.6 s to 0.0059 s) as compared to DAS beamforming technique. At the same time, we also achieved a significant improvement in image quality with 37.19 dB average and 41.37 dB maximum improved Peak Signal to Noise Ratio (PSNR), and 87.41% average and 95% maximum Structural Similarity Index Matrix (SSIM) value. We also achieved generalizability and precise image reconstruction by using the proposed model.
37.	Interference Aware Heuristics to Optimize Power Beacons for Battery-less WSNs A Kumar, J Singh - Proceedings of the International ACM Conference on Modeling Analysis and Simulation of Wireless and Mobile Systems, 2022 **Abstract:** To achieve an infinite lifetime of sensing infrastructure in Internet-of-Things, battery-less wireless powered sensor networks (WPSNs) are an important step. The nodes in battery-less WPSNs harvest and store energy in super-capacitors from RF signal which are periodically transmitted by power beacons (PBs) or chargers. However, using multiple power chargers requires a focus on a crucial problem of interference. The sensor nodes which are covered by more than one power beacons become unreliable because of the overlapping signals from chargers since the overlap can be constructive or destructive. In this paper, we propose an algorithm to optimize the number and placement of power beacons such that interference can be reduced. The result shows that our proposed optimal power beacon location (OPBL) algorithm reduces interference in 60% of cases and also reduces data transmission time (DTT) by 30% in 24% of cases in comparison to the state-of-the-art.

38.	Interoperability of -Band Sentinel-1 SAR and GRACE Satellite Sensors on PSInSAR-Based Urban Surface Subsidence Mapping of Varanasi, India A Tripathi, AR Reshi, M Moniruzzaman, KR Rahaman, RK Tiwari… - IEEE Sensors Journal, 2022 **Abstract:** The Sentinel-1 is an active synthetic aperture radar (SAR) satellite with a C -band SAR sensor operating at a center frequency of 5.405 GHz and a wavelength of 5.55 cm. With the availability of freely available SAR datasets from Sentinel-1, the persistent scatterer SAR interferometry (PSInSAR)-based urban surface subsidence mapping has become easy. However, apart from geological causes, the major cause of urban surface subsidence is the over-exploitation of groundwater that results in piezometric pressure loss in the aquifers resulting in net subsidence. With the Gravity Recovery and Climate Experiment (GRACE) satellite sensor, the groundwater level fluctuations can be very easily studied temporally. But the coarse spatial resolution of GRACE data makes the study of groundwater fluctuations difficult to study for smaller watersheds. This study aims to correlate the PSInSAR average surface line of sight (LOS) displacement from Sentinel-1, with the average groundwater fluctuations from the GRACE sensor temporally from May 2017 to February 2022. The study also compared the correlation between PSInSAR displacement in both VV and VH polarizations and observed the R2 values to be 0.63 and 0.65 for VV and VH polarizations, respectively, with GRACE data. After that, using the displacement and groundwater level fluctuation data, an estimation of a gravimetric anomaly due to a decrease in groundwater level was carried out for Varanasi city. The R2 , mean absolute error (MAE), and root-mean-square error (RMSE) were observed to be 0.84, 1.23, and 2.4, respectively, in gravimetric anomaly estimation, thus giving sufficient acceptance for interoperability of the two sensors.
39.	Investigating a deterministic yet computationally cheap combustion parameter for model predictive control of a CNG-diesel RCCI engine A Singh, MR Saxena, RK Maurya - Fuel, 2023 **Abstract:** This study investigates the changing deterministic features of the cycle-resolved location of maximum pressure and its correlation with combustion phasing for dynamical transitions in the combustion of a CNG-Diesel RCCI engine. The investigation is performed using nonlinear dynamical and chaotic methods such as return maps, recurrence, and cross recurrence plots. The experiments are performed on a single-cylinder automotive engine operated in RCCI mode with the aid of the development ECU. The experiments are conducted by running the engine at a fixed engine speed of 1500 rpm and a load of 3 bar BMEP. Diesel fuel is injected directly into the cylinder by following a double injection strategy using an equal amount of fuel in both the pilot and main injections. The effect of the start of main injection timing of diesel on combustion dynamics is investigated at two different masses of CNG. The predominance of deterministic periodic features is discovered in the cycle-resolved dynamics of the engine combustion during the RCCI regime. Results show that with advancement in diesel injection timing, the mode of combustion shifts from conventional dual fuel to RCCI, and this shift is coupled to the onset of noisy periodic-2 bifurcations., The periodic-2 behavior even transforms to periodic-3 and 4 with an increasing advancement in diesel injection timing for engines operating with a higher CNG mass. For most of the operating conditions, the deterministic features in the location of maximum pressure are comparable with that of combustion phasing. Recurrence and cross recurrence plots-based methodology advocates for the existence of strong correlations or at least a phase synchronization between the location of maximum pressure and combustion phasing when the engine operates in the RCCI regime, irrespective of diesel injection timing and amount of port-injected CNG fuel. The presence of similar deterministic features in the location of maximum pressure and combustion phasing and a strong relationship between these two at intermediate diesel injection timings in the RCCI regime for both the CNG masses makes this regime most suitable for using the location of maximum pressure as a feedback/controlled parameter for model predictive control of the

	engine.
40.	Ionic liquid functionalized Fe_3O_4 core–shell nanoparticles: A magnetically separable Brønsted acid catalyst for the synthesis of polythioamides A Singh, N Singh, N Kaur - Applied Organometallic Chemistry, 2022 **Abstract:** In these days, development of multicomponent-based polymerization is gaining much attraction. Keeping this point in view, we synthesized fluorescent conjugated and nonconjugated polythioamide in one-pot using dialdehyde, diamines, and elemental sulfur in presence of IL1–IL2@Fe_3O_4NPs as catalyst via Willgerodt–Kindler reaction. Herein, ionic liquid-coated over magnetized iron nanoparticles heterogenous catalyst were synthesized. Catalyst was characterized by Brunauer–Emmett–Teller (BET), X-ray photoelectron spectroscopy (XPS), powder X-ray diffraction (PXRD), transmission electron microscopy (TEM), and Fourier transform infrared (FTIR) spectroscopy. Polymerization of multicomponent reaction proceeds smoothly in the presence of catalyst at ambient temperature with excellent yield. As magnetic catalyst recovered easily from the reaction mixture, this method shows excessive potential for efficient polymerization approach toward structurally diversified polythioamides. By the development of new magnetic catalyst, we overawed the limitations of multicomponent polymerization such as the poor solubility of polymer, low molecular weight, stoichiometric balance, easy removal of catalyst, and complicated workup. The prepared polythioamides were characterized with ^{1}H-NMR, ^{13}C-NMR, FTIR spectroscopy, and gel permeation chromatography (GPC).
41.	Knowledge capture and its representation using concept map in bioinspired design S Sharma, P Sarkar - International Journal on Interactive Design and Manufacturing (IJIDeM), 2022 **Abstract:** Biological knowledge can be represented using different models textually and diagrammatically. One of the least explored diagrammatic methods for biological knowledge representation is concept map. In this paper, we present the growth in publications for concept map from 1974 to 2021 and attempt to capture the knowledge of phenomenon exhibited by the biological entity and represent its knowledge by information extraction for the use of designers in the bioinspired design process. A preliminary investigation has also been done to determine whether a causal mechanism can be found in the concept map. If yes, whether it is easy to abstract knowledge in a concept map or not. We also present the generic methodology to develop a concept map for any biological text with an example. To develop the concept map, biological knowledge is deconstructed from the text. Comparative text content analysis in biological text and concept has been done to know about redundancy. We then developed a completed concept map and assessed whether the participant understands the biological information without any intervention. The overall aim is to know whether knowledge can be captured and represented using concept maps for bioinspired design. This research aims to provide designers with a methodology to develop their own concept maps for biological entities. The overall goal is to foster meaningful learning and support bioinspired product design.
42.	Long-term impacts of COVID-19 pandemic on travel behavior B Aaditya, TM Rahul - Travel Behaviour and Society, 2022 **Abstract:** The need to understand the influence of the COVID-19 pandemic on the long-term travel behaviour of people has never been higher as a consequence of the second wave of pandemic. In this context, the current study aims to understand the willingness of people to use sustainable modes of transportation including shared modes of transport, and non-motorized transport, against non– shared modes of transport such as personal 2-wheelers and 4-wheelers in a post-vaccinated scenario. The study further models the willingness to choose public transportation under various COVID-19 preventive measures representing the perception of safety among people. An Integrated Choice and Latent Variable (ICLV) framework a employed

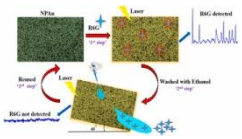
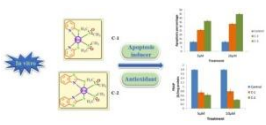
	in the modelling. The fear of contracting COVID-19 and the belief in remedial measures significantly influenced the mode choice of individuals. This highlighted a significant long-term impact of the pandemic on the travel behaviour of individuals. The study concludes by presenting different strategies that could be adopted to make the existing sustainable modes safer, and hence, more attractive.
43.	MiR-330-5p and miR-1270 target essential components of RNA polymerase I transcription and exhibit a novel tumor suppressor role in lung adenocarcinoma S Saproo, SS Sarkar, E Gupta, S Chattopadhyay, A Charaya…S Naidu - Cancer Gene Therapy, 2022 **Abstract:** Upregulation of RNA polymerase I (Pol I) transcription and the overexpression of Pol I transcriptional machinery are crucial molecular alterations favoring malignant transformation. However, the causal molecular mechanism(s) of this aberration remain largely unknown. Here, we found that Pol I transcription and its core machinery are upregulated in lung adenocarcinoma (LUAD). We show that the loss of miRNAs (miR)-330-5p and miR-1270 expression contributes to the upregulation of Pol I transcription in LUAD. Constitutive overexpression of these miRs in LUAD cell lines suppressed the expression of core components of Pol I transcription, and reduced global ribosomal RNA synthesis. Importantly, miR-330-5p/miR-1270-mediated repression of Pol I transcription exerted multiple tumor suppressive functions including reduced proliferation, cell cycle arrest, enhanced apoptosis, reduced migration, increased drug sensitivity, and reduced tumor burden in a mouse xenograft model. Mechanistically, the downregulation of miR-330-5p and miR-1270 is regulated by Pol I subunit-derived circular RNA circ_0055467 and DNA hypermethylation, respectively. This study uncovers a novel miR-330-5p/miR-1270 mediated post-transcriptional regulation of Pol I transcription, and establish tumor suppressor properties of these miRs in LUAD. Ultimately, our findings provide a rationale for the therapeutic targeting of Pol I transcriptional machinery for LUAD.
44.	MobiCache: a mobility-aware caching technique in vehicular edge computing V Sethi, S Pal - Proceedings of the 28th Annual International Conference on Mobile Computing And Networking, 2022 **Abstract:** Vehicular edge computing (VEC) brings computational resources at the edge of vehicular networks (VANETs). In VEC, the roadside unit (RSU) across the road segment acts as an edge server. The vehicle having less computational capability offloads high computation tasks to its nearby RSU for processing. There is a significant energy consumption occurs at the RSU in computing each high computation task. To minimize the energy consumption, a caching technique is used at RSUs. The greatest challenge of caching in VEC is the mobility of vehicles. In this poster, we propose a Mobility-Aware Caching technique (MobiCache) in VEC. MobiCache uses an actor-critic deep reinforcement learning framework to find the best routes for migrating the popular cache contents of RSUs according to the mobility pattern of vehicles. Simulation results show that our proposed caching strategy reduces the energy consumption by an average of 39.54% as compared to other existing caching techniques.
45.	Monitoring Spatiotemporal Patterns of Glacial Lakes in the Eastern Himalayas Using Satellite Data and Nonparametric Statistical Testing Techniques D Gaikwad, S Guha, RK Tiwari - Handbook of Himalayan Ecosystems and Sustainability, Volume 2, 2022 **Abstract:** Glaciers are retreating due to global warming, promoting the development and growth of the numerous glacial lakes in high mountain regions. These precarious glacial lakes impose severe threats as they increase the magnitude and frequency of glacial lake outburst floods, which can cause potential downstream risk, and a lack of water availability in the future. The variation in the rate of glacier recession and glacial lake changes is prominent in the Himalayas, especially in the eastern Himalayas. Therefore, the present study analyzes the expansion and

	contraction rates of the glacial lakes in the Sikkim in the last four decades using multispectral Landsat satellite images. For this purpose, 24 various types of glacial lakes were extracted as samples by manual delineation for 1988, 2000, 2008, 2014, and 2020. These sample glacial lakes were of different types, sizes, shapes, and situated at different elevations, which were acquired to predict the rate of glacial lake area change (RGLAC) for the entire Sikkim using inferential statistical techniques. In this regard, a nonparametric Friedman test has been used to identify whether the RGLAC is equal in all timeframes or not. If it is not equal, another nonparametric post hoc (Dann-Bonferroni) test gets automatically activated to determine which timeframes have a significantly different RGLAC. Finally, the authors noted that the total sample glacial lakes area has changed from 9.617-13.590 km^2, with an average rate of 0.013 km^2/year between 1988-2020. Also, they observed that the RGLAC was highest between 2000-2008; after that, it showed a downward trend. Overall, the area of the glacial lake has been changing heterogeneously throughout the study period. The authors suggest continuous and systematic monitoring of glacial lakes, which is essential to minimize the glacial hazards in the eastern Himalayas.
46.	Multi-scan laser bending of duplex stainless steel under different cooling conditions R Yadav, DK Goyal, R Kant - CIRP Journal of Manufacturing Science and Technology, 2022 **Abstract:** This study focuses on the effect of three different cooling conditions during multi-scan laser bending of duplex stainless-steel sheet. Results show that the trend of temperature distribution with number of scans is almost similar in all three conditions, but the peak temperature changes. The bend angle, heat affected zone, tensile strength and hardness are significantly affected by the cooling condition. The tensile strength and hardness of scanned specimen is increased compare to base material in all three cooling conditions. The microstructure shows grain refinement and sigma phase formation at the top and bottom surfaces, respectively, in all three cooling conditions.
47.	Mycobacterium tuberculosis exploits MPT64 to generate myeloid-derived suppressor cells to evade the immune system S Singh, SK Maurya, M Aqdas, H Bashir, A Arora…JN Agrewala - Cellular and Molecular Life Sciences, 2022 **Abstract:** *Mycobacterium tuberculosis (Mtb)* is a smart and successful pathogen since it can persist in the intimidating environment of the host by taming and tuning the immune system. *Mtb* releases MPT64 (Rv1980c) protein in high amounts in patients with active tuberculosis (TB). Consequently, we were curious to decipher the role of MPT64 on the differentiating dendritic cells (DCs) and its relation to evading the immune system. We observed that pre-exposure of differentiating DCs to MPT64 (DC^{MPT64}) transformed them into a phenotype of myeloid-derived suppressor cells (MDSCs). DC^{MPT64} expressed a high level of immunosuppressive molecules PD-L1, TIM-3, nitric oxide (NO), arginase 1, IDO-1, IL-10 and TGF-β, but inhibited the production of pro-inflammatory cytokines TNF-α, IL-6 and IL-12. DC^{MPT64} chemotaxis function was diminished due to the reduced expression of CCR7. DC^{MPT64} promoted the generation of regulatory T cells (Tregs) but inhibited the differentiation of Th1 cells and Th17 cells. Further, high lipid and methylglyoxal content, and reduced glucose consumption by DC^{MPT64}, rendered them metabolically quiescent and consequently, reduced DC^{MPT64} ability to phagocytose *Mtb* and provided a safer shelter for the intracellular survival of the mycobacterium. The mechanism identified in impairing the function of DC^{MPT64} was through the increased production and accumulation of methylglyoxal. Hence, for the first time, we demonstrate the novel role of MPT64 in promoting the generation of MDSCs to favor *Mtb* survival and escape its destruction by the immune system.
48.	Network analysis reveals that the tumor suppressor lncRNA GAS5 acts as a double-edged sword in response to DNA damage in gastric cancer S Gupta, PK Panda, W Luo, RF Hashimoto, R Ahuja - Scientific Reports, 2022

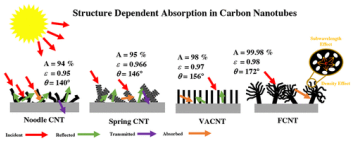
	Abstract: The lncRNA GAS5 acts as a tumor suppressor and is downregulated in gastric cancer (GC). In contrast, E2F1, an important transcription factor and tumor promoter, directly inhibits miR-34c expression in GC cell lines. Furthermore, in the corresponding GC cell lines, lncRNA GAS5 directly targets E2F1. However, lncRNA GAS5 and miR-34c remain to be studied in conjunction with GC. Here, we present a dynamic Boolean network to classify gene regulation between these two non-coding RNAs (ncRNAs) in GC. This is the first study to show that lncRNA GAS5 can positively regulate miR-34c in GC through a previously unknown molecular pathway coupling lncRNA/miRNA. We compared our network to several *in-vivo/in-vitro* experiments and obtained an excellent agreement. We revealed that lncRNA GAS5 regulates miR-34c by targeting E2F1. Additionally, we found that lncRNA GAS5, independently of p53, inhibits GC proliferation through the ATM/p38 MAPK signaling pathway. Accordingly, our results support that E2F1 is an engaging target of drug development in tumor growth and aggressive proliferation of GC, and favorable results can be achieved through tumor suppressor lncRNA GAS5/miR-34c axis in GC. Thus, our findings unlock a new avenue for GC treatment in response to DNA damage by these ncRNAs.
49.	Neutrosophic entropy-based ingenious measurement for fast fourier transforms based classification of process-parameters and wear resistance of friction-stir processed hybrid AA7075- B_4C aluminium metal-matrix composites R Kumar, J Singh, S Sharma, C Li… - Journal of Materials Research and Technology, 2022 **Abstract:** The underlying study propounds novel hyperbolic fuzzy entropy (HFE) and single valued neutrosophic entropy (NFE) based methodology for classifying the processing parameters employed for studying the wear-resistance of friction-stir-processing (FSP) of AA7075 aluminum, allow incorporated with B_4C particles under different reinforcement conditions. Fast Fourier transform (FFT) was applied for the acquisition of vibration data. An alloy sheet with a thickness of 5 mm and dimensions 180×160×5 was machined on the aluminium plates for the purpose of accommodating B_4C particles. The experiments were performed at varying tool rotational speeds (1400 rpm, 1500 rpm and 1600 rpm), feed rate (30 mm/min, 40 mm/min and 50 mm/min) with plunge depth and constant tilt angles of 3.14°. After acquitting vibration data through FFT, the lower and upper bounds from energy eigenvalues of each processing parameters were extracted and thereafter rehabilitated into the forms of non-probabilistic sets, also called fuzzy sets (FSs) and single-valued neutrosophic sets (SVNSs) consecutively. The tool rotational speed of 1600 rpm with feed rate 30 mm/min was found to be the most superlative processing parameter owing to its maximum HFE and NFE values respectively. The wear-properties of the fabricated-samples were investigated employing pin-on tribometer. The investigations made in this study reveal that the fabricated specimen with tool rotational-speed 1600 rpm and feed-rate 30 mm/min was having higher wear resistance and coefficient-of-friction (COF). The proposed entropy-based method of classification of processing parameters can help the readers to improve surface integrity and enhancement of mechanical & chemical properties of the selected aluminium alloy as well as other related metal composites.
50.	Numerical Investigation on the Effect of Fuel Injection Timing on Soot Particle Size and Number Characteristics of Diesel Engine S Rana, MR Saxena, RK Maurya, PC Shukla - SAE Powertrains, Fuels & Lubricants Conference & Exhibition, 2022 **Abstract:** Diesel engines are lucrative in terms of high thermal efficiency and low specific fuel consumption. The major drawbacks of these engines are high NOx and particulate matter (PM) emissions due to heterogeneous combustion. In the current emissions norms (BS-VI), a limit for particle number concentration is also introduced. There are few numerical studies investigating the soot particle size and number characteristics at different engine operating conditions. In this work, a parametric numerical study is conducted to investigate the effect of engine operating

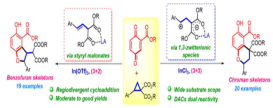
	parameters on PM characteristics such as number density, size, and volume fraction. Simulations were performed using the Reynolds Averaged Navier Stokes equation with renormalization group K-ε turbulence model available in ANSYS FORTE CFD software. A detailed reaction mechanism consisting of 243 species and 1765 reactions with 66.8/33.3 weight percent of n-decane / alpha methyl napthalene diesel surrogate is employed to simulate diesel combustion and emissions. Method of the moment has been employed for predicting soot particle number and size for closed cycle simulations in ANSYS FORTE CFD software. Results indicate that an advanced injection timing reduces the peak particle number density and mean PM average diameter due to reduced soot formation rates and increased oxidation rates. An increase in injected fuel mass enhances the particle number density, mean PM average diameter and PM volume fraction due to surface growth and polycyclic aromatic hydrocarbons (PAH) coagulation reactions in the presence of high acetylene concentration and pyrene. Additionally, results indicate that the formation of polyaromatic hydrocarbon species decreased with an increase in engine speed, thereby decreasing the PM number density, mean PM average diameter and PM volume fraction.
51.	Progress in biomass fast pyrolysis: An outlook of modern experimental approaches KB Ansari, M Danish, A Banerjee… - Innovations in Thermochemical Technologies for Biofuel Processing, 2022 **Abstract:** The fast pyrolysis technique has emerged over the years for converting biomass materials majorly into bio-oil, along with noncondensable gases and biochar. Bio-oil can be a suitable alternative to fossil fuel. However, its composition often becomes constrained while matching existing fuel quality. The industrial application of fast pyrolysis seeks immense research improving bio-oil quality (or composition) obtained from different biomass materials under different operating conditions. This chapter addresses the modern experimental approaches which contribute to biomass pyrolysis technology. Notably, a systematic bottom-up approach of the study of essential pyrolysis reactions (which governs the bio-oil composition) and the effect of transport (i.e., heat and mass transfer) on the reactions are discussed. The effect of catalytic materials (synthetic and natural) on the product yields from isothermal fast pyrolysis of biomass is also highlighted.
52.	Remote patient monitoring service for sleeping human postures in a WBAN A Vyas, S Pal, K Kaur – Smart Health, 2022 **Abstract:** Wireless Body Area Networks (WBANs) provide wireless remote patient monitoring services where doctors get patients' health records without physically visiting them. In WBANs, biosensors are placed on the patient's body that sense and transmit physiological data to the paired medical personnel. Such medical setups are appropriate for COVID-19 patient monitoring, where the patient remains isolated for an extended period. Sometimes, human body parts impede the signals transmitted by biosensors to the coordinator and this type of occlusion lasts for a longer duration during sleeping human postures. In such circumstances, an intermediate biosensor forwards the signals of the occluded biosensor node. The forwarding of messages results in quick depletion of energy resources at the intermediate biosensor, affecting the overall WBAN services. To resolve this, first, we propose an adaptive Relay-Node Centric (RNC) relay-based communication protocol for WBANs, which reduces energy used in relaying and improves the stability period of the network. Second, we design a novel simulation model using an existing real-life experimental dataset to simulate a WBAN placed on the sleeping patient's body. We derive a Discrete Markov Chain (DTMC) model from real-life data and use human biomechanisms to simulate biosensors' connectivity status in four human sleeping positions. Lastly, we evaluate the performance of RNC against the existing cost-function-based and Analytical Hierarchical Process (AHP) based relay selection protocols. Results obtained on the real-life dataset and designed simulation model show that RNC outperforms the existing methods in terms of network stability period and packet success ratio.

53.	Reservoir crowding in a resource-constrained exclusion process with a dynamic defect B Pal, AK Gupta - Physical Review E, 2022 **Abstract:** To understand the complicated transport processes that occur in biological and physical systems, we investigate a constrained totally asymmetric simple exclusion process with a stochastic defect particle. The defect particle might randomly emerge or vanish, resulting in a dynamic defect, and slows down the flow of moving particles when attached to the lattice. Using a mean-field technique, we examine the steady-state characteristics and boundary-layer analysis is provided to comprehend the properties of finite system. In a simplification, our theoretical method unifies three different parameter used to define the defect dynamics into one parameter termed the obstruction factor. It is found that the defect kinetics lead to emergence of phases where the current is defect restricted. The system shows nine phases overall, including bulk-induced and boundary-induced shock phases, with the phase schema showing no more than eight phases depending on the dynamics. We found that variation of obstruction does not lead to qualitative transition in the system, whereas the change in constraint on total particles affect the system qualitatively. All the theoretical outcomes have been validated using extensive Monte Carlo simulations.
54.	Response of Nd^{3+} and Sm^{3+} precipitating into rhabdophane and the leaching mechanism of associated monazite ceramics X Zhao, Y Teng, Y Li, X Zheng, Q Zheng, R Ma, G Liu…RAhuja… - Journal of the American Ceramic Society, 2022 **Abstract:** Rhabdophane has been considered an important permeable reactive barrier to isolate groundwater radionuclides, and evaluating its precipitation response to different species of radionuclide in acid solutions is critical. In this work, the effects of pH values on the precipitation behavior of Nd^{3+} and Sm^{3+} into La-rhabdophane are systematically investigated. Some specific issues such as ions removal, precipitation reaction kinetics, and crystal growth affected ions incorporation are discussed in detail, along with uncovering the veil of the Ln (La, Nd, and Sm) leaching mechanism of associated $La_{0.666}Nd_{0.167}Sm_{0.167}PO_4$ monazite ceramic based on dissolution experiments and density functional theory. The results reveal that Nd^{3+} and Sm^{3+} can be removed more than 98% in pH = 1 solution within 12 h, whereas uneven precipitation process to form unexpected stoichiometric ratio of rhabdophane has been observed in 30–50 nm short crystal. Grain growth effects based on spark plasma sintering can contribute to homogenize the materials composition with obtaining $La_{0.666}Nd_{0.167}Sm_{0.167}PO_4$ monazite ceramics. Furthermore, the binding energy of Ln–O in (1 0 0) surface of monazite plays an important role in controlling the leaching stability of Ln^{3+}, associated with the leaching activities are energetically favorable in the order of La > Nd > Sm for $La_{0.666}Nd_{0.167}Sm_{0.167}PO_4$ monazite.
55.	Reusable SERS substrate based on interconnected metal network structure H Sammi, RV Nair, N Sardana - Materials Chemistry and Physics, 2022 **Abstract:** In the present work, the fabrication of a facile, cost-effective, uniform, and reusable platform for the detection of analytes using surface-enhanced Raman scattering is discussed. An interconnected metal network structure made using gold (generally named as Nanoporous Gold) is fabricated via a time-varying chemical dealloying method. Using rhodamine 6G as a Raman reporter molecule, the surface-enhanced Raman scattering effectiveness of the dealloyed samples is studied. The 30- and 45-min etched samples show the highest enhancement induced by the large number of nano-ligaments and nano-gaps between the adjacent ligaments. The proposed substrates exhibit a five-fold SERS enhancement with an excellent uniformity over the sample surface with relative standard deviation value of less than ~20%. Moreover, through an ethanol wash, the nanoporous gold substrate can be easily reused at least four times with a reproducible SERS signal with the same SERS enhancement.

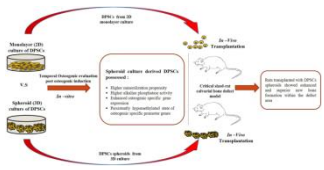
	Graphical Abstract: A facile, cost-effective, and reusable SERS substrate based on interconnected metal network structure is reported. The substrate can be reused at least four times by draining out adsorbed moieties via the drop-casting method in ethanol. 
56.	Role of Interface Trap Charges in the Performance of Monolayer and Bilayer MoS2-based Field-Effect Transistors A Rawat, A Goel, B Rawat - 35th International Conference on VLSI Design and 2022 21st International Conference on Embedded Systems (VLSID), 2022 **Abstract:** The two-dimensional MoS 2 -based field-effect transistor emerges as a promising candidate for scaling down the channel length beyond the end of silicon CMOS nanoelectronics. Although several recent experimental studies have reported the presence of interface trap charges between MoS 2 and oxide interface, their deleterious effects on MoS 2 -FET performance remain unexplored. Therefore, in this work, we investigate the digital performance of monolayer and bilayer MoS 2 -FETs in the presence of constant energy and Gaussian trap distributions. To this purpose, the trap charge description is introduced in device electrostatics using 2-D Poisson's equation, which is self-consistently solved with non-equilibrium Green's function (NEGF) equations for accurately capturing their effect in the semi-ballistic transport. It is found that monolayer MoS 2 -FET undergoes higher degradation in the drive current than bilayer MoS 2 -FET in both the cases of constant energy and Gaussian trap distributions. The interface trap charges possess severe limitations on the key MoS 2 -FET metrics, such as ON-current and sub-threshold slope, rather than the OFF-state current. Our studies suggest that minimizing the distributed trap at MoS 2 and oxide interface can significantly enhance the drive current, and hence, improve the speed and energy efficiency.
57.	Ruthenium(II) dimethyl sulphoxide based complexes: A potent inducer of apoptosis S Khatkar, SK Dubey, P Saraf, JK Bhardwaj, S Kumar, V Kumar, S Singh…G Singh… - Results in Chemistry, 2022 **Abstract:** Ruthenium (Ru) Dimethylsulphoxide complexes have appeared as a prominent compound among the potential metal-based drug for the cure of cancer. Cancer is marked with the uncontrolled proliferative activity that can be treated with apoptosis inducers. Therefore, in the present study the potentials of ruthenium complexes as an inducer of apoptosis evaluated through appropriate techniques. Two ruthenium (Ru) complexes of composition $[Ru^{II}(PyS)_2(DMSO)_2]$ **(C1)** and $[Ru^{II}(mbtz)_2(DMSO)_2]$ **(C2)** with co-ligands (**PySH**: 2-mercatopyridine and **mbtzH**: 2- mercaptobenzothiazole) have been synthesized and examined for their apoptosis inducing activity in ovarian granulosa cells. The biological assays revealed that both the complexes induce various histomorphological, cytotoxic and genotoxic alterations characteristic of apoptosis, within granulosa cells of ovarian antral follicles. Thus suggesting the anti-apoptotic and anti-cancerous activity of ruthenium (Ru) based complexes within granulosa cells of ovarian antral follicles. To the best of our knowledge such studies are scare. **Graphical Abstract:** 
58.	Schwinger effect and a uniformly accelerated observer

	S Kaushal - The European Physical Journal C, 2022 **Abstract:** This article investigates the Schwinger effect for fermions with background electric and magnetic fields of constant strengths from the point of view of a uniformly accelerated or the Rindler observer. The Dirac equation is solved in a closed form, and the field quantisation in the (3+1)(3+1)-dimensional Rindler spacetime is performed. The orthonormal local in and out modes for the causally disconnected right and left wedges and the Bogoliubov relations between them are obtained. Next, the global modes are constructed to cover the whole spacetime, and the Bogoliubov relationship between the local and global operators is found. Using them the squeezed state expansion of the global vacuum in terms of local states is acquired and accordingly, the spectra of created particles is found. Clearly, there are two sources of particle creation in this scenario – the Schwinger as well as the Unruh effects. Our chief aim is to investigate the role of the strength of the background electromagnetic fields on the spectra of created particles. We also discuss very briefly some possible implication of this result in the context of quantum entanglement.
59.	Seismic features and vulnerability of traditional building practices in the Himalayan State, Himachal Pradesh, India M Surana, A Ghosh, D Baldev - Journal of Building Engineering, 2022 **Abstract:** In the present study, widespread field surveys are conducted to identify the traditional building practices prevalent in the Indian state of Himachal Pradesh. The conducted field surveys led to the identification of the Kath-kunni, Thathara, Drystone, and Rammed earthen buildings in the study region. These building practices are studied, classified, and sketched for their siting, architectural and structural features, soil conditions and foundations. The qualitative seismic vulnerability assessment is conducted to highlight earthquake-resilient and vulnerable features of the studied traditional buildings.
60.	Sentiment-aware Classifier for Out-of-Context Caption Detection M Alkaddour, A Dhall, U Tariq, H Al Nashash, FA Shargie - Proceedings of the 30th ACM International Conference on Multimedia, 2022 **Abstract:** In this work we propose additions to the COSMOS and COSMOS on Steroids pipelines for the detection of Cheapfakes for Task 1 of the ACM Grand Challenge for Detecting Cheapfakes. We compute sentiment features, namely polarity and subjectivity, using the news image captions. Multiple logistic regression results show that these sentiment features are significant in prediction of the outcome. We then combine the sentiment features with the four image-text features obtained in the aforementioned previous works to train an MLP. This classifies sets of inputs into being out-of-context (OOC) or not-out-of-context (NOOC). On a test set of 400 samples, the MLP with all features achieved a score of 87.25%, and that with only the image-text features a score of 88%. In addition to the challenge requirements, we also propose a separate pipeline to automatically construct caption pairs and annotations using the images and captions provided in the large, un-annotated training dataset. We hope that this endeavor will open the door for improvements, since hand-annotating cheapfake labels is time-consuming. To evaluate the performance on the test set, the Docker image with the models is available at: https://hub.docker.com/repository/docker/malkaddour/mmsys22cheapfakes. The open-source code for the project is accessible at: https://github.com/malkaddour/ACMM-22-Cheapfake-Detection-Sentiment-aware-Classifier-for-Out-of-Context-Caption-Detection.
61.	Single Phase onboard Integrated Charger for Open-Ended Winding Induction Motor for EV Application A Azeem, S Payami, AVR Teja - IEEE 2nd International Conference on Sustainable Energy and Future Electric Transportation (SeFeT), 2022 **Abstract:** The battery charging unit is an integral part of the electrical vehicle (EV). The

	conventional charging system has a separate rectifier and filter circuitry that makes the charging system costly and bulky. The on-board charger (OBC) for electric vehicles (EV) is incorporated the same converter used for motoring operation, as a controlled rectifier and buck-boost converter. Integrated and isolated charger units can be configured as bidirectional and unidirectional and incapable to operate as vehicle-to-grid and vehicle-to-vehicle as well. AC Level-l and leve1-2 charging (up to 19 kW) can be easily integrated with the traction machine converter group installed in the EVs, no new elements are introduced in the power circuitry. In integrated EV charging battery, can be charged up to the rated traction power. Also, it does not need to require the reconfiguration of the converter, additional passive components without machine operation during steadystate charging. Additional freedom exists in the open-ended windings of induction motor with induction motor is that integrated charging directly with ac and dc can be employed. Integrated OBC is capable to provide the unity power factor (UPF) operation that further improves the performance of the charging unit. The proposed technique is validated on the experimental test bench.
62.	Structure Dependent Broadband Optical Absorption in Carbon Nanotubes V Ghai, H Singh, PK Agnihotri - ACS Applied Optical Materials, 2022 Abstract: Near-perfect black surfaces are desirable in many applications, including from space telescopes and satellites to energy harvesting and biomedical devices. Carbon nanostructures have emerged as potential candidates for fabricating ultrablack optical absorbers. Here, we have studied the structure-dependent light absorption capacity of carbon nanotubes in the broadband region of UV–vis–NIR. Four types of carbon nanotube (CNT) structures, noodle CNTs, spring CNTs, vertically aligned carbon nanotubes (VACNTs), and flower carbon nanotubes (FCNTs), are fabricated using the thermal chemical vapor deposition (CVD) technique. The light-trapping capacity of noodle CNT, spring CNT, VACNT, and FCNT is ≥94%, ≥95%, 98%, and ≥99.97%, respectively, in the UV–vis–NIR wavelength range. Varying the absorption of incident radiation in CNTs has been attributed to various structure-dependent parameters such as multiple scattering, light trapping sites, multiple length scales, and optical path length. It is shown that hierarchical structure imparts near perfect blackbody characteristics (absorption, >99.98%; emissivity, −0.98) to FCNTs. In addition, the superhydrophobic and self-cleaning behavior of VACNTs and FCNTs makes them suitable candidates for solar and antibacterial applications. 
63.	Sustainable Livelihood Security Index: A Case Study in Chirrakunta Rurban Cluster S Guha, DK Barik, VR Mandla – A book chapter of Geospatial Modeling for Environmental Management, 2022 **Abstract:** The present study emphasizes the importance of Sustainable Livelihood Security Index (SLSI) in Shyama Prasad Mukherjee Rurban Mission (SPMRP). This SLSI tool has the potential to identify the current sustainability condition and future needs to achieve and hold the sustainability tag. Chirrakunta Rurban Cluster is selected as a test site in this study. Three different indices viz. ecological security index (ESI), economic efficiency index (EEI), and social equity index (SEI) have been dealt with, using both spatial and nonspatial data. The selected indicators have been normalized followed by assignment of different weights to each index for computation of the final indices. By using these indices, SLSI has been estimated for each panchayat within this cluster. The results show that the only area having a very low SLSI score is Ada Panchayat which covers about 8.57% of the total area and 4.91% of the total population in this cluster and hence, it achieves the tag of Highly Sustainable (HS). The other

	nine panchayats that cover 75.34% of the total area and 52.38% of the total population come under Moderately Sustainable (MS) category. The remaining 16.09% of the total area and 42.71% of the total population come under Low Sustainable (LS) category in this cluster. Hence, there is an urgent need to reorient the development programmers. The investment for the development should be done on a priority basis for these vulnerable panchayats to provide them with proper resources and opportunities to ameliorate their ecological security, economic efficiency and social equity which may ascertain sustainable livelihood security to them. The regions at large require a strong and sound infrastructure to remove the deficiencies occurring at places.
64.	Switchable Reactivity of Cyclopropane Diesters toward (3 + 3) and (3 + 2) Cycloadditions with Benzoquinone Esters N Kaur, P Kumar, A Hazra, P Banerjee - Organic Letters, 2022 **Abstract:** Herein, we describe an unprecedented (3 + 3) cycloaddition reaction of the donor–acceptor cyclopropanes with quinone esters toward the construction of chroman scaffolds in moderate to good yields. Interestingly, the strategy is also adjustable toward a (3 + 2) cycloaddition by just switching the Lewis acid to furnish benzofuran scaffolds. Based on the choice of Lewis acid used, the same set of precursors has been used to deliver the benzopyran and benzofuran derivatives. 
65.	Switched Beam Array Antenna Optimized for Microwave Powering of 3-D Distributed Nodes in Clustered Wireless Sensor Network S Kumar, A Sharma - IEEE Transactions on Antennas and Propagation, 2022 **Abstract:** The IoT applications like smart warehouse, smart industry, and smart vertical farming will require microwave power transmission (MPT) to the densely deployed low power sensor nodes in three dimensional (3-D) space. To address this issue, a switched beam array antenna is synthesized as an MPT system to power the proposed 3-D clustered wireless sensor network (WSN). The 3-D space is divided into nine clusters, each illuminated individually with RF power using a dedicated patch antenna subarray. The subarrays can be switched on or off based on the energy requirement of the WSN cluster nodes resulting in efficient power transmission. Moreover, the low complexity of switched beam design reduces the cost and processing overhead as compared to the exiting adaptive beamforming systems in a dense WSN scenario. The subarray size and excitation coefficients are optimized with a constraint over the harvested DC power (P_{dc}) to enhance the 3-D coverage. In addition, the optimal location of the cluster head is evaluated to minimize the average power consumption of WSN cluster. The subarrays are designed and fabricated with the evaluated excitation coefficients, and P_{dc} measurements are carried out validating analytical results.
66.	Targeting dendritic cells with TLR-2 ligand-coated nanoparticles loaded with Mycobacterium tuberculosis epitope induce anti-tuberculosis immunity DK Das, MA Zafar, S Nanda, S Singh, T Lamba…JN Agrewala - Journal of Biological Chemistry, 2022 **Abstract:** Novel vaccination strategies are crucial to efficiently control tuberculosis, as proposed by WHO under its flagship program ‘End TB Strategy’. However, the emergence of drug-resistant strains of Mycobacterium tuberculosis (Mtb), particularly in those co-infected with HIV-AIDS, constitutes a major impediment to achieving this goal. We report here a novel vaccination strategy that involves synthesizing a formulation of an immunodominant peptide

	derived from the Acr1 protein of Mtb. This nanoformulation additionally displayed a toll-like receptor-2 (TLR-2) ligand to offer to target dendritic cells (DCs). Our results showed an efficient uptake of such a concoction by DCs in a predominantly TLR-2-dependent pathway. These dendritic cells produced elevated levels of nitric oxide, pro-inflammatory cytokines IL-6, IL-12, and TNF-α, and upregulated the surface expression of class MHC II molecules, as well as costimulatory molecules such as CD80 and CD86. Animals injected with such a vaccine mounted a significantly higher response of effector and memory Th1 cells and Th17 cells. Furthermore, we noticed a reduction in the bacterial load in the lungs of animals challenged with aerosolized live Mtb. Therefore, our findings indicated that the described vaccine triggered protective anti-Mtb immunity to control the TB infection.
67.	Temperature-dependent structural, mechanical, and thermodynamic properties of B2-phase Ti_2AlNb for aerospace applications K Goyal, C Bera, N Sardana - Journal of Materials Science, 2022 **Abstract:** Ti_2AlNb intermetallic is a potential substitute for Ni-based superalloys in next-generation aerospace materials. In the current work, the structural, mechanical, and thermodynamic properties of the Ti_2AlNb in B2 phase are studied at various temperatures by implementing first principle calculations under quasi-harmonic approximations. The lattice parameter, elastic moduli, and linear coefficient of thermal expansion (CTE) are well reproduced according to the experimental reports. The intermetallic remains mechanically and dynamically stable at all temperatures. The elastic moduli and microhardness decrease slightly from 0 to 1300 K. Furthermore, the calculations reveal that Ti_2AlNb remains ductile at all temperatures. Phonon calculations show that Nb atoms are dominant contributor to the vibrational modes. The temperature-dependent heat capacities, entropy, CTE, and isothermal bulk modulus are further investigated. Present calculations predict that the B2 phase Ti_2AlNb is a suitable candidate for the manufacturing of high-temperature application parts such as turbine blades of aerospace engines.
68.	Temporal Modulation of DNA Methylation and Gene Expression in Monolayer and 3D Spheroids of Dental Pulp Stem Cells during Osteogenic Differentiation: A Comparative Study S Raik, R Thakur, V Rattan, N Kumar, A Pal… - Tissue Engineering and Regenerative Medicine, 2022 **Abstract:** Background: Human mesenchymal stem cells are being used for various regenerative applications in past decades. This study chronicled a temporal profile of the transcriptional pattern and promoter methylation status of the osteogenic related gene in dental pulp stem cells (DPSCs) derived from 3-dimensional spheroid culture (3D) vis a vis 2-dimensional (2D) monolayer culture upon osteogenic induction. Methods: Biomimetic properties of osteogenesis were determined by alkaline phosphatase assay and alizarin red staining. Gene expression and promoter methylation status of osteogenic genes such as runt-related transcription factor-2, collagen1α1, osteocalcin (OCN), and DLX5 (distal-homeobox) were performed by qPCR assay and bisulfite sequencing, respectively. Furthermore, μ-Computed tomography (micro-CT) was performed to examine the new bone formation in critical-sized rat calvarial bone defect model. Results: Our results indicated a greater inclination of spheroid culture-derived DPSCs toward osteogenic

	lineage than the monolayer culture. The bisulfite sequencing of the promoter region of osteogenic genes revealed sustenance of low methylation levels in DPSCs during the progression of osteogenic differentiation. However, the significant difference in the methylation pattern between 2D and 3D derived DPSCs were identified only for OCN gene promoter. We observed differences in the mRNA expression pattern of epigenetic writers such as DNA methyltransferases (DNMTs) and methyl-cytosine dioxygenases (TET) between the two culture conditions. Further, the DPSC spheroids showed enhanced new bone formation ability in an animal model of bone defect compared to the cells cultivated in a 2D platform which further substantiated our *in-vitro* observations. Conclusion: The distinct cellular microenvironment induced changes in DNA methylation pattern and expression of epigenetic regulators such as DNMTs and TETs genes may lead to increase expression of osteogenic markers in 3D spheroid culture of DPSCs which make DPSCs spheroids suitable for osteogenic regeneration compared to monolayers. **Graphical Abstract:** 
69.	Unleashing an ML-based selection criteria for economic lot sizing in a smart batch-type production system N Kumar, BJ Singh, P Khope - The TQM Journal, 2022 **Abstract:** Purpose Inventory models are quantitative ways of calculating low-cost operating systems. These models can be either deterministic or stochastic. A deterministic model hypothesizes variable quantities like demand and lead time, as certain. However, various types of research have revealed that the value of demand and lead time is still ambiguous and vary unanimously. The main purpose of this research piece is to reduce the uncertainties in such a dynamic environment of Industry 4.0. Design/methodology/approach The current study tackles the multiperiod single-item inventory lot-size problem with varying demands. The three lot sizing policies – Lot for Lot, Silver–Meal heuristic and Wagner–Whitin algorithm – are reviewed and analyzed. The suggested machine learning (ML)–based technique implies the criteria, when and which of these inventory models (with varying demands and safety stock) are best fit (or suitable) for economical production. Findings When demand surpasses a predicted value, variance in demand comes into the picture. So the current work considers these things and formulates the proper lot size, which can fix this dynamic situation. To deduce sufficient lot size, all three considered stochastic models are explored exclusively, as per respective protocols, and have been analyzed collectively through suitable regression analysis. Further, the ML-based Classification And Regression Tree (CART) algorithm is used strategically to predict which model would be economical (or have the least inventory cost) with continuously varying demand and other inventory attributes.

	Originality/value The ML-based CART algorithm has rarely been seen to provide logical assistance to inventory practitioners in making wise-decision, while selecting inventory control models in dynamic batch-type production systems.
70.	Variation aware power management for GPU memories DS Maura, T Goel, K Goswami, DS Banerjee, S Das - Microprocessors and Microsystems, 2022 **Abstract:** In the midst of progressively shrinking silicon technologies, enhancements in performance and area requirements come at the cost of some side effects. One such cost is the deviation of nominal parameters of process, voltage, and temperature. Considered a manufacturing defect, variations limit the maximum achievable performance. These affected areas possess lower reliability and consume more power than their theoretical counterpart. In this paper, we study and mitigate variations observed in GDDRx based GPU memories. GPU devices are exploited primarily for their massive parallelism and applications with both regular and irregular memory accesses see significant performance benefits. We also find that these consume a significant portion of the total GPU power. We propose a variation mitigating and power-saving technique for GPU memories. This accounts for a power savings of up to 44.61% (20.3% on average). Simultaneously, we also maintain the device data which prevents page faults and re-computation costs. This, however, leads to some performance overheads, which are limited to 4%. Mitigation of process variation combined with state preservation leads to more reliable GPU computations. Additionally, our model lowers access latencies by 15.7% in comparison to a variation affected baseline GPU, which ultimately helps to improve the throughput of the device.
71.	WinDRAM: Weak rows as in-DRAM cache S Kumar, P Sinha, S Das - Concurrency and Computation: Practice and Experience, 2022 **Abstract:** The primary factor responsible for increasing the refresh rate is the presence of weak rows in a DRAM. They have a shorter retention time and lose charge faster than regular rows. Recently, a technique known as in-DRAM cache was introduced in which some DRAM rows act as a separate module. The in-DRAM cache can be used for a variety of purposes in DRAM. We present WinDRAM, an in-DRAM cache comprised of all the DRAM's weak rows. The most recently accessed rows are copied into the in-DRAM cache so that when the row is accessed again, both rows (original and copy) can be activated at the same time. Such simultaneous activation reduces activation time and, as a result, DRAM access latency. Dual-row activation is the term for this concept. Because weak rows are part of the in-DRAM cache and are frequently accessed, WinDRAM does not perform a periodic refresh on them. Existing techniques based on in-DRAM cache do not design the in-DRAM cache using weak rows. WinDRAM proposes a novel idea by designing the in-DRAM cache using weak rows. Because the weak rows do not need to be refreshed, the refresh interval of the remaining rows can be increased, resulting in a refresh rate reduction of 80% to 90%. The speedup is 15% to 25% faster than standard DRAM and 12.77% faster than previous work for high memory-intensive workloads. Overall energy consumption is also reduced by 10% to 15%
72.	WiperNet: A Lightweight Multi-Weather Restoration Network for Enhanced Surveillance A Kulkarni, S Murala - IEEE Transactions on Intelligent Transportation Systems, 2022 **Abstract:** Adherent raindrops, rainstreaks and snow severely degrade the perceptual quality of an image, eventually affecting the performance of several computer vision based applications which are applied in outdoor scenarios, e.g. , traffic monitoring, autonomous driving, etc . Due to the complex appearance properties, removal of such degradations from an image is a challenging task. Working towards mitigating this problem, in this paper, a lightweight network named as WiperNet is proposed which tackles the problem of raindrops, rain streaks and snow removal

	present in an image. The WiperNet makes use of the proposed Dual Restoration (DR) mechanism, where the input features are processed twice through the network. In the network, Multi-scale Context Aware Residual Block (MCARB) is proposed for integrating contextual information from various scales. Also, Adaptive Varying Receptive Fusion Block (AVRFB) is proposed for adaptively fusing the information acquired through different dilation rates. Finally, we propose a Feature Refinement Stream which makes use of multiple kernel sizes of convolution filters and spatio-channel attention blocks for focusing on relevant information for effective removal of the degradations while using the coarse outputs of the features from the initial layers of the network. Substantial experiments and ablation study scrutinize that the proposed lightweight WiperNet outperforms the existing state-of-the-art methods for raindrop, rain streak and snow removal. The code is provided at https://github.com/AshutoshKulkarni4998/WiperNet .